



PHONG NHA - KE BANG

**NATIONAL PARK
QUANG BINH, VIETNAM**

**RENOMINATION
EXPANDING CRITERION (VIII) AND
INSCRIPTION ON CRITERIA (IX) AND (X)**

JANUARY 2014

PHONG NHA - KE BANG

NATIONAL PARK

Quang Binh, Vietnam

RENOMINATION

**EXPANDING PROPERTY
AND INSCRIPTION ON CRITERA (VIII), (IX) AND (X)**

JANUARY 2014

Submitting Organization	- Ministry of Culture, Sport and Tourism, Vietnam
Management Organisation	- People's Committee of Quang Binh Province, Vietnam
Operating Organisation	- Phong Nha – Ke Bang National Park
Collaboration organisations	<ul style="list-style-type: none"> - Department of Agriculture and Rural Development, Quang Binh Province - Department of Forest Protection, Quang Binh Province - Department of Natural Resources and Environment, Quang Binh Province - Department of Science and Technology, Quang Binh Province - Department of Planning and Investment, Quang Binh Province - Department of Culture, Sport and Tourism, Quang Binh Province - Department of Education and Training, Quang Binh Province - People Committees of Districts, Communes in the nominated property
Research Institutions	<ul style="list-style-type: none"> - Forest Inventory and Planning Institute (FIPI) - Institute of Ecology and Biology Resources, Vietnam's Academy of Natural Science and Technology - Center for Natural Resources and Environmental Studies (CRES), Vietnam National University, Hanoi - Institute of Environment and Sustainable Development (IESD) - College of Natural Sciences, Vietnam National University, Hanoi
International Agencies	<ul style="list-style-type: none"> - The World Conservation Union (IUCN) - Flora and Fauna International (FFI) - World Wildlife Fund for Nature (WWF) - BirdLife International - Vietnam and Russia Tropical Centre - Cologne Zoo and Frankfurt Animal Association of German - Frankfurt Zoological Society, Germany/Endangered Primate Rescue Center. - Kreditanstalt für Wiederaufbau - German Financial Cooperation (KfW) - Deutsche Gesellschaft für Internationale Zusammenarbeit - German Society for International Cooperation (GIZ)
Advisors	<p>Howard Limbert (British Cave Research Association); Tilo Nadler (Frankfurt Zoological Society, Germany/Endangered Primate Rescue Center); Leonid Averejanov (Vietnam and Russia Tropical Centre). Greg Blake (Fauna & Flora Vietnam); Evelina Czernecki (Fauna & Flora Vietnam); Bas van Helvoort (CTA Phong Nha - Ke Bang Project) Nguyen Trung Thuc (Director of Phong Nha - Ke Bang Project)</p>

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. IDENTIFICATION OF THE PROPERTY	11
1.a. Country	11
1.b. State, Province or Region.....	11
1.c. Name of Property.....	11
1.d. Geographical coordinates to the nearest second.....	11
1e. Maps and plans showing boundary of area proposed for inscription and of any buffer zone	11
1f. Area nominated property (ha) and proposed buffer zone (ha).....	11
2. DESCRIPTION.....	13
2a. Description of Property.....	13
2a.1 Physical Aspects.....	13
2.a.2 Physical aspects influencing the ecological processes and biological processes.....	23
2.a.3 Biological Aspects	24
2.a.4 Significant on-going ecological and biological processes in the evolution of biodiversity in PNKB-KKL	45
2.a.5 Socio-economic Aspects	51
2.b History and Development.....	54
3. JUSTIFICATION FOR INSCRIPTION	55
3.1.a Brief Synthesis.....	55
3.1.b Criteria under which Inscription is proposed (and Justification for Inscription under these Criteria)	55
3.1.c Statement of Integrity.....	66
3.1.d. Protection and management requirements.....	69
3.2 Comparative Analysis	71
3.3 Proposed Statement of Outstanding Universal Value.....	76
4. STATE OF CONSERVATION AND FACTORS AFFECTING THE PROPERTY	79
4.a Present State of Conservation.....	79
4.b Factors affecting the Property.....	83

5. PROTECTION AND MANAGEMENT OF THE PROPERTY	85
5.a Ownership.....	85
5.b Protective Designation.....	85
5.c Means of Implementing Protective Measures.....	89
5.d Existing Plans related to Municipality and Region in which the Proposed Property is located	89
5.e Property Management Plan or other Management System.....	90
5.f Sources and Levels of Finance.....	93
5.g Sources of Expertise and Training in Conservation and Management Techniques.....	93
5.h Visitor Facilities and Infrastructure.....	93
5.i Policies and Programmes related to the Presentation and Promotion of the Property.....	95
5.j Staffing Levels and Expertise (professional, technical, maintenance).....	96
6. MONITORING	98
6.a. Key indicators for measuring state of conservation.....	98
6.b. Administrative arrangements for monitoring property.....	99
6.c. Results of previous reporting exercises.....	100
7. DOCUMENTATION	101
7.a. Photographs, slides, image inventory and authorization table and other audiovisual materials	101
7.b. Texts relating to protective designation, copies of property management plans or documented management systems and extracts of other plans relevant to the property.....	101
7.c. Form and date of most recent records or inventory of property.....	101
7.d. Address where inventories, records and archives are held.....	102
7e. Bibliography	104
8. CONTACT INFORMATION OF RESPONSIBLE AUTHORITIES.....	113
8.a. Preparer.....	113
8.b&c. Official Local Institution/Agency.....	116
8.d. Official Web address.....	118
9. SIGNATURE ON BEHALF OF THE STATE PARTY.....	119

LIST OF TABLES

Table 1: Zoning area of the property	12
Table 2: Areas of the NP in communes	12
Table 3: The three known Cave Systems in Phong Nha-Ke Bang National Park.	16
Table 4: Major soil types and their characteristics in Phong Nha-Ke Bang National Park. ...	20
Table 5: Main climatic data recorded from three meteorological stations situated in close proximity to Phong Nha-Ke Bang National Park.	22
Table 6: The representation of different forest vegetation types in Phong Nha-Ke Bang National Park.....	25
Table 7: Preliminary list of the vascular plants from different taxa recorded in Phong Nha-Ke Bang National Park.....	30
Table 8: Different plant geography elements found in Phong Nga-Ke Bang National Park. .	31
Table 9: List animal species in Phong Nha-Ke Bang National Park.	32
Table 10: Endemic vertebrates recorded in Phong Nha-Ke Bang National Park.	32
Table 11: List of threatened animal species in Phong Nha-Ke Bang National Park.	32
Table 12. Endemic mammal species to Vietnam found in Phong Nha-Ke Bang National Park.	34
Table 15. Endemic fish species recorded in Phong Nha - Ke Bang National Park	43
Table 16. Demographic data for communities living in the buffer zone of Phong Nga-Ke Bang National Park.....	51
Table17: Minority groups living in the Phong Nha-Ke Bang area	52
Table 18: A Comparison of Biodiversity Richness within Phong Nha-Ke Bang National Park to other World Heritage Sites	75
Table 19: Analysis of the threats to the natural resources in Phong Nha- Ke Bang National Park.	80
Table 20: Visitor numbers to Phong Nha- Ke Bang National Park from 1994-2012	94
Table 21. Staffing levels	97
Table 22: Key indicators for measuring the state of conservation.....	99

ACRONYMS AND ABBREVIATIONS

asl.	Above sea-level
NP	National Park
FFI	Fauna and Flora International
FIPI	Forest Inventory and Planning Institute
GEF	Global Environment Facility
IEBR	Institute of Ecology and Biological Resources
IUCN	World Conservation Union
LINC	Project for linking conservation of Phong Nha – Ke Bang NP with that of Hin Namno National Biodiversity Conservation Area in Laos.
NW	North West
SE	South East
SW	South West
PPC	Provincial People's Committee
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

This information, to be provided by the State Party, will be updated by the Secretariat following the decision by the World Heritage Committee. It will then be returned to the State Party confirming the basis on which the property is inscribed on the World Heritage List.

State Party	Socialist Republic of Vietnam
State, Province or Region	Bo Trach, Minh Hoa and Quang Ninh Districts, Quang Binh Province
Name of Property	Phong Nha – Ke Bang National Park
Geographical coordinates to the nearest second	N 17 ⁰ 21'12" - 17 ⁰ 44'51" E 105 ⁰ 46'33" -106 ⁰ 23'19".
Textual description of the boundary(ies) of the nominated property	This site is located in the middle of the Annamite Mountain Range to the southwest of the Gianh River, 40km from Dong Hoi City, 500 km from the Capital City of Hanoi, and close to the Vietnam-Laos border to the West. Phong Nha - Ke Bang shares its boundary with the Hin Namno Nature Reserve to the West, Minh Hoa District to the North, Bo Trach District to the East, and Quang Ninh District to the South. The park is located in one of the 200 Global Ecoregions (WWF, 2000) and within two of 62 Important Bird Areas (BirdLife International 2002)
A4 (or "letter") size map of the nominated property, showing boundaries and buffer zone (if present)	See attached zoning map (showing core zone and buffer zone)
Justification Statement of Outstanding Universal Value (text should clarify what is considered to be the outstanding universal value embodied by the nominated property)	<p><i>Statement of outstanding value</i></p> <ul style="list-style-type: none"> - Phong Nha-Ke Bang National Park was designated as a national park in 2001. It was inscribed for Criterion (viii) (former Criterion (i)) on the World Natural Heritage List in July 2003. In July 2013 the park was expanded to 126,236 ha, and protects a large portion of one of the best preserved tracts of limestone forest in Southeast Asia. - This area has had a long earth crust development history from the Ordovician period (464 Ma) to the present, including five major periods, namely: Late Ordovician - Early Silurian; Middle Devonian – Late Devonian; Carboniferous; Permian; Mezozoic and Cenozoic. The area has a complicated geological structure. - The endogenous and exogenous geological processes which have occurred from the Triassic to the present have created the diverse topography and geomorphology. - The episodic uplift of the limestone landscape from (at least) the

Tertiary and the successive karst development, rejuvenation and ongoing evolutionary karst development has created specialist habitats. The episodic uplift also resulted in complex inter-bedding, and capping with schists and apparent granites. The dissected karst plateau supports montane evergreen forest above 700 m. Below ground the plateau houses labyrinths of fossil passages and outstanding caves of different ages. The Truong Son Range may have served as a refugium for forest-dwelling species during the Pleistocene, when evergreen forests disappeared from lower elevations.

- Phong Nha-Ke Bang serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research. Hatinh Langur and its black form; three species of bent-toed geckos showing niche segregation in microhabitat use; 41 cave invertebrates species showed isolation, with only five species occurring in all three caves. Several primitive or relict species, including the Saola, Annamite Striped Rabbit and Laotian Rock Rat; the later has been identified as a 'Lazarus species', the only representative of a fossil lineage (Diatomyidae) from 11 million years ago (late Miocene). Two new species of blind scorpions were the first troglobitic scorpions found in mainland Asia.

- The PNKB National Park is of global significance for the conservation of biodiversity because its variety of forest ecosystems, both karst and non-karst, support a high diversity of plants and animals, including a number of karst specialist species, many endemic species and a number of species that are globally threatened. Its rich diversity of endangered species still includes large mammals such as Asiatic Black Bear, Malayan Sun Bear, Binturong, Large-antlered Muntjac, Saola, Gaur (*Bos gaurus*), and Tiger. Living in PNKB National Park are many endemic and restricted range species, including charismatic representatives such as the Ha Tinh Langur, Red-shanked Douc, Southern White-cheeked Gibbon, Large-antlered Muntjac, Crested Argus Pheasant, and Annam Flying Frog.

- PNKB is situated in the central Truong Son range (Annamites), which has been recognized as a critical landscape of the Greater Annamites Global 200 Ecoregion. The property is also an Indo-Burma global biodiversity hotspot, as well as four of seven restricted range species of the Annamese Lowland Endemic Bird Area that is not otherwise represented on the World Heritage List. Recently discovered karst endemics, includes vertebrates such as Hatinh Langur, Black Langur, Sooty Babbler, Bare-faced Bulbul and Limestone Leaf-Warbler. Of particular note is a 'Lazarus taxon': the Laotian Rock Rat, the only living species in a family that disappeared from the fossil record for 11 million years and was recently rediscovered by science.

- PNKB NP property has covered bay 94% of forest, and 84% of this is primary forest. The Park supports a high biodiversity. The Park hosts more than 2,744 species of vascular plants. Of greatest conservation significance to the park are the 419 known endemic

	<p>plant species of this part of Central. As of 2012, 10 species of plants recorded in the Park were considered globally Critically Endangered, and 13 were globally Endangered. The Park also supports 785 species of vertebrates, of which 35 are globally threatened. Seven of the nine primate species occurring in the park are globally threatened, and the Park is the most important refuge for three of them. The Park probably has the largest remaining populations of the globally endangered Southern Hatinh Langur and its form of Black Langur, a primate that is specialized for karst forest and endemic to Vietnam and Laos PDR. In addition, one genus and nine plant and 16 animal species were recently discovered that all appear to be new for science.</p> <p>Statement of Integrity</p> <p>- The overall integrity of PHKB National Park is high, with the park recently expanded in size to 123,326 ha, with a corresponding increase in the buffer zone size to 220,269 ha. The property is the largest protected area in Vietnam, and the largest protected karst landscape in South East Asia. It contains some of the world's finest and largest known caves and has outstanding geological, biodiversity, and natural beauty values. It is contiguous to the west with the Hin Namno Protected Area (82,000 ha.) in Laos P.D.R. which is an extension of the immense limestone plateau. Cooperation through the two State party's dialogue and the associated exchange of conservation management and scientific information further supports the integrity of this property.</p> <p>- Although part of the watershed to the South that feeds the Phong Nha cave system is not included in the property it is part of the buffer zone that is sparsely populated. Modalities are being explored to integrate the management of this area with the property. Issues of law enforcement, that in the past have been problematic, are improving with strengthened interagency cooperation, improved resources and the implementation of a Forest Law Enforcement Plan. The management of the property is now guided by a suite of plans, prepared through participatory processes, that align to the over- arching Strategic Management Plan. This includes a Sustainable Tourism Development Plan that guides the management of the rapidly increasing number of visitors to the property. The threats to the conservation of property are being reduced through the current management approach.</p>
<p>Criteria under which property is nominated (itemize criteria) (see Paragraph 77 of the Operational Guidelines)</p>	<p>The Karsts of Phong Nha-Ke Bang National Park have very unusual biological values, because of the interplay of surface and subsurface environments. The Karsts are associated with outstanding <i>biodiversity</i> above and below ground with markedly different species assemblages. Endemicity and diversity are the rule, especially in isolated karsts like Phong Nha-Ke Bang in the tropics (Clements <i>et al.</i> 2006). Karst has unusual habitat conditions and sometimes experiences drought at the surface when there is abundant water underground.</p>

Criterion (viii)

Criterion (viii): *to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.*

Phong Nha - Ke Bang was inscribed for Criterion (viii) on the World Natural Heritage List in July 2003. The extension area contains outstanding values to meet criterion (viii)

The geological structure of the Park expanded area expresses the diversity and long development history of the earth's crust. The earth's crust has undergone several main developmental stages (from the Ordovician period up to now) with five tectonic megacycles corresponding with the five geological evolution stages of the world.

The Property forms a sizable proportion of one of the most notable, large karst landscapes in Southeast Asia, the Phong Nha-Ke Bang – Khammouane Karst Landscape, which comprises the property itself, the contiguous reserve Hin Namno National Protected Area, which itself is loosely connected to Phou Hin Poon National Protected Area, both reserves in Lao P.D.R.. In terms of island biogeography, it compares extremely well with all other six World Heritage Sites in Southeast Asia, which protect tropical forest habitats. The contiguous landscape relationship of the karst landscape to the wet biodiversity-rich, evergreen forests of Nakai Nam Theun NPA, Vu Quang National Park and Giang Man Watershed is also recognized.

Unlike other karst areas in Vietnam, which generally consist of tower karst or cockpit karst, Phong Nha is probably best described as part of a larger dissected plateau, which also encompasses the Ke Bang and Hin Namno karsts. Most importantly, the limestone is not itself continuous, but demonstrates complex inter-bedding with shales and sandstones. Furthermore, the capping of schists and apparent granites which have probably been thrust over the limestone and is now eroded to a remnant outcrop - together with the complex inter-bedding - has led to a particularly distinctive topography.

On the surface there is a striking range of landscapes, ranging from deeply dissected ranges and plateau to an immense flat floored and enclosed valley – known to karst specialists as a pole. This is essentially a climax form, and indicates that the karst system is an old and mature one. There is evidence of at least one period of hydrothermal activity in the evolution of the karst. The plateau is probably one of the finest and most distinctive examples of a complex karst landform in Southeast Asia and, as already noted, has more in common with the Skocjan karst of Slovenia than with most other Asian karst landscapes.

Criterion (ix)

Criterion (ix): *to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.*

The Property forms a sizable proportion of one of the most notable, large karst landscapes in Southeast Asia, the Phong Nha-Ke Bang – Khammouane Karst Landscape (PNKB-KKL). The PNKB-KKL is extremely large, being some 230 km in length. The PNKB-KKL stretches latitudinally across the mountain crest of the Truong Son Range. The Property itself also represents the most significant and essentially intact karst ecosystem component within the Annamites Range Moist Forests, a Global 200 priority ecoregion whose outstanding biodiversity values are not otherwise represented on the World Heritage List. According to the more recent classification of terrestrial ecoregions by Olson et al, (2001), the property belongs to the Northern Annamites Rain Forests ecoregion, as well as two freshwater ecoregions (Northern Annam and Southern Annam).

The Property and Him Namno karsts may be best described as a large dissected plateau, of high elevation. The generally high altitude influences the climate conditions of the site, which is generally moist throughout the year. The complex inter-bedding with shales and sandstones, combined with the capping of schists and apparent granites which have probably been thrust over the limestone and is now eroded to a remnant outcrop, influences the soil types, including their soil thickness, their texture, their acidity and humus content, which in turn influence the composition and richness of the overlying vegetation. As a consequence, this plateau supports submontane and tropical moist evergreen forests (above 700m), as well as a diversity of epiphytic flora.

The Property itself is situated in the heart of Vietnam's main topographic feature, the Truong Son Range, which runs roughly north to south along the Vietnam-Laos border and into south-central Vietnam, and belongs to the Indochinese Rainforest biogeographical province in the Tropical Humid Forests biome (Udvardy, 2005). This mountain range forms an important barrier between the moist uplands of Vietnam and the drier monsoon forests of Laos; the western portion of the PNKB-KKL lies in a separate biogeographical unit - the Thaiindian Monsoonal Forest province (Udvardy, 2005). Furthermore, the Property traverses the transition zone between the subtropical northern and the tropical southern climates (Sterling & Hurley, 2005).

The Property itself is humid nearly all year round, with onshore winds from the East Sea bringing moist air from September to April. By sharp comparison, the karst landscape situated in Khammouane province has a tropical, monsoonal climate with a distinct wet season and a long, hot, dry season. Significantly, the

drainage area in Phong Nha-Ke Bang flows into the East Sea; meanwhile, the drainage area in Hin Namno National Protected Area flows both into PNKB as well as flows into the Xe Bang Fai River and thence into the Mekong River, one of the most biodiversity rich freshwater river ecosystems in Asia. It is thought that there is an underground mixing of the two drainage areas within the deep interior of the karst landscape, which may shift between high and low water conditions. This zoogeographical convergence across a notable mountain range might be expected to enhance speciation amongst aquatic forms, particularly fish and other subterranean aquatic invertebrates.

Within Indochina there is also a tentative suggestion that ancient climate fluctuations have influenced Vietnam's species diversity. Analyses of overlapping species distribution patterns in mainland Southeast Asia for a number of different taxonomic groups have led scientists to suggest that the Truong Son range served as a refugium for forest-dwelling species during cooler, drier times (Brandon-Jones, 1996; Groves & Schaller, 2000; Rabinowitz, 1997; Surridge et al., 1999; Timmins & Trinh Viet Cuong, 2001). While the focus of this proposition maybe partially based on the biodiversity in the essentially contiguous Nakai Nam Theun National Protected Area, it might also be assumed that this applies to the limestone karst forests of PNKB. This would also a consequence of the climatic variability, and hence niche availability, on each side of the Annamites crest. It is worth noting that there are also proponents who disagree with this theory; Gathorne-Hardy, *et al.* 2002 provides an alternative list of refugia.

This the high species diversity on the karst in Phong Nha-Ke Bang arises from a multitude of ecological niches afforded by complex terrains (e.g., fissured cliffs and extensive caves) and variable climatic conditions. High species endemism also occurs in Phong Nha Ke Bang because of its unique tectonic and eustatic histories and rich soil properties, its unusually high topography, its degree of isolation, and incidences of random events. The karst in Phong Nha-Ke Bang can be divided into surface and cave levels, both of which provide ideal conditions for speciation. On the karst surfaces of the Property, edaphic (soil-related) isolation produces a unique flora that includes many calcicoles (species adapted to growing on limestone). Because of their poor dispersal capabilities, plants and some animals, such as invertebrates, have to adapt to the highly alkaline conditions, the thin soil layers, and the desiccation on porous limestone bedrock. In the caves of Phong Nha-Ke Bang, animals such as the arthropods and fishes must evolve specializations to cope with fluctuating levels of light, water quantity, temperature, humidity, gas concentrations, and organic material (Culver et al. 2000).

Phong Nha-Ke Bang, similar to other karst landscapes, serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research (Ng 1991, Schilthuizen et al. 1999, Schilthuizen et al. 2005a). Case studies are provided from a wide range of taxa to demonstrate the rich evolutionary processes

occurring within the Property.

Many endemic taxa found in the National Park, such as the two similar langurs - the Hatinh Langur (*Trachypithecus hatinhensis*) and its black form (*T. ebenus*), have overlapping but distinct range boundaries. This patchy distribution may be due to climatic, geographic, or ecological barriers, or interspecific competition that prevented effective dispersal out of the patches. These specialised habitats that have fostered evolutionary development in the karst landscape continue to exist, including within caves (troglobitic species), at cave entrances (cave nesting volant vertebrates and the invertebrate communities that they support; low light specialist vegetation species), and within dolines (refugia for relict types dependent on the high humidity and colder air temperatures generated by caves). Among the reptiles, three phonetically similar, cryptic species of bent-toed geckos show niche segregation in microhabitat use.

Cave fauna in particular show the striking effect of isolation on species divergence. A preliminary study of the cave fauna from the Property found at least 41 species of invertebrates among 248 individual specimens collected from the three cave systems surveyed. Only five species were common across the three caves.

Of particular note, several primitive or relict species have been recently discovered in PNKB which have few or no close relatives, including the Saola (*Pseudoryx nghentinhensis*), Annamite Striped Rabbit (*Nesolagus timminsii*), and Laotian Rock Rat (*Laonastes aenigmamus*). The last of these, in particular, has been identified as a 'Lazarus species', the only representative of a lineage (Diatomyidae) that was previously only known from fossils that date to at least 11 million years ago, since the late Miocene. The relative stability and antiquity of subterranean ecosystems also enables relict faunas to persist. The discovery of two species of blind scorpions in Phong Nha-Ke Bang is highly significant, as there are currently only about 20 described cave-dwelling scorpions in the world that exhibit troglomorphic characteristics. The new species, *Vietbocap thienduongensis* and *V. canhi*, were the first troglobitic scorpions found in mainland Asia.

Criterion (x)

Criterion (x): *Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.*

Phong Nha-Ke Bang is the largest national park in Vietnam, and encompasses one of the largest areas of karst in Southeast Asia. The wealth of geologies and topographies in Phong Nha – Ke Bang National Park provides for significant ecosystem diversity in the form of humid tropical forest on limestone, tropical forest on hills,

surface freshwater on limestone areas and subterranean ecosystems, enabling high levels of biological diversity and endemism.

. Forest cover within the national park is very high, at 93.57%; some 83.74% is primary forest, s the highest percentage in any protected area in Vietnam. The park protects significant tracts of limestone, with endemic species including more than 2,000ha of the mono-dominant species of *Cacelodrus rupetris*, and the very rare orchids in abundance under the canopy.

Phong Nha-Ke Bang National Park is located in the middle of central Annamite Mountain Range and is a 200 Global Ecoregions (WWF, 2000), the Greater Annamite Ecoregion. and has one of the greatest concentrations of endemic species in a continental setting. It is also, one the “hottest” forested hotspot. . The property has abundant fauna and flora, including rare and threatened species. Its rugged terrain provides protection for its biodiversity through natural design. It possesses outstanding universal values for science and conservation.

Flora: The property comprises 196 families, 939 genera and 2,744 of vascular plants, and contains 133 threatened species and 427 plant taxa endemic to Vietnam This includes 28 endemic orchid species and a narrow endemic genus (*Oligoceras eberhardtii*).. There are ly, two plant genus endemic to the Park as *Oligoceras* and *Hiepia*.. Many threatened plant species with very high value occur in the Park, includings *Dipterocarpus kerrii* (CR), *Dipterocarpus turbinatus* (CR), *Dipterocarpus hasseltii* (CR), *Hopea chinensis* (CR), *Hopea hainanensis* (CR), *Hopea mollissima* (CR), *Hopea reticulata* (CR), *Hopea siamensis* (CR), *Vatica diospyroides* (CR), *Dalbergia bariaensis* (EN), *Dalbergia mammosa* (EN), *Erythrophleum fordii* (EN), *Hopea pierreii* (EN) and *Vatica cinerea* (EN).

Fauna: Faunal surveys have documented a total of 785 vertebrate species, including 104 threatened species. Twenty four species are park endemics.

Of the total 38 animal endemic species, 24 are endemic to the Park and of the 224 Vietnamese mammal species, 154 mammal species are recorded within the property and 42 species of these species are listed in the Vietnam Red Data Book and 20 species are listed in the IUCN Red List. Three mammal species are endemic to Vietnam. Notable mammal species among these are Hatinh Langur (EN), *Pygathrix nemaeus* (EN), White-cheeked Gibbon Tiger (EN), Saola (CR), Parti-coloured Flying Squirrel (EN), and Dhole (EN).

The rich and diverse rodent species (35) includes a discovery is the Laotian Rock Rat.. The Park is home to 19 small carnivore species, the largest number of small carnivore species found in any

protected area in Vietnam and has been identified as a global priority site for their conservation.

Phong Nha and Ke Bang has been identified by BirdLife International (2005) as two Important Bird Areas of Vietnam. Some 314 bird species out of the national total of 828 species have been recorded in the Park. This property is of particular interest for bird conservation as most species are not at immediate risk.

The property has rich herpetological diversity protecting significant numbers of reptile and amphibian species recorded in Vietnam. Six reptile and two amphibian species are endemic to Vietnam. Recently, six reptiles have been described as new restricted range species.. These species are restricted in range to Phong Nha – Ke Bang National Park.).

The specific characteristics of the rivers and stream in Phong Nha – Ke Bang support fish specialized to karst conditions. In the Park 170 fish species have been recorded, Thirteen species have a restricted range to the Phong Nha – Ke Bang National Park and 13 of them have been recently described as new species..

Initial insect surveys have recorded 369 insect species, including 270 species of butterflies which amounts to about one fifth of the butterfly species recorded in Vietnam.

Recently initial surveys in the caves have recorded 58 invertebrate species of which 2 new species of a new genus *Vietbocap* were described to science.

The Park possesses an outstanding cultural heritage from the Arem, Ruc and Ma Coong people living in the area. These are three of the lowest population tribes in the world.

The buffer zone of over 220,055 has been established to protect the National Park from all threats and unsustainable use. A Buffer Zone Development Plan is in the final stages of development, and is being prepared using a participatory process. The implementation agency is the Phong Nha – Ke Bang National Park.

REQUIREMENTS FOR PROTECTION AND MANAGEMENT

The overall integrity of the property is high and the key threats are effectively mitigated through the current management approach. In the long-term, management of the property focuses on ensuring the integrity of the geological and geomorphologic values, as well as the property's unique biodiversity; strengthening the legislative provisions; carefully monitoring the socio-economic activities within the national park; designing suitable eco-tours and tourism

	<p>developments ; increasing the use of technology in management; undertaking research to gain a more integrated understanding of the property's values; improving the staff capacity and enhancing community awareness and involvement.</p>
<p>Name and contact information of official local institution/agency</p>	<p>Organization: Phong Nha – Ke Bang National Park Management Board</p> <p>Address: Bo Trach District, Quang Binh Province, Vietnam</p> <p>Tel: 84-52-3675150</p> <p>Fax: 84-52-3675021</p> <p>E-mail: pnkb@quangbinh.gov.vn</p> <p>Web address: www.phongnhakebang.vn</p> <p style="text-align: center;">www.quangbinh.gov.vn</p>



Figure 0.1. Phong Nha - Ke Bang Region map

RENOMINATION OF EXPANDING PROPERTY AND INSCRIPTION ON CRITERA (VIII), (IX) AND (X)

1. IDENTIFICATION OF THE PROPERTY

1.a. Country

Socialist Republic of Vietnam

1.b. State, Province or Region

Bo Trach, Minh Hoa and Quang Ninh Districts - Quang Binh Province

1.c. Name of Property

Phong Nha – Ke National Park

1.d. Geographical coordinates to the nearest second

N 17⁰21'12" - 17⁰44'51",
E 105⁰46'33" - 106⁰23'33"

This site is located in the middle of the Annamite Mountain Range to the southwest of the Gianh River, 40km from Dong Hoi City, 500 km from the Capital City of Hanoi, and close to the Vietnam-Laos border to the west. Phong Nha – Ke Bang shares the boundary with Hin Namno Nature Reserve (a tentative natural World Heritage site) to the west, Minh Hoa District to the north, Bo Trach District to the east, and Quang Ninh District to the south. The Park is located in one of the 200 Global Ecoregions (WWF, 2000) and within two of 62 Important Bird Area (BirdLife International 2002)

1e. Maps and plans showing boundary of area proposed for inscription and of any buffer zone

- Map of Phong Nha – Ke Bang NP in Forest Special Use System of Vietnam.
- Zoning map of Phong Nha – Ke Bang NP

1f. Area nominated property (ha) and proposed buffer zone (ha)

- The area of the core zone is 123,326 ha.
- The area of the buffer zone is 220,055 ha.

Table 1: Zoning area of the property

Inscription year	World Heritage Site/core zone (ha)				Buffer zone (ha)
	Total	Strictly Protected area	Regeneration area	Administration area	
Inscribed in 2003	85,754	64,894	17,499	3,411	203,245
Proposed extension	123,326	100,296	19,619	3,411	220,0255

The core zone has been extended from 85,754 ha to 123,326 ha by Prime Minister Decision No 1062/QĐ-TTg dated 05/7/2013. The buffer zone consists of 13 communes that share their land boundaries with core zone. These are Hung Trach, Phuc Trach, Son Trach, Xuan Trach, Tan Trach, Thuong Trach and Phu Dinh (Bo Trach District), Thuong Hoa and Trung Hoa (Minh Hoa District), and Truong Son (Quang Ninh District). The establishment of the Buffer Zone occurred at the same time as the establishment of the National Park. The objectives and functions of the Buffer Zone are identified in the Investment Plan for Phong Nha – Ke Bang NP (2000). The priority management strategy for the establishment of the Buffer Zone was to reduce human impacts on the National Park. Local authorities are responsible for the management of lands and natural resources within the Buffer Zone.

Table 2: Areas of the NP in communes

No.	Commune	Total commune area	In Buffer zone	In Core zone
I	Min Hoa District	98,605.00	30,570.00	68,035.00
1	Dan Hoa	17,697.00	0.00	17,697.00
2	Hoa Son	18,031.00	8,615.66	9,415.34
3	Thuong Hoa	34,634.00	21,954.34	12,679.66
4	Trong Hoa	18,789.00	0.00	18,789.00
5	Trung Hoa	9,454.00	0.00	9,454.00
II	Bo Trach District	167,606.00	92,756.00	74,850.00
6	Hung Trach	9,515.00	0.00	9,515.00
7	Phuc Trach	15,360.00	0.00	15,360.00
8	Son Trach	6,022.00	1,156.00	4,866.00
9	Tan Trach	10,139.00	4,265.00	5,874.00
10	Thuong Trach	36,281.00	30,563.10	5,717.90
11	Xuan Trach	72,572.00	53,301.00	19,271.00
12	Phu Dinh	17,717.00	3,470.90	14,246.10
III	Quang Ninh District	77,384.00	0.00	77,384.00
13	Truong Son	77,384.00	0.00	77,384.00
	Total	343,595.00	123326.00	220,055.00

Source: Prime Minister Decision No 1062/QĐ-TTg dated 05/7/2013 on The Extension of Phong Nha – Ke Bang NP, 2013

2. DESCRIPTION

2a. Description of Property

2a.1 Physical Aspects

Geological development process

The geological structure of the Property expresses the diversity and long development history of the earth's crust. The earth's crust has undergone several main developmental stages (from the Ordovician period up to now) with five tectonic megacycles corresponding with the five geological evolution stages of the world.

1. Late Ordovician - Early Silurian stage (463.9 - 430 Ma)

The earth's crust was broken down and then subsided, forming the terrigenous sediments of the Long Dai formation (O₃-S₁/®) which are distributed in a linear form extending in a NW-SE direction, yielding fossils of Graptolithina of O₃- S₁ age (*Deirastrites convolutus*, *Monograptus halli*, etc.).

2. Middle - Late Devonian stage (D₂ - D₃) (386-362.5 Ma)

The earth's crust subsided for the second time, and the sea expanded. The sediments that evolved were composed of sandstone, siltstone and claystone intercalated with limestone, yielding characteristic fossil assemblages corresponding with the transgressive direction as follows:

Calceola sandalina, *Desquamatia kurbesekiana* (near-shore), *Stringocephalus burtini*, *Emanuella takwanesis*, *E.volhynica*, *Desquamatia ventrycosa*, *Scoliopora denticulata*, *Stachyodes costulata*, *S. lagowiensis* (shallow sea) and *Connodonta* (open sea).

3. Carboniferous - Permian stage (C-P) (362.5 - 245 Ma)

This was the stage when the Carboniferous - Permian limestone massifs were formed. The earth's crust in the Phong Nha-Ke Bang area was broken down for the third time, creating shallow, isometric basins (Marginal sea of continent), and yielding fossils aged from the Lower Carboniferous (*Crinoidea*, *Foraminifera*, and *Tetracoralla*) to the Middle Carboniferous (*Foraminifera*) and finally the Permian (*Foraminifera* and *Tetracoralla*).

4. Meozoic orogenic stage (Triassic, Jurassic, Cretaceous)

The Phong Nha – Ke Bang limestone massif was lifted up above the sea level, and karst, weathering and denudation processes occurred.

5. Cenozoic stage

This was the stage when the mountains and old karstic cave systems of Phong Nha – Ke Bang were formed, with ages respective to the following planation surface levels:

- 1,600–1,400m level: corresponding with the first generation of caves dating from the Oligocene (36 Ma).
- 1,000–800m (in the west) 700–600m (in the east) level: corresponding with the first generation of caves dating from the Miocene (23 Ma to 5 Ma).
- 600–400m and 300–200m levels: corresponding with Pliocene (5 - 1.6 Ma).
- 100–0m level (1.6 Ma to present), corresponding with various interglacial cycles in Quaternary: 100–80m: Gond - Mindel interglacial cycle (more than 800 Ka), 80–60m: Mindel - Riss interglacial cycle (over 300 Ka), 40–25m and 25–15m: Riss - Wurm interglacial cycle (over 70 Ka) and 15–6m: Flandrian transgression (18 - 4 Ka).

The endogenous and exogenous geological processes, which have occurred from the Triassic period up to now, have created the diverse topography and geomorphology in the area:

- Non-karst landforms: low, round-top mountains with planation surfaces, and abrasion-accumulation terraces along the valleys of the Son and Chay Rivers and at the margins of the central limestone massif.
- Transitional landforms, with a complicated alternation between limestone massifs and terrigenous terrain.
- Karst landforms characterized by old tropical karst formed mainly during the Cenozoic period, constituting 2/3 of the area of the site, and forming the largest limestone wilderness in the world (Pierre Gourou, 1966).

Topography

The Property forms a sizable proportion of one of the most extensive karst landscapes in Southeast Asia, according to the website: http://www.sges.auckland.ac.nz/sges_research/karst.shtm which provides maps and statistics of areas of carbonate rock outcrops throughout the world.

The karst landscape comprises the Property itself, the contiguous trans-boundary reserve Hin Namno National Protected Area, which itself is loosely connected to Phou Hin Poon National Protected Area, both latter reserves being located in Lao P.D.R. The karst landscape is gently curved on a south-east - north-west axis, being some 230 km in length and approximately 40 km wide for much of its length. The landscape is more or less a fully connected karst scape, with only a few minor gaps separating the karst landscape.

Phong Nha-Ke Bang itself represents the most significant and essentially intact karst ecosystem component within the Annamites Range Moist Forests, a Global 200 priority ecoregion whose outstanding biodiversity values are not otherwise represented on the World Heritage List. Thus, this Property which is proposed under criterion (ix) has sufficient size to demonstrate the key aspects of processes outlined below that are essential for the long term conservation of the karst ecosystem and the biological diversity which it contains.

The endogenous and exogenous geological processes, which have occurred from the Triassic period up to now, have created the diverse topography and geomorphology in the area:

- + Non-karst landforms: low, round-top mountains with planation surfaces, and abrasion-accumulation terraces along the valleys of the Son and Chay Rivers and at the margins of the central limestone massif.
- + Transitional landforms, with a complicated alternation between limestone massifs and terrigenous terrain.
- + Karst landforms characterized by old tropical karst formed mainly during the Cenozoic period, constituting 2/3 of the area of the site, and forming the largest limestone wilderness in the world (Pierre Gourou, 1966).

Unusual geological features

Unlike other karst areas in Vietnam, which generally consist of tower karst or cockpit karst, Phong Nha is probably best described as part of a larger dissected plateau, which also encompasses the Ke Bang and Hin Namno karsts. Some 28 per cent of the Property is over 700 m in altitude; the highest peak is at 1,213 m. Most importantly, the limestone is not itself continuous, but demonstrates complex inter-bedding with shales and sandstones. Furthermore, the capping of schists and apparent granites which have probably been thrust over the limestone and is now eroded to a remnant outcrop - together with the complex inter-bedding - has led to a particularly distinctive topography.

The caves alone demonstrate discrete episodic sequences of events, leaving behind various levels of fossil passages, some of them very high, and one of these in fact being near the summit of the plateau; formerly buried and now uncovered palaeokarst (karst from previous, very often ancient, periods of solution); evidence of major changes in the routes of underground rivers; changes in the solutional regime; deposition and later re-solution of giant speleothems and unusual features such as sub-aerial stromatolites (speleothems which are shaped by interaction between blue-green algae and the deposition of calcite). In particular, the location and form of the caves suggests that they owe much of their size and morphology to some as yet undetermined implications of the schists and granites which overlay the limestone and this is a remarkable feature in itself. There are also both re-sorted and layered schist-derived sands and granitic gravels in the caves. Then all this is overlain with evidence indicating long periods of human occupation and use.

On the surface there is a striking range of landscapes, ranging from deeply dissected ranges and plateau to an immense flat floored and enclosed valley – known to karst specialists as a polje. This is essentially a climax form, and indicates that the karst system is an old and mature one. There is evidence of at least one period of hydrothermal activity in the evolution of the karst. The plateau is probably one of the finest and most distinctive examples of a complex karst landform in Southeast Asia and, as already noted, has more in common with the Skocjan karst of Slovenia than with most other Asian karst landscapes.

Cave systems

The Phong Nha-Ke Bang caves comprise three known cave systems:

- i. The Phong Nha Cave System, with 21 caves of various sizes
- ii. The Vom Cave System, with 18 caves of various sizes
- iii. The Nuoc Mooc Cave System with eight caves of various sizes The Phong Nha Cave System, with 21 caves of various sizes

In May 2012 the total length of the cave systems in Phong Nha-Ke Bang was 170,000m. Since 1990, over 180 caves have been explored and surveyed. There are many underground rivers within the area and some are visible inside the caves. In some places they appear on the surface where they then flow downstream into the Chay and Son Rivers. Finally they merge with the Gianh River and flow out to sea.

Table 3: The three known Cave Systems in Phong Nha-Ke Bang National Park.

No.	Cave name	Commune	Year of investigation	Length of cave (m)	Altitude of cave (m)
I	Phong Nha cave system			50776	
1	Phong Nha Cave	Son Trach	1990, 1992, 2010	8,821	83
2	Toi cave	Son Trach	1990, 1992	5258	80
3	E cave	Thuong Trach	1994	845	-
4	Cha An cave	Thuong Trach	1992	667	15
5	Thung cave	Thuong Trach	1994	3351	133
6	En cave	Thuong Trach	1994,1997	2490	49
7	Khe Tien cave	Thuong Trach	1994	520	-15
8	Khe Ry cave	Thuong Trach	1997,1999	18902	120(+58-62)
9	Khe Thi cave	Thuong Trach	1994	35	-20
10	Dry Phong Nha cave	Thuong Trach	1994	981	-
11	Lanh cave	Thuong Trach	2001,2005	4718	-101,9
12	Doi cave	Thuong Trach	2001	539	17,3
13	Nuoc Nut cave	Thuong Trach	2003	2205	-
14	So Doi cave	Thuong Trach	2003	1124	
15	Ca cave	Thuong Trach	2001	361	-
16	Cay Nghien cave	Thuong Trach	2005	162	-52,5
17	Lau cave	Thuong Trach	2005	481	22,3
18	Moi cave	Thuong Trach	2005	408,2	-21,2
	Vom cave system			36063	
19	Vom cave	Thuong Trach	1994	15870	145
20	Dai Cao cave	Thuong Trach	1994	1645	28
21	Duat cave	Thuong Trach	1994	3927	45
22	Ca cave	Thuong Trach	1994	1500	60
23	Ho cave	Thuong Trach	1997	1616	46
24	Over cave	Thuong Trach	1997	3244	103(+93-10)
25	Pyging cave	Thuong Trach	1992	845	-94
26	Ruc Croong cave	Thuong Trach	1992	2800	45
27	Klung cave	Thuong Trach	2005	1086	-73,3
28	Kling cave	Thuong Trach	2005	120	-14,7
29	A Cu cave	Thuong Trach	2005	650	42.1 (22.7-19.3)

No.	Cave name	Commune	Year of investigation	Length of cave (m)	Altitude of cave (m)
30	Me Be Con cave	Thuong Trach	2005	733	-49,1
31	Duc cave	Thuong Trach	2005	1335	4,6
32	Hop cave	Thuong Trach	2005	188	5,9
33	Da Trang cave	Thuong Trach	2005	270	-37,6
34	Bin Dap cave	Thuong Trach	2005	64,4	-0,7
35	Doi cave	Thuong Trach	2005	86,4	17,3
36	Nuoc cave	Thuong Trach	2005	83	-17,8
	Nuoc Mooc System			4,424	
37	Nuoc Mooc Resurgence		2009	50	
38	Moi		2005	408	
39	Noise		2003,2009	497	
40	Ha Lau		2009, 2010	1542	
41	Nuoc Lan		2005	965	
42	Noi Bu		2010	159	
43	Salt & Pepper		2005	421	
44	Thuong Valley Sink		2012	382	

Source: The British Royal Cave Association (from 1992 to 2010)
(Howard Limbert, pers comms)

All outstanding values of geology and caves have been inscribed as Criterion (vili) [former criterion (ii)] by UNESCO in 2003.

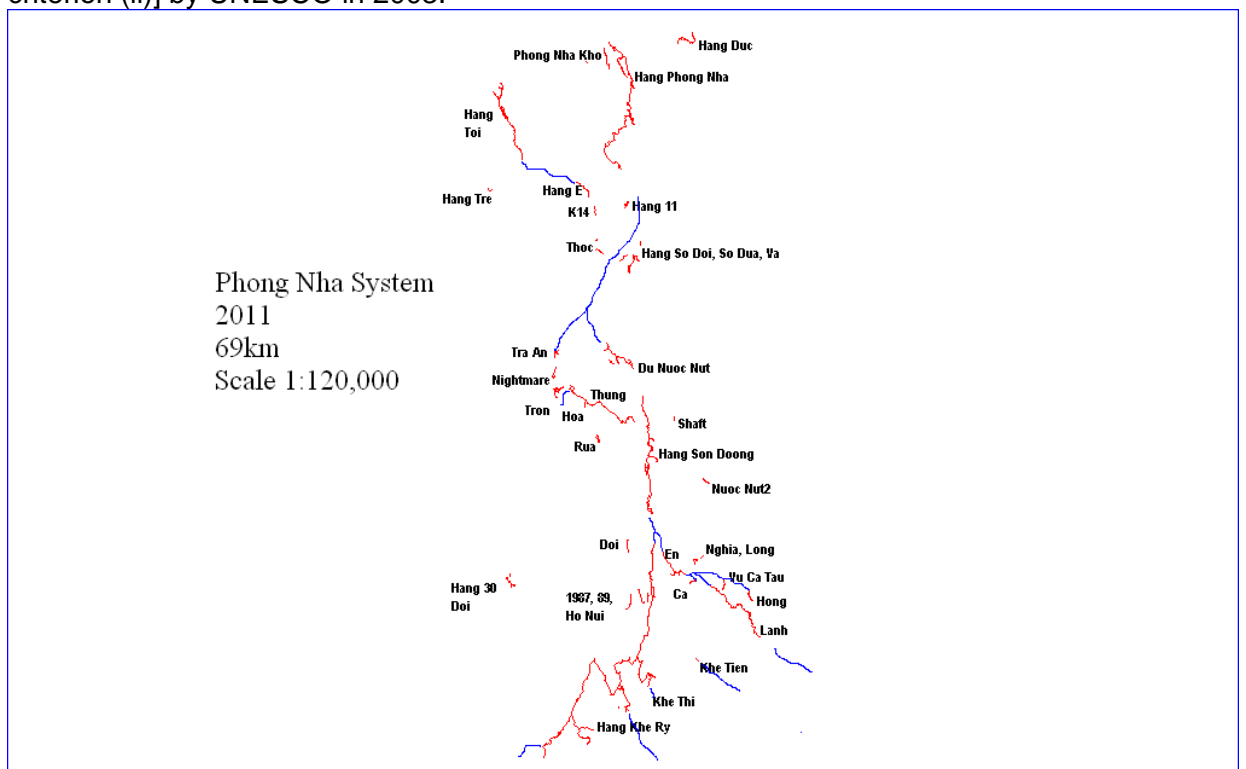


Figure 2.1. Phong Nha cave system (Limbert 2011)

Fossils recorded from different Formations

1. Phong Nha Formation (C_{1t} pn): The Phong Nha Formation [Le Hung, *in* Vu Khuc *et al.*, 1984] has its stratotype in the Phong Nha - Ke Bang area in Bo Trach and Minh Hoa districts, Quang Binh Province. The formation is largely distributed in the My Duc area, Quang Binh Province, and Cam Lo area, Quang Tri Province. The stratotype of the formation, situated in the Phong Nha Cave mouth, is about 100 m thick, composed of:

- (i) Black-grey organic clastic limestone and banded, thin-bedded cherty limestone with interbeds of red-brown shale, 60 m thick, containing Tournaisian fossils, such as: *Crurithyris urii* (brachiopods); *Bisphaera malevkensis*, *Parathurammina suleimanovi*, *Tournayellina beata*, *T. primitiva*, *Chernyshinella glomiformis*, *Septabrunsiina (Septabrunsiina) kingirica*, *S. Septatournayella evoluta*, *S. segmentata* (foraminifers), and *Rotiphyllum* sp., *Fedorowskia phongnhaensis*, *Cobaiphyllum* sp. (Rugose corals);
- (ii) Dark grey, thin- to medium-bedded organic clastic limestone interbedded with chert or containing small chert nests, 15 m thick, containing the coral *Pseudouralinia* aff. *tangpakonensis*, gastropods and brachiopods;
- (iii) Grey cherty shale, cherty limestone, 15 m thick, containing the trilobite *Phillipsia* sp. and ossicles of crinoids.

The Phong Nha Formation has been dated as Tournaisian of Early Carboniferous on the basis of collected rugoses and forams. The formation has a transitional relation upon the Cù Bai Formation and is unconformably overlain by the La Khê Formation (C₁ lk).

2. Bac Son Formation (C_{1v}-P₂ bs): The Bac Son Formation [Nguyen Van Liem, 1978] is composed only of carbonate sediments exposed in the North Vietnam Basin (Bac Bo) and Viet-Laotian Basin. This formation is largely distributed in both West Nghe An, Ha Tinh and Quang Binh areas of the Viet-Laotian Basin. In these areas, this formation has the sedimentary composition and fauna similar to those described in the Bac Bo region that are light grey, thick-bedded to massive limestone containing in abundance from Early Carboniferous, Visean to Middle Permian fossil groups, such as Foraminifera, Crinoids, Tabulates, Tetracorals, and others.. In the Viet-Laotian Basin, the Bac Son Formation rests conformably upon the Phong Nha Formation or La Khe Formation.

The limestone comprising Son Doong cave contains microfossils similar to those of the limestone of Phong Nha and Bac Son Formations in other areas of Vietnam, such as Ha Giang, Lang Son and Quang Ninh Provinces. These fossil groups are sufficiently large to be easily observed with the naked eye, and represent a tourist attraction.

In the one branch near First Doline, on the surface of limestone there are many beautiful fossils of Coral classes. They are single corals, having the horn-shape, about 3cm diameter and 10cm long. According to the preliminary determination of Dr. Nguyen Duc Khoa (member of Vietnam Paleontological and Stratigraphical association) they are representatives of the Tetracoral group, belong to the Family Dibunophyllidae – in the early Carboniferous age.

Hang Son Doong Survey 2010

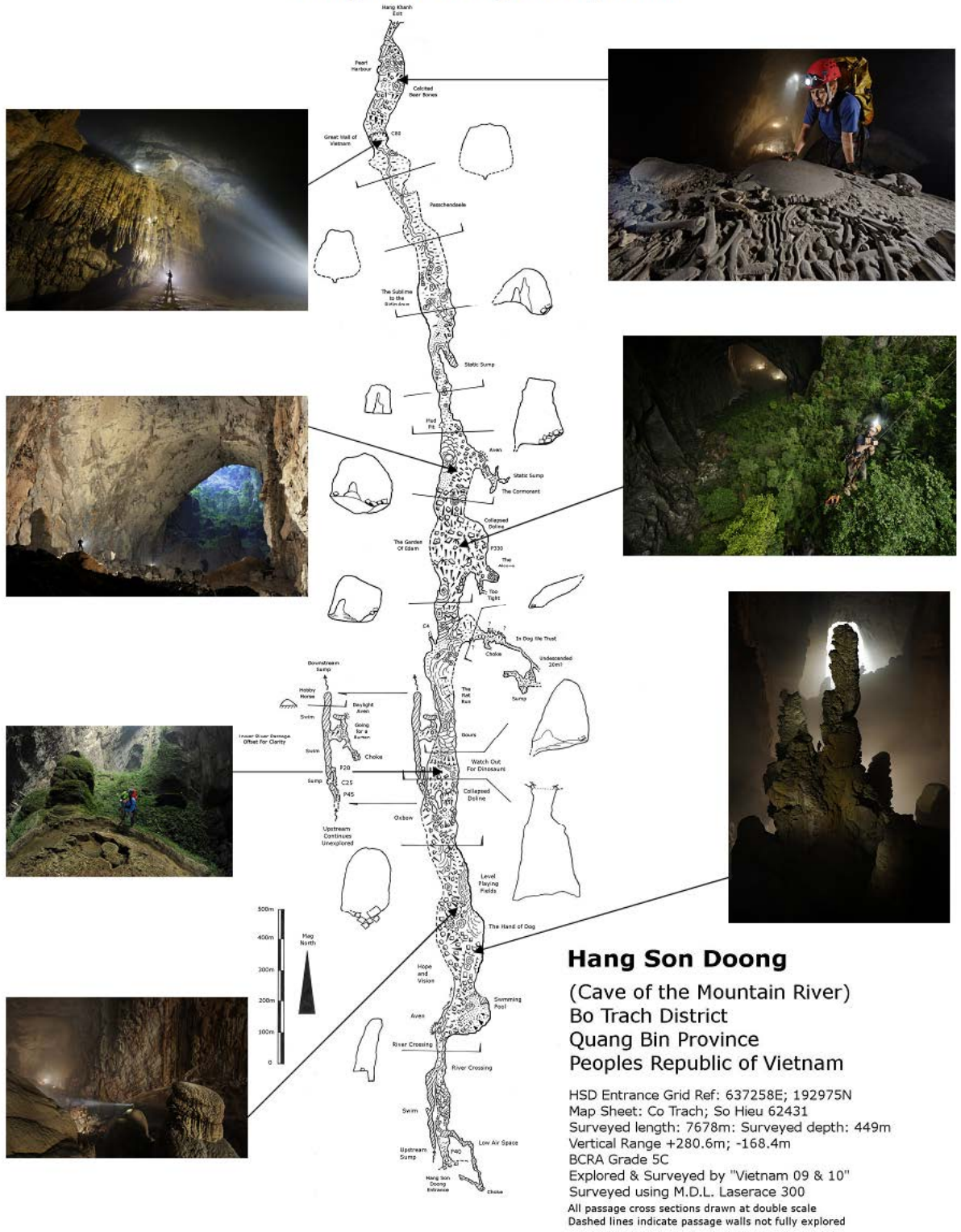


Figure 2.2. Son Dong cave (Limbert 2010)

Soil

In Phong Nha-Ke Bang National Park, different soil types have been formed from the different mother rock. The major soil types are described in Table 4 below:

Table 4: Major soil types and their characteristics in Phong Nha-Ke Bang National Park.

Soil types		Area		Locations	Characteristics
Vietnamese TAXO.	FAO-UNESCO	(ha)	(%)		
Ferralite- Macgalit black soil developed on lime stone (MgFv)	Rhodic/Acric Ferrasols	very small area			Thin soil layer, high stoniness, $pH_{KCl} > 7$, high Ca^{+2} , Mg^{+2} exchange
Red-brown ferralite soil on lime stone mountain (Fv)	Rhodic Ferrasols	9,522	7.2	Eastern regions	Thin to medium soil layer, rich humus, $pH_{KCl} = 5.5-6.0$; high Ca^{+2} , Mg^{+2} exchange
Yellow-red ferralite soil developed on big clay rock, schist & transforming stone (Fs)	Orthic Ferrasols (FRo)	2,805	2.1	South-East regions	Medium to thick soil layer, rather heavy soil texture, 2-4% organic carbon, low cation exchange capacity
Yellow-red soil on Magma acid rock (Fa)	Ferralite Acrisols (Acf)	5,062	3.8	Areas that are sloped	Thin soil layer, rather soft soil texture, 1-1.5% organic carbon, low pH: 4.0-4.7
Light Yellow ferralite soil on sandy stone (Fq)	Ferralite Acrisols (Acf)	591	0.4	Lower parts in Eastern regions	Thin to medium soil layer, soft soil texture, acidic soil $pH < 4.5$, low humus content (0.5-1.5%)
Accumulated silty soil in lime stone valley (Tv) and (T1, T2)	Accumulated silty soil in limestone valley (Tv) and (T1, T2)	4,555	3.4	Limestone valleys	Medium to thick soil layer, soft soil texture, 4-6% humus contents, $pH_{KCl} = 5.5-6.0$; rather good soil
Limestone mountain with juvenile Karst	Limestone mountain with juvenile Karst	108,916	82.3	Widely distribution in the whole region	Strong karst development process, no surface water running, only underground water, strongly divided system, steep, with difficult accessibility
Other soils	Other soils	875	0.7		

Climate

The climatic conditions under which karst evolves is particularly influential in determining the resulting landscape style (Salomon 2006; Ford & Williams 2007); water availability being a key climatic factor in karst evolution.

Rainfall and humidity

Phong Nha-Ke Bang National Park is situated in a region of high rainfall with an average of 2,000 mm to 2,500 mm per year. In particular in the limestone area near the Vietnam-Laos border the rainfall is about 3,000 mm per year. The highest rainfall is concentrated in September, October and November. The rainy season is from July until December (centred on the period from September to November). The rainfall during this period accounts for 88% of the total annual rainfall, though

there is rain in every month and on more than 160 days a year. The dry season is from January until June and the lowest rainfall is in February and March. In spite of low rainfall, the average number of rain days still exceeds more than 10 days per month. Mean annual relative humidity is 83-84%. In the period between September and April, humidity is the highest (85-90%). The period from May until August experiences hot and dry NW winds, resulting in lower humidity.

Temperature

The annual mean temperature is 23 - 25⁰C. The maximum temperature is 41.6⁰C (May 1992). The minimum temperature is 5.5⁰C (January 1993). Annual mean temperature in Phong Nha-Ke Bang National Park is lower than in the coastal area by 1⁰C. The lowest temperature is in December, January and February. The highest temperature is in June, July and August, with a mean temperature greater than 28⁰C. The daily variation in temperature is high: about 10⁰C in summer and 8⁰C in winter.

Wind

In the winter the Site experiences NE winds and sometimes E or SE winds appear. In the summer a SW wind is common, which sometimes changes to a hot and dry NW wind in June, July and August. From September until April there are sometimes E and SE winds that arise from the East Sea.

Table 5: Main climatic data recorded from three meteorological stations situated in close proximity to Phong Nha-Ke Bang National Park.

Climatic descriptors	Tuyen Hoa	Ba Don	Dong Hoi
Annual mean temp.	23.8°C	24.3°C	24.6°C
Lowest temp.	5.9°C (Jan)	7.6°C (Dec)	7.7°C (Jan)
Highest temp.	40.1°C	40.1°C	42.2°C
Annual mean rainfall	2266.5 mm	1932.4 mm	2159.4 mm
No. of rain days per year	159 days	130 days	135 days
Highest rainfall per day	403 mm	414 mm	415 mm
No. of drizzle days per year	18 (Jan, Feb, Mar)	9.3 (Nov)	17 (Dec)
Av. air humidity	84%	84%	83%
Av. minimum humidity	66%	67%	68%
No. of foggy days	47 (Jul, Aug, Sept)	20 (Sept, Oct)	13.8 (Sept, Oct)
Air evaporation	1031 mm	1035 mm	1222 mm
Coordinates			
Latitude	17°50'	17°45'	17°-29'
Longitude	106°08'	106°25'	106°37'
Altitude	25 m	8 m	7 m
Observation period	1961-2000	1960-1999	1900-2000

Hydrology

Phong Nha-Ke Bang National Park is the catchment area of many streams and rivers that feed into the Gianh River, and into the East Sea located only 22 km east of the Property. Of note, the distance between the head of the watershed in the mountains and the sea is exceptionally short. The Site also has a massive karst area; hence, underground rivers are common. Seemingly, there are no large rivers on the topographic map of the area. On the ground, many small streams feed into the Rao Thuong stream. These streams flow into the Chay and Choc Rivers, which create the upper area of the Gianh River. In the rainy season, dry streams become full of water, but after the rains, the water withdraws rapidly to the underground rivers. The flooding season takes place from September to November, with the largest floods occurring in the middle of September and October. Besides the main rain and flood season, rain in May and June sometime cause large floods. In the dry season, from February to August, almost all the streams in Phong Nha-Ke Bang become “dead streams”, resulting in very low water levels in the Chay and Son Rivers. Of hydrological interest, the rainy season and flood season in the rivers and streams is from June to October, which start becoming “dead streams” from November to May.

2.a.2 Physical aspects influencing the ecological processes and biological processes

Size of the Property

The Property forms a sizable proportion of one of the most notable, large karst landscapes in Southeast Asia, the Phong Nha-Ke Bang – Khammouane Karst Landscape (PNKB-KKL), which comprises the property itself, the contiguous trans-boundary reserve Hin Namno National Protected Area, which itself is loosely connected to Phou Hin Poon National Protected Area, both reserves in Lao P.D.R.. Phong Nha-Ke Bang National Park protects 123,326 ha of limestone; Hin Namno National Protected Area (17° 15' 17° 40' E; 105° 43' 105° 09' W), covers 82,000 ha and Phou Hin Poon National Protected Area (17°26'-18°05' N, 104°25'-105°10' E) covers 162,000 ha mostly of sparsely-vegetated karst at 180-850 m.

The site also represents the most significant and essentially intact karst ecosystem component within the Annamites Range Moist Forests, a Global 200 priority ecoregion whose outstanding biodiversity values are not otherwise represented on the World Heritage List. According to the more recent classification of terrestrial ecoregions by Olson et al, (2001), the property belongs to the Northern Annamites Rain Forests Ecoregion, as well as two freshwater ecoregions, namely the Northern Annam and Southern Annam Ecoregions.

Altitudinal Aspects of the Property

The Property and Hin Namno karsts may be best described as a large dissected plateau. Some 28 per cent of the Property is above 700m. The generally high altitude of the Property as a whole influences the climate conditions of the site, which is generally moist throughout the year as a consequence of the prevailing climatic conditions on the Vietnamese side of the Trung Son Range. This plateau supports submontane and tropical moist evergreen forests (above 700m), as well as a diversity of epiphytic flora. This high strata vegetation in turn supports certain taxonomic groups (reptiles and amphibians) which may be more diverse than those found in drier, more seasonal parts of the karst landscape.

Diversity of the Mother Rock and associated Soils

The complex inter-bedding with shales and sandstones, combined with the capping of schists and apparent granites which have probably been thrust over the limestone and is now eroded to a remnant outcrop, influences the soil types, including their soil thickness, their texture, their acidity and humus content. These soil properties will in turn influence the composition and richness of the overlying vegetation.

Trans-boundary climate variations and implications for karst and biodiversity evolution

In the overview for the Annamites Ecoregion it states that “*Climatic conditions often change abruptly along the mountain crest. Lower moisture input from the northeast monsoon winds produces mean annual rainfall in montane habitats of this ecoregion in Laos that are lower at 1,500-2,500 millimeters (mm) and more seasonal than those of the Northern Vietnam Lowland Rain Forests*”.

The Phong Nha-Ke Bang – Khammouane Karst Landscape stretches latitudinally across the mountain crest of the Truong Son Range. The Property itself is humid nearly all year round, with onshore winds bringing moist air from September to April. By comparison, the karst landscape situated in Khammouane Province has a tropical, monsoonal climate with

a distinct wet season and a long, hot, dry season. The province receives over four-fifths of its annual rainfall during the south-western monsoon, from May to October. The average annual temperature lies in the region of 26-29°C. In the hottest month, usually April, daytime temperatures in the lowlands may rise to over 40°C. In the coolest months of December and January, very low temperatures are frequently recorded. This seasonal aridity places severe constraints on karst development, because this climatic condition leads to a scarcity of water, thereby limiting dissolution and permitting other geomorphological processes to dominate landscape evolution.

These marked regional variations in climate also have a significant impact on the ecological and biological processes in the evolution and development of both the karst ecosystem and the evolution of the communities of plants and animals. This will include the vegetation found in the different parts of this Phong Nha-Ke Bang - Khammouane Karst Landscape. It will also have a marked influence on the faunal assemblages both above and below ground, including the freshwater ecosystems.

Probable zoogeographical convergence of the two drainage areas

Significantly, the drainage area in Phong Nha-Ke Bang flows into the East Sea, a marine environment. Meanwhile, the drainage area in Hin Namno reportedly flows out of the karst into the Xe Bang Fai River and thence into the Mekong River, one of the most notable freshwater river ecosystems in Asia. However, the karst drainage areas flowing in opposite directions are not easily delimited. The drainage basins and routes followed by karst water are not obvious, because the drainage paths are largely subterranean. However, it is best to envisage these groundwater divides as zones, because their plan position can shift between high and low water conditions

It is thought that there may be an underground mixing of the two drainage areas within the deep interior of the karst landscape. Anecdotal reports from 2010 and 2011 about water originating in Laos coming out of the PNKB karst have been reported. One of the rangers at the Nuoc Mooc nature trail said that there are times when brown water flows out of the Nuoc Mooc spring when there has been little or no rain on the Vietnam side, but presumably rain on the Lao side. In August 2011, a second report indicated that when there was a lot of flooding in Khammouane but not much rain in PNKB at that time, that brown water and increased flows came out of Nuoc Mooc and other places in the karst. There may be a connection, at least during the height of the wet season, but the current evidence is unclear and largely anecdotal. Some good hydrogeological studies using dye tracing are probably warranted to address this issue. This zoogeographical convergence, if confirmed, might be expected to enhance speciation amongst aquatic forms, particularly fish and other subterranean aquatic invertebrates.

2.a.3 Biological Aspects

Vegetation

Based upon interpretation of remote sensing data on vegetation cover and ground-truthing field surveys conducted by the Forest Inventory and Planning Institute (2005), forest cover within the National Park is 93.57%, of which primary forest covers 83.74%. Consequently, Phong Nha-Ke Bang National Park has one of the highest levels of forest cover within the protected areas of Vietnam.

The diversity of geology, geomorphology and landforms in Phong Nha-Ke Bang National Park have caused corollary of the diversity of ecosystems such as land mountainous ecosystems, karst ecosystems and river ecosystems. Vegetation and habitats have been developed over a long time in these ecosystems. Based upon the FAO (1986) classification

of vegetation types in the Phong Nha-Ke Bang National Park, there are eleven vegetation types and subtypes as follows:

Table 6: The representation of different forest vegetation types in Phong Nha-Ke Bang National Park.

No.	Vegetation types	Code	Area (ha)	%
1	Tropical dense moist evergreen forest with major broadleaf species on limestone above 700 m asl.	1.1	31,464.00	25.51
2	Low tropical montane evergreen forest with major broadleaf species on hills above 700 m asl.	1.2	1061.14	0.86
3	Low tropical montane evergreen forest with major coniferous species on limestone above 700m asl.	1.3	2,145.00	1.74
4	Tropical dense moist evergreen forest on limestone under 700m asl.	2.1	71,512.36	57.99
5	Tropical dense moist evergreen forest on hills under 700m asl.	2.2	11,029.00	8.94
6	Degraded evergreen forest on limestone	2.3	2,300.00	1.86
7	Degraded evergreen forest on hills	2.4	1,731.00	1.40
8	Riverine forest	2.5	154.30	0.13
9	Tree and shrub savanna on limestone	2.6	325.00	0.26
10	Tree and shrub savanna on hills	2.7	1,212.00	0.98
11	Other lands	2.8	392.20	0.32
	Total		123,326.00	100.00

Some major forest types and subtypes are described as follows:

(1) *Tropical dense moist evergreen forest on limestone under 700 m asl.*

This is the most dominant vegetation type (71,512.36 ha or 57.99%), distributed mainly in the north and centre of the Property. This vegetation type covers almost all of the limestone area of Phong Nha-Ke Bang. It comprises many tropical plant species. In the National Park, the most common tree species are *Hopea sp.*, *Hopea mollissima*, *Sumbaviopsis albicans*, *Garcinia fragraeoides*, *Excentrodendron hsienmu*, *Chukrasia tabularis*, *Photinia arboreum*, and *Dyospyros salettii*, and the dominant families at this site are Euphorbiaceae, Meliaceae, Sapindaceae, Elaeocarpaceae, Moraceae, Ebenaceae and Anacardiaceae. Furthermore, three gymnosperm species, namely *Cycas balansae*, *Dacrydium pierrei* and *Nageia fleuryii*, have a scattered distribution in the Phong Nha-Ke Bang area.

The plant species composition of Phong Nha-Ke Bang National Park is rather different from that of other protected areas situated on limestone such as: Cuc Phuong, Ba Be and Cat Ba National Parks. Families such as the Lauraceae and Fagaceae and tree species including *Terminalia myriocarpa*, *Cinnamomum balansae*, *Vatica tonkinensis*, *Castanopsis indica*, *Dysoxylon cochinchinensis*, *Tetrameles nudiflora*, *Parashorea sinensis*, *Schima sp.* and *Albizia lucida* are

common within the national parks mentioned above but have scattered distributions in Phong Nha-Ke Bang.

The typical phenomena of tropical evergreen forests such as buttress, cauliflory, giant trees and woody climbers are easily observed in Phong Nha-Ke Bang. On the rough, steep limestone slopes bushes and small trees with twisted trunks can be seen. Seedlings can only grow in holes and cracks in the limestone that have accumulated soil. In general, natural regeneration in limestone forest is very poor, so it is very difficult for the forest to recover after disturbance.

This forest type is stratified into three layers:

- i. *Canopy layer*: composed of tall trees such as: *Dracontomelum dupperreanum*, *Canarium album*, *Mischocarpus oppositifolius*, *Syzygium cuminii*, *Elaeocarpus dubius*, *Aglaiia gigantea*, *Hopea sp*, *Excentrodendron hsienmu* and *Diospyros salettii*, with an average diameter of 40-50 cm. At the foot of the limestone karst, *Dipterocarpus kerrii*, a species in the Family Dipterocarpaceae (diameter is 70-120cm and height is 30-50m) is rather common. Individual trees of this species often emerge from the canopy layer.
- ii. *Sub-canopy layer*: The dominant tree species are: *Sumbaviopsis albicans*, *Knema corticosa*, *Trigonostemon sp.*, *Glochidion sp.*, *Endospermum sinense* and *Engelhardtia chysolepis*. The size of these trees is smaller (15-18cm in diameter), but the density is high and this sub-layer is continuous.
- iii. *Understorey*: This layer is well-developed in moist areas. The dominant plant species are *Begonia spp.*, *Impatien balsamina*, *Homanolaema aromatica* and *Curculigo spp.* This forest type can be divided in two sub-types as:
 - (a) *Tropical dense moist evergreen forest on lower parts of slopes and valleys along streams of limestones*. Co-dominant species are large specimens of *Dipterocarpus kerrii*, *Dracontomelum dupperreanum*, *Canarium album*, *Mischocarpus oppositifolius*, *Pometia pinnata*, *Diospyros dasyphylla*, *Allospodias lakonensis*, *Pterospermum spp.*, *Aglaiia sp.*, *Chisocheton paniculatus* etc. These forests provide habitat for many animals including herbivorous and carnivorous mammals, primates and pheasants.
 - (b) *Tropical dense moist evergreen forest on ridges and upper parts of limestone*. Co-dominant species are smaller trees such as *Ficus spp.*, *Syzygium cuminii*, *Elaeocarpus dubius*, *Hopea sp.*, *Excentrodendron hsienmu*, etc. These forests provide suitable habitat for leaf monkeys, eagles, hornbills, etc.

(2) *Low tropical montane evergreen forest above 700m asl (with major broadleaf species on limestone)*

This forest type occupies 31,464 ha, or 25.5% of the total area of Phong Nha-Ke Bang National Park. It is distributed on the continuously narrow range of limestone mountains along the Vietnam-Laos border. In Vietnam, almost all the limestone mountains are under 700m asl., except some limestone towers without vegetation, so the occurrence of this vegetation type at Phong Nha-Ke Bang is very unusual. This forest type comprises rough karst towers, the surfaces of which are covered with crevices and holes which accumulate soil. Plants grow inside these crevices and holes and also grow on the limestone walls and cracks. The soil in this area is well-drained and thin, so most trees are slow growing and stunted.

The flora is dominated by the following species: *Cinnamomum litsaefolium*, *Litsea viridis*, *Machilus platicarpa*, *Phoebe lanceolata*, *Quercus glauca*, *Quercus quangtriensis*, *Quercus bambusaefolia*, *Pometia pinnata*, *Excentrodendron hsienmu*, *Syzygium spp.*, *Madhuca*

pasquieri, *Croton yunanensis*, *Knema conferta* and *Ficus spp.*. Gymnosperm species have scattered distributions in this forest type such as *Podocarpus imbricatus*, *Podocarpus neriifolius*, and *Nageia fleuryi*. The dominant families are Lauraceae, Fagaceae, Theaceae and Rosaceae. The understorey includes representatives of the Rubiaceae, Araliaceae, Araceae and Selaginellaceae.

(3) *Low tropical montane evergreen forest above 700m asl (with major coniferous species on limestone)*

A rapid survey (by National Park and FIPI staff in 2006) in small karst areas above 700m asl. at Km No.38, close to Road 20 (1.5 km from Arem village to the SE belonging to Tan Trach Commune, Bo Trach District, ca. 17°23'32"N, 106°12'46"E) Averyanov *et al.* found *Calocedrus rupestris* Averyanov (in Vietnamese Bach xanh nui da). This tree species is mono-dominant to form a forest type of low tropical montane evergreen forest with major coniferous species. The area of this forest type covers over 2,145 ha, or 1.7% of the total area of the Park.

The density of *Calocedrus rupestris* is about 40-50 huge trees per ha. Otherwise some coniferous species such as *Podocarpus neriifolius* and *Dacrydium elatum* are found in this vegetation type. Close to 100 orchid species were also recorded in this forest type.

It is very important to underline and understand that very large samples of primary coniferous forests on rocky limestone are still evident in Phong Nha – Ke Bang National Park. This type of vegetation represents the most endangered kind in the world, which in areas of its primary distribution is completely extinct (Phan Ke Loc *et al.*, 1999). Limestone coniferous forests in this area are composed of sub-endemic and endemic species like the recently discovered *Calocedrus rupestris*. Some of these trees are aged at more than 500 years and represent an absolutely unique plant formation of global importance (Averyanov *et al.*, 2004d). These intact primary forests support extremely high levels of plant diversity which is very rich in numerous endemic species. Some very rare species of orchids such as *Paphiopedilum concolor* and *P. malipoense* occur here in great abundance. There are many areas where they are found intact and include very large colonies.

(4) *Degraded evergreen forest on limestone.*

This vegetation subtype is distributed along Road No.20 and in the area next to the villages in the N and NE of the site. It derived directly from tropical dense moist evergreen forest on limestone, and is influenced by human activity. The available data indicate most of this forest is distributed on not-too-steep or rough topography. The main reasons for forest degradation are medicinal plant collection, wood cutting (mainly valuable timber species and large trees), rattan gathering and illegal hunting. In the areas of minimal impact the forest structure of this vegetation type is similar to that of primary forest, but softwood trees tend to be replaced by hardwood trees.

In heavily impacted areas the shade-demanding tree species of primary forest are replaced by light demanding fast-growing species of secondary forest such as: *Mallotus apiculatus*, *Macaranga denticulata*, *Tetrameles nudiflora*, *Litsea cubeba*, *L. monosepala*, *Commersonia bartramia*, *Alchornea spp.*, etc. The main impacts are war bombs and logging or forest fire.

In the areas that have heavy impacts from exploitation or forest fire, almost all the shade-demanding tree species of primary forest are replaced by light demanding fast-growing species of secondary forest such as: *Mallotus apiculatus*, *Macaranga denticulata*, *Tetrameles nudiflora*, *Litsea cubeba*, *L. monosepala*, *Commersonia bartramia*, *Alchornea spp*, etc.

The main soil in this vegetation type is red-brown ferralite soil, which originates from limestone and is highly fertile. It provides an excellent medium for the development of shrubs and grasses. If the forest is well managed and protected, this vegetation type will return to its original condition.

This vegetation type is divided into three habitats as:

(i) Slightly logged primary closed evergreen seasonal tropical lowland broad-leaved forest on lower part of slopes and along streams of limestone mountains. Co-dominants tree species are *Bischofia javanica*, *Lagerstroemia sp.*, *Dracontomelon duperreanum*, *Anogeissus acuminata*, *Pometia pinnata*, *Ficus sp.*, *Allospodias lakonensis*, *Pterospermum spp.*, *Aglaia sp.*, *Chisocheton paniculatus* and some others.

(ii) Heavily logged with evidence from forest fire. Secondary semi-open evergreen seasonal tropical lowland forest that is a stunted and gnarled mixture of broad-leaved woodlands and scrub on rocky ridges and on upper parts of mountains composed on solid and stratified marble-like highly eroded crystalline limestone. Co-dominant species include *Pistacia cucphuongensis*, *Phyllanthus spp.*, *Memecylon sp.*, *Alstonia quangxiensis*, *Quercus sp.*, *Pittosporum sp.*, scandent shrubs and Apocynaceae.

(iii) Regenerated from heavy impacts and repeatedly deteriorated by war bombs and fire. Secondary semi-open evergreen seasonal tropical lowland broad-leaved woodlands and scrub on rocky ridges and upper parts of mountains composed on solid and stratified marble-like highly eroded crystalline limestone. Co-dominant species include *Streblus ilicifolius*, *Streblus macrophyllus*, *Randia sp.*, *Canthium sp.*, *Rutaceae* and *Gleditsia sp.*

(5) *Tropical dense moist evergreen forest on hills under 700m asl.*

This vegetation type covers a large area (11,029 ha) and is concentrated in three areas. One area is situated in the E of the Site from the stream of Va Village, along Road No.20, to the Rao Thuong River. The second area mainly covers all the mountain range of Co Khu. The third area is distributed in the South East of the Ke Bang area. These areas are characterized by different mother rocks (sandstone, schist and acidic granite) and most of the streams in these areas are on the surface. The soil is red-yellow or yellow ferralite, and of varying thickness.

This vegetation type is dominated by evergreen tree species while deciduous trees, such as *Dipterocarpus kerrii*, *Anogeissus acuminata*, *Pometia pinnata*, *Lagerstroemia calyculata* have scattered distributions. Broad-leaved tree species are dominant in the canopy layer. Gymnosperm species have scattered distributions above 800-900m asl. This vegetation type is rather rich in timber resources because it develops on moist and thick soil. Large trees about 100 cm in diameter are rather common. This vegetation type provides a good habitat for animals. Many animal species with high scientific and economic values can be found, such as Gaur *Bos gaurus*, Muntjak species *Muntiacus spp.*, Sun Bear *Helarctos malayanus*, Sunda Pangolin *Manis javanica*, flying squirrels and many birds.



Large trees in primary forest



Orchids in primary forest



Primary forests



New genus *Hiepia corymbosa*



Limestone habitat of new species
Peliosanthes argenteostriata
Aver. & N.Tanaka

Figure 2.3. Pictures of the vegetation in Phong Nha - Ke Bang

Source: Nguyen Tien Hiep 2012

Flora

The diversity of vegetation and habitat in this area causes high floral biodiversity. The surveys of the botanical diversity of Phong Nha – Ke Bang National Park to date, although less than comprehensive indicate a rich and diverse flora at Phong Nha – Ke Bang. The preliminary list of vascular plant stands at 193 families, 906 genera and 2,651 species.

Table 7: Preliminary list of the vascular plants from different taxa recorded in Phong Nha-Ke Bang National Park

Taxon	Family	Genus	Species
1. Psilotophyta	1	1	1
2. Lycopodiophyta	2	3	17
3. Equisetophyta	1	1	2
4. Polypodiophyta	23	78	202
5. Pinophyta	6	10	19
6. Magnoliophyta	163	846	2503
- Magnoliopsida	134	659	1958
- Liliopsida	29	187	545
Total	196	939	2744

Phong Nha - Ke Bang is located in the middle of Central Vietnam and the flora in Phong Nha – Ke Bang is representative of the transition zone of two big floristic regions: the North and the South. This area is the southern most location of some tree species of the northern floristic region such as: *Excentrodendron tonkinensis*, *Platanus kerrii*, *Dipterocarpus retusus* and *Burcera tonkinensis*, etc. This area is the northern most boundary for some tree species of the southern floristic region, such as *Dipterocarpus kerrii*, *D. grandiflorus*, *Dialium cochinchinensis* and *Pterocarpus macrocarpus*, etc. In particular, the isolated karst area of Phong Nha – Ke Bang National Park, and extending into Laos PDR displays extremely high endemism due to its location, limestone geology, topography and isolation from other karst landscapes. The diversity is greater than the surrounding areas as it is a convergence zone. The site supports 427 plant species that are endemic to Vietnam. In particular, two narrowly endemic genera *Oligocera* and *Hiepia* are confined to the site. In addition there is a coniferous species that is only found in karst areas: *Cacelodus rupetris* (Averyanov). Otherwise 28 orchid species endemic to Vietnam have been found in the Park including *Bulbophyllum hiepii*, *Cleisostoma simondii*, *Cymbidium atropurpureum*, *Paphiopedilum dianthum*, *Paphiopedilum malipoensec*, *Biermannia calcarata*, *Bulbophyllum insulsum*, *Bulbophyllum macraei*, *Bulbophyllum tixieri* Seidenf., *Chiloschista trudelii*, *Cleisostoma melanorachis*, *Epigeneium labuanum*, *Eria boniana*, *Eria gagnepainii*, *Eria globulifera*, *Eria thao*, *Liparis averyanoviana*, *Liparis petraea*, *Liparis pumila*, *Malleola seidenfadenii*, *Micropera poilanei*, *Panisea albiflora*, *Phalaenopsis gibbosa*, *Pteroceras simondianum*, *Thrixspermum fleuryi*, *Anoectochilus calcareous*, *Mischobulbum longiscapum* and *Rhomboda petelotii*.

Table 8: Different plant geography elements found in Phong Nga-Ke Bang National Park.

No.	Geography element	Number of species
1	Vietnam endermism	427
2	Tonkin endemism	151
3	Central Vietnam endemism	164
4	South endemism	46
5	Vietnam endemism	66
6	Indochina endemism	535
7	Shouthern China endemism	172
8	Hunan, Taiwan, Philippines element	62
9	Himalaya element	7
10	India element	243
11	Malaysia element	58
12	Indonesia-Malaysia element	38
13	Indonesia-Malaysia-Ocean Australia element	14
14	Tropical Asia element	305
15	Palaeo-tropical element	33
16	New tropical and circum tropical element	31
17	East Asia element	36
18	Asia element	45
19	Northern temperate element	1
20	Wide disposing element	19
21	Exotic and migrant element	29

The site conditions are important habitats for high value and threatened plant species. Among the recorded plant list, 116 threatened species are listed in the Vietnam Plant Red List (1996) and the IUCN Red List (2006).

Fauna

The extensive ecosystems with a high percentage of forest cover in the National Park are excellent habitats for a diversity of animals. Results of faunal surveys from 1991 to 2012 and most recently in 2011 have identified 813 vertebrate species, comprising of 154 mammal species, 117 reptile and 58 amphibian species, 314 bird species and 170 fish species. Discoveries of further species are highly likely based on the steady upward trend

since the 1991 survey. The Park is an outstanding refuge for biodiversity for both Asia and the world.

Table 9: List animal species in Phong Nha-Ke Bang National Park.

No.	Taxon	Order s	Families	Species
1	Mammal	10	32	154
2	Bird	15	51	314
3	Reptile	2	16	117
4	Amphibian	1	8	58
5	Fish	10	34	170
	Total	38	141	813

The fauna of Phong Nha – Ke Bang is representative of the northern Annamite Mountain Range and is closely related to the Indo-Malaya fauna. The property is a centre of animal endemism. Among species recorded at the site, there are 41 known animal species that are endemic to Vietnam and the Annamite Mountain Range.

Table 10: Endemic vertebrates recorded in Phong Nha-Ke Bang National Park.

No.	Taxon	Endemic species to Annamite Range	Endemic species to NP
1	Mammal	9	3
2	Bird	4	3
3	Reptile	6	5
4	Amphibian	2	-
5	Fish	17	16
	Total	38	24

Among the recorded animal species, about 88 species were listed in the Vietnam Red Data Book (2007), 73 species are listed in the 2011 IUCN Red List and 41 species are endemic to Vietnam (Nguyen Xuan Dang, 2011).

Table 11: List of threatened animal species in Phong Nha-Ke Bang National Park.

No.	Taxon	Threatened species	VN Decree N° 132	Vietnam Red Data Book (2006)	IUCN Red List 2012
1	Mammal	48	42	41	20
2	Bird	19	17	8	-
3	Reptile	26	14	20	11
4	Amphibian	7	-	4	4
5	Fish	4	-	3	1
	Total	104	73	76	35

Notable characteristics of the Phong Nha–Ke Bang fauna:

The fauna of Phong Nha – Ke Bang until relatively recently was even more diverse. Hunting pressure has significantly reduced populations of larger mammals and the status of these species in the Park is unclear and thought to be declining. The Park still provides significant habitat for the restoration of existing populations, either through natural recovery or re-introductions.

The numerous caves, abundant food sources and low human population density provide good habitats for several primate species. Nine species and sub-species of primates have been recorded at the site, which equates to 43% of the total number of Vietnam's primate species. All these species are listed in Decree 32/2006/ND-CP dated 30 March 2006 of the Council of Ministers, and all of them are listed in the Vietnam Animal Red List (2012). The site supports four Primate taxa endemic to the Annamites including Hatinh Langur (*Trachypithecus francoisi hatinhensis*) and its black form (*T. ebenus*), Red-shanked Douc langur (*Pygathrix nemaeus*), White-cheeked Gibbon (*Hylobates leucogonis*), two species of Slow Loris (*Nycticebus coucang*), and Pygmy Loris (*Nycticebus pygmaeus*) which is endemic to Indochina. The property supports almost all of the total world population of Hatinh Langur and it is the most abundant species in the park. The extension area of National Park also has an abundance of monkeys with 7 species: Stump-tailed macaque, Assamese macaque, Rhesus macaque, Pig-tailed macaque, Hatinh langur, Black langur and Red-shanked douc monkey. This karst area with many caves supports the largest number of bat species in Vietnam. There are 46 bat species in the park making up 43% of the total number of bat species in Vietnam. The park has great potential for bat research and conservation.

This karst area with many caves supports the largest number of bat species in Vietnam. There are 46 bat species recorded in the site equivalent to 43% of the total number of bat species in Vietnam. The National Park has great potential for bat conservation. The caves also support endemic cave species of fish, the recently discovered cave scorpions and 58 cave invertebrates species showing isolation, with only five species occurring in all three caves.

The cave survey (2012) of invertebrates shows potential for a high endemic regional fauna species. There were 730 individuals including 58 species-groups belonging to 7 classes, 22 orders identified in 21 caves identified so far. The survey confirmed two new species and one new genus of scorpion (*Vietbocap*). Many of the new species identified in the cave survey have yet to be described.

Mammals

Among the 139 recorded mammal species, there are 46 species listed in the Vietnam Mammal Red List (2003) and 30 species listed in the IUCN Red List of Threatened Species. In particular there are 9 mammal species endemic to the Annamite Mountain Range and 3 species that are endemic to Vietnam.

Table 12. Endemic mammal species to Vietnam found in Phong Nha-Ke Bang National Park.

TT	Scientific name	English name	Endemic to NP	Endemic to Annamites	IUCN Red List
1	<i>Trachypithecus hatinhensis</i>	Hatinh Langur	+	+	EN
2	<i>Trachypithecus elenus</i>	Black Langur	+	+	
3	<i>Pygathrix nemaeus</i>	Red-shanked Douc langur		+	EN
4	<i>Nomascus siki</i>	Southern White-cheeked Gibbon		+	EN
5	<i>Pseudoryx nghetinhensis</i>	Saola		+	CR
6	<i>Megamuntiacus vuquangensis</i>	Large-antlered Muntjac		+	EN
7	<i>Muntiacus truongsonensis</i>	Annamites Muntjac		+	DD
8	<i>Laonastes aenigmamus</i>	Laotian Rock Rat	+	+	EN
9	<i>Nesolagus timminsii</i>	Annamites Striped Rabbit		+	DD

Status of some threatened species

- (i) *Sao La - Pseudoryx nghetinhensis* (CR). A skull specimen has been recorded in Hoa Son Commune, Minh Hoa District. Up to now this specimen is kept by a household in Hoa Son Commune.
- (ii) *Gaur - Bos gaurus* (EN). Two herds of Gaur occur in the Site, one of them on U Bo Mountain while the other on Ba Zang Mountain. The total number of Gaur is estimated at about 10-12 animals.
- (iii) *Tiger - Panthera tigris* (EN). From 1997 to 1998 tigers were observed by local people in Tan Trach Commune, Bo Trach District (Nguyen Xuan Dang et al. 1999). Recently Tiger footprints have been recorded on Co Khu Mountain and near the Doong Village.
- (iv) *Clouded Leopard - Neofelis nebulosa* (EN). Previous surveys have recorded in PNKB NP World Heritage Site. The 2011 survey found putative footprints of the Clouded Leopard in both Thuong Hoa and Hoa Son survey areas on day time transects, indicating that it may be present in the national park extension area. Further one possible track of a Leopard was found on a transect in Ma Rinh, Hoa Son.
- (v) *Red-shanked Douc Langur - Pygathrix nemaeus* (EN). This species is the third most common primate species in the Park (Hatinh Langur and Assamese). The

population of this species was estimated to be about 455 to 2,137 individuals in 2007 (Haus et al. 2007) although it is thought this number is greatly reduced due to hunting pressure in recent years.

- (vi) *Hatinh Langur - Trachypithecus laotum hatinhensis* (EN). Estimated 1,670 to 2,610 Hatinh Langurs were recorded in the Park in 2009 (Haus et al 2009). In the 2011 survey it was found to be the most abundant primate species in the park. Recently this species has been observed on the karst cliffs in the Park and along the Ho Chi Minh Trail.
- (vii) *Southern White-cheeked Gibbon* (EN). Estimated 37 heds including about 101 individuals were recorded in U Bo Mountain of the Park in 2009 (Le Trong Dat et all. 2009). The Park has about 50 herds thar is the largest population of this species in Vietnam (Nguyen Xuan Dang, 2013)
- (viii) Macaques being more abundant. In 2009 this population was estimated to be about 1,316 (± 871) individuals (Haus *et al.* 2009). And the 2011 survey findings aligned with 2009 results.

Rodents

Rodent fauna in Vietnam is rich and diverse. Survey results of 2011 showed that rodent fauna in PNKB NP is quite rich and diverse. To date (2011), 35 rodent species of 20 genera and 5 families have been recorded in PNKB NP. These account for 50% of total species number, 69 % of total genera number and 100% of total family number of all the rodents in Vietnam. Only 5 species of insectivores have been recorded in PNKB NP.

New family discovery

During the 2011 survey, 4 specimens of a mysterious living-fossil, the "Kne-cung" or Laotian Rock Rat (*Laonastes aenigmamus*), were collected. This is the first record of this species in the Park, and also the first record of this species in Vietnam. With this record, not only is one more new species (*Laonastes aenigmamus*) added to the mammal checklist of Vietnam, but also a new genus (*Laonastes*) and a new family (*Diamtomyidae*). More importantly, this record increases the chances for conservation of this species. It was confirmed in Thuong Hoa Commune and reported to exist also in Hoa Son Commune. Both these communes have a strong tradition of trapping rats for food. "Kne-cung" is seriously threatened by snaring activities of local residents. It is probable that the species may also occur in other limestone areas of the park, having the same habitat and being contiguous.

Small Carnivore and Loris

Survey results of 2011 obtained evidence for the presence of 2 loris species, 9 species of mustelids, 9 species of viverrids, and 2 species of herpestids in PNKB NP. However, the team was only able to directly confirm (through direct observation and/or specimen collection) the presence of 13 of these 22 species. The presence of other species was confirmed through interviews and critically reviewing records from previous surveys

The presence of 19 small carnivore species indicates that PNKB NP is home to the highest number of small carnivore species found in any protected area of Vietnam. PNKB NP should therefore be seen as one of the most important areas for small carnivore conservation in Vietnam. North Vietnam itself is identified as one of the world's priority sites for small carnivore conservation (Schreiber et al., 1989).



Red-shanked Douc langur
(Photo: Ha Thang Long, 2011)



Ha tinh langur
(Photo: Ha Thang Long, 2011)



Chrotogale owstoni and *Hylopetes alboniger* (Photo: Nguyen Manh Ha)



Laonastes aenigmamus
(Photo: Nguyen Xuan Dang)

Figure 2.4. Pictures of mammal species in Phong Nha - Ke Bang

Birds

Phong Nha – Ke Bang supports 314 species in 51 families and 15 orders, including 8 species listed in the Vietnam Red Data Book. Five species are endemic to the Annamite Range, of which 3 species are endemic to the eastern region of the Annamite Range (Central Vietnam).

Phong Nha-Ke Bang NP lies within most of two Important Bird Areas (IBAs): Phong Nha (VN039) and Ke Bang (VN040) which were identified by BirdLife International (2002). The two IBAs support four of seven restricted range species of the Annamese Lowlands EBA (see Table X)

Table 13. Restricted range species of the Endemic Bird Area

No.	Common Name	Scientific Name	VN039	VN040
1	Crested Argus	<i>Rheinardia ocellata</i>	X	X
2	White-cheeked Laughingthrush	<i>Garrulax vassali</i>		
3	Short-tailed Scimitar Babbler	<i>Jabouilleia danjoui</i>	X	X
4	Sooty Babbler	<i>Stachyris herbeti</i>	X	X
5	Grey-faced Tit Babbler	<i>Macronous kelleyi</i>		X

Notes: X = confirmed to regularly occur in significant numbers

Of the total 159 species recorded in the extension area, 143 and 121 species were recorded in Thuong Hoa and Hoa Son respectively. Composition of bird communities recorded from the two survey locations are very similar to each other because they are within the same limestone landscape between old Park and extension area.

Of the total number of species confirmed during the 2011 survey, five species are considered near-threatened at a global level (BirdLife International 2011) (Table 13). Additionally, two other species are considered Vulnerable at a national level (Anon 2007). Three of the seven Restricted-range species which define the Annamese Lowlands Endemic Bird Area, were recorded from the extension area (Table X above).

Table 14: Globally and nationally threatened and Near-threatened bird species recorded during the field survey

No.	Common name	Scientific name	IUCN 2012	VN-RDB 2006
1	Chestnut-necklaced Partridge	<i>Arborophila charltonii</i>	NT	
2	Blyth's Kingfisher	<i>Alcedo hercules</i>	NT	
3	Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	NT	VU
4	Short-tailed Scimitar-babbler	<i>Jabouilleia danjoui</i>	NT, RRS	
5	Sooty Babbler	<i>Stachyris herberti</i>	NT, RRS	VU
6	Grey-faced Tit Babbler	<i>Macronous kelleyi</i>	RRS	

Notes: Global status: NT = Near Threatened as per BirdLife International (2011). National status: R = Rare; V = Vulnerable; VU = Vulnerable as per Anon. (2007); RRS = Restricted-range Species



Stachyris herberti in limestone habitat in Thuong Hoa commune



Phylloscopus calciatilis in limestone habitat



Alcedo hercules, a new record species to Phong Nha - Ke Bang NP in tropical evergreen broad leaf and river habitats

Figure 2.5. Pictures of the Birds in Phong Nha - Ke Bang

Source: Ngo Xuan Tuong 2012

Reptiles and Amphibian

Results of successive surveys: by the Forest Inventory and Planning Institute (1991, 1999), RAS/WWF project (1997), and Cologne University (2005) and the 2011 survey in Phong Nha – Ke Bang have recorded 175 species of the herpetofauna of PNKB NP and adjacent areas (117 species of reptiles and 58 species of amphibians). The research team discovered eight new records for the herpetofauna of PNKB NP and adjacent areas: Red-tailed Ground Skink *Scincella rufocaudata*, Annam Keelback *Parahelicops annamensis*, Chinese Habu *Protobothrops mucrosquamatus*, Big-eared Toad *Ingerophrynus macrotis*, Zhushihe Mountain Toad *Ophryophryne pachyproctus*, Chapa Frog *Babina chapaensis*, Tonkin Bug-eyed Frog *Theلودerma corticale*, and Taylor's Bug-eyed Frog *Theلودerma stellatum*. Remarkably, the specimen of caecilian collected in Hoa Son Commune may represent a new species (*Ichthyophis* sp.).

Among 175 species recorded from the enlarged PNKB NP, 30 species are globally or nationally threatened: 24 species listed in the Vietnam Red Data Book (2007), 15 species listed in the IUCN Red List (2012), 14 species listed in the Governmental Decree No. 32 (2006), and 14 species listed in the appendices of CITES (2011). Although the number of threatened species is high (about 20% of the total species), they are very rare in the wild.

New species discovered from PNKB NP and adjacent area

During the last decade, Phong Nha – Ke Bang National Park has been known as a cradle of the new discoveries with 16 new species and one new subspecies have been described since 2000, comprising one species of amphibians, seven new species of lizards, and seven species and one subspecies of snakes, and one species of turtle. Many of them were described by Assoc. Prof. Dr. Thomas Ziegler and his working group from Cologne Zoo, who discovered 13 new species and one new subspecies from the enlarged national park area.



Ichthyophis sp. New species



Protothrops cornutus



Sphenomorphus tetradactylus



Gekko scientiadventura



Thạch sùng ngón phong nha kẻ bàng
Cyrtodactylus phongnhakebangensis



Ếch cõy sần bắc bộ *Theلودerma corticale*

Figure 2.6. Reptiles and Amphibians in Phong Nha-Ke Bang

Source: Nguyễn Quảng Trường 2012

Table 15. List of the new Amphibian and Reptile species discovered from Phong Nha – Ke Bang NP

TT	Common name	Scientific name
	Amphibians	Amphibia
1.	Quyêt's Treefrog	<i>Gracixalus quyeti</i> (Nguyen, Hendrix, Boehme, Vu & Ziegler, 2008)
	Lizards	Sauria
2.	Hidden Bent-toed Gecko	<i>Cyrtodactylus cryptus</i> Heidrich, Roesler, Vu, Boehme & Ziegler, 2007
3.	Phongnhakebang Bent-toed Gecko	<i>Cyrtodactylus phongnhakebangensis</i> Ziegler, Roesler, Hermann & Vu, 2002
4.	Roesler's Bent-toed Gecko	<i>Cyrtodactylus roesleri</i> Ziegler, Nazarov, Orlov, Nguyen, Vu, Dang, Dinh & Schmitz, 2010
5.	Phongnhakebang Gecko	<i>Gekko scientiaventura</i> Roesler, Ziegler, Vu, Hermann & Boehme, 2005
6.	Boehme's Supple Skink	<i>Lygosoma boehmei</i> Ziegler, Schmitz, Heidrich, Vu & Nguyen, 2007
7.	Four-fingered Skink	<i>Sphenomorphus tetradactylus</i> (Darevsky & Orlov, 2005)
8.	Nogge's Water Skink	<i>Tropidophorus noggei</i> Ziegler, Vu & Bui, 2005
	Snakes	Serpentes
9.	Bourret's Cat Snake	<i>Boiga bourreti</i> Tillack, Ziegler & Le, 2004
10.	Thanh's Reed Snake	<i>Calamaria thanhi</i> Ziegler & Le, 2005
11.	Ruhrstrat's Wolf Snake	<i>Lycodon ruhstrati abditus</i> Vogel, David, Pauwels, Sumonth, Norval, Hendrix, Vu & Ziegler, 2009
12.	Andrea's Keelback	<i>Amphiesma andreae</i> Ziegler & Le, 2006
13.	White-lipped Keelback	<i>A. leucomystax</i> David, Bain, Nguyen, Orlov, Vogel, Vu & Ziegler, 2007
14.	Smith's Snake	<i>Fimbrios smithi</i> Ziegler, David, Miralles, Doan & Nguyen, 2008
15.	Sievers' Three Horn-scaled Pitviper	<i>Protobothrops sieversorum</i> (Ziegler, Herrman, David, Orlov & Pauwels, 2000)
16.	Truongson Pitviper	<i>Viridovipera truongsonensis</i> (Orlov, Ryabov, Bui & Ho, 2004)
	Turtles	Testudines
17.	Cyrlornated Box Turtle	<i>Cuora cyclornata</i> Blank, McCord & Le, 2006

Notes: Summarized after Nguyen et al. (2009), Ziegler & Vu (2009), Ziegler & Nguyen (2010), and Ziegler et al. (2010).

Fish

Phong Nha – Ke Bang is the centre of endemism for fish species. Among the fish species recorded in the site 15 species are endemic to Vietnam and one species *Hemibagrus centralus* is of high economic value.

In PN-KB national park the survey undertaken in 2006 concluded that 162 fish species have been identified belonging to 85 genus, 34 families and 11 orders. Among them, 19 immigrant sea species; 8 species occurred in caves; 10 new species were found out for science. This freshwater fish fauna in Vietnam has been researched the most thoroughly.

Table 16: The comparison of freshwater fish biodiversity of PN-KB with this of Vietnam

	Area (km ²)	Species number	In comparison with Vietnam's
Vietnam	330,991	544	
PN-KB and surrounding areas	4,000	162	More than 25 times
KB limestone mountains and surrounding areas (include Laos)	10,000	327	More than 20 times

Although geographical areas are located in the same basin of Son river, they are isolated in the underground rivers so that became different faunae with different compositions of fish species (see Table 16)

According to Nguyen Thai Tu, a fish specialist (2006), reasons for typical fish endemism are as follows:

The underground rivers divide the fresh water ecosystems into many small ecological components with different composition of fish species. This creates good conditions for the formation of many narrow endemic species.

Phong Nha – Ke Bang is close to the sea and many sea fish species migrate upstream.

Phong Nha – Ke Bang is located in the N of the Annamite Range where there are many zoogeographical factors such as South China factor, Mekong factor, immigration factors of the sea and native factors.

Table 15. Endemic fish species recorded in Phong Nha - Ke Bang National Park

No.	Name of species	Endemic to Vietnam	Endemic to East Annamite
1	<i>Aspidoparia viridis nsp.</i>	+	+
2	<i>Yaoshanicus macrocorpus nsp.</i>	+	+
3	<i>Rasborinus albus</i> Tu	+	+
4	<i>Rasborinus hautus</i> Tu	+	+
5	<i>Acheilognathus lamus</i> Tu	+	+
6	<i>Acrossocheilus albus nsp.</i>	+	+
7	<i>Acrossocheilus benasi vuha</i> Tu	+	+
8	<i>Acrossocheilus carongensis nsp.</i>	+	+
9	<i>Acrossocheilus fissirostralis nsp.</i>	+	+
10	<i>Acrossocheilus lineatus nsp.</i>	+	+
11	<i>Acrossocheilus longianalis nsp.</i>	+	+
12	<i>Acrossocheilus macrosquamatus</i> (Yen)	+	+
13	<i>Carassioides phongnhaensis nsp.</i>	+	+
14	<i>Cyprinus melanes</i> (Yen)	+	+
15	<i>Glyptothorax interspinalum</i> Yen	+	+
16	<i>Percottus tonkinensis</i> Yen	+	+



Lobocheilos sp. (new recorded)



*Schistura hungdang*1. (new recorded)



*Schistura hungdang*2. (new recorded)



Bostrychus sinensis (Redlist CR)



Konosirus punctatus (Redlist VU)



Anguilla marmorata (redlistVU)



Clupanodon thrissa (Redlist EN)



Hypsibarbus annamensis (Redlist)

Figure 2.7. Fishes in Phong Nha - Ke Bang
Source: Nguyen Thai Tu and Ho Anh Tuan 2012

Insects

Results of insect surveys in the Park have recorded 369 insect species of 40 families and 13 orders, including two species of *Mantis religiosa* and *Lamproptera curius* listed in the Vietnam Animal Red List

Butterflies surveys have recorded 270 species corresponding to one fourth to one fifth of the total number of species recorded in Vietnam. All butterfly families listed in Vietnam occur in Phong Nha – Ke Bang NP. *Celaenorrhinus incestus* and *Halpe pethethronix pagaia* belong to Hesperidae and are described as new species to science by A.L. Devyatkin in 2000.

Insect fauna in Vietnam is relatively poorly studied. Future studies will discover more insect species.

2.a.4 Significant on-going ecological and biological processes in the evolution of biodiversity in PNKB-KKL

Unique Physical factors

As described in Section 2.1.2., there are a number of physical factors that influence the rich biodiversity in Phong Nha-Ke Bang National Park. The Property forms a sizable proportion of one of the most notable, large karst landscapes in Southeast Asia, the Phong Nha-Ke Bang – Khammouane Karst Landscape (PNKB-KKL). The Property and Hin Namno karsts may be best described as a large dissected plateau. The generally high altitude of the Property as a whole influences the climate conditions of the site, which is generally moist throughout the year as a consequence of the prevailing climatic conditions on the Vietnamese side of the Truong Son Range. This will encourage evergreen forests, as well as a diversity of epiphytic flora and certain taxonomic groups (reptiles and amphibians) which may be less diverse in drier, more seasonal parts of the karst landscape. The complex inter-bedding with shales and sandstones, combined with the capping of schists and apparent granites will influence the soil properties, which will in turn the composition and richness of the overlying vegetation. The Phong Nha-Ke Bang – Khammouane Karst Landscape stretches latitudinally across the mountain crest of the Truong Son Range, which itself shows strong variability in climatic conditions. These marked regional variations in climate also have a significant impact on the evolution of the communities of plants and animals. Finally the Phong Nha Ke Bang drainage systems – linked to the East Sea, may converge with Hin Namno drainage system in to the Mekong. However, this hydro-geological confluence needs further investigation, and confirmation.

Biogeographical Location of the Property

The Property itself is situated in the heart of Vietnam's main topographic feature, the Truong Son Range, which runs roughly north to south along the Vietnam-Laos border and into south-central Vietnam, and belongs to the Indochinese Rainforest biogeographical province in the Tropical Humid Forests biome (Udvardy, 2005). This mountain range forms an important barrier between the moist uplands of Vietnam and the drier monsoon forests of Laos; the western portion of the PNKB-KKL lies in a separate biogeographical unit - the Thaiindian Monsoonal Forest province (Udvardy, 2005). Furthermore, the Property

traverses the transition zone between the subtropical northern and the tropical southern climates (Sterling & Hurley, 2005).

Biodiversity arks

The high species diversity on the karst in Phong Nha-Ke Bang arises from a multitude of ecological niches afforded by complex terrains (e.g., fissured cliffs and extensive caves) and variable climatic conditions. High species endemism also occurs in Phong Nha Ke Bang because of its unique tectonic and eustatic histories and rich soil properties, its unusually high topography, its degree of isolation, and incidences of random events. The karst in Phong Nha-Ke Bang can be divided into surface and cave levels, both of which provide ideal conditions for speciation. On the karst surfaces of the Property, edaphic (soil-related) isolation produces a unique flora that includes many calcicoles (species adapted to growing on limestone). At the same time, the vegetation supports animal species somewhat different from those in non-karstic areas, such as in the contiguous protected areas, Nakai Nam Theun National Protected Area, Vu Quang National Park and the Giang Mann watershed. Because of their poor dispersal capabilities, plants and some animals, such as invertebrates, have to adapt to the highly alkaline conditions, the thin soil layers, and the desiccation on porous limestone bedrock. In the caves of Phong Nha-Ke Bang, animals such as the arthropods and fishes must evolve specializations to cope with fluctuating levels of light, water quantity, temperature, humidity, gas concentrations, and organic material (Culver et al. 2000).

An ancient climatic refugia

Within Indochina there is also a tentative suggestion that ancient climate fluctuations have influenced Vietnam's species diversity. Analyses of overlapping species distribution patterns in mainland Southeast Asia for a number of different taxonomic groups have led scientists to suggest that the Truong Son range served as a refugium for forest-dwelling species during cooler, drier times (Brandon-Jones, 1996; Groves & Schaller, 2000; Rabinowitz, 1997; Surridge et al., 1999; Timmins & Trinh Viet Cuong, 2001). While the focus of this proposition maybe partially based on the biodiversity in the essentially contiguous Nakai Nam Theun National Protected Area, it might also be assumed that this applies to the limestone karst forests of PNKB. This would also a consequence of the climatic variability, and hence niche availability, on each side of the Annamites crest. It is worth noting that there are also proponents who disagree with this theory; Gathorne-Hardy, et al. (2002) provides an alternative list of refugia.

Outstanding Biodiversity Endemism of the Property

Fauna: 427 taxa are endemic to Vietnam and two genera (Oligocera and Hiepia) are endemic to the Park.

Primate: Two primate taxa of Ha Tinh Langur *Trachypithecus hatinhensis* and black form of Ha Tinh Langur *Trachypithecus hatinhensis ebenus* are narrow endermic to limestone area.

Reptiles and Amphibian: 17 species endemic to the Park and adjacent areas.

Cave fauna: one genus is endemic to the Park

Interesting evolutionary case studies

Phong Nha-Ke Bang, similar to other karst landscapes, serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research (Ng 1991, Schilthuizen et al. 1999, Schilthuizen et al. 2005a). Below are described some interesting case studies found within a wide range of biological taxa in the Property which demonstrate a number of ecological and biological processes in the evolution of biodiversity in Phong Nha-Ke Bang.

Trachypithecus langurs

The langurs of the genus *Trachypithecus* provide an interesting evolutionary case study, showing notable genetic variation within the Phong Nha-Ke Bang – Khammouane Karst Landscape, with two species currently listed on the IUCN Red List from the landscape. Three forms are recognized, namely the Ha Tinh Langur *Trachypithecus hatinhensis*, a black form of Ha Tinh Langur *Trachypithecus hatinhensis ebenus*, and the Lao Langur, *T. laotum*; only two species are currently recognized as full species.

The endangered Ha Tinh Langur *Trachypithecus hatinhensis* (black body with long tail, white stripe on cheeks) has its largest single population globally within the Property. It seems to be currently restricted to limestone areas in the western part of Quang Binh and Quang Tri Provinces (from 19°39'N, 105°29'E south to 16°10'N, 107°40'E), and in the eastern part of Khammouane and Savannakhet Provinces in Lao PDR (Nadler et al. 2003). Its range in Lao PDR appears to be limited (Nadler et al. 2003), where it has only been recorded with certainty from Hin Namno NPA (Duckworth et al. 1999). The western limit of the range of the species in Lao PDR is unclear. However, genetic work suggests it should be considered a subspecies of the Lao Langur *T. laotum* (Roos et al. 2001, Roos, 2004).

The form *ebenus* (all black including head, with a long tail) is restricted to Khammouane and Savannakhet Provinces in Lao PDR, with a marginal extension into the western part of Quang Binh Province, Viet Nam. It is found in Hin Namno NPA, and the southern Phou Hin Poun NPA, mainly in Gnommalat District. The precise limits of the range are unclear, particularly in Vietnam. The overlap zones of this form with *laotum* and *hatinhensis* are not well defined. Morphological and genetic data also suggests that the Indochinese black langur (*T. ebenus*) is a morph of the Hatinh langur. The vulnerable Lao Langur, *T. laotum* (a black body with long tail, white-head) is common throughout its range (Phiapalath, 2010), which is estimated at between 500-2,000 km² (R. Timmins pers. comm.). Reliable population estimates depend greatly on differentiating between *laotum* and *ebenus* in the Phou Hin Poun area.

Niche Segregation in microhabitat use of three sympatric bent-toed geckos

Three phonetically similar, cryptic species of bent-toed geckos *Cyrtodactylus phongnhakebangensis*, *C. cryptus*, and *C. roesleri* were recently discovered in the karstic rainforest formations in Phong Nha-Ke Bang National Park. First, *C. phongnhakebangensis* was described in 2002. *Cyrtodactylus cryptus* was later discovered by Heidrich et al. (2007). In 2010, *C. phongnhakebangensis* was split into two species: *C. phongnhakebangensis* and *C. roesleri* (Ziegler et al. 2002; Heidrich et al. 2007; Ziegler et al. 2010). The ecological niches and abundance of these three species were compared, following Dias and Rocha (2007) in classifying ecological niches by the three dimensions of diet, microhabitat, and activity period. The microhabitat use of the three sympatric

Cyrtodactylus was analyzed in order to generate ecological insights into their spatial requirements.

Similar microhabitat use was observed by the two sympatrically occurring species within heterogeneous forest sites, and clear niche segregation for the third species. *Cyrtodactylus roesleri* and *C. phongnhakebangensis* were found in a surrounding with a high amount of rock cover, while *C. cryptus* seems not to be associated with karst areas at all. Many gecko species show adaptations to karstic environments (e.g., Grismer et al. 2009), which provide crevices and caves for oviposition and shelter. Hence, *C. cryptus* might have adapted differently to acquire access to these requirements. Preliminary molecular phylogenies confirm a close relationship between the karst-associated species *C. phongnhakebangensis* and *C. roesleri*, while *C. cryptus* is a phylogenetically more distant species (Ziegler et al. 2010).

Although differences in microhabitat use might mirror habitat availability (Johnson et al. 2006), the chosen habitat characteristics show not only the potential niche, but also the realized niche. Habitat segregation is obvious for *C. cryptus*, but the observed overlap in common resource use between *C. roesleri* and *C. phongnhakebangensis* does not necessarily indicate competition as gekkonids often have highly specific microhabitat preferences (Welton et al. 2009). The remaining question is whether this sympatric occurrence enforces interspecific competition or if they evolved to co-exist by other ways of resource partitioning. All three species use niches in the vertical dimension, which are especially variable in tropical forests (Bobrov, 1993). The parameters of the selected microhabitat correlated with morphometric values such as size or weight, and the largest species, *C. phongnhakebangensis*, seems to occur at higher perches and more often inside caves. *C. phongnhakebangensis* was found more often on larger karst formations and a variety of caves, whereas *C. roesleri* occurred on smaller karst agglomerations. Grismer et al. (2010) reported similar results for a gecko in Malaysia: syntopic species inhabited different types of habitats and the smaller geckos occurred on vegetation versus the bigger ones on stone. Habitat segregation by different use of substrates is also known for other lizard species (e.g., Du Plessis and Mouton 2011).

Diversity of Cave invertebrates

Cave fauna in particular show the striking effect of isolation on species divergence. A preliminary study of the cave fauna from the Property found at least 41 species of invertebrates among 248 individual specimens collected from the three cave systems surveyed. Only five species were common across the three caves.

Laotian Rock Rat – a Lazarus taxon

The Laotian Rock Rat or kha-nyou *Laonastes aenigmamus*, sometimes called the "rat-squirrel", was first described from Khammouane province in 2005 (Jenkins et al. 2005), who considered the animal to be so distinct from all living rodents. They placed it in a new family, Laonastidae. It is in the monotypic genus *Laonastes*. In 2006, the classification of the Laotian rock rat was disputed (Dawson et al. 2006) who suggested instead it belongs to the ancient fossil family Diatomyidae, which was thought to have been extinct for 11 million years, since the late Miocene. It would thereby represent a Lazarus taxon. The animals resemble large, dark rats with hairy, thick tails like those of a squirrel. Their skulls are very distinctive and have features that separate them from all other living mammals.

Jenkins *et al.* (2004) did not compare the specimens to known rodent fossils. After such a comparison, Dawson *et al.* (2006) were of the opinion that the Laotian rock rat belongs to a previously described family which had only been known from fossils, the Diatomyidae. The Diatomyidae are known from a series of fossils from the early Oligocene (~32.5 mya) until the Miocene (~11 mya). The discovery of the Laotian rock rat means an 11 million-year gap exists in the fossil record where no diatomyids have been found. Dawson *et al.* (2006) described the Diatomyidae as a Lazarus taxon due to this gap. Dawson described *Laonastes* as the "coelacanth of rodents".

During a biodiversity survey conducted on small mammals in Phong Nha-Ke Bang National Park in 2011, four specimens of the Laotian Rock Rat *Laonastes aenigmamus* were obtained in Thuong Hoa Commune, Minh Hoa District, Quang Binh Province. (Dang *et al.*, (2102), confirming the presence of this species in Vietnam.

Cave Scorpions – a relictual taxa in the subterranean ecosystem

The relative stability and antiquity of subterranean ecosystems enable relict faunas to persist (Gibert and Deharveng 2002). During invertebrate surveys conducted in 21 caves in August and November 2011, two troglomorphic species were discovered which belong to two mono-specific genera of the Family Pseudochactidae. This family of scorpions was first described from central Asia in 1998 based on a single species. Two new scorpion species of new genus (*Vietbocap*) has been published. The first species was named *Vietbocap thienduongensis* (Lourenco & Pham, 2012), or *Thien Duong scorpion* since they were found in Thien Duong cave. The second was found in Tien Son cave with scientific name of *Vietbocap canhi* Lourenco & Pham, which was published in Zookeys. Two of these species belong to the Family Pseudochactidae.

To date, only four species from three genera from the Family Pseudochactidae have been described in the world. These comprise one species from the genus *Pseudochatas* found in Uzbekistan and Tajikistan, one species from the genus *Troglokhammouanus* found in Laos; and two species of *Vietbocap* found in Vietnam. All four species are confined inside caves. Isolation from the outside environment and the special light condition and humidity condition have generated the endemic species in the area. It is actually no surprise that tropical karsts, affected by bioclimatic changes and sea-level fluctuations, have generated various relictual taxa. The overall picture is, however, of a lower diversity of relicts than in temperate caves, in line with the lower intensity of bioclimatic fluctuations in the tropics, as stressed by Chapman, (1986).



Vietbocap canhi



Vietbocap thienduongensis



Telema sp.



Lagynochthonius sp1.



Tetrablemma sp.



Tyrannochthonius sp.



Lagynochthonius sp2.



Lagynochthonius sp3.



Leptoneta sp.



Diestrarmena sp1.



Diestrarmena sp2.



Diestrarmena sp3.

Figure 2.8. Cave INVERTEBRATE in Phong Nha - Ke Bang
Source: Pham Dinh Sac 2012

2.a.5 Socio-economic Aspects

Population inside the core zone

There are a village in the core zone of Phong Nha-Ke Bang National Park, village number 39 or Arem village, Tan Trach Commune, Bo Trach District. This village is home to 72 households and 401 people.

Before 1962, the Arem ethnic group lived in the deep forest, in houses made of bamboo and leaves, or in the rocky caves. These people lived by gathering forest products or hunting. After 1992, the Vietnamese Government set up a new settlement programme which since then supports village 39 for the Arem people. The villagers are provided food, cattle and seedlings provided by the Management Board of the National Park and local authorities under the jurisdiction of Programmes 135, 661, etc. In recent years the Arem people have participated in conservation activities of the National Park. They have set up their own forest protection team with the support of the Park Management Board. This team has the responsibility for patrolling and monitoring impacts to forests surrounding their village.

The Buffer zone Communities of Phong Nha- Ke Bang National Park

Phong Nha-Ke Bang National Park is situated in 13 communes with a total population of 64,544 people in 14,967 households (data of 2002).

Table 16. Demographic data for communities living in the buffer zone of Phong Nga-Ke Bang National Park

No	District/ Commune	Area (ha)		Household		People		Person / Km ²
		Total	Inside Park	Total	Inside Park	Total	Inside Park	
I	Minh Hóa	98,605.00	30,570.00	3.831	0	17,144	0	32
1	Dân Hóa	17,697.00	0.00	834		3,519		19
2	Hóa Sơn	18,031.00	8,615.66	369		1,607		9
3	Thượng Hóa	34,634.00	21,954.34	706		3,095		9
4	Trọng Hóa	18,789.00	0.00	693		3,636		19
5	Trung Hóa	9,454.00	0.00	1.229		5,287		55
II	Bố Trạch	167,606.00	92,756.00	10.207	72	43,428	401	190
6	Hưng Trạch	9,515.00	0.00	2.716		11,104		117
7	Phú Định	15,360.00	0.00	659		2,719		18
8	Phúc Trạch	6,022.00	1,156.00	2.478		10,761		178
9	Sơn Trạch	10,139.00	4,265.00	2.582		10,653		105
10	Tân Trạch	36,281.00	30,563.10		72		401	1
11	Thượng Trạch	72,572.00	53,301.00	461		2,457		3
12	Xuân Trạch	17,717.00	3,470.90	1.311		5,734		32
III	Quảng Ninh	77,384.00	0.00	929	0	3,972	0	5
13	Trường Sơn	77,384.00	0.00	929		3,972		5
	Total	343,595.00	123,326.00	14.967	72	64,544	401	19

Source: District statistics, 2012

All communes in the Buffer Zone area are listed as a priority for economic development programmes such as: 135 (infrastructure upgrading), 661 (forest plantation and regeneration), Central Poverty Reduction Project (supported by the ADB), etc. These programmes and projects support the local people in economic development and forest protection and regeneration. In particular the Vietnamese Government and the Germany Bank (KfW) and GIZ are in the process of implementing up a large project on “Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha-Ke Bang National Park Region.”

Characteristics of ethnic groups at Phong Nha-Ke Bang

The Phong Nha-Ke Bang area is not only famous for its cave system, beautiful landscape and high biodiversity but it is also famous for the minority groups living in the area. Besides the Kinh (majority Vietnamese) ethnic group, there are two main ethnic groups: Bru-Van Kieu and Chut.

Table17: Minority groups living in the Phong Nha-Ke Bang area

District/ Commune	Total	Kinh	Bru Van Kieu				Chut			
			Van Kieu	Khua	Ma Coong	Tri	Ruc	Sach	May	Arem
<u>Minh Hóa</u>	<u>17144</u>	<u>8787</u>	<u>0</u>	<u>4604</u>	<u>0</u>	<u>0</u>	<u>392</u>	<u>1263</u>	<u>2090</u>	<u>8</u>
Dân Hóa	3519	457		1621					1441	
Hóa Sơn	1607	640		4				963		
Thượng hoá	3095	2323		10			392	300	62	8
Trọng Hóa	3636	80		2969					587	
Trung Hóa	5287	5287								
<u>Bố Trạch</u>	<u>43829</u>	<u>40861</u>	<u>142</u>	<u>0</u>	<u>2347</u>	<u>60</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>419</u>
Hưng Trạch	11104	11104								
Phúc Trạch	2719	2719								
Sơn Trạch	10761	10761								
Tân Trạch	10653	10511	142							
Thượng Trạch	401									401
Xuân Trạch	2457	32			2347	60				18
Phú Định	5734	5734								
<u>Quảng Ninh</u>	<u>3972</u>	<u>1681</u>	<u>2291</u>							
Trường sơn	3972	1681	2291							
Total	64945	51329	2433	4604	2347	60	392	1263	2090	427

Source: District statistics, 2012

Bru - Van Kieu Ethnic Group:

- i. The Bru - Van Kieu has the largest population of all the ethnic groups living in the Northern Annamite Mountain Range (except Kinh group). The Bru - Van Kieu belong to the Mon - Kho Me language group, a group native to Indochina, which includes groups such as the Van Kieu, Khua, Ma Coong, Tri and So.

- ii. Among the ethnic groups mentioned above, the Van Kieu is largest and most widely distributed in the Annamite Mountain Range. The Tri and the Ma Coong ethnic groups are distributed in Thuong Trach and Tan Trach Communes, Bo Trach District and Laos. The Khua ethnic group is mostly distributed in Dan Hoa Commune, Minh Hoa District.

Chut Ethnic Group:

Ha Van Tan and Pham Duc Duong in the article “About languages of Viet - Muong” in Ethnology Magazine volume 1 – 1997 wrote that the Chut language is the oldest one in the Viet - Muong language group and that this language split from the Viet - Muong language in the 10th or 11th century. The Chut ethnic group includes many ethnic sub-groups such as the Sach, May, Ruc and Arem.

Arem and Ruc people

In the language of the Chut ethnic group, the meaning of “Ruc” is the place that has an underground stream and “Arem” is defined as a rocky cave or rocky arch. The Arem are located inside the Park in Village 39, Thuong Trach District while the Ruc are located in the Buffer Zone, Thuong Hoa Commune. The Arem and Ruc people are not only the smallest groups of the Chut ethnic minority but they are also two of smallest groups in Vietnam. They live isolated from other communities in the limestone karst area. In 2006, the Arem group consisted of only 202 people, and the Ruc group consisted of only 322 people.

The Arem and Ruc have their own distinct languages, which are parts of the Viet-Muong branch of the Mon-Khmer language family. Since 1992 the Arem and Ruc people started to live in houses. In the past they preferred to move around deep within the forest, dwelling in caves, trees, or temporary shacks. The Ruc and Arem were the last groups of people to start building houses in the 1960's.

Cultural heritage

The oldest evidence of human occupation of the area is the Neolithic axe heads and similar artifacts found in some caves. There are some relics of the Ham Nghi King, the final King of the Nguyen Dynasty before the French colonial period, found on Maria Mountain in the North of the Park. Currently the Arem ethnic group live in two villages in the core zone while the Ruc and Ma Coong people live in the Buffer Zone of Phong Nha-Ke Bang National Park. Until 1962 these indigenous people lived in the forest in houses made of bamboo and leaves or in the caves, using forest products and hunting as a way of life. They used simple tools and their clothes were made from the bark of a toxic forest tree (*Antiaris toxicaria*) and lianas. Since 1992 the Government of Vietnam has set up two new settlements for these 475 people, who are the two smallest ethnic groups in Vietnam. These people are familiar with a number of economically valuable species, especially precious timber such as Mun and Hue (*Diospyros spp.* And *Dalbergia tonkinensis*), and oil-extraction from species such as Tau (*Hopea hainanensis*) and many medicinal plants. The Phong Nha Cave has long been a site of religious and touristic importance, with an old Cham Temple discovered in the cave and this was a site for worship in the 9th and 10th centuries. During the war with the USA the Phong Nha – Ke Bang forest and caves were a garrison and weapons store for the Vietnamese Army.

2.b History and Development

In the middle of the 16th Century, Duong Van An (1550) was the first author to write about the Phong Nha Cave. He was followed by Le Quy Don (1776), who also described this Cave.

Before 1920, very few people knew about Phong Nha because it is situated far from residential centers. After 1920, Phong Nha began to be used for tourism and from 1920-1930 the Governor-General started organizing people to visit Phong Nha Cave. In 1937, the tourist office (Tourist Colonial en Indochine) published a brochure to promote tourism in Phong Nha. This site ranked second in Indochina for tourism.

The book "Indochine" by Madrolle (1954) describes Phong Nha Cave including a sketch map representing the full 853m length of Phong Nha Cave and emphasized that this was a rare wonder in Vietnam. An old Cam Temple was also discovered inside the cave at the same time. Since 1975 the local authorities recognized the important role of the Phong Nha - Ke Bang area, and many activities to protect this area have been carried out. Tourism activities have been reorganized since 1990, and the numbers of tourists have increased year by year. Many guesthouses have been built near the Xuan Son ferry and a team of boatmen are willing to take visitors to Phong Nha Cave.

Phong Nha Nature Reserve (5000ha) was listed in Vietnam's Special Use Forest System by Decision 194/CT dated 9 August 1986. In 1993 the reserve area was extended to 41,132ha. A Management Board of Phong Nha Nature Reserve was established in 1994. In 2000 Phong Nha Nature Reserve was extended again to 85,754ha including the Ke Bang karst area and was upgraded to a National Park named Phong Nha-Ke Bang National Park. This Park was inscribed on the World Natural Heritage List under *Criterion* (i) [now *criterion* (vii)] in July 2003.

In 5 July 2013, Phong Nha - Ke Bang was decided to expand up to 123,326 ha including continuous karsts in the North.

From 1991 up to now, many biodiversity and geology surveys have taken place in the Phong Nha – Ke Bang area. The results of these provided good information for the management of Phong Nha – Ke Bang National Park.

3. JUSTIFICATION FOR INSCRIPTION

3.1.a Brief Synthesis

Phong Nha - Ke Bang National Park encompasses 126,236 ha of limestone forest in the middle of the central Truong Son (Annamites) Range, being contiguous with Namno National Protected Area in Lao P.D.R. By 1920, the Phong Nha – Ke Bang area was already recognized to be of outstanding natural beauty. More recently, the national park was described as a critical landscape in the Greater Annamites Global 200 Ecoregion (WWF, 2000), and was inscribed for Criterion (viii) on the World Natural Heritage List in July 2003. The property is also an Indo-Burma global biodiversity hotspot, as well as an Endemic Bird Area that is not otherwise represented on the World Heritage List. With respect to being nominated under criteria (viii), this area has had a long earth crust development history from the Ordovician period (464 Ma) to the present, including five major periods, namely: Late Ordovician - Early Silurian; Middle Devonian – Late Devonian; Carboniferous; Permian; Mesozoic and Cenozoic. The episodic uplift also resulted in complex inter-bedding. The endogenous and exogenous geological processes which have occurred from the Triassic to the present have created diverse topography and geomorphology, including “underground rivers”, “dry caves”, “terraced caves”, “suspended caves”, “dendritic caves”, and “intersecting caves”. With respect to Criterion ix, the episodic uplift of the limestone landscape from (at least) the Tertiary and the successive karst development, rejuvenation and ongoing evolutionary karst development has created specialist habitats. The dissected karst plateau supports montane evergreen forest above 700 m. The Truong Son Range may have served as a refugium for forest-dwelling species during the Pleistocene, when evergreen forests disappeared from lower elevations. Phong Nha-Ke Bang serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research, with case studies being described from all taxonomic groups. These include speciation in langurs, niche microhabitat segregation in bent-toed geckos, cave invertebrate isolation, primitive or relict species, including the Saola, Annamite Striped Rabbit and Laotian Rock Rat (a ‘Lazarus species’) and new species of blind scorpions. With respect to Criterion (x), many endemic and near-endemic vertebrates are associated with this ecoregion, which has been identified as one of the greatest concentrations of endemic species in a continental setting found anywhere. Of greatest conservation significance, there are 419 known endemic plant species from Central Vietnam and Laos, as well as 829 species of vertebrates, of which 69 are globally threatened. The overall integrity of PHKB National Park is very high, being the largest protected karst landscape in South East Asia.

3.1.b Criteria under which Inscription is proposed (and Justification for Inscription under these Criteria)

The Karsts of Phong Nha-Ke Bang National Park have very unusual biological values, because of the interplay of surface and subsurface environments. The Karsts are associated with outstanding *biodiversity* above and below ground with markedly different species assemblages. Endemicity and diversity are the rule, especially in isolated karsts like Phong Nha-Ke Bang in the tropics (Clements *et al.* 2006). Karst has unusual habitat conditions and sometimes experiences drought at the surface when there is abundant water underground.

Criteria (viii)

Based on the UNESCO's classification of World Heritage, among the four criteria for world natural heritage, outstanding values in the expanded area of Phong Nha- Ke Bang National Park have potential to meet criterion (viii).

Criterion (viii) states: to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

The geological structure of the Property expresses the diversity and long development history of the earth's crust. The earth's crust has undergone several main developmental stages (from the Ordovician period up to now) with five tectonic megacycles corresponding with the five geological evolution stages of the world. These comprise:

Late Ordovician - Early Silurian stage (463.9 - 430 Ma)

Middle - Late Devonian stage (D₂ - D₃) (386-362.5 Ma)

Carboniferous - Permian stage (C-P) (362.5 - 245 Ma)

Mezozoic orogenic stage (Triassic, Jurassic, Cretaceous)

Cenozoic stage

The endogenous and exogenous geological processes, which have occurred from the Triassic period up to now, have created the diverse topography and geomorphology in the area:

- Non-karst landforms: low, round-top mountains with planation surfaces, and abrasion-accumulation terraces along the valleys of the Son and Chay Rivers and at the margins of the central limestone massif.
- The Property forms a sizable proportion of one of the most notable, large karst landscapes in Southeast Asia, the Phong Nha-Ke Bang – Khammouane Karst Landscape (PNKB-KKL), which comprises the property itself, the contiguous reserve Hin Namno National Protected Area, which itself is loosely connected to Phou Hin Poon National Protected Area, both reserves in Lao P.D.R.. In terms of island biogeography, it compares extremely well with all other six World Heritage Sites in Southeast Asia, which protect tropical forest habitats. The contiguous landscape relationship of the karst landscape to the wet biodiversity-rich, evergreen forests of Nakai Nam Theun NPA, Vu Quang National Park and Giang Manh Watershed is also recognized.

Unlike other karst areas in Vietnam, which generally consist of tower karst or cockpit karst, Phong Nha is probably best described as part of a larger dissected plateau, which also encompasses the Ke Bang and Hin Namno karsts. Most importantly, the limestone is not itself continuous, but demonstrates complex inter-bedding with shales and sandstones. Furthermore, the capping of schists and apparent granites which have probably been thrust over the limestone and is now eroded to a remnant outcrop - together with the complex inter-bedding - has led to a particularly distinctive topography.

The caves alone demonstrate discrete episodic sequences of events, leaving behind various levels of fossil passages, some of them very high, and one of these in fact being near the summit of the plateau; formerly buried and now uncovered palaeokarst (karst from previous, very often ancient, periods of solution); evidence of major changes in the routes of underground rivers; changes in the solutional regime; deposition and later re-solution of giant speleothems and unusual features such as sub-aerial stromatolites (speleothems which are shaped by interaction between blue-green algae and the deposition of calcite). In particular, the location and form of the caves suggests that they owe much of their size and morphology to some as yet undetermined implications of the schists and granites which overlay the limestone and this is a remarkable feature in itself. There are also both resorted and layered schist-derived sands and granitic gravels in the caves. Then all this is overlain with evidence indicating long periods of human occupation and use.

On the surface there is a striking range of landscapes, ranging from deeply dissected ranges and plateau to an immense flat floored and enclosed valley – known to karst specialists as a polje. This is essentially a climax form, and indicates that the karst system is an old and mature one. There is evidence of at least one period of hydrothermal activity in the evolution of the karst. The plateau is probably one of the finest and most distinctive examples of a complex karst landform in Southeast Asia and, as already noted, has more in common with the Skocjan karst of Slovenia than with most other Asian karst landscapes.



Figure 3.1. Son Dong cave (Source: Edward Longstreet)

Criteria (ix)

Based on the UNESCO's classification of World Heritage, among the four criteria for world natural heritage, outstanding values in Phong Nha-Ke Bang have potential to meet criterion (ix).

Criterion (ix) states: to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

The Property forms a sizable proportion of one of the most notable, large karst landscapes in Southeast Asia, the Phong Nha-Ke Bang – Khammouane Karst Landscape (PNKB-KKL). The PNKB-KKL is extremely large, being some 230 km in length. The PNKB-KKL stretches latitudinally across the mountain crest of the Truong Son Range. The Property itself also represents the most significant and essentially intact karst ecosystem component within the Annamites Range Moist Forests, a Global 200 priority ecoregion whose outstanding biodiversity values are not otherwise represented on the World Heritage List. According to the more recent classification of terrestrial ecoregions by Olson et al, (2001), the property belongs to the Northern Annamites Rain Forests ecoregion, as well as two freshwater ecoregions (Northern Annam and Southern Annam).

The Property and Him Namno karsts may be best described as a large dissected plateau, and is therefore of high elevation. Some 28 per cent of the Property is above 700m. The generally high altitude of the Property as a whole influences the climate conditions of the site, which is generally moist throughout the year as a consequence of the prevailing climatic conditions on the Vietnamese side of the Truong Son Range. The complex inter-bedding with shales and sandstones, combined with the capping of schists and apparent granites which have probably been thrust over the limestone and is now eroded to a remnant outcrop, influences the soil types, including their soil thickness, their texture, their acidity and humus content. These soil properties in turn influence the composition and richness of the overlying vegetation. As a consequence, this plateau supports submontane and tropical moist evergreen forests (above 700m), as well as a diversity of epiphytic flora. This dwarf stature evergreen vegetation in turn supports certain taxonomic groups (reptiles and amphibians) which may be more diverse than those found in drier, more seasonal parts of the PNKB-KKL to the west.

The Property itself is situated in the heart of Vietnam's main topographic feature, the Truong Son Range, which runs roughly north to south along the Vietnam-Laos border and into south-central Vietnam, and belongs to the Indochinese Rainforest biogeographical province in the Tropical Humid Forests biome (Udvardy, 2005). This mountain range forms an important barrier between the moist uplands of Vietnam and the drier monsoon forests of Laos; the western portion of the PNKB-KKL lies in a separate biogeographical unit - the Thaiindian Monsoonal Forest province (Udvardy, 2005). Furthermore, the Property traverses the transition zone between the subtropical northern and the tropical southern climates (Sterling & Hurley, 2005).

The Property itself is humid nearly all year round, with onshore winds from the East Sea bringing moist air from September to April. By sharp comparison, the karst landscape situated in Khammouane province has a tropical, monsoonal climate with a distinct wet season and a long, hot, dry season. The Khammouane karst receives over four-fifths of its

annual rainfall during the south-western monsoon, from May to October. The seasonal aridity in Khammouane province places severe constraints on karst development, because this climatic condition leads to a scarcity of water, thereby limiting dissolution and permitting other geomorphological processes to dominate landscape evolution. These marked regional variations in climate also have a significant impact on the ecological and biological processes in the evolution and development of this karst ecosystem and the communities of plants and animals evolutionary processes, both above and below the ground.

Significantly, the drainage area in Phong Nha-Ke Bang flows into the East Sea some 22 km to the east, a marine environment. Meanwhile, the drainage area in Hin Namno National Protected Area flows both into PNKB as well as flows into the Xe Bang Fai River and thence into the Mekong River, one of the most biodiversity rich freshwater river ecosystems in Asia. It is thought that there is an underground mixing of the two drainage areas within the deep interior of the karst landscape, which may shift between high and low water conditions. This zoogeographical convergence across a notable mountain range might be expected to enhance speciation amongst aquatic forms, particularly fish and other subterranean aquatic invertebrates.

Within Indochina there is also a tentative suggestion that ancient climate fluctuations have influenced Vietnam's species diversity. Analyses of overlapping species distribution patterns in mainland Southeast Asia for a number of different taxonomic groups have led scientists to suggest that the Truong Son range served as a refugium for forest-dwelling species during cooler, drier times (Brandon-Jones, 1996; Groves & Schaller, 2000; Rabinowitz, 1997; SurrIDGE et al., 1999; Timmins & Trinh Viet Cuong, 2001. While the focus of this proposition maybe partially based on the biodiversity in the essentially contiguous Nakai Nam Theun National Protected Area, it might also be assumed that this applies to the limestone karst forests of PNKB. This would also a consequence of the climatic variability, and hence niche availability, on each side of the Annamites crest. It is worth noting that there are also proponents who disagree with this theory; Gathorne-Hardy, *et al.* 2002 provides an alternative list of refugia.

This the high species diversity on the karst in Phong Nha-Ke Bang arises from a multitude of ecological niches afforded by complex terrains (e.g., fissured cliffs and extensive caves) and variable climatic conditions. High species endemism also occurs in Phong Nha Ke Bang because of its unique tectonic and eustatic histories and rich soil properties, its unusually high topography, its degree of isolation, and incidences of random events. The karst in Phong Nha-Ke Bang can be divided into surface and cave levels, both of which provide ideal conditions for speciation. On the karst surfaces of the Property, edaphic (soil-related) isolation produces a unique flora that includes many calcicoles (species adapted to growing on limestone). At the same time, the forest vegetation supports animal species somewhat different from those in non-karstic areas, such as in the contiguous protected areas, Nakai Nam Theun National Protected Area, Vu Quang National Park and the Giang Mann watershed. Because of their poor dispersal capabilities, plants and some animals, such as invertebrates, have to adapt to the highly alkaline conditions, the thin soil layers, and the desiccation on porous limestone bedrock. In the caves of Phong Nha-Ke Bang, animals such as the arthropods and fishes must evolve specializations to cope with fluctuating levels of light, water quantity, temperature, humidity, gas concentrations, and organic material (Culver et al. 2000).

Phong Nha-Ke Bang, similar to other karst landscapes, serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research (Ng 1991, Schilthuizen et al. 1999, Schilthuizen et al. 2005a). Case studies are provided from a wide range of taxa to demonstrate the rich evolutionary processes occurring within the Property.

Many endemic taxa found in the National Park, such as the two similar langurs - the Hatinh Langur (*Trachypithecus hatinhensis*) and its black form (*T. ebenus*), have overlapping but distinct range boundaries. This patchy distribution may be due to climatic, geographic, or ecological barriers, or interspecific competition that prevented effective dispersal out of the patches. It could also be that these taxa have not yet recolonized other areas since the last glacial maximum 18,000 years ago, even though they may be capable of doing so. These specialised habitats that have fostered evolutionary development in the karst landscape continue to exist, including within caves (troglobitic species), at cave entrances (cave nesting volant vertebrates and the invertebrate communities that they support; low light specialist vegetation species), and within dolines (refugia for relict types dependent on the high humidity and colder air temperatures generated by caves).

Among the reptiles, three phonetically similar, cryptic species of bent-toed geckos *Cyrtodactylus phongnhakebangensis*, *C. cryptus*, and *C. roesleri* which were recently discovered in the karstic rainforest formations in Phong Nha-Ke Bang National Park, show niche segregation in microhabitat use. *Cyrtodactylus roesleri* and *C. phongnhakebangensis* were found in a surrounding with a high amount of rock cover, while *C. cryptus* seems not to be associated with karst areas at all. Preliminary molecular phylogenies confirm a close relationship between the karst-associated species *C. phongnhakebangensis* and *C. roesleri*, while *C. cryptus* is a phylogenetically more distant species.

Cave fauna in particular show the striking effect of isolation on species divergence. A preliminary study of the cave fauna from the Property found at least 41 species of invertebrates among 248 individual specimens collected from the three cave systems surveyed. Only five species were common across the three caves.

Of particular note, several primitive or relict species have been recently discovered in PNKB which have few or no close relatives, including the Saola (*Pseudoryx nghentinhensis*), Annamite Striped Rabbit (*Nesolagus timminsii*), and Laotian Rock Rat (*Laonastes aenigmamus*). The last of these, in particular, has been identified as a 'Lazarus species', the only representative of a lineage (Diatomyidae) that was previously only known from fossils that date to at least 11 million years ago, since the late Miocene. The Rock Rat was described as the "coelacanth of rodents". The persistence of more primitive or relict species such as these could be attributed to long-term habitat stability in the region, the effect of a stable climate and of regular uplifts over a long period maintaining a suitable distribution of habitat types.

The relative stability and antiquity of subterranean ecosystems also enables relict faunas to persist. The discovery of two species of blind scorpions in Phong Nha-Ke Bang is highly significant, as there are currently only about 20 described cave-dwelling scorpions in the world that exhibit troglomorphic characteristics. The new species, *Vietbocap thienduongensis* and *V. canhi*, were the first troglobitic scorpions found in mainland Asia.

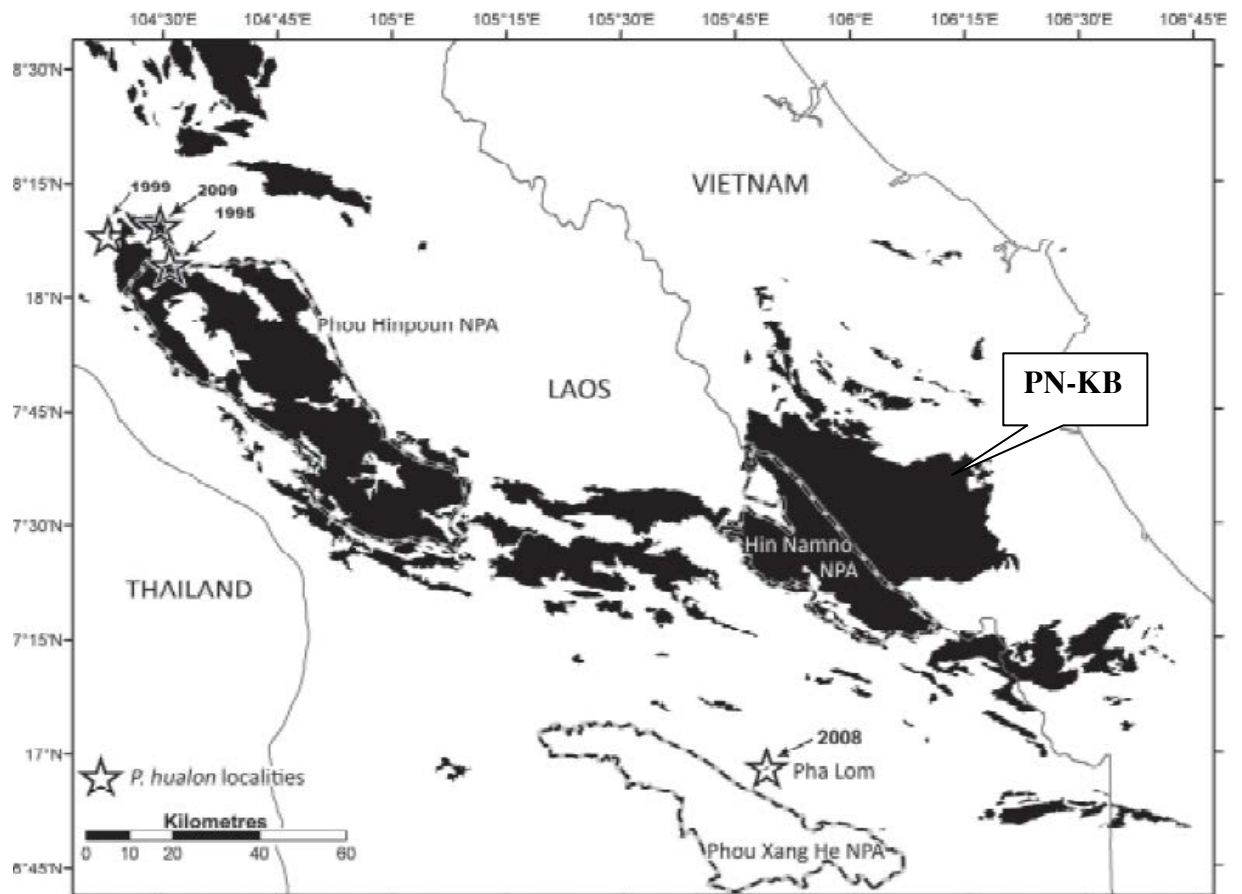


Figure 3.2. Landscape of Karst in Southeast Region

Source: http://www.sges.auckland.ac.nz/sges_research/karst.shtm

Criteria (x)

Based on the UNESCO's classification of World Heritage, among the four criteria for world natural heritage, outstanding values in Phong Nha-Ke Bang have potential to meet criterion (x).

Criterion (x): *Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation*

Phong Nha-Ke Bang is the largest national park in Vietnam, and encompasses one of the largest areas of karst in Southeast Asia. The wealth of geologies and topographies in Phong Nha – Ke Bang National Park provides for significant ecosystem diversity in the form of humid tropical forest on limestone, tropical forest on hills, surface freshwater on limestone areas and subterranean ecosystems, enabling high levels of biological diversity and endemism.

Eleven forest types have been identified and mapped for the Park. Forest cover within the national park is very high, at 93.57%; Some 83.74% is primary forest, which is the highest percentage in any protected area in Vietnam. The park protects significant tracts of limestone, including 22,500ha of montane evergreen forest on limestone above 700m asl. which is of global outstanding values. Furthermore, there is more than 1,000ha of the mono-dominant species of *Cacelodrus rupetris*, an endemic species to limestone in Vietnam. This a unique forest type also contains orchids *Paphiopedilum spp.* and other very rare orchid species in abundance under the canopy.

The PNKB National Park is located in the middle of central Annamite Mountain Range. This area has been identified as one of 200 Global Ecoregions (WWF, 2000), the Greater Anamite Ecoregion. The park is within the Northern Annamite microregion and considered a terrestrial priority, because it is one of the greatest concentrations of endemic species in a continental setting. It is also part of the Indo Burma hotspot, and is the “hottest” forested hotspot with high importance for biodiversity conservation (CI, 2012). The park also supports four of the seven restricted range species of the Annamese Lowlands Endemic Bird Area (Birdlife International). The PHKB National Park has abundant fauna and flora, including rare and threatened species. Its rugged terrain provides protection for its biodiversity through natural design. Accordingly, it possesses outstanding universal values for science and conservation.

Flora: Based on recent botanical surveys, the total number of vascular plants recorded from the site comprises 196 families, 939 genera and 2,774 vascular plant species. The current vascular plant list for the National Park contains 203 threatened species, of which 93 species are listed in the Vietnam Red Data Book and 133 species are listed in the IUCN Red List of Threatened Species 2012. Of note, the Park protects 427 plant species endemic to Vietnam, including two narrow endemic genera *Oligoceras* and *hiepia* to the Park. *Cacelodrus rupetris*, a large coniferous tree, is an endemic species to limestone areas of Vietnam. Many threatened plant species with very high value occur in the Park, including *Dipterocarpus kerrii* (CR), *Dipterocarpus turbinatus* (CR), *Dipterocarpus hasseltii* (CR), *Hopea chinensis* (CR), *Hopea hainanensis* (CR), *Hopea mollissima* (CR), *Hopea reticulata* (CR), *Hopea siamensis* (CR), *Vatica diospyroides* (CR), *Dalbergia bariaensis* (EN), *Dalbergia mammosa* (EN), *Erythrophleum fordii* (EN), *Hopea pierrei* (EN) and *Vatica cinerea* (EN).

Fauna: Faunal surveys have documented a total of 813 vertebrate species, including 104 threatened species, 76 of them listed in the Vietnam Red Data Book and 35 species listed in the IUCN Red List of Threatened Species. Some 41 species are endemic to the Annamite Mountain Range (Vietnam and Laos), of which 30 are Vietnamese endemics.

In particular of the total of 38 animal endemic species are endemic to Vietnam and Vietnam has 224 mammal species with 154 mammal species have been recorded in Phong Nha – Ke Bang; 41 species of these species are listed in the Vietnam Red Data Book and 20 species are listed in the IUCN Red List. Nine mammal species are endemic to the Annamite Range, while two species are endemic to Vietnam. Notable mammal species

among these are Hatinh Langur *Trachypithecus laotum hatinhensis* (EN), *Pygathrix nemaeus* (EN), White-cheeked Gibbon *Nomascus siki*, Tiger *Panthera tigris* (EN), Saola *Pseudoryx nghetinhensis* (CR), Particoloured Flying Squirrel *Hylopetes alboniger* (EN), and Dhole *Cuon alpinus* (EN).

PNKB National Park has a rich and diverse rodent fauna, comprising 35 rodent species. A recent new discovery is the Laotian Rock Rat, described as “the coelocanth of mammals”. The Park is home to 19 small carnivore species, which is the largest number of small carnivore species found in any protected area in Vietnam; the site has been identified as a global priority site for small carnivore conservation (Schreiber et al 1989).

Phong Nha and Ke Bang has been identified by BirdLife International (2005) as two of more than 60 Important Bird Areas of Vietnam. Some 388 bird species out of the national total of 828 species have been recorded in the Park. Of these, 20 species are listed in the Red Data Book of Vietnam and 17 species are listed in the IUCN Red List. Seven bird species are endemic to the Annamite Mountain Range and four species are endemic to Vietnam. The Sooty Babbler *Stachyris herberti* occurs only in the karst area of the Phong Nha – Ke Bang NP and in an adjacent karst area in Laos. Notable recorded bird species include the Vietnamese Pheasant *Lophura hatinhensis* (EN), Edward’s Pheasant *Lophura edwardsi* (EN), and Silver Pheasant *Lophura nycthemera* (EN). This property is of particular interest for bird conservation because most species are not at immediate risk.

Phong Nha – Ke Bang has exceedingly rich herpetological diversity. The park protects 117 of the 458 reptile species found in Vietnam and 58 of the 162 recorded in Vietnam. Twenty-four of these herps are listed in the Red Data Book of Vietnam and 15 species are listed in the IUCN Red List. Seventeen reptile and amphibian species are endemic to Vietnam. Between 2000 and 2010, seventeen reptiles and amphibians have been described as new species to science, for example: *Triceratolepidophis sieversorum* Ziegler et al. 2000, *Cyrtodactylus phongnhakebangensis* Ziegler et al. 2002, *Gekko scientiadventura* Rosler et al. 2004, *Tropidophorus noggei*, *Camalaria thanhi* Ziegler 2005, *Trimeresurus truongsonensis* Ziegler 2004, and the amphibian *Rana megatymparum*. These seven species are restricted in range to Phong Nha – Ke Bang NP and most probably to a small area in Laos. Notable reptile species include *Cuora galbinifrons* (CR), *Cuora trifasciata* (CR), *Mauremys mutica* (EN), *Pyxidea mouhotii* (EN), *Ocadia sinensis* (EN), *Indotestudo elongata* (EN) and *Palea steindachneri* (EN).

The specific characteristics of the rivers and stream in Phong Nha – Ke Bang support a fish fauna specialized to karst conditions. In the Park 170 fish species have been recorded, of which four are listed in the Red Data Book of Vietnam. Of those found in the Park, 13 species have a restricted range to the Phong Nha – Ke Bang NP and 12 of them have been recently described as new species (Thai Tu, 2006 and 2012).

Initial surveys in the National Park have recorded 369 insect species, including 270 species of butterflies which amounts to about one fifth of the butterfly species recorded in Vietnam.

All recent surveys show a highly endemic regional fauna with many rare species. For example the 2012 cave invertebrate survey recorded 58 species-groups belonging to 7 classes, 22 orders identified in 21 caves. The survey confirmed two new species and one new genus of scorpion (*Vietbocap*) were described. Many new species were identified and are yet to be described.



la io VU



Rhinolophus thomasi VU



Rhinolophus paradoxolophus



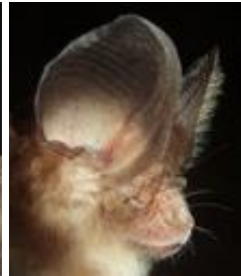
H. scutinares VU



New species
Rhinolophus sp. [nov.]



H. scutinares



H. pomona



R. macrotis



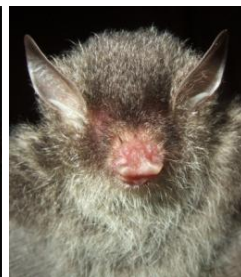
M. ecaudatus



S. blanfordi



T. melanopogon



M. cineracea



M. cyclotis



M. eleryi



M. tiensa

Figure 3.3. Pictures of Bats in Phong Nha - Ke Bang

Source: Nguyen Dinh Thong 2012

3.1.c Statement of Integrity

Phong Nha-Ke Bang was first designated as a national park in 2001. The protected area encompassed 85,754 ha, while the buffer zone covered 203,245 ha. In a committed effort to strengthen the integrity of the Property, the Vietnamese Government and the Quang Binh Provincial Peoples Committee agreed to extend the reserve northwards in July 2013, increasing the area of karst landscape under protection to 123,326 ha, with a corresponding increase in the buffer zone area – to 220,055 ha following Decision No 1062/QD TTg dated 05/7/2013 by Prime Minister. Phong Nha-Ke Bang National Park is the largest protected area in Vietnam, and is the largest karst protected landscape in Southeast Asia and contains some of the world's finest and largest known caves. All elements of its outstanding geological and biodiversity values are found within the Property.

Phong Nha-Ke Bang National Park is surrounded by a buffer zone of 220,269 ha. The purpose of this zone is to support the protection and integrity of the park by reducing pressure on its natural and biological resources. Regulations have been prepared to apply to the management of the buffer zone Decree 117 dated x/x/ 2010 and most recently the intention is for the management of the buffer zone to be undertaken jointly, including the FPD and the National Park rangers combining their law enforcement information. A Buffer Zone Development Plan, created through a participatory process, is in final stages of preparation. Its purpose is to ensure the buffer zone supports the integrity of the park.

Phong Nha – Ke Bang National Park is situated on an immense karst plateau named the Phong Nha-Ke Bang-Hin Namno Limestone Block. To the west the park is contiguous with the Hin Namno National Protected Area (82,000 ha) in the Laos People's Democratic Republic. On the Vietnamese side, the limestone occupies an area of over 200,000 ha. In combination with the neighbouring limestone area located in the Laos People's Democratic Republic, the total area of this karst region is about 300,000 ha and is one of the largest karst areas in the World. The area in Laos P.D.R. is part of the same Global 200 ecoregion and possesses similar attributes to Phong Nha-Ke Bang area.

The natural steep topography of the national park, the limited accessibility, the relatively low economic value of the natural resources, (particularly commercially important tree species), and poor agricultural potential means that the Property has been subjected to low developmental pressure, apart from the peripheral margins and river valleys. Much of the property is intact primary forest, through natural design. The rich endemic flora and fauna includes a diversity of primates, as well as medium and small-sized mammals, reptiles and amphibians, fish and invertebrates. It also includes the subterranean fauna. However, many of the larger ungulates, which might more usually be the target of poaching and snaring, are localized in distribution and occur at much lower densities. The Property is substantially forested with 94% cover, and 84% of this is primary forest.

Phong Nha-Ke Bang serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research. Case studies comprise the similar Hatinh Langur and its black form; three phonetically similar, species of bent-toed geckos showing niche segregation in microhabitat use; 41 cave invertebrates species showed isolation, with only five species occurring in all three caves. Several primitive or relict species, including the Saola, Annamite Striped Rabbit and Laotian Rock Rat; the later has been identified as a 'Lazarus species', the only representative of a fossil lineage (Diatomyidae) from 11 million

years ago (late Miocene). Two new species of blind scorpions were the first troglobitic scorpions found in mainland Asia.

Phong Nha-Ke Bang National Park is relatively remote and the central area is impenetrable with mountainous and rugged dissected terrain. This provides natural protection giving its endemic and threatened species a natural refuge. This includes primates, large and small mammals, birds, reptiles amphibians fish, insects and the highly specialised karst troglobitic species including fish. The frontier to the west is mountainous and remote and accordingly is naturally well protected, providing further protection to this refuge. In the centre of the Park is the unique forest type of *Cacelodrus rupetris* and *Paphiodedilum spp.* This area is strictly protected.

Protected area cooperation is also being strengthened between the National Park authorities and the protected area authorities in Hin Namno National Protected Area (NPA), Laos P.D.R. The two neighbouring Provincial authorities have initiated annual meetings to discuss cooperation in the protection of the two Protected Areas. This cooperation through dialogue between the two state parties will help ensure the integrity of this property and of the entire area through a shared management vision, some shared training and scientific knowledge exchange taking place.

The National Park is divided into three management zones: strictly protected (100,296 ha) ecological recovery (19,619 ha) and administrative service (3,411 ha). The National Park Management Board currently reports directly to PPC. It has an approved strategic management plan and operational management plan in place that guides the park's management which were prepared through participatory processes involving government agencies and community representatives.

Visitor interest in the national park is growing rapidly as the extraordinary and breath-taking caves and forested karst landscape become known. To help manage this, a Sustainable Tourism Development Plan has been prepared and it is used to guide development. The plan includes a visitor management plan. This plan is comprehensive and is used to guide the decision-making in the park for the management of tourism. A number of relatively accessible caves are open to visitors, with the world's largest known cave, Son Doong, as a wild cave closed to tourists, and with very restricted access. Consideration of proposed new tourism development is undertaken against the guidelines in the plan. This plan is aligned to the over-arching Strategic Management Plan.

There are a number of issues that affect the integrity of the property and efforts to mitigate these threats are effectively addressed as part of the management approach adopted:

- (1) A major part of the Ca Roong watershed to the South that feeds the Phong Nha cave system is not included in the property although it is included in the buffer zone. The National Park Management board are looking for modalities to manage the very sparsely populated area among relevant agencies in the Province, recognising it as being an integral part of the karst system within the National Park.
- (2) Law enforcement activities have been hampered in recent years. However, a Forest Law Enforcement Action Plan is strengthening interagency cooperation, and increasing effectiveness with improved resources, training and increased staff. The combining of the Law Enforcement Division with the District Forest Protection Department with a joint integrated mandate for both core zone and buffer zone protection will further contribute to improved effectiveness.

- (3) Illegal activities: especially logging and hunting. These two activities remain real threats to the integrity of the property. Efforts to achieve more effective control have included better interagency cooperation between FPD and the National Park, investment in more staff, training and equipment. Improvement is ongoing through management action, enforcement and monitoring, all essential to ensure the integrity of the property is not compromised. To guide strengthened law enforcement the NP Management Board has developed a Law Enforcement Action Plan. There is increased strength in forest protection arrangements with the FPD reporting directly the PPC. Also the FPD is being separated into an independent agency with the intention of the National Park Management Board reporting to FPD.
- (4) Environmental impact of infrastructure and tourism development: Environmental impact assessment is undertaken for all infrastructure developments including roads and tourism. Road 20 crosses the property providing access to the Arem and Ruc people. The current road improvements have been subject to an EIA, and road improvement including widening has been strictly controlled including no road worker's camps being established in the park, minimal realignment and the canopy cover kept intact.

The Ho Chi Minh highway, constructed outside and to the north of the property is justifiably and appropriately located. It provides benefit to the National Park opening up views of and access to the Ke Bang forest area. The highway also greatly enhances year-round traffic flow from the North and South of the country and route 20, which crosses the property, is small and has little impact on its natural values. All road construction in the area requires careful planning and construction as impacts from construction processes as well as indirect impacts on the property may threaten the values of the site.

The overall integrity of the property is high and the key threats are effectively mitigated through the current management approach. In the long-term, management of the property focuses on ensuring the integrity of the geological and geomorphologic values, as well as the property's unique biodiversity; strengthening the legislative provisions; carefully monitoring the socio-economic activities within the national park; designing suitable eco-tours and tourism developments ; increasing the use of technology in management; undertaking research to gain a more integrated understanding of the property's values; improving the staff capacity and enhancing community awareness and involvement.

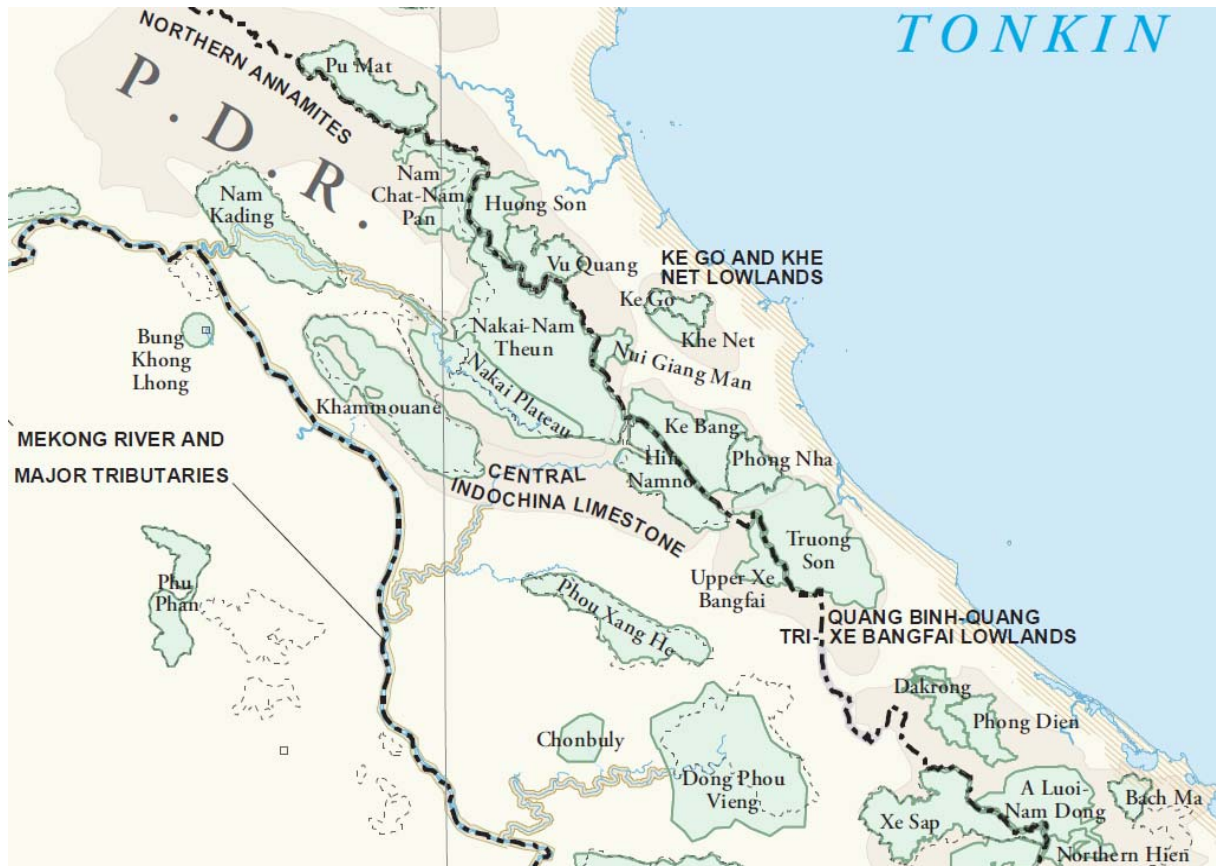


Figure 3.4. : Conservation outcomes in Indochina
(Source IUCN)

3.1.d. Protection and management requirements

Challenges

National Park is experiencing some difficulties to address effectively the protection and management activities:

- (1) Funds allocated annually for the Park Management Board are less than the budget request in the Investment Plans;
- (2) Lack of human resources in both the number and capacity in regulatory standards;
- (3) The coordination between the agencies of law enforcement are low, and
- (4) Lack of funding for buffer zone development Plan.

In addition, the park is also faced threats (presented in Section 4 and 5). Of which there are several threats serious impact to the Park as: Animal hunting, illegal logging timber and non-timber forest products, and the negative impact by tourism.

Requirements

The number of Ranger Stations has increased from 8 to 12 in 9/2013. The number of rangers is increasing and they have been enhanced capacity to effectively enforcement. A monthly information network program was developed for forest rangers. Of which the ranger stations plan to patrol every month and use GPS to identify hot spots of the threats, combined with monitoring biodiversity. The park rangers at the each station have to make grid points by GPS and send a report to the Headquarter of Park Ranger for the preparing management and monitoring activities.

In 2012, Quang Binh People Committee has built a Coordination Regulation (Regulation No 193) between the armed forces in the Quang Binh province, including rangers, environmental police, border limitary and village protection teams.

The Park Management Board has been supported by the provincial professional departments such as the Department of Natural Resources and Environment to support the issue on environmental impact assessment, techniques of environmental control; Department of Culture, Sports and Tourism to support the professional issues on Heritage conservation and tourism controlling activities; Forest Protection Department, Environmental Police , Border Limitary and communal and district armed forces to support the law enforcement.

Operation Management Plan and Strategic Management Plan have been approved by the provincial People's Committee. Of which the commitment on investment for the Park management and protection activities is up to 2020 and longer term.

Master Plan of sustainable development of eco-tourism is also approved as a basis for visitor and tourist impact controlling, monitoring and management.

A Master Plan of Buffer Zone management and development are also preparing. This Plan will identify orientation of natural conservation and economic development in the Buffer Zone. Prime Minister Decision No. 24/2012/QD-TTg on investment policies of special credit, this is an opportunity to determine the long-term operational support for conservation goals and development in the Buffer Zone.

Management Board and Phong Nha - Ke Bang Project are promoting a programme of participation protection and management involving communities and local people, and promoting the local human resources, increasing the awareness and responsibility of local communities, looking for ways to share the benefit for the communities living in the buffer zone. In recent years, many communities and families have benefits from forest protection contracts

The park has been expanded to the area of 123 326 ha by Decision No 1062/QD-TTg dated 05/7/2013 of the Prime Minister. It is a good opportunity to protect integrity property, as well as an opportunity to government and donors support to the park.

In the future, the key activities should be improved as:

- (1) Strengthening the infrastructure and equipments, especially for the ranger stations, such as weapons, tools support to the law enforcement, computers, cameras, GPS, binoculars, information and equipments for security patrols.
- (2) Improving the structure of Management Board, specially recruiting more rangers according to the Decree No 117/2010/ND-CP by the Government.
- (3) Enhancing the coordination between agencies and other armed units to involve in the property activities.
- (4) Increasing the participation of communities, raising awareness education on environmental and forest protection, especially the communities living near the Park boundaries.
- (5) Mobilizing the technical assistance and funds from the state agencies and non-governmental organizations for conservation activities; enlisting the support both financial and technical from UNESCO for the property protection activities; capacity building for controlling impacts by climate change.

3.2 Comparative Analysis

Overview

To date 193 Natural World Heritage sites have been inscribed in more than 100 countries. The sites in temperate countries differ greatly from Phong Nha-Ke Bang in terms of their geological and geographical characteristics and climatic and biotic conditions. Some sites located in Africa and America have similar climatic conditions but they are very different in their geographical and biotic conditions. The biodiversity of Phong Nha-Ke Bang should be compared to Natural World Heritage sites or tentative sites, especially the sites located in karst areas in Asia and Australia.

Phong Nha-Ke Bang is part of the Indo-Burma biodiversity hotspot (Conservation International), a distinction it shares with Ha Long Bay (not inscribed under biodiversity criteria and largely marine), and the two natural World Heritage properties in Thailand. This hotspot is home to at least 13,500 vascular plant species, of which 7,000 are endemic to this hotspot (representing 2.3 % of the world's plant species), and 2,185 vertebrate species, of which 528 are endemic to this hotspot (representing 1.9 % of the world's vertebrate species). At the time of the original hotspot analysis, which identified 25 hotspots (now there are 34), Indo-Burma was identified as one of the eight "hottest" hotspots when considering various measures of endemism and habitat loss. Indo-Burma was also among the 11 hotspots that were identified as "hyperhot" priorities for conservation investment. In 2012, this hotspot was ranked by CI as the "hottest" forested hotspot in the world, with high importance for biodiversity conservation (high levels of endemism). Phong Nha Ke Bang is also part of the Annamese Lowlands Endemic Bird Area which is not yet represented on the World Heritage List.

According to the numbers provided in the nomination dossier, Phong Nha Ke Bang has considerably more plant species than Puerto-Princesa Subterranean National Park in the Philippines, the three components parts of South China Karst and other Vietnamese protected areas, and more plant species than Dong Phrayayen-Khao Yai in Thailand (Table 1). PNKB also has more mammal species than any other karst World Heritage property in

the region except for the much larger Three Parallel Rivers of Yunnan, more freshwater fish species than any other karst World Heritage property in the region, and more bird species than other Vietnamese karst sites, Puerto-Princesa in the Philippines, Gunung Mulu in Malaysia and the three component parts of South China Karst. PNKB's herpetofauna has as many species as Gunung Mulu and Thungyai-Huai Kha Khaeng and more species than other Vietnamese karst sites, Puerto-Princesa, Three Parallel Rivers of Yunnan and the three component parts of South China Karst.

Few World Heritage properties contain as diverse a primate fauna as Phong Nha-Ke Bang: in Asia, Phong Nha-Ke Bang with nine species has more primate species than Thung Yai-Huai Kha Khaeng (8), Dong Phrayayen-Khao Yai (7) and Gunung Mulu (5). PNKB is of outstanding importance for the survival of the globally endangered Hatinh langur, a karst specialist endemic to Central Vietnam and PDR Lao, whose largest remaining single population occurs in the park. Phong Nha-Ke Bang is also home to a viable population of the globally endangered red-shanked douc langur and is the most important protected area in Vietnam for the globally endangered southern white-cheeked gibbon.

At 126,326 ha, Phong Nha-Ke Bang is already over 20 times as large as Puerto-Princesa and almost twice as large as Gunung Mulu and South China Karst. Phong Nha-Ke Bang, with the neighbouring Him Namno Biodiversity Conservation Area in PDR Lao, is one of the largest areas of intact forest habitat on limestone karst still found in Indo-China. 94% of PNKB is covered by forests, 84% of which is primary forest, the highest percentage of primary forest remaining in any Vietnamese protected area.

World Heritage Sites in Southeast Asia

There are seven notable World Heritage Sites with karst in South-east Asia, most of which protect tropical forests similar to Phong Nha-Ke Bang National Park. These comprise Lorentz National Park in Papua, Indonesia and the Tropical Rainforest Heritage of Sumatra; Gunung Mulu National Park in eastern Sarawak; the Puerto-Princesa Subterranean River National Park on the island of Palawan in the Philippines, and the Dong Phraya Yen - Khao Yai Complex and the Thung Yai-Huai Kha Khaeng, both in continental Thailand. Lastly, there is the archipelago of Ha Long Bay, in northern Vietnam. .

The nearest existing natural World Heritage property is Ha Long Bay, also in Vietnam (vii, viii), the world's most extensive and best known example of tropical tower karst invaded by the sea. It covers 1,500 sq. km and includes some 1600 islands and islets forming a spectacular seascape of limestone pillars. The karst formations differ substantially from the Phong Nha-Ke Bang plateau and the vegetation is sub-tropical.

Lorentz National Park, covering 2,505,600 ha, is Indonesia's largest conservation area, and is generally recognized as one of the last vast wilderness areas of Southeast Asia. It has been inscribed under Criteria (viii), (ix) and (x). The karst limestone area is also extensive, reaching over 5,000 m in altitude. The area also contains fossil sites which provide evidence of the evolution of life on New Guinea. The site is part of the Australian Plate, known as Sahul, and once formed part of the super-continent Gondwana. The origin of most New Guinea fauna is closely linked to Australia, and very dissimilar from the biodiversity found in Phong Nha-Ke Bang.

The 2.5 million hectare Tropical Rainforest Heritage of Sumatra site (inscribed under criteria (vii), (ix) and (x)) comprises three national parks: Gunung Leuser National Park,

Kerinci Seblat National Park and Bukit Barisan Selatan National Park. The site protects the distinctive and diverse biota of Sumatra, which is very different from the biodiversity of Phong Nha-Ke Bang.

Puerto-Princesa Subterranean River National Park in the Philippines has been inscribed under Criteria (viii) and (x) as a World Heritage site on a karst area. It covers 5,753 ha in the Palawan Biogeographical Province, and thus supports very different biodiversity from Phong Nha-Ke Bang National Park. In addition limestone forests at this site are much smaller than those in Phong Nha-Ke Bang. Another tentative karst site with inscribed proposal of Criterion (x) in the Philippines is Coron Island that also lacks biodiversity information. Otherwise this site contains completely different island ecosystems from the ecosystems of Phong Nha-Ke Bang.

Gunung Mulu National Park (52,864ha) on the island of Borneo in Sarawak Malaysia has been inscribed on the World Natural Heritage List for Criteria (vii), (viii), (ix) and (x). Given the high endemism of species in Borneo, there is exceedingly little similarity between any taxa found in Mulu and Phong Nha-Ke Bang. This site is located in karst area and the tropical forests on limestone are smaller than those in Phong Nha-Ke Bang. In addition Phong Nha-Ke Bang has many more recorded numbers of vertebrate animal species than those recorded at Gunung Mulu National Park.

Both Huai Kha Khaeng (257,464ha) and Thungyai Naresuan (320.00ha) Sanctuaries (inscribed as World Heritage in Thailand under criteria (vii), (ix) and (x)) and the Dong Phrayayen-Khao Yai Forest Complex (inscribed under criterion (x)) - both in Thailand - are largely non-karst areas for which the karst areas are not yet well known. Both the properties in Thailand belong to the same Udvardy biogeographic province as PNKB: the Indochinese Rainforest. However, PNKB belongs to the Northern Annamites Rain Forests WWF ecoregion and the Annamite Range Moist Forests WWF Global 200 priority ecoregion, both of which are not yet represented on the World Heritage List.

World Heritage Sites in China and Australia

There are a number of karst world heritage sites in China, where karst is a common geological feature. However, all these sites support sub-tropical flora and fauna, being subject to much colder weather conditions in the winter months. Mount Emei and Leshan Giant Buddha (China) is inscribed on criteria (iv), (vi) and (x) in the World Heritage List. This site has a total area of 15,400 ha and is located in limestone area, which has high values of biodiversity. This site however is located in the sub-tropical area at an elevation from between 500m to 3,099m asl. Thus this site's biotic elements are very different from Phong Nha-Ke Bang. The area of limestone forests in Mount Emei and Leshan Giant Buddha much smaller than that in Phong Nha-Ke Bang. Mount Emei and Leshan Giant Buddha show sub-tropical fauna and flora while in Phong Nha-Ke Bang there is tropical fauna and flora. Therefore there are fewer numbers of mammals, reptiles and amphibian on Mount Emei and Leshan Giant Buddha compared to Phong Nha-Ke Bang.

The World Heritage site of Three Parallel Rivers of Yunnan Protected Areas (China) (inscribed under criteria (vii), (viii), (ix) and (x)) consists of 15 protected areas with a total area of 1,698,400 ha (in eight geographic clusters) in the mountainous NW of Yunnan Province. This sites geographical position is close to Vietnam, but its ecological elements are different from that in Phong Nha-Ke Bang National Park. Three Parallel Rivers is located at a high altitude with an elevation of between 760m and 6,740m asl. so forest types are montane sub-tropical forests and temperate forests. This site has recorded

diversity and endemism of flora (6,000 species). This site is also the home to abundant mammals and birds. However there are fewer reptiles, amphibians and fish in this site compared to Phong Nha- – Ke Bang.

The South China Karst region extends over a surface of half a million km² lying mainly in Yunnan, Guizhou and Guangxi provinces. It represents one of the world's most spectacular examples of humid tropical to subtropical karst landscapes. The stone forests of Shilin comprise a wider range of pinnacle shapes than other karst landscapes with pinnacles, and a higher diversity of shapes and changing colours. The cone and tower karsts of Libo, also considered the world reference site for these types of karst, form a distinctive and beautiful landscape. Wulong Karst has been inscribed for its giant dolines (sinkholes), natural bridges and caves. However, they are very dissimilar to the Phong Nha-Ke Bang plateau. The biodiversity is very different from that of the Annamites ecoregion.

The Blue Mountains National Park in Australia is located in mountainous terrain and has been inscribed for Criterion (x) but there are fewer plant and animal species compared to Phong Nha-Ke Bang and the limestone forest types are larger and more diverse than those in the Blue Mountains.

Overall, compared to other sites Phong Nha-Ke Bang has outstanding universal value not only because of its diversity in biodiversity and ecosystems but also because it is part of the Annamites Mountain Range and has a very high level of endemism. Of the 41 species that are endemic to this region, 23 are found only in Phong Nha- Ke Bang. These are two plant, one primate, one bird, six reptile, 1 amphibian and 12 fish species. In addition one plant, one bird, six reptile, one amphibian, 12 fish and two butterfly species have been described as new species to science in the last decade. Phong Nha – Ke Bang is the central part of the Annamites that have been identified as one of the areas of great biodiversity significance in the world by WWF, Conservation International and by BirdLife International.



Figure 3.5. Karst landscape in Phong Nha - Ke Bang

Table 18: A Comparison of Biodiversity Richness within Phong Nha-Ke Bang National Park to other World Heritage Sites

Property, State Party	Total area (ha)	Natural WH criteria	Mammal species (endemics)	Bird species (endemics)	Reptile species (endemics)	Amphibian species (endemics)	Fresh water fish species (endemics)	Vascular plant species (endemics)
PNKB, Viet Nam ⁱ	123,326	viii, vii, x	126 (9)	314 (4)	117 (6)	58 (2)	170 (17)	2,744 (427)
Ha Long Bay, Viet Nam	150,000	vii, viii, x	14	40	8	4	?	?
South China Karst, China	47,588	vii, viii	Libo: 59 Shilin: 42 Wulong: 46	Libo: 137 Shilin: 87 Wulong: 174	Libo: 75 Shilin: 44 Wulong: 48		Libo: 43 Shilin: 12 Wulong: 64	Libo: 1,532 Shilin: 889 Wulong: 558
Three Parallel Rivers of Yunnan PAs, China	939,441	vii, viii, ix, x	173 (81 Chinese)	417 (22 Chinese)	59 (27 Chinese)	36 (25 Chinese)	76 (35 Chinese)	6,000+ (2,700 Chinese)
Lorentz National Park, Indonesia	2,505,600	viii, ix, x	123	411	324	90	100+	?
GunungMulu National Park, Malaysia	52,864	vii, viii, ix, x	81	270 (24 Bornean)	55	76	48	3,500
Puerto-Princesa Subterranean River National Park, Philippines	5,753	vii, x	30	91	18	10	?	800
Dong Phrayayen – Khao Yai Forest Complex, Thailand	615,500	x	112	392	200+ (9)		?	2,500 (16)
Thungyai – Huai Kha Khaeng Wildlife Sanctuaries, Thailand	577,464	vii, ix, x	120	400	96	43	113	?

3.3 Proposed Statement of Outstanding Universal Value

The Phong Nha – Ke Bang property is of outstanding natural beauty with its dissected karst plateau, including vast subterranean cave systems, supporting karst specialist and endemic biodiversity above and below the ground.

This property serves as a natural laboratory for biogeographical, ecological, evolutionary, and taxonomic research. It is situated in the central Truong Son range (Annamites), It has been recognized as a critical landscape of the Greater Annamites Global 200 Ecoregion identified as one of the greatest concentrations of endemic species in a continental setting found anywhere.

Criterion (viii)

This area has had a long earth crust development history from the Ordovician period (464 Ma) to the present, including five major periods, namely: Late Ordovician - Early Silurian; Middle Devonian – Late Devonian; Carboniferous; Permian; Mesozoic and Cenozoic. The area has a complicated geological structure. The endogenous and exogenous geological processes which have occurred from the Triassic to the present have created the diverse topography and geomorphology.

Non- karst landforms: low, round-up Mountains with plantation surfaces, abrasion-accumulation terraces along the valleys of the Son and Chay Rivers and at the margins of the central limestone massif.

Transitional landforms, with complicated alternation between limestone massifs and terrigenous terrain.

Karst landforms characterized old tropical karst formed mainly from the Mesozoic, but the most clear signals in the Cenozoic were constituting 2/3 of the area of the heritage site and forming the largest limestone wilderness in the world (Pierre, 1996). The karst formation process has left behind distinct and peculiar imprints such as “underground rivers”, “dry caves”, “terraced caves”, “suspended caves”, “dendritic caves”, and “intersecting caves”, related with the orogenic phases and tectonic faults in the Cenozoic from the Oligocene (36 Ma.) to the present.

Criterion (ix)

The episodic uplift of the limestone landscape from (at least) the Tertiary and the successive karst development, rejuvenation and ongoing evolutionary karst development has created specialist habitats. The episodic uplift also resulted in complex inter-bedding, and capping with schists and apparent granites. The dissected karst plateau supports montane evergreen forest above 700 m. Below ground the plateau houses labyrinths of fossil passages and outstanding caves of different ages. The Truong Son Range may have served as a refugium for forest-dwelling species during the Pleistocene, when evergreen forests disappeared from lower elevations.

Phong Nha-Ke Bang is a natural laboratory. Case studies comprise the similar Hatinh Langur and its black form; three phonetically similar, species of bent-toed geckos showing niche segregation in microhabitat use; 41 cave invertebrates species showed isolation, with

only five species occurring in all three caves. Several primitive or relict species, including the Saola, Annamite Striped Rabbit and Laotian Rock Rat; the later has been identified as a 'Lazarus species', the only representative of a fossil lineage (Diatomyidae) from 11 million years ago (late Miocene). Two new species of blind scorpions were the first troglobitic scorpions found in mainland Asia.

Criterion (x)

The property PNKB National Park, is of global significance for biodiversity conservation, having abundant flora and fauna, including many rare and threatened species. The rugged terrain provides protection for its biodiversity through natural design. It possesses outstanding universal values for science and conservation.

The wealth of geologies and topographies creates significant ecosystem diversity and endemism. Humid tropical forest on limestone, tropical forest on hills, surface freshwater on limestone areas and subterranean ecosystems, include both karst and non-karst, specialist species, many endemic and some globally threatened species. Endangered species include large mammals such as Asiatic Black Bear, Malayan Sun Bear, Binturong, Large-antlered Muntjac, Saola, Gaur, and Tiger (recent provisional unconfirmed records).

Endemic and restricted range species, include charismatic representatives such as the Red-shanked Douc, Southern White-cheeked Gibbon, Crested Argus Pheasant, and Annam Flying Frog. Recently discovered karst endemics, include the Hatinh Langur. The property is a global priority for small carnivore conservation being home to 19 species. As most bird species are not at immediate risk, it is of interest for bird conservation.

Forest cover within the property is very high, at 94% with 84% primary forest. The property protects significant tracts of limestone, with more than 2,000ha of the endemic monodominant species of *Cacelodrus rupetris*, and under the canopy an abundance of very rare orchids. Of great conservation significance to the park are the 419 known endemic plant species. Seven of the nine primate species are globally threatened, and the property is the most important refuge for three of them. Found here is the largest remaining populations of the globally endangered Southern White-cheeked Gibbon and Hatinh Langur, specialized for karst forest and endemic to Vietnam and Laos PDR. In addition, one genus and nine species were recently discovered that all appear to be new for science (Avervanov et al. 2011).

Statement of Integrity

The overall integrity of PHKB National Park is high, with the park recently expanded in size to 123,326 ha, with a corresponding increase in the buffer zone size to 220,269 ha. The property is the largest protected area in Vietnam, and the largest protected karst landscape in South East Asia. It contains some of the world's finest and largest known caves and has outstanding geological, biodiversity, and natural beauty values. It is contiguous to the west with the Hin Namno Protected Area (82,000 ha.) in Laos P.D.R. which is an extension of the immense limestone plateau. Cooperation through the two State party's dialogue and the associated exchange of conservation management and scientific information further supports the integrity of this property.

Although part of the watershed to the South that feeds the Phong Nha cave system is not included in the property it is part of the buffer zone that is sparsely populated. Modalities are being explored to integrate the management of this area with the property. Issues of law enforcement, that in the past have been problematic, are improving with strengthened interagency cooperation, improved resources and the implementation of a Forest Law Enforcement Plan. The management of the property is now guided by a suite of plans, prepared through participatory processes, that align to the over-arching Strategic Management Plan. This includes a Sustainable Tourism Development Plan that guides the management of the rapidly increasing number of visitors to the property. The threats to the conservation of property are being reduced through the current management approach.

Protection and management requirements

The key threats are effectively mitigated through the current management approach. In the long-term, management of the property focuses on ensuring the integrity of the geological and geomorphologic values, as well as the property's unique biodiversity; strengthening the legislative provisions; carefully monitoring the socio-economic activities within the national park; designing suitable eco-tours and tourism developments ; increasing the use of technology in management; undertaking research to gain a more integrated understanding of the property's values; improving the staff capacity and enhancing community awareness and involvement

4. STATE OF CONSERVATION AND FACTORS AFFECTING THE PROPERTY

4.a Present State of Conservation

Present state of natural resource and environment conservation

Many areas of karst and caves in the National Park and its buffer zone have been untouched. All mineral exploitations occur at a distance from the Park and have not effect on the geological and geographical values.

The topography of the karst is full of obstacles and difficult of access, therefore poverty protection measures have been strengthened and impacts to the site have been mitigated. Other impacts such as roads do not affect the biodiversity as shown in an assessment by a UNESCO Delegation.

Forest cover has been increased from 84.27% (in 1998) to 94% (in 2012). An objective of the Management Board shows that the total area of forest land degraded by cutting and shifting cultivation will be regenerated in the future.

Up to now, there is lack in recorded data on species trends. Several results of investigations show that almost of all threatened species have been in decline since the end of the 19th Century. As an example, elephant populations have not been found recently in the Park (Do Tuoc, 2006). Some species however have remained stable or have slightly increased in numbers since the Phong Nha – Ke Bang NP Management Board was established in 2000, such as the Hatinh Langurs which have returned to the karst cliffs along Road No.20.

Recently, environmental impacts from ecotourism have been minimised and these activities are promoting conservation in the area. Tourism activities have been organized in Phong Nha and Tien caves outside the core zone, so these activities do not affect the biodiversity of the Park.

Inside the Park there is one village of ethnic minority people, the Arem and consists of 40 households. The Arem have stopped their shifting cultivation methods and are no longer a wandering tribe. They have received support from the local authorities and National Park to settle in houses and practice permanent cultivation methods in land use planning. The Arem have participated in natural resource protection in the Park.

Addressing the threats to natural resources

Table 19: Analysis of the threats to the natural resources in Phong Nha- Ke Bang National Park.

	Activities	Impacts on natural resources	Current situation/ management	Proposed management measures/actions
1	Illegal mine fishing, hunting and wildlife trade	Forest resource depletion and biodiversity & loss of rare species	Still occurring and management is working hard to minimise these activities	Law enforcement for control, training for awareness
2	Extractive logging and NTFP collection: timber, rattan, bamboo, medicine plant, resin, bee honey	Disturbance to the forest ecosystem	Occurring as a major practices	Proper planning and practice for extraction along with resource development
3	Upland cultivation on fixed areas	Soil structure and fertility loss, degradation, erosion	Still occurs due to minimal land available to inhabitants of Buffer Zone	Introduce and apply proper techniques and model systems for slopping land and effective land-use planning
4	Afforestation with exotic & fast growing species	Major disturbances and diversity loss to the forest ecosystem: soil changes, forest function & structure changes, species composition change	Not evident	Prohibit the introductions of exotic plant and animal species to the area
5	Disturbance of catchment area	Erosion and sedimentation of caves and rivers	Minimal occurrences in Truong Son and Tan Trach Communes	Sustainable catchment area management
6	Disturbance of caves	Disturbance on bat habitats	Currently occurring in some caves	Prohibited in caves located inside the Park
7	Livestock grazing	Disturbance of vegetation, regeneration and wildlife habitats	Occurring in small areas in Arem village	Pasture planning for livestock in Arem village.
8	Tourism	Disturbances on the forest ecosystem and pollution to the environment	Occurring in some caves in PNKB NP	Sustainable management & community ecotourism programs

- **Hunting and wildlife trading.** There was ample evidence of hunting in the Park and wildlife trading in surrounding areas. Annual average statistics by Forest Rangers show that about 150 violations occur each year such as illegal hunting, logging and wildlife trade.
- **Illegal logging and collection of non-timber forest products.** Before the National Park was established the main activity in the area was timber logging of species

with high economic value such as *Dalbergia tonkinensis* (Hue) and *Diospyros sp.* (Mun soc). Since the establishment of the Park Management Board these activities have been mitigated and only occur at very low level. This is probably a result of the conservation efforts regarding these activities. Several species of non-timber forest products such as rattan, bee honey, bamboo, orchids and medicinal plants are still illegally collected by local people.

- **Catchment area erosion and cave/river sedimentation.** All land in the catchment area of the Park belongs to the three communes of Thuong Trach, Tan Trach and Truong Son. Collection of forest resources close to the Laos Border in Truong Son and Thuong Trach Communes show evidence of slight impacts from human activities. Currently these impacts are low however, they should be controlled and this can be achieved by the development of a sustainable catchment management plan for the area.
- **Disturbance of caves:** Some caves have been disturbed by local people collecting bat guano and hunting, and inappropriate tourism development.
- **Livestock grazing:** Livestock grazing was witnessed on several occasions surrounding Arem village inside the core zone of the Park. Livestock grazing can exert direct influence upon natural vegetation and regeneration including defoliation and trampling, and indirect influences by disturbing wildlife populations.
- **Tourism:** The numbers of visitors is increasing in this area and this has the potential to create impacts to rivers, caves and the forest by increasing pollution, animal habitat disturbance and ornamental plant exchange. This can be managed providing that an appropriate management plan is in place.

Measures on natural conservation

Defining the Boundary. Phong Nha-Ke Bang National Park has two zones which are the core zone and the buffer zone. Among them, the core zone expanded to a total area of 123,326 ha by Decision N° 1062/QĐ-TTg dated 05/7/2013 by the Prime Minister. The Park boundary has been planned to be reviewed and landmarks and notice-boards.

Protection of natural resource and environment. Forest protection has involved community participation through activities of forest allocation, establishment of village forest protection groups and forest fire controlling teams.

Reforestation. Natural regeneration and reforestation of about 20,000 ha has been implemented by the Park Management Board involving community participation.

Training and propagation of natural conservation. A Conservation Programme has been organized and planned for 10 communes within the Buffer Zone. This consists of environmental education and natural conservation documentation which is provided to local people, visitors and local schools.

Watershed management. Catchment areas to the west of the Park, close to the Laos P.D.R. border, belong to the property. Catchment areas in the Southwest of the Park are also assigned as "Protected Forest" of the Gianh River under the National Protected Forest system according to Decision N° 186/2006/TTg dated 14/8/2886 by Government.

Integrated conservation: Phong Nha-Ke Bang connects to the west to a protected area of karst area named Hin Namno National Protected Area in Laos. These protected areas together become one of the biggest karst areas in the World, which is a large contiguous area for the integrity of biodiversity conservation. Two projects on trans-boundary biodiversity conservation have been established. These are the Trans-boundary Conservation Project (RAS/93/102/WWF/UNDP) and LINC implemented by WWF Indochina. These projects have set up the relationships between Vietnam and Laos in biodiversity conservation. The authorities of Quang Binh Province (Vietnam) and Khammouane Province (Laos) have committed and signed an agreement, on 14th October 2006, to undertake trans-boundary conservation. Recent years, Phong Nha - Ke Bang and Hin Namno are supporting by KfW and GIZ on conservation and development.

From 8-10/12/2006 World Heritage Center of UNESCO Committee had a meeting with Quang Binh province and the park management to discuss on transnational conservation measures.

From 2010 to present, annual meetings between the two trans-boundary protected areas for development of activities supporting to the property conservation. A provincial level meeting of the two border provinces to promote transboundary cooperation in natural conservation.

Eco-tourism management. A Master Plan of Sustainable Development Eco-tourism was approved by Quang Binh PPC in 2012. The Management Board oversees ecotourism at Phong Nha-Ke Bang National Park, which is advantageous for integrated conservation and ecotourism development. This creates a good opportunity to control tourism impacts on this natural area. Many forms of participatory tourism development have involved communities such as: Establishing community boat teams for visitor transport, and other ecotourism services in communities. A Centre for Eco-Culture & Tourism has been established under the National Park Management Board, which has responsibilities for organizing eco-tourism activities and minimising environmental impacts. Regulations on ecotourism services are set up for community boat teams, photographers, hotels/guesthouse, restaurants, etc., and tourists. For example an article on tourist transport boats shows that all boats are prohibited to use engines inside caves. The Centre for Eco-Culture & Tourism has a team for garbage collection. More than 400 waste baskets are being installed in tourist areas for garbage collection.

Sustainable socio-economic development. The Park Management Board and Quang Binh PPC have supported the Arem people to settle in their village by providing land use planning, infrastructure construction and sustainable crops.

Communes in the Buffer Zone are a priority over others programmes of economic development such as: Programme 135 (National Programme of Rural Infrastructure Development), Programme 661 (National Programme Reforestation), and Central Poverty Reduction Project (ADB project). In particular a substantial project on Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha-Ke Bang NP Region funded by KfW and GIZ is implementing to support both core zone and buffer zone. This project is creating opportunities for biodiversity conservation in the Park and economic development in the Buffer Zone.

Government support: Annual investment shows that Phong Nha-Ke Bang has been supported by the Ministry of Agriculture and Rural Development and by the Quang Binh Provincial authorities (more detail in 6c). The Management Board has been supported with a sustainable government investment.

4.b Factors affecting the Property

(i) Development Pressures (e.g., encroachment, adaptation, agriculture, mining)

Phong Nha-Ke Bang National Park is far from industrial and residential areas, however there is always a possibility of impacts from a high population density in the Buffer Zone, causing encroachment on the Park.

Solutions

Communes in Buffer Zone are of high priority for programmes or projects on economic development, land use planning and sustainable natural resource management.

Ensure effective mechanisms for controlling mineral exploitation, hunting and natural resource encroachment.

(ii) Environmental Pressures (e.g., pollution, climate change, desertification)

Phong Nha-Ke Bang is situated in a high rainfall zone (about 3000 mm per year), so transportation on the Son River is rather difficult in the rain season (August to November). The site area is affected by the dry hot SW wind from May to September. Recently the increased use of motor boats for tourism transportation is causing water pollution.

Solutions

Strengthening forest protection to prevent illegal wood cutting, and stop shifting cultivation, along with implementing forest protection and reforestation activities to maintain high forest cover in the watershed area of Phong Nha – Ke Bang NP.

Gradually promote the use of electric motors to replace the current diesel powered engines in boats.

(iii) Natural disasters and Preparedness (earthquakes, floods, fires etc)

This is not an earthquake zone however, this is a watershed area and there are many steep inclines with many rivers and streams. Therefore floods occur on a regular basis between June and September. Erosion in the catchment area from flooding increases the sedimentation in underground and above-ground rivers causing a minimal problem for some species. Forest fires sometimes occur during the dry season.

Solutions

There are policies on land and forest allocation to households in order to promote community participation for reforestation of watershed areas of the Park and the Buffer Zone.

As a national park, the site has a management plan to control potential natural disasters and has a warning system for forest fires and shifting cultivation in the area. The national park has an educational programme in place to inform local people about forest protection including fire management.

(iv) Responsible Visitation

Numbers of visitors and boats has increased during recent years causing environmental pollution of the caves, and damaging the biodiversity of the area. A Master Plan for tourism development by the Quang Binh Province has identified that Phong Nha – Ke Bang NP will become a priority destination for eco-tourism. Thus due to the increase in visitor numbers the amount of waste is also increasing and an effective management plan needs to be established.

Solutions

There are activities to promulgating the regulations of tourist activities in this site, training for officers and tourist guides, assessing environment impacts and implementing negative impact mitigation approaches. Another plan is focusing on decreasing diesel motor boats while increasing electric boats in the Park. Besides, there are activities on education and public awareness enhancement to follow legal regulations of visitors and the establishment of a garbage collection team and sites planned for more than 400 waste bins. As a long terms strategy, an ecotourism plan, funded by ADB will be implemented and will design suitable eco-tours in the area.

(v) Numbers of Inhabitants within the Property and the buffer zone

Estimated population located within:

Area of property:	401 people
Buffer zone:	54,143 people
Total:	51,544 people
Year:	2012

People living within the boundary of the National Park cause minimal pressure on natural resources including a small demand for natural products such as land for cultivation, timber, firewood and fish. In the Buffer Zone this is a different matter as the pressure on forest resources is increasing due to the annually increasing population as well as an increase in the demand for natural resources.

Solution

The Park has established a project to support people living in the Park by assisting in the construction of infrastructure, stable agricultural production, participatory natural resource protection, along with strengthening the propagation and education related to Park protection for the local people living in the Buffer Zone.

During the implementation of the following projects: Programme 135, Poverty Reduction Project and KfW Projects, the livelihood of people living in both the Core Zone and Buffer Zone has improved therefore reducing pressures on the forest and ensuring the involvement of local communities in the protection of the area and in future, participating in ecotourism activities.

In particular another project that is being implemented in the catchment area of Truong Son Commune involves local communities to participate in watershed area protection. The Management Board of Phong Nha – Ke Bang is implementing an animal grazing plan for the ethnic minority people living in and around the park.

5. PROTECTION AND MANAGEMENT OF THE PROPERTY

5.a Ownership

As stated in National Land Law issued in 2003, the Socialist Republic of Vietnam is the owner the whole land area. The Phong Nha – Ke Bang NP Management Board, under the jurisdiction of the Quang Binh PPC, is in charge of the management of the National Park (85,734ha), the district local authorities are in charge of the management of the Buffer Zone (about 200,99ha, based on the boundaries of communes encompassing the protected area).

5.b Protective Designation

National Park (core zone)

The whole area inside Phong Nha-Ke Bang National Park, including land, forest resources, landscape, lakes, caves, and historical relics, comprising an area of 123,326 ha is owned by the state according to the following government decisions:

- Decision N^o 194/ CT dated 9/8/1986 by the Chairman of the Council of Ministers on the establishment of Phong Nha Nature Reserve.
- Decision N^o 941 QD/UB dated 18 November 1993 by Quang Binh PPC on establishing the management board of Phong Nha Nature Reserve.
- Decision N^o 236 dated 12 December 1986 by the Minister of Culture and Information to recognize Phong Nha-Xuan Son as a national relic landscape area.
- Decision N^o 189/2001/QD-TTg dated 12/12/2001 by the Prime Minister on the upgrade Phong Nha Nature Reserve to Phong Nha-Ke Bang National Park.
- Decision N^o 1270/QD-TTg dated 12/8/2009 by the Prime Minister on the identification of ten site as special national relics, including Phong Nha-Ke Bang National Park.
- Decision N^o 1062/2013/QD-TTg dated 05/7/2013 by the Prime Minister on the expanding Phong Nha-Ke Bang National Park.
- Decision N^o 24/2002/QD-UB dated 20/2/2002 by the Quang Binh PPC on the establishment of the Management Board of Phong Nha-Ke Bang National Park.
- Decision N^o 65/2003/QD-UB dated 28/11/2003 by the Quang Binh PPC on the restructure of the Management Board of Phong Nha-Ke Bang National Park.
- Decision N^o 36/2013/QD-UB dated 2012 by the Quang Binh PPC on the restructure of the Management Board of Phong Nha-Ke Bang National Park.

Buffer Zone

The Buffer Zone consists of communes that share their land and boundaries with the Core Zone. The Buffer Zone is a specific area that supports the conservation of the Phong Nha – Ke Bang NP. The Buffer Zone is identified as a priority area for

forest resource management and social economic development according to Prime Minister Decision N° 186/2006/QĐ-TTg dated 14/8/2006 on promulgation of the management of three forest categories (former Decision N° 08/2001/QĐ-TTg) an Decree N° 117/2010/NĐ-CP dated 24/12/2010 by the Government on Special Use Forest system management. Land and natural resources in the Buffer Zone are managed by local authorities according to the Law on Land (2003).

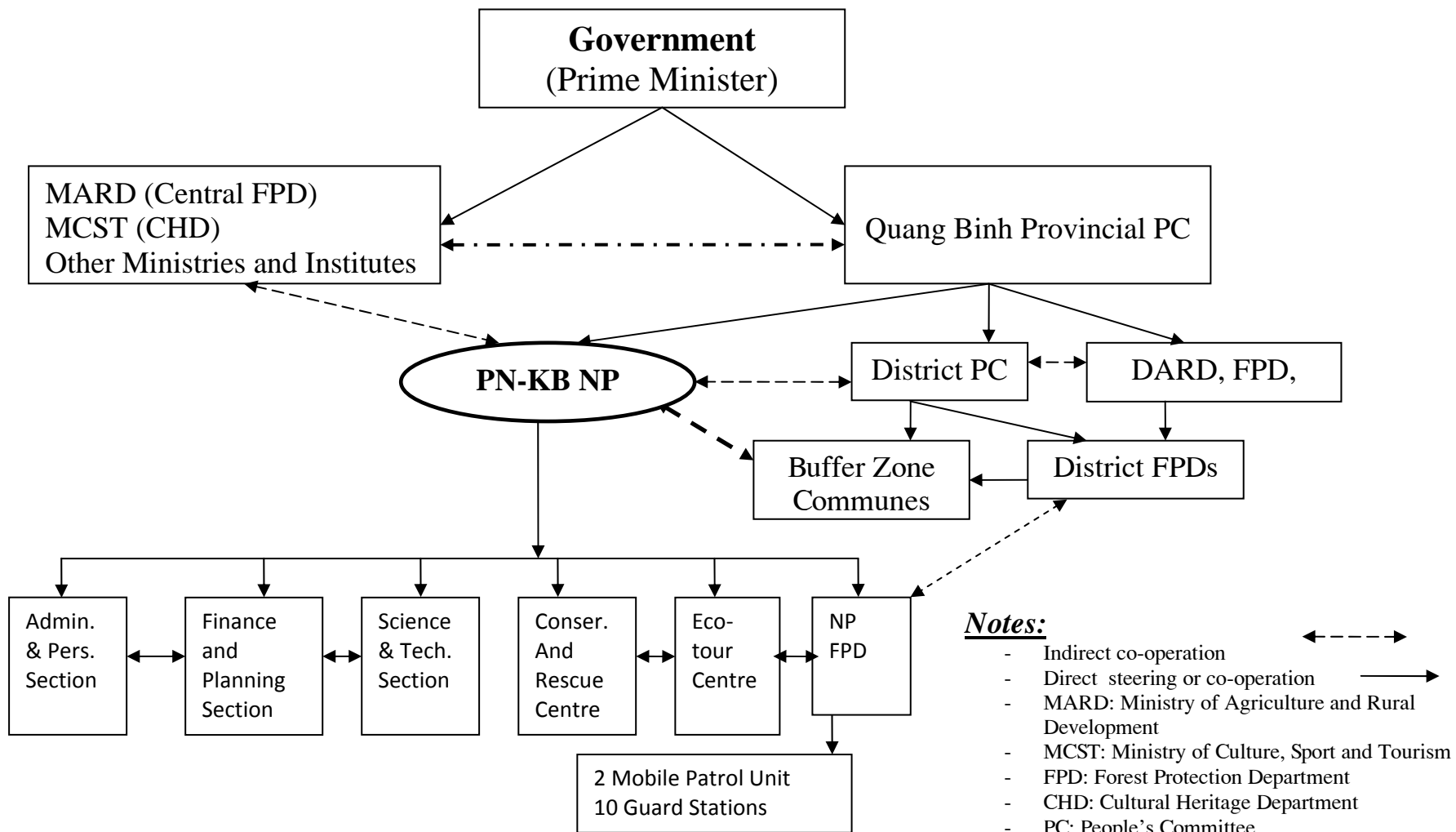


Figure 5.1. Organizational Arrangements of Phong Nha- Ke Bang National Park and buffer zone management and protection

Governing:

- Government institutions such as the Ministry of Agriculture and Rural Development (Central Forest Protection Department), Ministry of Culture, Sport and Tourism (Central Department of Cultural Heritage) support the Phong Nha-Ke Bang National Park by providing specific purpose policies and technologies. National Institutes and Universities support the Phong Nha-Ke Bang National Park by transferring technology and expertise.
- Quang Binh PPC is the decision-maker and directly supports the Phong Nha-Ke Bang National Park by establishing provincial policies and budgets.
- Provincial institutions such as The Department of Culture and Information, the Department of Science and Technology, the Department of Natural Resource and Environment, the Department for Trade and Tourism, the Department of Agriculture and Rural Development and the Provincial Forest Protection Department have responsibilities for providing support and expertise to the Phong Nha-Ke Bang Management Board.

Structure of the Phong Nha-Ke Bang National Park Management Board:

- The Phong Nha-Ke Bang National Park Management Board, under the jurisdiction of the Quang Binh PPC, is in charge of the management of the National Park (123,326 ha)
- The Forest Protection Bureau comprises of 8 forest guard stations and 1 mobile patrol unit. This section has the responsibility for all protection activities in the Park.
- The Personnel and administration section is in charge of administrative, personnel and infrastructure services.
- The Financial and Planning Section is in charge of financial services and Park activity plans.
- The Science and Foreign section is in charge of the implementation of research programmes and setting up mechanisms for Park conservation.
- The Center for Conservation and Rescue is in charge of natural activities and plant and animal rescue.
- The Centre for Ecology and Cultural Tourism has the responsibility for the management of tourism activities in the Park and surrounding areas.

Local Authorities and communities:

- The District and Commune People's Committees are in charge of the management of the Buffer Zone (220,055ha, based on the boundaries of communes encompassing the protected area). District and Commune People's Committees have responsibilities for corpora ting with the Phong Nha-Ke Bang Management Board in natural conservation activities under policies from the Quang Binh PPC. The District Forest Protection Department in corporation with Park Forest Protection Bureau is in charge of controlling and monitoring forest resource in the Buffer Zone.
- Local communities living in and adjacent to Phong Nha-Ke Bang National Park participate in natural resource protection in the Park area and use sustainable methods in natural resource management.

5.c Means of Implementing Protective Measures

Activities entailing the protection of natural forests and resources are overseen by the Phong Nha – Ke Bang NP Management Board. These are implemented in the following manner:

- + Establishment of ten Ranger Stations and two Mobile Patrol Units. The main duty of rangers within these is to prevent illegal timber extraction, limestone exploitation, hunting, and fishing.
- + Put into effect education programs to increase the awareness of local communities and authorities about natural conservation needs and efforts.
- + To carry out programs in the Buffer Zone (with a total area about 200,000ha) to improve the living standards of local people and involve them in forest and biodiversity protection.
- + To protect the rivers, caves, and other features of the landscape, including relics.
- + To control any environmental impacts within Phong Nha - Ke Bang NP.
- + To guide tourist in the Park and surrounding areas. Regulations on ecotourism activities have been established for boat transport team, photographers, hotels and guesthouses, restaurants and visitors.

In general, the Management Board has good equipment and is capable of fulfilling their duties.

Local communities have been involved in natural resource conservation such as forest protection, agreement on hunting and ecotourism activities.

Many regulations and agreements have been signed by Quang Binh PPC such as the regulations on property protection between provincial armed agencies and the agreement on the protection of both protected areas in Laos and Vietnam.

5.d Existing Plans related to Municipality and Region in which the Proposed Property is located

Decision N^o 79/2007/TTg dated 31 May 2007 by the Prime Minister on the approval of the Biodiversity Action Plan for Vietnam that is a priority action by the Vietnamese Government following the Convention on International Biodiversity in which Phong Nha – Ke bang is classified as a priority protected area for conservation.

Decision N^o 192/2003/QD-TTg dated 17 September 2003 by the Prime Minister on the approval of the strategy of Protected Areas, Phong Nha – Ke Bang is classified as a priority protected area for conservation.

The Master Plan for economic development in Quang Binh Province for the period between 2001-2010, defining the objectives for land use and tourism development strategies in the Phong Nha – Ke Bang area to protect the area's environment, landscape, caves, and biodiversity values.

Transboundary Biodiversity Protection Plan, a result of the cooperation between Laos and Vietnam, in particular Quang Binh Province (on the Vietnamese side) and Khammoune Province (on the Laotian side). The main purpose of this plan is the integrated conservation of the large limestone area in central Vietnam and Laos. From 1996 up to now, many international workshops on trans-boundary conservation planning between Vietnam and Laos have been organized in Vietnam and Laos.

Quang Binh Province has a programme for the protection of natural resources in the watershed of the Phong Nha – Ke Bang area.

For the period between 2005-2015 a Hunting & Wildlife Trade Control action plan has been established for Quang Binh and Ha Tinh Provinces (Vietnam), and Bolikhamxai and Khammoune Provinces (Laos).

Many plans for improving the living standards of local people in the Buffer Zone aimed at decreasing human pressure on forest resources and biodiversity. These programmes include economic mechanism improvement; innovation rural plans for all communes in the province, socio-culture planning, infrastructure planning, National boundary region development plans, education and health care improvement plans, etc.

There are several projects in this area as: Programme 135 - community infrastructure construction (from 2000-present); Programme 134 - cultivated land use planning (from 2005-present); Central Poverty Reduction Project - ADB project (2004-2011); a Project on Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha – Ke Bang NP Region - KfW (2008-2015), etc.

5.e Property Management Plan or other Management System

A Management Plan for establishing Phong Nha Nature Reserve was approved by Quang Binh PPC in the Decision N° 964 QD/UB dated 13 December 1993.

A Management Plan for upgrading Phong Nha Nature Reserve to Phong Nha – Ke Bang NP was approved by Prime Minister in the Decision N° 189/2001/QD-TTg dated 12 December 2001.

An Operation Management Plan and a Strategy Management Plan for National Park have been approved by Quang Binh PPC in 2013

An eco-tourism plan, funded by Phong Nha - Ke Bang Project has been formulated for Phong Nha – Ke Bang NP in 2008 and approved by Quang Binh PPC in 2010.

Decision No 1062/QD-TTg dated 05/7/2013 by Prime Minister on expanding Phong Nha Ke – Ke Bang NP to a total area of 123,326ha to include limestone areas in Minh Hoa District.

After Phong Nha- Ke Bang National Park was inscribed on the World Natural Heritage List in July 2003, many areas of the management system of the National Park were established such as:

- A Centre for Ecology and Culture Tourism under the Management Board of Phong Nha-Ke Bang National Park established in 2004, and an activities plan (2005-2010) had been formulated for the Centre.
- A Centre for Scientific Research and Wildlife Rescue under the Management Board of Phong Nha-Ke Bang National Park established in 2004. Annual activity plans for the Centre are approved by the Park Management Board.
- Eight Forest Guard Stations were established and positioned along Road No.20 and the Ho Chi Minh Trail. The activity plan for each forest guard station is formulated annually.
- Participatory plans for patrolling and fire control are formulated annually. Village forest protection and forest fire controlling teams have been established for all villages in the Core Zone and the Buffer Zone of the National Park.



Figure 5.1. Tourism flows through Vietnam

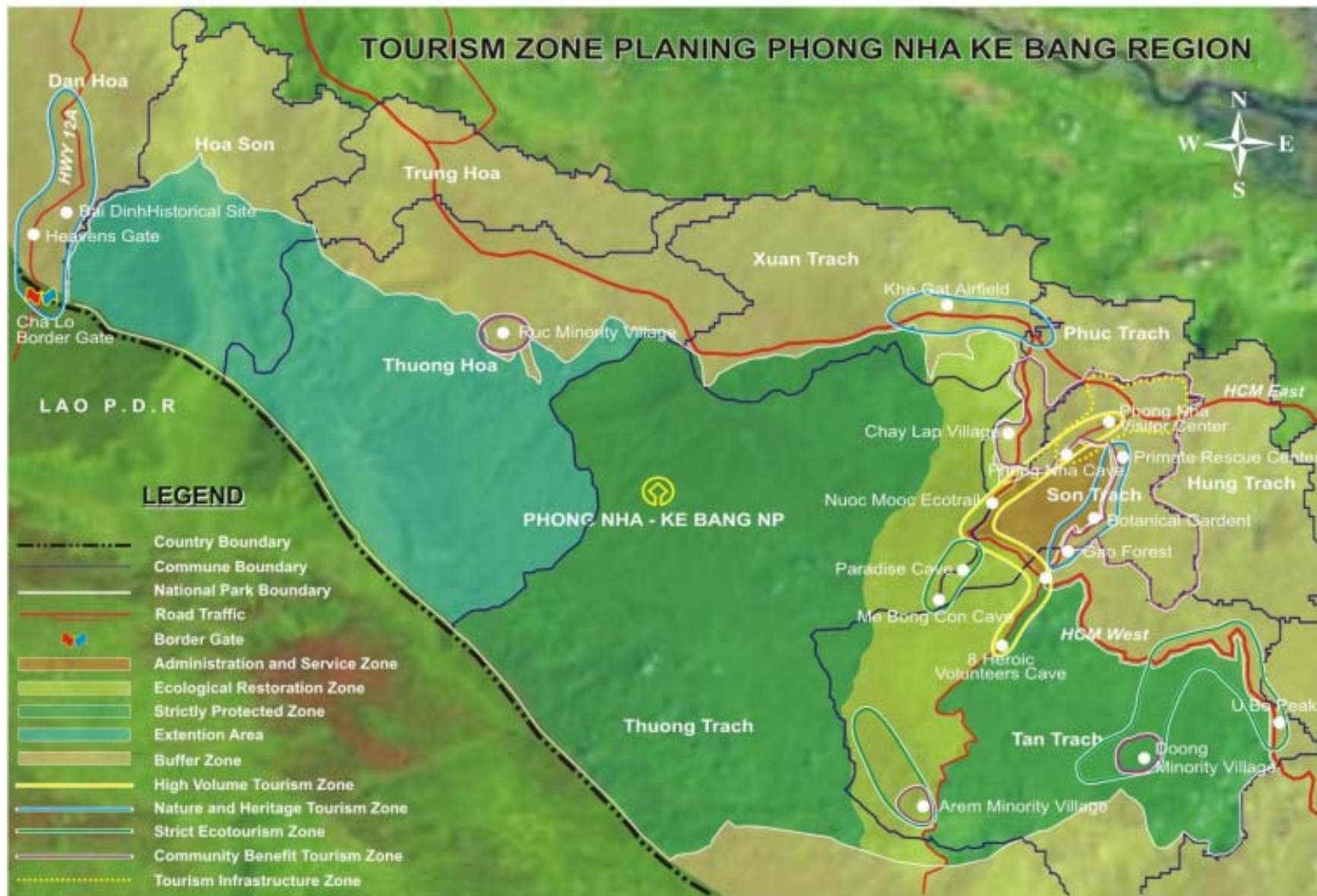


Figure 5.1. Map of the tourism zones of the Phong Nha - Ke Bang National Park Region

5.f Sources and Levels of Finance

The finances are largely provided from the Government budget through the Phong Nha-Ke Bang Management Board as follows:

- + Construction of the office of the Management Board.
- + Implementation of projects for biodiversity assessment, investigation of caves, etc.
- + Managing the tourism to caves and relics in the area.
- + Management of the National Park and protection its natural resources.
- Sources of finance :
 - + Government sources are mainly provided for the construction of offices, for payment of salaries and for the other activities of the management boards: Phase 1 from 1993-2012 included an investment of 70 billion Vietnamese Dong (about 3.5 million USD); Phase 2 from 2007-2015, 3 billion Vietnamese Dong (equivalent 200,000 USD per year) is invested annually.
 - + Another source of finances is the sale of tickets to visitors and from other tourist service: estimated at about 20 billion Vietnamese Dong equivalent to about 1,000,000 USD per year.
 - + International NGOs and donors have provided funds for surveys and research, and Buffer Zone development programmes, such as the LINC project (about 150,000 USD), KfW and GIZ (about 16 million USD), and others sources from small grants implemented by FFI, Cologne University, etc.

5.g Sources of Expertise and Training in Conservation and Management Techniques

Most of the staff responsible for the conservation and management of the site have graduated from different colleges and universities, such as the Forestry University, the National Economic University, Hanoi National University, Hue Agro-Forestry University, Hue University, Culture University and Ranger School.

Sources of expertise and training are available from national authorities or other organizations to the property such as: The Forest Protection Department under the Ministry of Agriculture and Rural Development, Vietnam Forestry University, Hanoi National Natural University, Forest Inventory and Planning Institute (FIPI), Institute for Ecology and Biology Research, the Natural Conservation Training Centre in Cuc Phuong National Park, and other colleges and institutes.

5.h Visitor Facilities and Infrastructure

The organization system and tourism services of Quang Binh Province are as follows:

- The Culture, Sport and Tourism Department of Quang Binh Province is the Government Office responsible for managing all tourism activities in the area:

- + Private and service companies have 100 hotels and guesthouses in Quang Binh Province.
- + State companies have 15 hotels and guesthouses in the whole province.
- + More than ten hotels in Dong Hoi City are 2 star standard and above.
- Phong Nha – Ke Bang National Park has a Centre for Culture and Ecology Tourism including a boat team, a guide team and many local participants from villages.

Tours:

- North-south Vietnam to be held from North to South or back. During that visitors can see a variety of scenic and historic sites across Vietnam, Phong Nha-Ke Bang is the middle stopping point.
- Tours to Phong Nha - Ke Bang mainly from the cities of Hanoi, Ho Chi Minh, Da Lat, Vung Tau, Nha Trang, Da Nang.

Internal tours held in Phong Nha - Ke Bang:

- Route 1: Visiting Phong Nha and Tien Son caves.
- Route 2: Exploring the mysterious depths of Phong Nha Cave.
- Route 3: Exploring the nature in Rao Thuong - Hang En.
- Route 4: Visiting Chay River and Toi cave.
- Route 5: Ecotourism of Nuoc Moc site.
- Route 6: Visiting historical temples by along Road 20.
- Route 7: Ecotourism of Thuy Cung cave - Sinh Ton valley.
- Rout 8: Home stay in Xuan Son.

Visitor:

- Domestic visitors mainly come from Hanoi, Hai Phong, Nam Dinh, Ho Chi Minh, Da Lat, Vung Tau, Nha Trang, Da Nang provinces and cities.
- In the recent years, the number of foreign tourists coming to Phong Nha- Ke Bang has increased year by year.

Table 20: Visitor numbers to Phong Nha- Ke Bang National Park from 1994-2012

Year	Domestic visitors	Foreign visitors
1994	1,000	0
2000	84,482	955
2003	196,227	1,291
2004	329,438	2,241
2005	251,657	4,266
2006	257,646	7,158
2007	240,493	11,795
2008	250,919	11,346
2008	303.015	8.615
2009	290.582	10.425
2011	267.143	10.521
2012	266.021	10.626

Tourism equipment of the Tourism Management Centre

- There are two vehicles for transportation of tourists, one with 12 seats and the other with 36 seats.
- There are 310 motor boats for transporting visitors along the Son River.
- A rescue team for tourists and an environmental team have been established.

5.i Policies and Programmes related to the Presentation and Promotion of the Property

Related policies include:

- The State Law on Cultural Heritage was passed on 29 June 2001 by the National Assembly of the Socialist Republic of Vietnam.
- The State Law on Forest Protection and Development was passed on 3 December 2004 29, 2001 by the National Assembly of the Socialist Republic of Vietnam. Decree N° 23/2006/ND-CP dated 3 March 2006 on implementation of the Law on Forest Protection and Development.
- The State Law on Land was passed on 26/11/2003 by the National Assembly of the Socialist Republic of Vietnam.
- The State Law on Environment was passed on 29 November 2005 (former 1994) by the National Assembly of the Socialist Republic of Vietnam.
- The State Law on Fisheries was passed on 26 November 2003 by the National Assembly of the Socialist Republic of Vietnam.
- Vietnam Forestry Development strategy (2006 - 2020) was promulgated and enclosed with the Decision N° 18/2007/QD-TTg, dated 5 February 2007, by the Prime Minister.
- Decree N° 139/2004/ND-CP dated 25 June 2004 by the Government on the penalization of administration violence in the forest management and protection, forest product management.
- Decree N° 32/2006/ND-CP dated 30 March 2006 by the Government on the management of plant and animal threatened species.
- Decision N° 245/1998/QD-TTg dated 21 December 1998 by Prime Minister on the government decentralized administration of all government levels' responsibilities for forest and forested land management.
- Decision N° 186/2006/QD-TTg dated 14 August 2006 by Prime Minister on the declaration of a management protocol of three forest categories.
- Resolution N° 08/2006/CT-TTg dated 8 March 2006 by Prime Minister on the enhancement of urgent measures on illegal forest cutting, exploiting and firing.
- In the Biodiversity Action Plan for Vietnam, approved by the Decision N° 79/2007/QD-TTg dated 31/5/2007 by Vietnam Prime Minister, Phong Nha – Ke Bang is classified as a priority protected area.

Related programmes include:

- National Programme 135 (long term) has supported the upgrade of infrastructure in constrained communes in the whole country. All communes in the Buffer Zone of Phong Nha – Ke Bang are included in this programme.
- National Programme 661 (long term) has supported forest protection, regeneration and reforestation. Forests in Phong Nha – Ke Bang NP and its Buffer Zone are prioritized for protection and regeneration.
- National Programme 134 (long term) has supported cultivated land use planning to mountainous communes. All communes in the Buffer Zone of Phong Nha – Ke Bang are included in this programme.
- Central Poverty Reduction Project (supported by ADB, 2004-2008) has supported poverty alleviation in Quang Binh, Quang Tri, Thua Thien-Hue and Kon Tum provinces. All communes in the Buffer Zone of Phong Nha – Ke Bang are included in this project.
- Project on Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha – Ke Bang NP Region (funded by KfW, 2007-2012) supports participatory Phong Nha – Ke Bang NP management, biodiversity assessment, Park expansion, economic development of Buffer Zone communes, ecotourism development, etc.
- Ecotourism development project (ADB, 2008-2010) is going to support eco-tourism development and planning in several Protected Areas in Central Vietnam, including Phong Nha – Ke Bang NP.

5.j Staffing Levels and Expertise (professional, technical, maintenance)

Phong Nha-Ke Bang National Park has a total staff number of 202, structuring as follows:

- National Park leaders: 4 including 1 Director and 3 Deputy Directors, two of whom are Forestry Engineers and the other graduated from the University of Culture.
- The Forest Protection Bureau comprises 10 forest guard stations, 2 mobile patrol units with a total of 93 staff. All of them graduated from the Forestry University or the Forest Protection School.
- The Scientific and Technological Section: 6 staff, graduated from the Forestry University or the National Natural Sciences University.
- The Personnel and administration section: 17 staff.
- The Centre for Natural Conservation and Wildlife Rescue: 27 staff, graduated from the Forestry University or the National Natural Sciences University.
- The Personnel and administration section: 17 staff.
- The Centre for Ecology and Culture Tourism: 54 staff

- Aside from this there are 266 non-permanent staff work in Phong Nha – Ke Bang NP on seasonal contracts.

Table 21. Staffing levels

No	Level	Total	Regular staff	Education level			Contract
				University	Specialist school	Other	
1	Leader	4	4	4			
2	Admin & Personnel	17	17	11	1	5	
3	Science and Technology		6	6	0		
4	Finance and Planning	8	8	7	1		
5	Centre for Conservation and Rescue	27	27	22	4	1	
6	Centre for Tourism	122	54	46	21	55	68
7	Forest Protection Bureau	291	93	6	84	4	198
	Total	468	202	95	111	65	266

Source: Phong Nha – Ke Bang NP, 2012

6. MONITORING

6.a. Key indicators for measuring state of conservation

Nature conservation at Phong Nha – Ke Bang is the priority task of the management board, therefore an assessment of forest resources, biodiversity, karst, caves and river water resources is extremely necessary. Monitoring the effectiveness of protection activities in the area should be based on the following key indicators:

Forest areas and vegetation

- The forest cover in Phong Nha – Ke Bang NP is more than 93 percent, including the forests on limestone areas and hills. There are three important forest types that should be monitored and these are: tropical moist evergreen forest on limestone, coniferous forest on limestone and tropical moist evergreen forest on hills.
- Forest area and forest structure are the most important and distinct elements for monitoring the effectiveness of protection activities. For example if both the quality and quantity of primary forest is reduced there is a need to revise protection activities and plans.

Biodiversity

- The Phong Nha – Ke Bang NP has a high value of biodiversity with a larger number of animal and plant species. There are many threatened and endemic plant species including *Excentrodendron hsienmu*, *Garcinia fagraeoides*, *Markhamia stipulate* and a large number of Dipterocarpaceae species, etc; and animal species such as Hatinh Langur, Red-shanked Douc Langur, White-cheeked Gibbon and Pheasants. Changes of the individual number of threatened and endemic species and their habitats are important indicators for assessing the conservation situation.
- Habitats of key plant and animal species, especially limestone forest and caves are key indicators for monitoring.

Demography and people activities affected to the property

Demography of the Arem and their activities inside the Core Zone are key indicators for monitoring. Activities and socio-economic development projects that can affect the property are construction, encroachment and grazing. These must be monitored regularly to ensure impacts are kept to a minimum.

Status of air and water pollution in rivers and caves

- The forest cover of catchment areas of rivers and streams in the south west of the Park are indicators for water quality and cave accumulation, whereas water flows and cave accumulation are also indicators for monitoring of forest quality in catchment areas.
- Prior to 1993 there were few visitors to the area. From 1995 until now visitor numbers have increased from year to year. The increase in visitors and the increasing amount of litter is one reason for air and water pollution in the rivers and caves.

- To mitigate environment pollution, monitoring air and water quality in the rivers and caves is necessary. This monitoring will provide information and data on environmental pollution in the area and management will be able to apply effective solutions to protect the Site. The colour of the stalactites and stalagmites in caves are also indicators for monitoring tourism impacts.

Table 22: Key indicators for measuring the state of conservation

Indicator	Period	Location of Record
Forest area (forest cover)	Yearly	Limestone forest and forest on hills inside the Park
<i>Cacelodrus rupetris</i> forest area and its population	Yearly	Km No.38, Road No.20, limestone area.
Population of some animal species	Yearly	Sample plots inside the Park
Sensitive karst areas may be exploited	Monthly	Karst areas in the National Park and its Buffer Zone
Water quality of the Son River	Every 3 year	Son river
Illegal forest product collecting and fishing violations	Daily	Whole park
Cave river sedimentation	Every 3 year	In underground rivers
Number of visitor and tourism affecting the Park	Yearly	Caves, roads and other landscapes
Population and infrastructure inside the property	Yearly	Arem village
Encroachment and other activities affecting the Park	Yearly	Arem village and Buffer Zone communes

6.b. Administrative arrangements for monitoring property

In the administration sectors, the highest level with responsibility for managing and monitoring activities at the site is the People's Committee of Quang Binh Province, the Ministry of Culture, Sport and Tourism, the Ministry of Agriculture and Rural Development. The institutional framework for management and monitoring of the site are as follows:

- The Phong Nha – Ke Bang NP Management Board has the responsibility for monitoring all activities relevant to the management of natural resources in the Park, for example biodiversity monitoring, forest resource impact monitoring, etc.
- The Department of Agriculture and Rural Development and the Provincial Forest Protection Department have the responsibility for monitoring activities of forest and aquatic resource management in both the Core Zone and Buffer Zone.
- The Department of Natural Resources and Environment has the responsibility for monitoring activities of land, rock, karst, mine and water resource management in the Park.
- The Department of Science and Technology has responsibilities for monitoring activities relevant to science and technology in the Park.

- The Department of Culture and Information has responsibilities for monitoring activities relevant to cultural conservation and development in the both of Core Zone and Buffer Zone.
- District Forest Protection Departments have responsibilities for monitoring activities of forest management in the Buffer Zone.
- Communities in the Core Zone and Buffer Zone are able to participate in monitoring activities of natural resource management in their areas.

6.c. Results of previous reporting exercises

- Project of biodiversity assessment of Phong Nha Nature Reserve was implemented by the Forest Inventory and Planning Institute and the Institute for Ecology and Biology Research (1991), Government project.
- Project RAS/93/102 (1997) assessed biodiversity in Phong Nha – Ke Bang and the border areas.
- Project LINC/WWF (1998-1999) for linking conservation of Phong Nha – Ke Bang NP with that of the Hin Namno National Biodiversity Conservation Area in Laos.
- Theme of fish fauna in the North of the Annamite Mountain Range was carried out by Vinh Education University (this university is located in Nghe An Province), Government project.
- Project FFI/DANIDA (2004-2007) for biodiversity assessment and nature conservation support was implemented by Fauna and Flora International (FFI), funded by the DNIDA-Denmark.
- Project for biodiversity conservation and animal rescue (2005-2008) has been implemented by Cologne University - Germany.
- Theme of flora research (2005) was implemented by the Hanoi University, Government project.
- Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region Project (2008-2015)

7. DOCUMENTATION

7.a. Photographs, slides, image inventory and authorization table and other audiovisual materials

Id. No	Format (slide/ print/ video)	Caption	Date of Photo	Photographer / Director of the video	Copyright owner (if different than photographer/ director of video)	Contact details of copyright owner (Name, address, tel/fax, and email)	Non-exclusive concession of rights
1.	Print JPEG Bitmap files	Biodiversity and forest type picture	2000 To 2013	PN-KB NP, FIPI, IEBR, Cologne, Frankfurt.	PN-KB NP	PN-KB NP Quang Binh Province	Yes
2.	Slides	Biodiversity and forest type picture	2000 to 2013	PN-KB NP, FIPI, IEBR, Cologne, Frankfurt.	PN-KB NP	PN-KB NP Quang Binh Province	Yes
3.	Video	PN-KB NP	2006 & 2013	Le Phuong Mai, VTV2 Reporter Email: sukem@yahoo.com	Phong Nha - Ke Bang NP	Phong Nha - Ke Bang NP Quang Binh Province	Yes

7.b. Texts relating to protective designation, copies of property management plans or documented management systems and extracts of other plans relevant to the property

7.c. Form and date of most recent records or inventory of property

- Before 1990, there were only a few studies on geography and geology.
- On 9 August 1986, Phong Nha Nature Reserve (5000 ha) was declared in Vietnam's Special Use Forest System by Decision 194/CT.
- On 12 December 1986, Phong Nha and Xuan Son Ferry were declared in the National Heritage System by Decision N^o 236-VH/QD from the Ministry of Culture and Information.
- From 1990 to 2005, research and survey activities in the Phong Nha – Ke Bang cave system were conducted by the British Cave Research Association in cooperation with the Faculty for Geology and Geography of the Vietnam National University.
- In 1991, the Forest Inventory and Planning Institute (FIPI) carried out surveys of vegetation cover, flora, fauna and socio-economic characteristics of the area in order to establish a management plan for Phong Nha Nature Reserve.
- In 1993, the Quang Binh PPC approved the management plan for the reserve, and a management board was set up following Decision N^o 941 QD/UB dated 18 November 1993 by Quang Binh PPC.

- From 1991 to 1995, a survey of primate species was conducted by a group of zoologists from FIPI and the Forestry University.
- From 1996 to 1997, a group of scientists conducted research on the biodiversity of the Phong Nha area and organized a symposium on biodiversity conservation along the Laos-Vietnam border, sharing the experiences on forest and biodiversity management of the two neighboring countries (RAS project).
- In 1997, the Department of Science, Technology and Environment of Quang Binh Province carried out an environmental assessment of activities in Phong Nha Nature Reserve.
- In 1999, a group of scientist led by R.J. Timmins produced a report entitle "A preliminary assessment of the conservation importance and conservation priorities of Phong Nha – Ke Bang NP". This project was funded by DANIDA/Netherlands Embassy.
- In 1999, scientists from the Vietnam - Russia Tropical Center conducted a "zoological - botanical expedition to the Ke Bang area". This was sponsored by the LINC/WWF Project.
- In 1999, the Forest Inventory and Planning Institute implemented a project entitled "Project for establishing the Phong Nha – Ke Bang NP in period 2000 to 2005".
- On 12/12/2001 Phong Nha Nature Reserve was upgraded to Phong Nha – Ke Bang NP by Decision N° 189/2001/QD-TTg by the Prime Minister.
- A Management Board was established for Phong Nha – Ke Bang NP by Decision N° 24/2002/QD-UB dated 20/2/2002 by the Quang Binh PPC.
- The Management Board of Phong Nha – Ke Bang NP was restructured by Decision N° 65/2003/QD-UB dated 28/11/2003 by the Quang Binh PPC
- In July 2003 Phong Nha – Ke Bang NP was inscribed on the World Natural Heritage List, criterion (i) (now criterion (viii)).
- From 2000 to 2012 many biodiversity surveys were conducted by the FFI, BirdLife International, Cologne University, Frankfurt Zoological Society, FIPI, Hanoi University and Vinh University.
- From 2010 - 2012, many biodiversity surveys were held in expanding area of Phong Nha - Ke Bang National Park.
- On 05/7/2013, Phong Nha -Ke Bang National Park is expanded up to 123,326 ha according to the Decision 1062/QD-TTg by Prime Minister.

7.d. Address where inventories, records and archives are held

1. The Social Science and Information Institute: Where ancient books are available
Address: Trang Thi Street - Hanoi - Vietnam.
2. The Department of Culture Heritage - the Ministry of Ministry of Culture, Tourism and Sport: All nomination and legal documents relevant to Phong Nha – Ke Bang NP.
Tel: +84) 04 943 7611

Address: 51-53 Ngo Quyen Street - Hanoi - Vietnam

3. World Wide Fund for Nature (WWF): All documents of RAS and LINC projects.
Tel: (+84) 04 7366375
Address: Horison Hotel - Cat Linh Street - Hanoi - Vietnam.
4. Fauna and Flora International (FFI): biodiversity and FFI project documents.
Tel: (+84) 04 7194117
Address: 340 Nghi Tam Street - Tay Ho District- Hanoi - Vietnam
5. BirdLife International: Bird inventory documents of Phong Nha – Ke Bang NP.
6. Forest Inventory and Planning Institute (FPI): All of maps, photos, biodiversity inventories and management plans of Phong Nha – Ke Bang NP
Tel: (+84) 04 8615513, Fax: (+84) 04 8616081
Address: Thanh Tri District - Hanoi - Vietnam
7. The Natural Science University - Hanoi University: All documents of Geology of Phong Nha – Ke Bang NP.
Address: Nguyen Trai street - Hanoi - Vietnam
8. The Institute for Ecology and Biology Resources: Documents of biodiversity in Phong Nha – Ke Bang NP
Tel: (+84) 04 8360870 Fax: (+84) 04 8361191
Address: 18 Hoang Quoc Viet Street - Hanoi - Vietnam
9. Vinh Education University: Documents on fish biodiversity in Phong Nha – Ke Bang NP and North Annamite Range.
10. Vietnam Television (VTV2): All video clips of Phong Nha – Ke Bang NP
Address: 43 Nguyen Chi Thanh Street - Hanoi - Vietnam
11. Phong Nha – Ke Bang NP: All documents on biodiversity, maps, videos and photos.

7e. Bibliography

- Averyanov, L.V. 2005. *Preliminary survey of orchids (Orchidaceae) in Phong Nha – Ke Bang NP*. FFI and Counterpart International, Hanoi, Vietnam.
- Averyanov, L.V., Phan Ke Loc, Nguyen Tien Hiep, A. L. Averyanova, Pham Van The and Nguyen Tien Vinh. 2005. *Preliminary survey of orchids (Orchidaceae) in Phong Nha – Ke Bang NP*. Hanoi.
- BirdLife International. *Directory of Important Bird Area in Vietnam*.
<http://www.birdlifeindochina.org/iba/english/index.htm>
- Bobrov, V.V. 1993. Spatial organization of a tropical lizard community in a forested area in northern Vietnam. *Herpetozoa* 6:21–28.
- Brandon-Jones, D. 1996. The Asian Colobinae (Mammalia: Cercopithecidae) as indicators of Quaternary climatic change. *Biological Journal of the Linnean Society* 59:327–350.
- Clements, R., N.S. Sodhi, M. Schilthuizen and P.K.L. Ng. 2006. Limestone Karsts of Southeast Asia: Imperiled Arks of Biodiversity. *Bioscience* Vol. 56. No. 9. 733 - 742.
- Culver DC, Master LL, Christman MC, Hobbs HH. 2000. Obligate cave fauna of the 48 contiguous United States. *Conservation Biology* 14: 386–401.
- Dawson, M. R., L. Marivaux, C-K Li, K.C. Beard and G. Metais. 2006. *Laonastes* and the "Lazarus effect" in Recent mammals. *Science* 311: 1456-1458.
- Dinh Hai Duong, 2004. *Report on camera trapping in strictly protected sub-zone No 1 in Phong Nha – Ke Bang NP*. Phong Nha – Ke Bang NP, Quang Binh Province, Vietnam.
- Đình Sắc Pham. 2012. *Biodiversity Survey of Cave Invertebrates in and around the Phong Nha–Ke Bang National Park, Quang Binh, Vietnam*. A Report produced for the Nature Conservation and Sustainable Natural Resource Management in Phong Nha-Ke Bang National Park Region Project.
- Do Tuoc, 2002. *The characteristics in North Central Vietnam*, WWF 'Primate conservation incorporating mammal fauna and some issues regarding its preservation in limestone forests in Vietnam, in sustainable development and protection of the forest and biodiversity on limestone mountains of Vietnam'.
- Do Tuoc *et al.*, (2006). *Report on the Fauna of Phong Nha – Ke Bang NP*. The Forest Inventory and Planning Institute, Hanoi, Vietnam.
- Duckworth, J. W., Salter, R. E. and Khounblin, K. 1999. *Wildlife in Lao PDR: 1999 Status Report*. IUCN, Vientiane, Laos.
- Du Plessis, I.J., and P.leF.N. Mouton. 2011. Habitat preferences of three sympatric lacertid lizards in the arid Tankwa Karoo Basin of South Africa. *African Zoology* 46:88–94.
- Eames J. C., Lambert F. R., and Nguyen Cu, 1995. A survey of the Annamese lowlands, Vietnam, and its implication for the Conservation of Vietnamese and Imperial Pheasants *Lophura hatinhensis* and *L. Imperialis*. *Bird Conservation International* 4: 343 – 382.
- Eames J. C., Lambert F. R. and Nguyen Cu, 1995. Rediscovery of the Sooty babbler *Stachyris herberti* in central Vietnam. *Bird Conservation International* 5: 129 – 135.

- Farkas, B. & T. Ziegler 2002.: A note on the distribution of *Amyda cartilaginea* (Boddaert, 1770) in Vietnam. *Hamadryad*, 27(1):149-154.
- Ford, D.C. and Williams, P.W. 2007. *Karst Hydrogeology and Geomorphology*. Wiley, Chichester, 562 pp.
- Fritz, U., Niekisch, M. & T. Ziegler (1999): *Rediscovery of the holotype of Geoemyda tcheponensis Bourret, 1939 (Reptilia: Testudines: Bataguridae)*. - Zoologische Abhandlungen, Staatliches Museum für Tierkunde, Dresden 50(2): 243-247.
- Fritz, U., Ziegler, T., Herrmann, H.-W. & E. Lehr (2002): *Intergration between subspecies of Cuora galbinifrons Bourret, 1939 and Pyxidea mouhotii (Gray, 1862) in southern North Vietnam (Reptilia: Testudines: Geoemydidae)*. - Faunistische Abhandlungen, Staatliches Museum für Tierkunde, Dresden 23: 59-74.
- Gathorne-Hardy, F.J., Syaukani, R.G. Davies, P. Eggleton, and D.T. Jones. 2002. Quaternary rainforest refugia in south-east Asia: using termites (Isoptera) as indicators. *Biological Journal of the Linnean Society* 75:453–466.
- Geissmann T. , Nguyen Xuang Dang, N. Lormee, and F. Momberg, 2000. *Gibbons, Vietnam Primate Conservation, Status Review 2000, Part 1*.
- GFA Consulting Group 2006. Project Preparation Study *Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha- Ke Bang NP Region, Vietnam*. Final draft, GFA, Germany.
- Gibert J, Deharveng L. 2002. Subterranean ecosystems: A truncated functional biodiversity. *BioScience* 52: 473–481.
- Grismer, L.L., C.K. Onn, E. Quah, M.A. Muin, A.E. Savage, J.L. Grismer, N. Ahmad, L.F. Greer, and A.C. Remegio. 2010. Another new, diminutive Rock Gecko (*Cnemaspis Strauch*) from Peninsular Malaysia and a discussion of resource partitioning in sympatric species pairs. *Zootaxa* 2569:55–66.
- Groves, C.P. and G.B. Schaller. 2000. The phylogeny and biogeography of the newly discovered Annamite artiodactyls. Pages 261–282 in E.S. Vrba and G.B. Schaller, eds., *Antelopes, Deer, and Relatives: Fossil Record, Behavioral Ecology, Systematics, and Conservation*. Yale University Press, New Haven, Connecticut, USA.
- Haffer, J. 1969. Speciation in Amazonian forest birds. *Science* 165:131–137.
- Heidrich, A., H. Rosler, V.N. Thanh, W. Bohme, and T. Ziegler. 2007. Another new *Cyrtodactylus* (Squamata : Gekkonidae) from Phong Nha-Ke Bang National Park, central Truong Son, Vietnam. *Zootaxa* 1445:35–48.
- Herrmann, H.-W., Ziegler, T., Malhotra, A., Thorpe, R. S. & C. Parkinson (2004): Redescription and systematics of *Trimeresurus cornutus* (Serpentes: Viperidae) based on morphology and molecular data. *Herpetologica* 60(2): 211-221.
- Herrmann, H.-W., Ziegler, T., Stuart, B. L. & N. L. Orlov (2002): New findings on the distribution, morphology and natural history of *Triceratolepidophis sieversorum* (Serpentes: Viperidae). *Herpetological Natural History, La Sierra* 9(1): 89-94.
- Haus T., Vogt M., Forster B. Vu Ngoc Thanh and Ziegler T. 2009. Distribution and population densities of diurnal primates in the karst forests of Phong Nha – Ke Bang

- National Park, Quang Binh Province, Central Vietnam. *Intl.J. Primatology* 30(2):301-312.
- Howard Limbert , 1991 to 2011. British Speleological Expedition
- Jenkins, P.D., C W. Kilpatrick, M. F. Robinson and R. J. Timmins. 2004. Morphological and molecular investigations of a new family, genus and species of rodent (Mammalia: Rodentia: Hystricognatha) from Lao PDR. *Systematics and Biodiversity* 2 (4): 419-454.
- Kouznetsov G.V., Pham Huy Phuong, 1999. *Investigation of Biological diversity in Mammals (Particularly Bats)*, (as a result of the Complex Zoological Botanical expedition to the Ke Bang area).
- Kruskop S., 1999. *Study of the Bat fauna* (as a result of the Complex Zoological Botanical Expedition to the Ke Bang Area)
- Le Khac Quyet & T. Ziegler (submitted): *Protobothrops cornutus* (Smiths horned pitviper) – *Herpetological Review*, submitted 27/07/2004.
- Le Khac Quyet & T. Ziegler, 2003. First record of the Chinese crocodile lizard from outside of China: Report on a population of *Shinisaurus crocodilurus* Ahl, 1930 from North-eastern Vietnam. *Hamadryad*, Tamil Nadu 27(2): 193-199.
- Le Khac Quyet & T. Ziegler, 2004. Geographic Distribution of *Euprepiophis mandarinus* (Mandarin Ratsnake). *Herpetological Review*, Clovis 35(3): 291-292.
- Le Xuan Canh *et al*, 1996. *Report on survey results of Phong Nha – Ke Bang area, Quang Binh Province*. Ras/93/102, WWF Hanoi.
- Le Xuan Canh, 1993. Evidence for the existence of *Trachypithecus francoisi hatinhensis*, *Asian Primates* 2 (3-4):2.
- Lourenço, W. R. & Đình Sắc Pham. 2010. A remarkable new cave scorpion of the family Pseudochactidae Gromov (Chelicerata, Scorpiones) from Vietnam. *ZooKeys*, Vol. 71, p. 1-13.
- Lourenço W. R. & Đình Sắc Pham. 2012. "A second species of *Vietbocap* Lourenço & Pham, 2010 (Scorpiones: Pseudochactidae) from Vietnam". *Comptes Rendus Biologies* 335 (1): 80–85.
- Lunde, D. P., Musser, G. G. & T. Ziegler, 2004. *Description of a new species of Crocidura (Soricomorpha: Soricidae, Crocidurinae) from Ke Go Nature reserve, Vietnam*. – *Mammal Study* 29: 27-36.
- Mebs, D., Kuch, U., Herrmann, H.-W. & T. Ziegler. 2003. *Biochemical and biological activities of the venom of a new species of pitviper from Vietnam, Triceratolepidophis sieversorum*. - *Toxicon*, Elsevier 41: 139-143.
- Ministry of Science Technology and Environment, 2007. *Red Book of Vietnam*. The Publisher of Science and Technique, Hanoi.
- Moulds, T., Pham Dinh Sac, and R. Mouritz. 2010. Preliminary Survey of Cave Fauna in the Phong Nha-Ke Bang World Heritage Site, Vietnam. Unpublished report to GTZ, May 2010, pp 34.
- Musser GG, A. L. Smith, M.F. Robinson and D.P. Lunde. 2005. Description of a new genus and species of rodent (Murinae, Muridae, Rodentia) from the Khammouan Limestone

- National Biodiversity Conservation Area in Lao PDR. *American Museum Novitates* 497: 1–31.
- Nadler, T., Momberg, F., Nguyen Xuan Dang and Lormée, N. 2003. *Vietnam Primate Conservation Status Review 2002. Part 2: Leaf Monkeys*. Fauna and Flora International- Vietnam Program and Frankfurt Zoological Society, Hanoi, Vietnam.
- Nadler, T. and Streicher, U. 2004. The Primate of Vietnam-An Overview. In Conservation of Primates in Vietnam. (T. Nadler, U. Streicher and Ha Thang Long, eds.). Hanoi, 5-15.
- Nadler T., 2010. Status of Vietnamese primates - complement and revision. In Nadler et al. (2010). Conservation of Primates in Indochina. Frankfurt Zool. Society and Conservation International. Hanoi, 3-17
- Ng P.K.L. 1991. *Cancrocaeca xenomorpha*, new genus and species, a blind troglobitic freshwater hymenosomatid (Crustacea: Decapoda: Brachyura) from Sulawesi, Indonesia. *Raffles Bulletin of Zoology* 39: 59–73.
- Nguyen Nghia Thin, 2006. *Report on flora of Phong Nha - Ke Bang NP*. Hanoi University, Hanoi.
- Nguyen Thai Tu - Ho Anh Tuan, 2003. *Phong Nha-Ke Bang is one of genesis center of Cyprinini*. Problems of Basic Research in life sciences, The 2nd National Conference in life sciences, Hue, 25-26 July 2003. Sciences and Techniques publishing house Hanoi, 2003: 1129-1133.
- Nguyen Thai Tu - Le Viet Thang - Le Thi Binh, 1997. *Phong Nha - Ke Bang - A Paradise for Ichthyologists*. Quang Binh Science and Technology Bulletin, N0.7-1997:29.
- Nguyen Thai Tu - Le Viet Thang - Nguyen Xuan Khoa - Le Thi Binh, 1999. *The Genus Cyprinus Linnaeus, 1758 and Speciation of a new species (Cyprinus quidatensis) by Geographical Isolation*. Publishing House of Hanoi National University, Hanoi 1999: 8-15.
- Nguyen Thai Tu - Le Viet Thang - Nguyen Xuan Khoa, 1999. *A New Species of the Genus Chela (Hamilton, 1922). Proceedings of the Seminar on Northern Truong Son Biodiversity (The second)*. Publishing House of Hanoi National University, Hanoi 1999: 16-22.
- Nguyen Thai Tu - Le Viet Thang - Nguyen Xuan Khoa, 1999. *Phong Nha Ichthyofauna. Proceedings of the Seminar on Northern Biodiversity (The second)*. Publishing House of Hanoi National University, Hanoi 1999: 22-24.
- Nguyen Thai Tu - Le Viet Thang - Nguyen Xuan Khoa, 2000. *Genus Lissocheilus Weber et de Beaufort, 1916 and two new Species of Fish Recently Discovered on Quang Binh, Vietnam*. Problems of Basic Research in Biology; National Conference on Biology, August 2000. Publishing House of Hanoi National University, Hanoi 1999: 475- 476.
- Nguyen Thai Tu et al., 2004 *Unique of Phong Nha - Ke bang Limestone Moutains Ichthyofauna*. Vietnam Ecological Association - National Workshop. Hanoi, 20 December 2004.
- Nguyen Thai Tu et al., 2006. *The fish fauna of Phong Nha - Ke Bang Limestone Mountains and Means of Reasonable Use*. (unpublished), Vinh University.

- Nguyen Thai Tu, 1995. *A fish family (Cyprinidae), An Important Zoogeographical District (Northern Truong Son) for Vietnam Fishery*. Proceedings of Scientific & Technical Research Works, Ministry of Fisheries (1986-1990): 73-75.
- Nguyen Thai Tu, 1995. *Northern Truong Son - An Exclusive Zoogeographic District*. Proceedings of the Seminar on Northern Truong Son Biodiversity (The First). Science & Technique Publishing House, Hanoi, 1995.
- Nguyen Thai Tu, 1995. *Orientation Report, Seminar on the North Truong Son Biodiversity (The First)*. Proceedings of the Seminar on the North Truong Son Biodiversity (The First), p. 7-10. Science & Technique Publishing House, Hanoi, 1995.
- Nguyen Thai Tu, 1999. *Orientation Report of Seminar on Northern Truong Son Biodiversity*. (The Second) Publishing House of Hanoi National University, Hanoi 1999: 5-6.
- Nguyen Thai Tu, 2004. *Conservation of unique and valuable fish diversity in Phong Nha-Ke Bang Limestone Mountains*. ARCBC Regional Research Grant Conference Bangkok-Thailand. 01-01-December 2003.
- Nguyen Van Sang, Ho Thu Cuc, Nguyen Quang Truong, 2005. *A checklist of Amphibians and Reptiles of Vietnam*. Institute of Ecology and Biology Research, Hanoi.
- Nguyen Xuan Dang, Nguyen Manh Ha, 2002. *Preliminary results of Survey on Bat Fauna (Chiroptera) at Phong Nha – Ke Bang (Quang Binh)*. In Sustainable Development and Protection of the Forest and Biodiversity on Limestone Mountains of Vietnam, Hanoi.
- Nguyen Xuan Dang, Pham Nhat, Pham Trong Anh, D. Handrichsen, 1998. *Result of survey on mammal Fauna in Phong Nha – Ke Bang Area, Quang Binh, Vietnam*. Fauna and Flora international, Indochina office, Hanoi.
- Nguyen Xuan Dang, Nguyen Xuan Nghia, Nguyen Manh Ha, Le Duc Minh, Nguyen Duy Luong, and Dinh Huy Tri 2012. The First Record of Living Fossil Species (*Laonastes aenigmamus*) in Phong Nga-Ke Bang, Quang Binh Province, Vietnam. *Tap Chi Sinh Hoc*, 34(1): 40-47.
- Ovel C. and Nguyen Thi Dao, 1998. LINC: *Linking Hin Namno and Phong Nha through parallel conservation: Phase I Phong Nha – Ke Bang Nature reserve, Vietnam*. WWF Indochina programme, Hanoi.
- Pham Nhat and Do Tuoc, 1999. *Thematic report on fauna of Phong Nha - Ke Bang*. FIPI, Hanoi..
- Phạm Nhat, Do Tuoc and Truong Van La, 1995. *A survey for Hatinh Langur (Trachypithecus francoisi hatinhensis)*. FIPI, Hanoi.
- Phiapalath, P. 2010. Brief Report of Lao Langur *Trachypithecus laotum* Survey Phou Hin Poun National Protected Area, Khammouane Province. Report to: Provincial Division for Protected Area Management, Provincial Agriculture and Forestry Office, Khammouane Province, Lao PDR.
- Phong Nha - Ke Bang, 2005. *Training workshop memoir on strengthening the management and protection capacity of Phong Nha - Ke Bang NP, World's Heritage*. Phong Nha - Ke Bang NP, Quang Binh, Vietnam.
- Rabinovitz, A. 1997. Lost world of the Annamites. *Natural History* 106:14–18.

- Robertson, S, 2004. *Assessment of threats to Phong Nha - Ke Bang NP, Quang Binh province, Vietnam*. Report No 1, No 2, No 3 7 No 4; FFI and counterpart International, Hanoi, Vietnam.
- Roos, C. 2004. *Molecular evolution and systematics of Vietnamese primates*. In: Nadler, T., U. Streicher, and Ha Thang Long (eds). *Conservation of Primates in Vietnam*: 23-28.
- Roos, C., T. Nadler, Y. P. Zhang, H. Zischler. 2001. *Molecular evolution and distribution of the superspecies Trachypithecus [francoisij]*. *Folia Primatol.* 72: 181-182.
- Rosler H., T. Ziegler, Vu Ngoc Thanh, Hans – Werner Hermann, and W. Bohe, 2005. *A new lizard of genus Gekko Laurenti, 1768 (Squamata: Sauria: Gekkonidae) from the Phong Nha – Ke Bang NP, Quang Binh province, Vietnam*. *Bonner zoologische Beitrage* 53(1/2): 135 – 148.
- Ruggeri, N. and Timmins, R. 1996. An initial summary of diurnal primate status in Laos. *Asian Primates* 5(3-4): 1-3.
- Salomon, J.-N. 2006. *Précis de karstologie*. 2nd Edition. Presses Universitaire de Bordeaux, 289 pp.
- Schilthuizen M, Vermeulen JJ, Davison GWH, Gittenberger E. 1999. Population structure in a snail species from isolated Malaysian limestone hills, inferred from ribosomal DNA sequences. *Malacologia* 41: 283–296.
- Schilthuizen M, Liew TS, Bin Elahan B, Lackman-Ancrenaz I. 2005a. Effects of karst forest degradation on pulmonate and prosobranch land snail communities in Sabah, Malaysian Borneo. *Conservation Biology* 19: 949–954.
- Schilthuizen M, Cabanban AS, Haase M. 2005b. Possible speciation with gene flow in tropical cave snails. *Journal of Zoological Systematics and Evolutionary Research* 43: 133–138.
- Stattersfield A.J., Crosby M. J., Long A. J. and Wege D. C., 1998. Endemic bird area of the world priorities for biodiversity conservation. Birdlife conservation series N^o7. Birdlife International, Cambridge, U. K. IUCN, 2004. 2004 IUCN Red list of threatened Species <www.redlist.org> . Downloaded on 29 December 2008.
- Surridge, A.K., R.J. Timmins, G.M. Hewitt, and D.J. Bell. 1999. Striped rabbits in Southeast Asia. *Nature* 400:726.
- Timmins R., Do Tuoc, Trinh Viet Cuong, and D.K. Hendrichsen, 1999. *Preliminary assessment of the conservation importance and conservation Priorities of the Phong Nha – Ke Bang Proposed NP, Quang Binh Province, Vietnam*. WWF, Hanoi.
- Timmins, R.J., and Trinh Viet Cuong. 2001. *An Assessment of the Conservation Importance of the Huong Son (Annamite) Forest, Ha Tinh Province, Vietnam, Based on the Results of a Field Study for Large Mammals and Birds*. Center for Biodiversity and Conservation at the American Museum of Natural History, New York, New York, USA. 94 pp.
- Timmins, R.J. & Boonratana, R. 2008. *Trachypithecus laotum*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 20 June 2013.

- Vassiliev B. D., 1999. *Herpetological investigations: In Results of the complex Zoological – Botanical expedition to the Ke Bang Area.*
- Vietnam Forest Protection Department, 2005. *Hunting and wildlife trade control action plan for Quang Binh and Ha Tinh provinces (Vietnam), and Bolikhamxai and Khammoune provinces (Laos).* Forest Protection Department, Hanoi, Vietnam.
- Vogt, M., Forster, B., Pagel, T. & T. Ziegler, 2006. *Neues vom Naturschutzprojekt des Kölner Zoos in Vietnam.* – Zeitschrift des Kölner Zoo 49(1): 35-49.
- Vu Ngoc Thanh, Rösler, H. & T. Ziegler, 2006. *On the occurrence of the four-striped bent-toed gecko, Cyrtodactylus quadrivirgatus Taylor, 1962, in Vietnam.* – Hamadryad, in press.
- Welton, L.J., C.D. Siler, A. Diesmos, and R.M. Brown. 2009. A new bent-toed gecko (Genus *Cyrtodactylus*) from Southern Palawan Island, Philippines and clarification of the taxonomic status of *C. annulatus*. *Herpetologica* 65:328–343.
- Williams, P. 2008. *World Heritage Caves and Karst: A global review of karst World Heritage properties: present situation, future prospects and management requirements.* Gland, Switzerland: IUCN. 57 pp.
- Ziegler T., and J. Kohler, 2001. *Rhacophorus orlovi* sp. n., *Cin* neuer Ruderfrosch aus Vietnam (Amphibia, Anura: Rhacoporidae). *Saunia*, Berlin 23(3): 37 – 46.
- Ziegler T., Hermann. H., W.; Vu Ngoc Thanh, Le Khac Quyet, Nguyen Tan Hiep, Cao Xuan Chinh, Luu Minh Thanh and Dinh Huy Tri, 2004. *The Amphibian and reptiles of the Phong Nha - Ke Bang NP, Quang Binh Province, Vietnam.* Hamadryad, Tamil Nadu 28(1-2): 19-42.
- Ziegler T., Herrmann H. W., P. Orlov, and O. S. G. Pauwels, 2000. *Triceratolepidophis sieversorum*, a new genus, and species of plover (Reptilia: Serpentes, Viperidae, Crotalinae) from Vietnam. *Russian Journal of Herpetology*, Maskau 7(3): 199 – 214.
- Ziegler T., Le Khac Quyet, 2005. *A new species of mountain range, Vietnam.* *Zootaxa*. 1042 : 27 – 38.
- Ziegler T., Vu Ngoc Thanh and Bui Ngoc Thanh, 2005. *A new water skink of the genus Tropidophorus from the Phong Nha – Ke Bang NP, central Vietnam* (Squamata: Sauria: Scincidae). *Salamandra* 41(3) : 137 – 146.
- Ziegler, T. & G. Vogel, 1999. *On the knowledge and specific status of Dendrelaphis ngansonensis (Bourret, 1935) (Reptilia: Serpentes: Colubridae).* *Russian Journal of Herpetology*, Moskau 6(3): 199-208.
- Ziegler, T. & H.-W. Herrmann, 2000. *Preliminary list of the herpetofauna of the Phong Nha - Ke Bang area in Quang Binh province, Vietnam.* *Biogeographica*, Paris 76(2): 49-62.
- Ziegler, T. & H.-W. Herrmann, 2002. *Wiederentdeckung zweier gehörnter Grubenotterarten in Vietnam.* *Mitteilungen Zoologische Gesellschaft für Arten- und Populationsschutz e.V.* 18(2): 24-26.
- Ziegler, T. & Hoang Xuan Quang, 2005. *Geographic Distribution: Sinonatrix aequifasciata (Equal-banded Watersnake).* - *Herpetological Review*. 36(1): 84.
- Ziegler, T. & J. Köhler, 2001. *Rhacophorus orlovi* sp. n., *ein* neuer Ruderfrosch aus Vietnam (Amphibia: Anura: Rhacophoridae). - *Sauria*, Berlin 23(3): 37-46.

- Ziegler, T. & Le Khac Quyet, 2006.: *A new natricine snake of the genus Amphiesma (Squamata: Colubridae: Natricinae) from the central Truong Son, Vietnam.* – Zootaxa, in press.
- Ziegler, T. & M. Vences, 2002. *The tadpole of Rhacophorus verrucosus Boulenger, 1893 from Vietnam (Amphibia: Anura: Rhacophoridae).* - *Faunistische Abhandlungen, Staatliches Museum für Tierkunde, Dresden* 22(2): 319-327.
- Ziegler, T. & Vo Ba Phong, 2005. *Geographic Distribution: Cylindrophis ruffus (Red-tailed Pipe Snake).* - *Herpetological Review.* 36(1): 81.
- Ziegler, T. Le Khac Quyet, 2005. *A new species of reed snake, Calamaria (Squamata: Colubridae), from the Central Truong Son (Annamite mountain range), Vietnam.* *Zootaxa* 1042: 27-38.
- Ziegler, T., 1999. *A Vietnamese trapping technique for capturing butterfly lizards (Leiolepis).* *Herpetological Review, Clovis* 30(3): 153-154.
- Ziegler, T., 2002. *Die Engmaulfrösche Vietnams (Familie Microhylidae).* *Aquaristik Fachmagazin* 34(4): 83-88.
- Ziegler, T., 2002. *Herpetologisch Neues aus einem der letzten Tieflandfeuchtwälder Vietnams.* *Reptilia, Münster* 7(3): 41-49.
- Ziegler, T., 2004. *Erforschung der Artenvielfalt im Vietnamprojekt des Kölner Zoos: Die Amphibien und Reptilien von Phong Nha – Ke Bang.* *Zeitschrift des Kölner Zoo* 47(4): 137-171.
- Ziegler, T., 2006. *Seltene Echsen-Entdeckung aus Vietnam nach ZDF-Magazin „Abenteuer Wissen“ benannt.* *Aquaristik Fachmagazin & Aquarium heute* 38(1): 112.
- Ziegler, T., Böhme, W. & W. Bischoff, 1999. *Comments on the grass lizards (Lacertidae: Takydromus) of Vietnam and Myanmar.* *Hamadryad, Tamil Nadu* 24(1): 39-42.
- Ziegler, T., Herrmann, H.-W. & J. Köhler, 2002. *Geographic distribution. Rhacophorus orlovi (Orlov's Tree Frog).* *Herpetological Review, Clovis* 33(2):146.
- Ziegler, T., Herrmann, H.-W., David, P., Orlov, N. & O. S. G. Pauwels, 2000. *Triceratolepidophis sieversorum, a new genus and species of pitviper (Reptilia: Serpentes: Viperidae: Crotalinae) from Vietnam.* *Russian Journal of Herpetology, Moskau* 7(3): 199-214.
- Ziegler, T., Hoang Xuan Quang & Nguyen Ba Trinh, 1999. *Königskobra-Biß mit Folgen.* *Reptilia, Münster* 4(1): 69-71.
- Ziegler, T., Hoang Xuan Quang & W. Böhme, 1998. *Beitrag zur Kenntnis der Schnellläufer-Eidechsen Vietnams (Reptilia: Lacertidae: Takydromus).* *Herpetofauna, Weinstadt* 20(114): 24-34.
- Ziegler, T., R. Nazarov, N. Orlov, T.Q. Nguyen, T.N. Vu, K.N. Dang, T.H. Dinh, and A. Schmitz. 2010. *A third new Cyrtodactylus (Squamata: Gekkonidae) from Phong Nha-Ke Bang National Park, Truong Son Range, Vietnam.* *Zootaxa* 2413:20–36.
- Ziegler, T., Ohler, A., Vu Ngoc Thanh, Le Khac Quyet, Nguyen Xuan Thuan, Dinh Huy Tri & Bui Ngoc Thanh, 2005. *New amphibian and reptile records for the Phong Nha – Ke Bang NP and adjacent areas, Quang Binh Province, central Truong Son, Vietnam.* In

- Programme and Abstracts, 13th Ordinary General Meeting, Societas Europaea Herpetologica (SEH), 27th September – 2nd October, Bonn, Germany: 120-121.
- Ziegler, T., Rösler, H. & Hoang Xuan Quang, 2004. *Geographic Distribution. Cyrtodactylus irregularis (Irregular Bent-Toed Gecko)*. – Herpetological Review, Clovis 35(3): 285-286.
- Ziegler, T., Vu Ngoc Thanh & Bui Ngoc Thanh, 2005. *A new water skink of the genus Tropidophorus from the Phong Nha – Ke Bang NP, central Vietnam (Squamata: Sauria: Scincidae)*. Salamandra 41(3): 137-146.
- Ziegler, T., Vu Ngoc Thanh, Le Khac Quyet, Nguyen Quang Truong, Hallermann, J., Le Vu Khoi & Thach Mai Hoang, 2006. *Neue Verbreitungsnachweise einiger wenig bekannter vietnamesischer Amphibien und Reptilien*. Sauria, in press.
- Ziegler, T., and T.N. Vu. 2009. Ten years of herpetodiversity research in Phong Nha-Ke Bang National Park, Central Vietnam. *In: Phong Nha-Ke Bang National Park and Cologne Zoo, 10 years of Cooperation (1999–2009)*. Tri, N.T.D., K. N. Dang, and P. T. H. Yen (Eds.), Quang Binh: 103–124.

8. CONTACT INFORMATION OF RESPONSIBLE AUTHORITIES

8.a. Preparer

- (1) **Name:** Dr. Nguyen Quoc Dung
Title: Team leader and editor of the Nomination
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-6870978; **Mobile:** (+84) 903277731; **Fax:** (+84) 04-8616081
Email: dungfipi@yahoo.com
- (2) **Name:** Mrs. Jo Brease
Title: Preparation of Criterion (x)
Address: 32 Belvedere Road, Wellington 6021, New Zealand
Tel: **Fax:**
Email: jo@jobreeseandassociates.co.nz
- (3) **Name:** Mr. John Parr
Title: Preparation of Criterion (ix)
Address:
Tel: **Fax:**
Email: jwkparr103@gmail.com
- (4) **Name:** Dr. Nguyen Huy Dung
Title: Assessment of factors affecting to the property
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-6870978 **Fax:** (+84-4) 8616081
Email: dungfipi@hn.vnn.vn
- (5) **Name:** Mr. Dang Thang Long
Title: Report on fauna of Phong Nha – Ke Bang NP.
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-8615513 **Fax:** (+84) 04-8616081
Email:
- (6) **Name:** Mr. Do Tuoc
Title: Senior zoologist - report on fauna of Phong Nha – Ke Bang NP.
Address: Forest Inventory and Planning Institute, Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-6870978 **Fax:** (+84) 04-8616081
Email: dungfipi@gmail.com
- (7) **Name:** Mr. Vu Van Can
Title: Senior botanist - report on flora of Phong Nha – Ke Bang NP.
Address: Forest Inventory and Planning Institute, Thanh Tri, Hanoi, Vietnam
Tel: (+84) 40-6870978 **Fax:** (+84) 04-8616081
Email:
- (8) **Name:** Mr. Nguyen Manh Hung
Title: Socio-economic assessment of the property area
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-6870978 **Fax:** (+84) 04-8616081
Email: manh_hungfipi@gmail.com

- (9) **Name:** Msc. Vu Tien Dien
Title: GIS - Satellite image interpretation and mapping
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-8616481 **Fax:** (+84) 04-8616081
Email: dienfipi@gmail.com
- (10) **Name:** Mrs. Vu Thi Ngoc Tram
Title: GIS - mapping
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-8616481 **Fax:** (+84) 04-8616081
Email: tramfrec73@gmail.com
- (11) **Name:** Mr. Le Manh Tuan
Title: Team member of reparation of report on flora in Phong Nha – Ke Bang NP.
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-8616481 **Fax:** (+84) 04-8616081
Email: tuanfrec@gmail.com
- (12) **Name:** Mr. Pham Ngoc Bay
Title: Preperation of Report on butterfly in Phong Nha – Ke Bang NP.
Address: Forest Environment and Resource Centre (FREC) of the Forest Inventory and Planning Institute (FIPI), Thanh Tri, Hanoi, Vietnam
Tel: (+84) 04-8616481 **Fax:** (+84) 04-8616081
Email: phamngoc.bayi@gmail.com
- (13) **Name:** Pr. Dr. Nguyen Nghia Thin
Title: Preparation of Report on flora in Phong Nha – Ke Bang NP.
Address: Hanoi University- Thanh Xuan, Hanoi, Vietnam
Tel: (+84) 04-9331971; **Email:** nnthin@vnn.vn
- (14) **Name:** Pr. Dr. Phan Ke Loc
Title: Preparation of Report on Orchid
Address: Hanoi University, Hanoi, Vietnam
Tel: (+84) 04-8565087
Email: pkeloc@yahoo.com
- (15) **Name:** Dr. Nguyen Tien Hiep
Title: Preparation of Report on Orchid and Report on Flora in extention area.
Address: Institute for Ecology and Biology Research, Hoang Quoc Viet, Hanoi, Vietnam
Tel: (+84) 04-8565087
Email: ntienhiep@hn.vnn.vn
- (16) **Name:** Dr. Nguyen Thai Tu
Title: Preparation of Report on fish fauna in Phong Nha - Ke Bang NP.
Address: Education University - Vinh city, Vietnam.
Tel: (+84) 038-
Email: hoanhtuan18@yahoo.com
- (17) **Name:** Mrs. Le Phuong Mai
Title: Director of the biodiversity film
Address: VTV2, Vietnam Television - 43 Nguyen Chi Thanh, Hanoi, Vietnam
Tel: (+84) 04-7715366, Mobile: (+84) 988086277

Email: phuongmavtv2@gmail.com

- (18) **Name:** Msc. Nguyen Viet Cuong
Title: Assessment of mangement activities
Address: National Cultrural Heritage Department, Member of Consultant Group of UNESCO Vietnam, 51-53 Ngo Quyen , Ba Dinh, Ha Noi, Vienam
Tel: (+84) 052-823268, **Mobile:** (+84)912145001
Fax: (+84) 052-675021
Email:
- (19) **Name:** Mr. Luu Minh Thanh
Title: Document collection and assessment
Address: Former Director, Phong Nha – Ke Bang Management Board, Bo Trach District, Quang Binh Province, Vietnam
Tel: (+84) 052-675149, **Mobile:** (+84)913079192
Fax: (+84) 052-675021
Email: thanh_luuminh@yahoo.com
- (20) **Name:** Mr. Dinh Huy Tri
Title: Document collection
Address: Vice Director, Phong Nha – Ke Bang Management Board, Bo Trach District, Quang Binh Province, Vietnam
Tel: (+84) 052-675150, **Mobile:** (+84) 903425606
Fax: (+84) 052-675021
Email: dinhhuyltri@gmail.cm
- (21) **Name:** Mr. Greg Blake
Title: Technical and language advisor and nomination editor
Address: Fauna and Flora International - Quang Binh, 02 Le Van Huu, Dong Hoi City, Quang Binh province, Vietnam
Tel: (+84) 052-250004, **Mob:** (+84) 905 995 323; **Fax:**
Email: corvus.tas@gmail.com
- (22) **Name:** Mrs. Evelina Czernecki
Title: Technical and language advisor and nomination editor
Address: Fauna and Flora International - Quang Binh, 02 Le Van Huu, Dong Hoi City, Quang Binh province, Vietnam
Tel: (+84) 052-250004, **Mob:** (+84) 906 537 201; **Fax:**
Email: evelinacz@yahoo.com.au
- (23) **Name:** Dr. Baney Long
Title: Technical advisor
Address: WWF Vietnam Office 39 Xuan Dieu, Tay Ho, hanoi, Vietnam
Tel: (+84) 914 065 315
Email: baney.long@wwfgreatermekong.org / barneylong@boltblue.com
- (24) **Name:** Dr. Tilo Nadler
Title: Technical advisor
Address: Frankfurt Zoological Society, Germany/Endangered Primate Rescue Center, Vietnam.
Tel: (+84) 030-848002
Fax: (+84) 030-848002
Email: t.nadler@mail.hut.edu.vn

8.b&c. Official Local Institution/Agency

• Government Agencies:

1. Ministry of Agriculture and Rural Development: Government agency in charge of managing Vietnam's forestry, agriculture, and water resources.

Minister: Cao Duc Phat

Address: 2A - Ngoc Ha - Ba Dinh - Hanoi

Tel: (+84) 04 3733 5718

Fax: (+84) 04 3845 4319

2. Ministry of Culture, Sport and Tourism: Government agency in charge of culture, sport and tourism, including all Vietnam world heritage sites.

Minister: Hoang Tuan Anh

Address: 51-53 Ngo Quyen - Hoan Kiem - Hanoi

Tel: (+84) 04 3943 9487

Fax: (+84) 04 3943 9009

3. National Forestry Office (VNFOREST): Government agency under the Ministry of Agriculture and Rural Development responsible for the management and protection of all Vietnam forest areas.

Director: Ha Cong Tuan

Address: 2A- Ngoc Ha - Ba Dinh - Hanoi

Tel: (+84) 04 3733 5680

Fax: (+84) 04 3733 5685

4. Department of Culture Heritage: Government agency under the Ministry of Ministry of Culture, Sport and Tourism responsible for the protection of Vietnam's heritage.

Director: Nguyen The Hung

Address: Address: 51-53 Ngo Quyen - Hoan Kiem - Hanoi

Tel: (+84) 04 9436191

Email: [nthung@dsvh.gov.vn](mailto: nthung@dsvh.gov.vn)

• Quang Binh Province

1. The People's Committee of Quang Binh Province: Government management in Quang Binh Province.

Chairman: Nguyen Huu Hoai

Address: The People's Committee of Quang Binh Province - Dong Hoi City

Tel: (+84) 052.3822341

Fax: (+84) 052.3822791

2. Department Culture, Sport and Tourism of Quang Binh Province: This government institution has responsibility for culture, sport and tourism including world heritage sites in Quang Binh Province.

Director: Luong Van Luyen

Address: Department Culture and Information - Dong Hoi City, Quang Binh, Vietnam

Tel: (+84) 052-3824271; Fax: (+84) 052-3821191; [luyenlv.svhttdl@quangbinh.gov.vn](mailto: luyenlv.svhttdl@quangbinh.gov.vn)

3. Department of Agriculture and Rural Development of Quang Binh Province: Government institution for agriculture, aquaculture and forestry in Quang Binh Province.

Director: Phan Van Khoa

Address: Department of Agriculture and Rural Development - Dong Hoi City, Quang Binh, Vietnam.

Tel: (+84) 052-3822761; Fax: (+84) 052-3821573; khoapv.snn@quangbinh.gov.vn

4. The Forest Protection Department of Quang Binh Province: This government institution has responsibility for management and protection of forest areas in Quang Binh Province.

Director: Pham Hong Thai

Address: Forest Protection Department - Dong Hoi City, Quang Binh, Vietnam

Tel: (+84) 052-3822598; Fax: (+84) 052-3821553; thaiph.snn@quangbinh.gov.vn

5. Department of Science and Technology of Quang Binh Province: Government institution for sciences, technology and environment in Quang Binh Province.

Director: Nguyen Duc Ly

Address: Department of Science Technology and Environment, Dong Hoi City, Quang Binh, Vietnam

Tel: (+84) 052-3821685; Fax: (+84) 052-3822808; nguyenducly1961@yahoo.com

6. Department of Natural Resource and Environment of Quang Binh Province: Government institution for natural resource and environment management of Quang Binh Province.

Director: Le Minh Ngan

Address: Department of Natural Resource and Environment, Dong Hoi City, Quang Binh, Vietnam.

Tel: +84) 052-3825830; Fax: (+84) 052-3824064; nganlm.stnmt@quangbinh.gov.vn

7. The People's Committee of Bo Trach District: Government management in Bo Trach District, Quang Binh Province.

Chairman: Phan Van Gon

Address: The People's Committee of Bo Trach District, Quang Binh, Vietnam.

Tel: (+84) 052-3862275; Fax: (+84) 052-3862121; gonpv.bt@quangbinh.gov.vn

8. The People's Committee of Minh Hoa District: Government management in Minh Hoa District, Quang Binh Province.

Chairman: Dinh Quy Nhan

Address: The People's Committee, - Quy Dat Town, Minh Hoa District, Quang Binh, Vietnam.

Tel: (+84) 052-3572323; Fax: nhandq.mh@quangbinh.gov.vn

9. The People's Committee of Quang Ninh District: Government management in Quang Ninh District, Quang Binh Province.

Chairman: Nguyen Viet Anh

Address: The People's Committee, - Quan Hau Town, Quang Ninh District, Quang Binh, Vietnam.

Tel: (+84) 052-3872083; Fax: (+84) 052-3872302; anhnv.qn@quangbinh.gov.vn

- **Phong Nha – Ke Bang National Park**

Phong Nha – Ke Bang Management Board: This government institution under the jurisdiction of the People's Committee of Quang Binh Province has directly responsibility for the management of the whole Phong Nha – Ke Bang NP.

Director: Le Thanh Tinh

Address: Phong Nha – Ke Bang NP, Bo Trach District, Quang Binh Province, Vietnam.

Tel: (+84) 052-3675150; Fax: (+84) 052-3675021; tinhlt.pnkb@quangbinh.gov.vn

8.d. Official Web address

www.quangbinh.gov.vn

www.phongnhakebang.vn

9. SIGNATURE ON BEHALF OF THE STATE PARTY

**Ministry of Culture, Sport and Tourism
Socialist Republic of Vietnam
Minister**

**UNITED NATIONS EDUCATIONAL
SCIENTIFIC AND CULTURAL ORGANIZATION**

Date Received:

Identification No:

CONVENTION CONCERNING THE PROTECTION OF THE
WORLD CULTURAL AND NATURAL HERITAGE

Appendix 2a
THE BIODIVERSITY IN PHONG NHA - KE
BANG NATIONAL PARK

(Part I: Flora)

PHONG NHA - KE BANG
NATIONAL PARK
Quang Binh Province, Vietnam

2009

**REPORT ON VASCULAR PLANTS
IN PHONG NHA - KE BANG NATIONAL PARK**

(Part I: Flora)

**Nguyễn Quốc Dũng
Lê Mạnh Tuấn**

TABLE OF CONTENTS

		3
1.	..... Error! Bookmark not defined.	
1.1. OBJECTS.....	Error! Bookmark not defined.	
1.2. CONTENTS	Error! Bookmark not defined.	
1.3. METHOD OF STUDY	Error! Bookmark not defined.	
1.3.1. Data collection in the field .....	.
1.3.2. Establishment of inventory lines and location .....	.
1.3.3. Collection of samples .....	.
1.3.4. Method in the laboratory.....	.	
1.3.5. Assess and check the scientific names of research samples. ....	.
1.3.6. Making a list.....	.	
1.3.7. Method for assessment of the diversity of the vegetation cover. .	.	
1.3.8. Method for assessment of the plant diversity by classification ....	.
2.	..... Error! Bookmark not defined.	
2.1 NATURAL CONDITONS.....	Error! Bookmark not defined.	
2.1.1. Geographical and administrative location .....	.
2.1.2. Topography and soil conditions.....	.	
2.1.3. Climate .....	.
2.1.4. Hydrological regime.....	.	
2.2. SOCIAL CONDITIONS	Error! Bookmark not defined.	
2.2.1. Population density .....	.
2.2.3. Composition of nationalities .....	.
2.2.4. Distribution of labour .....	.
2.2.5. State of forestry economy: .....	.
1. FLORA DIVERSITY IN PHONG NHA – KÊ BÀNG	4	
1.1. Diversity of classification	4	
1.2. Diversity of factors creating the flora by geography	11	
1.3. Diversity on live forms	14	
4.2. SCIENTIFIC VALUE OF THE FLORA.....	15	
4.2.1. Plant resource of Phong Nha-Ke Bang National Park	15	
4.2.2. Rare and valuable tree species endangered to extinction	18	
5.	..... Error! Bookmark not defined.	
5.1. FLORA DIVERSITY IN PHONG NHA – KÊ BÀNG NATIO NAL PARK	Error! Bookmark not defined.	
5.1.1. Diversity on classification .....	.
5.1.2. Diversity on geographical factor .....	.
5.1.3. Diversity on live form .....	.
5.1.4. Diversity of plant resources in Phong Nha-Ke Bang National Park ....	.
5.2. Recommendations on measures for conservation.....	.	
	.....	25
List of vascular plants in Phong Nha - Ke Bang NP		

NP	National Park
FFI	Fauna and Flora International
FIPI	Forest Inventory and Planning Institute
IEBR	Institute of Ecology and Biological Resources
IUCN	World Conservation Union
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWF	World Wide Fund for Nature

1. FLORA DIVERSITY IN PHONG NHA – KỂ BÀNG

1.1. Diversity of classification

1.1.1. Diversity of classification in taxon branch

During studying, besides collecting samples on the ground, the list for species composition of the flora of Phong Nha – Kẻ Bàng National Park is also made basing on the method of inheriting from other studies. Basing on which, the list of vascular plants has been established and arranged by the system of Brummitt (1992) consisting of 2744 species, belonging to 939 genera of 196 families. The distribution of taxon in different genera of the flora of Phong Nha – Kẻ Bàng National Park is described in the Table 1 below.

Table 1. Distribution of families, genera, species and its percentage by branches

Taxon	Family	Genus	Species
1. Psilotophyta	1	1	1
2. Lycopodiophyta	2	3	17
3. Equisetophyta	1	1	2
4. Polypodiophyta	23	78	202
5. Pinophyta	6	10	19
6. Magnoliophyta	163	846	2503
- Magnoliopsida	134	659	1958
- Liliopsida	29	187	545
Total	19	939	2 44

The above-mentioned Table showed that most of taxons are concentrated in *Magnoliophyta* with 163 families accounting for 83,16%, 846 genera accounting for 90,1% and 2503 species accounting for 91,2% compared with total number of families, genera, species of the flora, then *Polypodiophyta* with 23 families accounting for 11,73 %, 78 genera accounting for 8,31% and 202 species accounting for 7,36%. The remaining branches of (*Lycopodiophyta*, *Equisetophyta*, *Pinophyta*) accounts for unimportant proportion. So, the vascular plants in Phong Nha – Kẻ Bàng National Park only have 5 out of 6 vascular high-grade plant branches of Vietnam, no unique representative of *Psilotophyta* branch is found in this region.

Compared with Vietnam flora, it is found that the flora in Phong Nha – Kẻ Bàng National Park has a flora with a great number of species in the system of national parks and protected areas of Vietnam at present. It plays an important role in the structure of the flora of Vietnam representing 2,62% of total species, generally, the vascular high-grade plant branches in Phong Nha

– Kê Bàng National Park occupies over 25,94% of total species in the composition of vascular high-grade plant branch (see Table 2).

Table 2. Compare percentage of number of species of the flora of Phong Nha – Kê Bàng with the flora of Vietnam

Taxon	PN-KB	Vietnam		To Vietnam	
	Species	%	Species	%	
Psilotophyta	1	0,04	2	0,02	50,00
Lycopodiophyta	17	0,62	57	0,54	29,82
Equisetophyta	2	0,07	2	0,02	100,00
Polypodiophyta	202	7,36	644	6,08	31,37
Pinophyta	19	0,69	63	0,60	30,16
Magnoliophyta	2503	91,22	9812	92,74	25,51
Total	2. 44	100	10.580	100	25 94

Compare on the species composition of the flora of Phong Nha – Kê Bàng National Park with other National parks representing different ecological regions of the whole country: Hoang Lien National Park represents the flora of the high mountains with sub-tropical climate and temperate climate; Cúc Phương represents the old flora of the North of Vietnam and is the best taken care; Pù Mát and Bạch Mã represent for the flora belonging to North Trường Sơn Range, these two plant systems are most closely related compared with the plant system of Phong Nha – Kê Bàng in terms of geographical and other natural conditions; Cát Tiên represents the typical tropical flora in the South of Vietnam. The result of comparison can be seen in Table 3.

Through the above-mentioned Table, once again, it shows the important role of this flora compared with that of the whole country, it not only has a high rate in terms of total of species that can compare with the flora with richest species at present (Pù Mát) but also has a very high proportion on number of species of *Polypodiophyta*, this is similar like in Bạch Mã, it shows that such are has a very good environmental conditions, typical for the tropical area on Trường Sơn range where contained many interesting things but still unknown in terms of biodiversity..

Table 3. Compare percentage of number of species of the flora of Phong Nha – Kê Bàng National Park with the flora of Bạch Mã National Park, Cúc phương National Park, Cát Tiên National Park and the flora of the mountainous area of Hoang Lien

Taxon	Spec.	% VN	Spec.	% VN	Sp.	% VN
	PN-KB		Bạch Mã		Pù Mát	
Psilotophyta	1	50,00	1	50,00	1	50,00
Lycopodiophyta	17	29,82	16	28,07	18	31,58
Equisetophyta	2	100,00	1	50,00	1	50,00

Polypodiophyta	202	31,37	162	25,16	149	23,14
Pinophyta	19	30,16	20	31,75	16	25,40
Magnoliophyta	2503	25,51	1468	14,96	2309	23,53
Total	2 44	25 94	1 8	15	2494	23 5
Taxon	Cúc Phương		Cát Tiên		Hoang Lien	
Psilotophyta	1	50,00	1	50,00	1	50,00
Lycopodiophyta	9	15,79	10	17,54	19	33,33
Equisetophyta	1	50,00	0	0,00	2	100,00
Polypodiophyta	129	20,03	90	13,98	298	46,27
Pinophyta	5	7,94	7	11,11	13	20,63
Magnoliophyta	1712	17,45	1239	12,63	1691	17,23
Total	185	1 55	134	12 3	2023	19 12

Assessment of species composition of the flora is also reflected by two classes in *Magnoliophyta* by De Candole, when the rate of class of *Magnoliopsida* compared with *Liliopsida* reaches at about 3/1 then, representative for all flora carries tropical characteristics (by Phạm Bình Quyền, Nguyễn Nghĩa Thìn 2002). During the study, through the list of plant species in Phong Nha – Kẻ Bàng National Park, the density of the two classes are reflected by number of taxons of families, genera and species, described in Table 3 above, as a result, it shows that *Magnoliopsida* completely dominated *Liliopsida*, this class has 134 families accounting for 68.37%, 659 genera for 70.18% and 1958 species for 71.36%, while *Liliopsida* only has 29 families, accounting for 14.8%, 187 genera for 19.91% and 545 species for 19.86% of total number of families, genera, species of *Magnoliophyta* in the muscular high-grade in Phong Nha-Ke Bang. The ratio of species between two classes is $1958/545 = 3.59$. This showed that the flora of Phong Nha-Ke Bang National Park has very typical tropical characteristics..

Table 4. Compare the density of two classes of *Magnoliophyta* in the flora of Phong Nha-Ke Bang with other National Parks

					Bạch Mã		Cúc Phương			
	
Magnoliopsida	1958	78,23	1938	83,93	1096	75,69	1286	76,73	1368	80,90
Liliopsida	545	21,77	371	16,07	352	24,31	390	23,27	323	19,10
	2 44	100	2309	100	1448	100	1	100	1 91	100

Compare this density of Phong Nha-Ke Bang with other national parks showed similar characteristics, it means that the absolute dominancy of *Magnoliopsida* always appears in the areas of tropical characteristics in the flora of Vietnam.

Table 5. Compare indicators of the flora of Phong Nha-Ke Bang with other flora.

			Bạch Mã	Phượng		
Family	14,00	12,23	8,95	9,66	9,03	10,12
Genus	2,92	2,68	2,16	1,94	1,92	2,83
Genus/ family	4,79	4,56	4,15	5,00	4,70	3,86
	21 4	19 4	15 2	1 0	15 5	1 81

Table 4 showed that Magnoliopsida of Phong Nha-Ke Bang has the highest density compared with Hoang Lien and Cúc Phượng, this once again indicates the degree of diversity of the flora here, tropical characteristics of Phong Nha-Ke Bang have been recognized not only in terms of the quantity of species more than other areas, but also of the density of *Magnoliopsida* and *Liliopsida*.

Diversity is also reflected in other indicators that are the indicator of diversity of families and genera in the flora, in deed, if one family or one genus of a flora has more species, then, such family or such genera can be considered as diversified. Indicators of families and genera are averagely calculated in the whole flora as criterion for assessment of diversity degree of a flora. The higher of such total indicators, the bigger the diversity will be. Such indicators of Phong Nha-Ke Bang indicated as follows: Family indicator is 14 (in average, each family has 14 species), genera indicator is 2,92 (in average, each genus has 2,92 species) and each family averagely has 4,79 genera. Comparison between such indicators and other national parks is given in Table 5.

The above-mentioned Table showed that the flora of Phong Nha-Ke Bang has a very high diversity indicator, higher than Pù Mát, compared with the above national parks with high diversity indicators, Phong Nha-Ke Bang has the highest diversity indicator in Vietnam. This affirms, once again, the highest level of diversity of the flora in Phong Nha-Ke Bang through indicators of families, genera as well as average number of genera of each family in Phong Nha-Ke Bang compared with other national parks, including Cúc Phượng, Hoang Lien, Cát Tiên and Bạch Mã National Parks which are considered as very diversified floras in Vietnam. It is obvious until now that the species composition of the flora in Phong Nha-Ke Bang is the most diversified in Vietnam.

1.1.2. Diversity in classification of taxon

In addition to the evaluation of the diversified level of the flora in taxon branch and class of the above-mentioned *Magnoliopsida*, similarly, diversity level of lower taxons can be assessed through defining the most diversified families, genera, families and genera of individual simple...

Assessment of the family diversity level, each flora area usually has specific characteristics as one family has many species in the structure of the flora. The most diversified families are usually common families and concentration of these 10 families usually creates specific characteristics of that flora.

In the process of the study, 43 most diversified families have been listed (more than 20 species), although accounting for only 71.21% of total species (1744 species) and 62,41% of total genera of the flora (586 genera) (see Table 4).

Table 4. The most diversified families

1	Orchidaceae	77	8,20	295	10,72
2	Rubiaceae	41	4,37	155	5,63
3	Euphorbiaceae	41	4,37	145	5,27
4	Lauraceae	12	1,28	95	3,45
5	Fabaceae	28	2,98	70	2,54
6	Moraceae	9	0,96	62	2,25
7	Apocynaceae	21	2,24	49	1,78
8	Fagaceae	4	0,43	47	1,71
9	Rutaceae	13	1,38	45	1,64
10	Verbenaceae	10	1,06	45	1,64
10		25	2 .2	1008	3 4
11	Annonaceae	16	1,70	43	1,56
12	Poaceae	29	3,09	43	1,56
13	Polypodiaceae	17	1,81	37	1,34
14	Asteraceae	24	2,56	37	1,34
15	Myrsinaceae	4	0,43	37	1,34
16	Caesalpinaceae	11	1,17	36	1,31
17	Urticaceae	12	1,28	36	1,31
18	Theaceae	8	0,85	34	1,24
19	Vitaceae	7	0,75	34	1,24
20	Araceae	13	1,38	34	1,24
21	Dryopteridaceae	14	1,49	32	1,16
22	Melastomataceae	10	1,06	32	1,16
23	Sterculiaceae	13	1,38	32	1,16
24	Acanthaceae	16	1,70	31	1,13
25	Asclepiadaceae	14	1,49	31	1,13
26	Meliaceae	12	1,28	31	1,13
27	Cyperaceae	9	0,96	27	0,98
28	Areaceae	11	1,17	26	0,95
29	Begoniaceae	1	0,11	25	0,91
30	Mimosaceae	7	0,75	25	0,91
31	Myrtaceae	6	0,64	25	0,91
32	Gesneriaceae	12	1,28	24	0,87
33	Celastraceae	9	0,96	23	0,84
34	Cucurbitaceae	15	1,60	23	0,84

35	Magnoliaceae	4	0,43	23	0,84
36	Ebenaceae	1	0,11	22	0,80
37	Flacourtiaceae	7	0,75	22	0,80
38	Convallariaceae	7	0,75	22	0,80
39	Zingiberaceae	8	0,85	22	0,80
40	Aspleniaceae	1	0,11	21	0,76
41	Piperaceae	3	0,32	21	0,76
42	Araliaceae	7	0,75	20	0,73
43	Elaeocarpaceae	2	0,21	20	0,73
43		58	2 41	1959	1 21

Table 6 showed that the flora of Phong Nha-Ke Bang with 10 most diversified families (rank in order from 1 to 10) although only occupying 5.1% of total families of the whole flora, but, number species has reached at 36.54% of total species of the flora (1008 species) and 27.26% of the total genera of the whole flora (256 genera). The most diversified families consist of Orchid (Orchidaceae) 295 species, 77 genera; Coffee (Rubiaceae), 155 species, 41 genera; Euphorbiaceae: 145 species, 41 genera; Orchidaceae: 123 species, 46 genera; Lauraceae: 95 species, 12 genera; Moraceae: 62 species, 9 genera; Fabaceae 70 species, 28 genera; Rutaceae: 45 species, 13 genera; Verbenaceae: 45 species, 10 genera; Fagaceae: 47 species, 4 genera; Myrsinaceae: 48 species, 5 genera.

It is assessed that out of 10 most diversified families in the flora of Phong Nha-Ke Bang National Park, no Poaceae has been found, this family has only 43 species, 29 genera, ranking 12th out of 196 families of Phong Nha-Ke Bang in terms of species richness, this is the family which its representatives are species suitable with affected environment, typically light-demanding species...this indicated that Phong Nha-Ke Bang, besides diversity and abundance in plant species composition, it also showed that this is the place where natural environment has not encroached.

Out of total 37 families, it has been found that only one species in the flora of Phong Nha-Ke Bang has some families as single species in the flora of Vietnam. These families are very rarely seen except some exotic species introduced to Vietnam for planting with purposes, families of single species present randomly in the flora indicated the oldness of the flora and its diversity level, not only in terms of species composition, but also in habitat and important factors which decide the distribution of species, factors of migration ...

Together with the process of assessment of the diversity of plant families, the most diversified genera have been also assessed, as a result, out of 939 genera collected from the flora of Phong Nha-Ke Bang, 42 genera with more than 10 species, the most diversified genera from the flora of Phong Nha-Ke Bang has been enumerated in Table 7. From this study, it indicated that 10 genera (belonging to 8 families, most of them are the most diversified

families of this flora as listed above) are the most diversified genera, number of species of these genera, at least is 21 species, although accounting for 1.065% of total genera of the flora, but 10 most diversified genera of the flora of Phong Nha-Ke Bang represent at 10.07% of total species of the whole flora (361 species).

Table 7. The most diversified genera of the muscular high-grade in Phong Nha-Ke Bang

1	Bulbophyllum	Orchidaceae	42	1,53
2	Ficus	Moraceae	40	1,45
3	Dendrobium	Orchidaceae	30	1,09
4	Litsea	Lauraceae	27	0,98
5	Liparis	Orchidaceae	26	0,95
6	Begonia	Begoniaceae	25	0,91
7	Lithocarpus	Fagaceae	23	0,84
8	Diospyros	Ebenaceae	22	0,80
9	Asplenium	Aspleniaceae	21	0,76
10	Ardisia	Myrsinaceae	21	0,76
10			2	10 0
11	Lasianthus	Rubiaceae	20	0,73
12	Syzygium	Myrtaceae	19	0,69
13	Mallotus	Euphorbiaceae	18	0,65
14	Piper	Piperaceae	18	0,65
15	Bauhinia	Caesalpiniaceae	17	0,62
16	Elaeocarpus	Elaeocarpaceae	17	0,62
17	Glochidion	Euphorbiaceae	16	0,58
18	Tetrastigma	Vitaceae	16	0,58
19	Cinnamomum	Lauraceae	15	0,55
20	Ixora	Rubiaceae	14	0,51
21	Eria	Orchidaceae	14	0,51
22	Antidesma	Euphorbiaceae	13	0,47
23	Dalbergia	Fabaceae	12	0,44
24	Quercus	Fagaceae	12	0,44
25	Hedyotis	Rubiaceae	12	0,44
26	Garcinia	Clusiaceae	11	0,40
27	Castanopsis	Fagaceae	11	0,40
28	Archidendron	Mimosaceae	11	0,40
29	Psychotria	Rubiaceae	11	0,40
30	Eurya	Theaceae	11	0,40
31	Callicarpa	Verbenaceae	11	0,40
32	Chiloschista	Orchidaceae	11	0,40
33	Hoya	Asclepiadaceae	10	0,36

34	Michelia	Magnoliaceae	10	0,36
35	Helicia	Proteaceae	10	0,36
36	Mussaenda	Rubiaceae	10	0,36
37	Glycosmis	Rutaceae	10	0,36
38	Pterospermum	Sterculiaceae	10	0,36
39	Symplocos	Symplocaceae	10	0,36
40	Clerodendrum	Verbenaceae	10	0,36
41	Thrixspermum	Orchidaceae	10	0,36
42	Smilax	Smilacaceae	10	0,36
10			8	24 9
			939	100

The most diversified genus is *Bulbophyllum* (Orchidaceae) with, the presence of a great number of species of a typically tropical genus with fully live forms including the most specific forms "creepers – bottle neck", parasite, aerial... only existed in the tropical forest, again, proved the tropical characteristics of this flora; followed by *Ficus* (Moraceae) 40 species, *Dendrobium* (Orchidaceae) with 30 species *Litsea* (Lauraceae) with 27 species, *Lithocarpus* (Fagaceae) with 23 species, etc. Total number of species belonging to 10 most diversified genera of the flora of Phong Nha-Ke Bang National Park is 277 species, accounting for 10.07% of total species of the flora while they represent only more than 1% of total genera of the whole flora.

It has been observed that out of 10 genera of most diversity of the flora, there still existed genera *Begonia*, *Dendrobium* with *Ficus* and *Diospyros* of typical characteristics of the tropical region, and besides, topography herein is also very diversified, and *Begonia*, *Dendrobium* represent famous topography of steep and dangerous mountains.

1.2. Diversity of factors creating the flora by geography

Taxons of flora composition consists of different geographical factors. These taxons can be similar or different on plant geographical factors at different levels. From the collected information on the distribution of the species of the flora of Phong Nha-Ke Bang, according to the classification of geographical factors for the flora of Vietnam by Le Tran Chan (1999), results gained are presented in Table 8.

Out of 2744 vascular plant species in the flora of Phong Nha-Ke Bang National Park, geographical distribution of 2055 species (representing for 74.89% of species of the whole flora) has been defined as a basis for assessment of the diversity in terms of geographical factor and relationship in terms of origin that creating such flora with neighboring flora. Factors created by

geographical conditions of the flora of Phong Nha-Ke Bang National Park are presented in Table 8 and figure 1 here below.

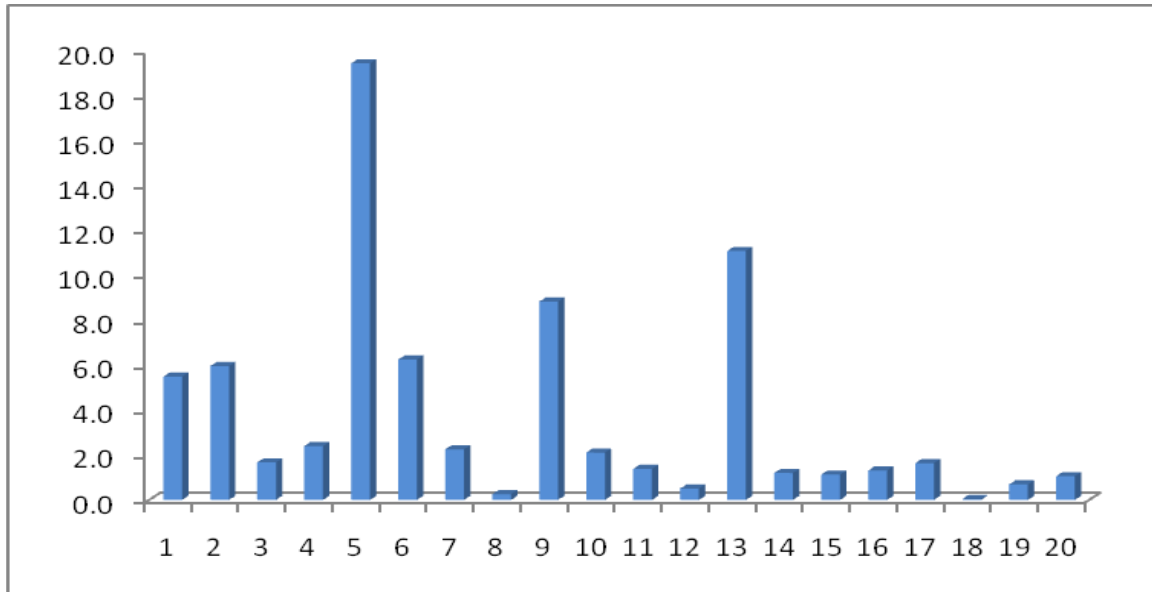
Table 8. Spectrum of geographical factors of the flora of Phong Nha-Ke Bang National park.

No.	Geography element	Number of species	%
A	Endemism	425	15.5
1	Tonkin endemism	151	5.50
2	Central Vietnam endemism	14	5.98
3	South Vietnam endemism	46	1.68
4	Vietnam endemism	66	2.41
B	Asian Tropics	1129	41.14
5	Indochina endemism	535	19.50
6	Shouthern China endemism	172	6.27
7	Hunan, Taiwan, Philippines element	62	2.26
8	Himalaya element	7	0.26
9	India element	243	8.86
10	Malaysia element	58	2.11
11	Tropical Asia element	14	0.51
12	Indonesia-Malaysia element	38	1.38
C	Acient Tropics	8	2.84
13	Asian element	33	1.20
14	Palaeo-tropical element	45	1.64
D	Temperate element	3	1.35
15	East Asia element	36	1.31
16	Northern temperate element	1	0.04
E	Inter tropical element	33	12.24
17	New tropical and circum tropical element	31	1.13
18	Indonesia-Malaysia-Australia	305	11.12
F (19)	Wide disposing element	19	0.69
G (20)	Exotic and migrant element	29	1.06
H	Other	689	25.11
	TOTAL	244	100

Table 8 and Figure 1 showed that the group of tropical factors dominated completely compared with the remaining groups with a total of 1129 species, representing 41.14% of total species of this flora (including endemic factors in

Vietnam), while, temperate factors only account for 1.35%, including Northern temperate element is the lowest percent at 0.04%.

Figure 1. Structure of composition on geography of all species of the flora of Phong Nha-Ke Bang National Park.



Vietnam endemic factor with total of 15.56%, consisting of 427 species, of which endemic factor in the whole country (present in many localities in the whole country) consisting of 66 species, representing at 5.49%, near endemic and endemic species for the Central part of Vietnam have 164, accounting for 5.97% of total species of the Park. In this region, special attention should be given to one endemic genus with only single species of *Oligoceras* belonging to *Euphorbiaceae* with *Oligoceras eberhardtii* species. In addition, a new species belonging to *Gymnospermae* has been recently discovered (on the top of the rocky mountain along the Road 20 from Tám Cô Cave to Cà Ròng. This is an old plant species that appeared some 400 years ago, now still remained on the rocky mountain top i.e *Calocedrus rupestris* Averyanov. Other special species has been so far discovered herein, which was formerly considered by many scientists as fellow-creature (Synonym) of species (*Vernicia montana* Lour.) belonging to *Euphorbiaceae*. That is *V. cordata* introduced by Prof. Phạm Hoàng Hộ in the publication namely Vietnam Vegetation. For the first time, it has been found by our study team in the mountainous area between Hồ Chí Minh Road linking to Hang Én valley.

For relationship between the flora of Phong Nha-Ke Bang with the neighboring phytogeographical factors, Vietnam is a place converging migratory flows from different places in the world and also where a number of plant groups arose and now became indigenous and endemic species. Defining its relationship with the floras of India, Malezi, Indochina, South China, Himalaya by percent of number of species belonging to this distribution area, then, it has been found that this flora is most closely related with Indochina vegetation (19.46%), next to the factor of Indonesia-Malaysia-Australia (11.09%), India (8.84%), South China (6.24%), Factor of Malezi (5.58%) then factor of Northern temperate, lowest percentage of (4.47%).

1.3. Diversity on live forms

Results on live forms collected from the study showed that the flora of Phong Nha-Ke Bang is also very diversified. Out of 2774 species of the whole flora, then, the live form of 2447 species has been identified, mainly including species belonging to group of coppiced trees on the ground with total number of 1823 species (representing at 74.5% of total number of species), obtaining spectrum of live form of 78.8% (only known species), with all the live forms of muscular high-grade flora. The remaining groups occupy a small ratio from 4% to 9%, out of total live form-defined species, there are 220 hidden coppiced trees (8.99% of total species of the flora); 210 half-hidden coppiced trees (8.58% of total number of species), 99 tree species with buds near the ground (4.05% of total species), 95 coppiced trees aged 1 year (3.88% of total species).

With complete live forms, the flora of Phong Nha-Ke Bang National Park has indicated typically tropical characteristics, of which, group of coppiced trees on the ground (group of trees representing different live forms in the tropical area) completely dominating the remaining groups. These groups represent temperate and –semi desert temperate flora...

Table 9. Structure of live-form composition of the flora of Phong Nha-Ke Bang

No	Lifeform	Code	Species	(%)
1	Phanerophytes	Ph	1823	74,50
	- <i>Megaphanérophytes</i>	<i>Mg</i>	80	3,27
	- <i>Mesaphanérophytes</i>	<i>Me</i>	371	15,16
	- <i>Microphanérophytes</i>	<i>Mi</i>	577	23,58
	- <i>Nanophanérophytes</i>	<i>Na</i>	267	10,91
	- <i>Epiphytes</i>	<i>Ep</i>	176	7,19
	- <i>Parasite</i>	<i>Pp</i>	13	0,53
	- <i>Phanerophytes - Succulentés</i>	<i>Suc</i>	1	0,04
	- <i>Liannes</i>	<i>Lp</i>	337	13,77
	- <i>Herbaceous</i>	<i>Hp</i>	1	0,04
2	Chamaephytes	Ch	99	4,05
3	Hemicryptophytes	Hm	220	8,99
4	Cryptophytes	Cr	210	8,58
5	Therophytes	Th	95	3,88

Spectral of the live form of the flora of Phong Nha-Ke Bang National Park is established as follows:

$$SB = 74,50 Ph + 4,05 Ch + 8,99 Hm + 8,58 Cr + 3,88 Th$$

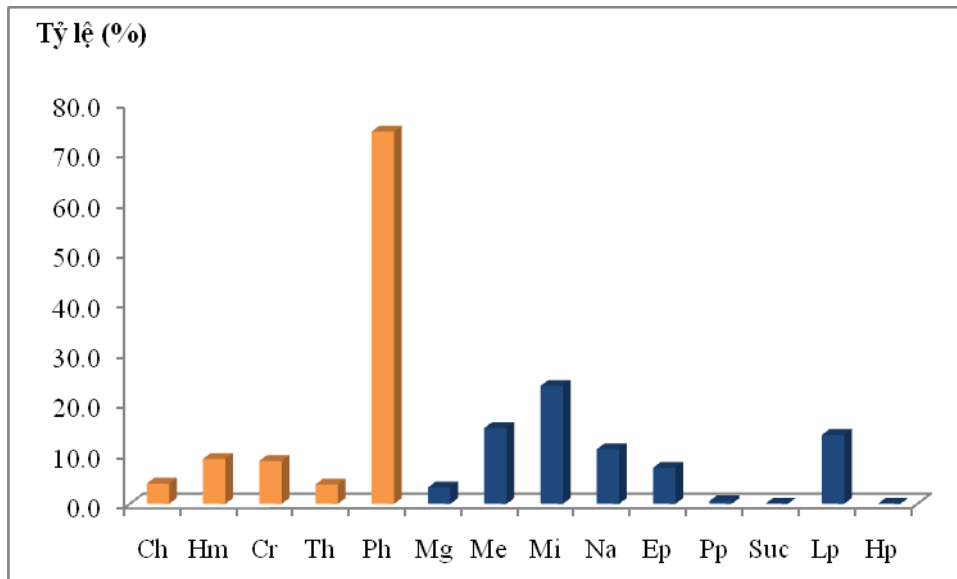


Figure 2. Spectrum of the live form of the flora in Phong Nha-Ke Bang National Park

To know more about the importance of this live form, it should analyze more carefully each small group of this live form. By doing this, it showed that group of coppiced trees on the ground has full composition from big and high trees (live form of Me or Mg in the group of MM) to bushes, low coppiced trees (live form of Na) of the plant in the structure of the layer of standing trees to creepers, parasitic trees of the plants in upper layer, coppiced trees on the vegetation represent for the humid and shade demanding plant group growing in the forest, besides, there appeared trees with stumps full of water suitable with dry and severe environment. In this group, a rather high rate of the climbing trees and parasitic trees in the plant group of the upper layer increases the value of biodiversity of the flora, these are live forms which can only be seen in the tropical forests, therein, existed beautiful orchid flowers or interlacing and twisting creepers on the forest creating a neglected sensation for those who, for the first time, want to discover explore the natural world of the tropical primitive forests.

2. SCIENTIFIC VALUE OF THE FLORA

2.1. Plant resource of Phong Nha-Ke Bang National Park

Presently, biodiversity in general and plant diversity in particular are being considered by many biological scientists in recent years. For Vietnam, due to consequences of a long war, shifting cultivation and unplanned exploitation leading to serious destruction of the forests, increasing the area of open land and barren hills, destroying and losing heavily plant resources, resulting in unbalance of ecological system. Besides, in recent years, most of the provinces from the North to the South, from the mountainous area to the plain area, have been seriously affected by big floods destroying crops, houses, roads... causing big losses valued at thousands of billions of Dong VN.

That is why, proper use and protection of natural resources, protection of forests, protection of rare, rich and diversified genetic resources have become an urgent matter in the cause of economic development of the country.

Table 10. Useful tree species

No	Useful	Code	Species	%
1	Medicine	M	995	45.94
2	Wood	T	446	20.59
3	Food	F	360	16.62
4	Ornament	Or	187	8.63
5	Fat oil	Oil	70	3.23
6	Poision	Mp	36	1.66
7	Essential	E	35	1.62
8	Fiber	Fb	25	1.15
9	Dyer	Dy	4	0.18
10	Latex	Sap	3	0.14
11	Others	K	5	0.23
	Total		2166	100

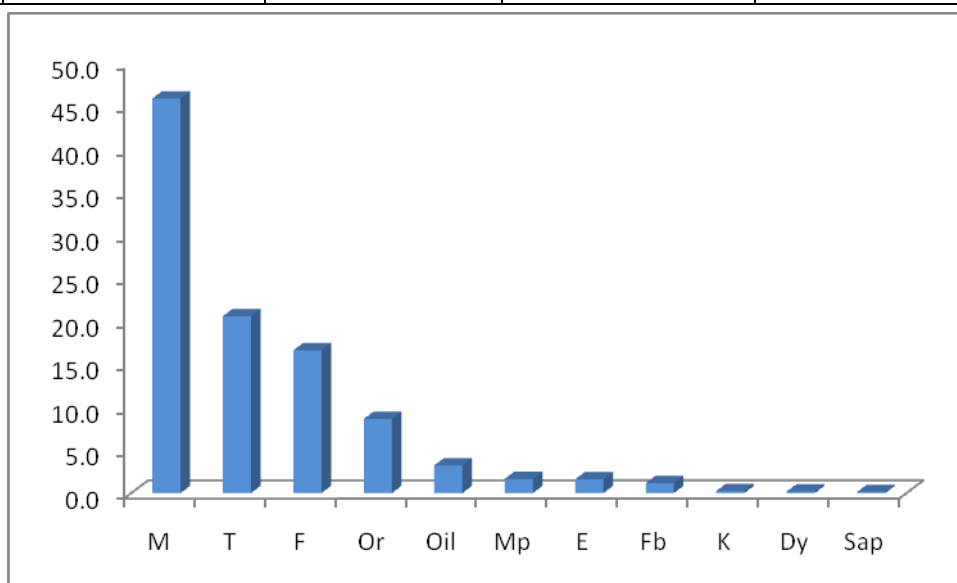


Figure 4. Value of use of the flora of Phong Nha-Ke Bang National Park

During the study and analysis of the value of use of the forest tree species of the flora of Phong Nha-Ke Bang National Park, information on all species in the list of plants of the Park has been collected, from which species were assessed and classified into one of the purpose of use. Results from study, analysis and collection of information on usage, resources of useful trees of Phong Nha-Ke Bang National Park are presented at Table 10 and Figure 4.

It is found that the flora of Phong Nha-Ke Bang National Park has 2166 useful tree species, accounting for 78.94% of total number of species of the entire flora. If compare this rate with some other floras in the country, it showed that this rate is not low, however, if including the number of useful tree species and its importance in the area compared with the general flora of the whole country, it is obvious that this is a rather rich natural resources. Of which the most useful is medicinal plant sources with a total of 995 species (accounting for 36.18% of total species of the entire flora). Some valuable medicinal plants used by the community such as: *Drynaria fortunei*, *Rauvolfia cambodiana*, *Strychnos* sp., *Clematis buchaniana*...

Followed by value of timber sources, 446 wooded tree species were collected in Phong Nha-Ke Bang National Park, accounting for 16.22% of total species in the flora, out of which there are many species with direct value to the community living in the area, not only useful for national economy, but also of significance for the future while the forests continue to be destroyed, even exhausted, then, this will become a very useful natural resources, now, we know how to stop illegal and unplanned logging, this natural resources and other natural resources offered by nature to Phong Nha-Ke Bang National Park in particular and human-being in the World in general should be effectively protected.

Some timber tree species of high economic value in the area like *Fokienia hodginsii*, *Shorea chinensis*, *Hopea astoni* spp, *Dalbergia balansae*, *Madhuca pasquieri*, *Vatica cinerea*, *Dalbergia tonkinensis*, *Pterocarpus macrocarpus*, *Michelia balansae*, and *Erythrophleum fordii*. etc...

Man for ages from the time when there was no agricultural and industrial revolutions, our life completely relied on what the nature offered to us from food to clothes, all of them were products from the forests and nature. The most important product was food that provided to many generations of human being, from the primitive life until modern life, when civilization of mankind developed to a high level people now still use a lot of forest products as food. Out of 1357 useful tree species in Phong Nha-Ke Bang National Park, 350 species are used for different purposes, used for eating, drinking of the people (spice, flavouring, food, foodstuff for people and animals...), accounting for 14.63% of total species in the Park.

Besides, nature still grants to Phong Nha-Ke Bang National Park other unique sources i.e tree species used for ornament. People grow trees, besides its outside beauty with nice and colourful flowers, with beautiful decorative plants created by tree grower, people feel comfortable and at ease as if they come closer to wild nature. Abundant decorative plants in Phong Nha-Ke Bang National Park with 187 species of this value, main species were seen including orchids (Orchidaceae) and some other species belong to *Begoniaceae*...

Other natural resources found in Phong Nha-Ke Bang National Park are values that people used for ages, some newly species discovered by scientists in recent years have different values of use like for extracting essential oils, fat oil, poison used for making medicine for medical treatment and potential for medical study in the future, used as construction materials for housing, kitchen utensils, handicrafts...all together built up abundant natural resources of Phong Nha-Ke Bang National Park.

2.2. Threatened species

Basing on the list in the Red Data Book of Vietnam (2007), IUCN Redlist (2013) and Government Decree No 32/2006/ND-CP on threatened species, 49 species recorded in Phong Nha-Ke Bang National Park are now endangered to extinction, accounting for 2,05% of total species of the flora. Considering the role of conservation of flora of Phong Nha-Ke Bang National Park compared with the whole country, then this flora represents at 14,54% of total species listed in the Red Book of Vietnam, therefore, this is the storage of many valuable and rare genetic sources of Vietnam that requires policies and concrete measures to conserve them.

Table 11. List of threatened plant species

		200	2013	32
	.			
	1.			
1.	<i>Selaginella tamariscina</i> (P. Beauv.) Spring	VU		
	.			
	2.			
2.	<i>Drynaria bonii</i> H. Christ	VU		
3.	<i>Drynaria fortunei</i> (Kunze ex Mett.) J.Sm.	EN		
	.			
	3.			
4.	<i>Cephalotaxus mannii</i> Hook.f.	VU	VU	IIA
	4.			
5.	<i>Calocedrus rupestris</i> Aver.		EN	IIA
6.	<i>Fokienia hodginsii</i> (Dunn) A. Henry & H. H. Thomas	EN	LR	IIA
	5.			
7.	<i>Cycas pectinata</i> Buch. -Ham.		VU	IIA
8.	<i>Cycas siamensis</i> Miq.		VU	IIA
9.	<i>Cycas taiwaniana</i> Carruth.		EN	IIA
	.			
10.	<i>Dacrydium elatum</i> Wall. ex Hook.		LR	
11.	<i>Dacrycarpus imbricatus</i> (Blume) de Laub.		LR	
12.	<i>Nageia fleuryi</i> (Hickel) de Laub.		NT	
13.	<i>Nageia wallichiana</i> (C. Presl) Kuntze		LR	
14.	<i>Podocarpus neriifolius</i> D.Don		LR	
	.			
15.	<i>Amentotaxus yunnanensis</i> H.L.Li		EN	
	.			
	.1.			
	8.			

		200	2013	32
16.	<i>Chroesthes lanceolata</i> (T. Anders.) B. Hansen	CR		
17.	<i>Psiloesthes elongate</i> Benoist	EN		
	9.			
18.	<i>Mangifera dongnaiensis</i> Pierre		EN	
19.	<i>Mangifera foetida</i> Lour.		LR	
20.	<i>Mangifera indica</i> L.		DD	
21.	<i>Pistacia cucphuongensis</i> Dai		VU	
	10.			
22.	<i>Alphonsea monogyna</i> Merr. et Chun		VU	
23.	<i>Enicosanthellum plagioneurum</i> (Diels) Ban		LR	
24.	<i>Xylophia pierrei</i> Hance		VU	
	11.			
25.	<i>Centella asiatica</i> (L.) Urb. in Mart.		LC	
	12.			
26.	<i>Alstonia scholaris</i> (L.) R. Br.		LR	
27.	<i>Kibatalia laurifolia</i> (Ridl.) Woods.	VU		
28.	<i>Rauvolfia micrantha</i> Hook.f.	VU		
29.	<i>Rauvolfia verticillata</i> (Lour.) Baill.	VU		
30.	<i>Tabernaemontana corymbosa</i> Roxb. ex Wall.		LR	
31.	<i>Winchtia calophylla</i> A. DC.	VU		
32.	<i>Wrightia laevis</i> Hook. f.		LR	
	13.			
33.	<i>Aralia chinensis</i> L.		VU	
	14.			
34.	<i>Asarum balansae</i> Franch.	EN		IIA
35.	<i>Asarum caudigerum</i> Hance			IIA
36.	<i>Asarum wulingense</i> Liang			IIA
37.	<i>Balanophora laxiflora</i> Hemsl. in F. Forbes & Hemsl.	EN		
	15.			
38.	<i>Markhamia stipulata</i> var <i>kerrii</i> Sprague	VU		IIA
	1 .			
39.	<i>Bursera tonkinensis</i> Guillaum.	VU	VU	
40.	<i>Dacryodes breviracemosa</i> Kalkm.		VU	
41.	<i>Protium serratum</i> (Wall. ex Colebr.) Engl.	VU		
	1 .			
42.	<i>Caesalpinia sappan</i> L.		LR	
43.	<i>Dialium cochinchinense</i> Pierre		LR	
44.	<i>Erythrophleum fordii</i> Oliv.		EN	IIA
45.	<i>Sindora tonkinensis</i> A.Chev. exK.. et S.Larsen	EN	DD	IIA
46.	<i>Zenia insignis</i> Chun		LR	
	18.			
47.	<i>Codonopsis celebica</i> (Blume) Thuan	VU		
48.	<i>Codonopsis javanica</i> (Blume) Hook. f & Thoms.	VU		
	19.			
49.	<i>Bhesa robusta</i> (Roxb.) Ding Hou		LR	
50.	<i>Euonymus chinensis</i> Lindl.	EN		

		200	2013	32
51.	Lophopetalum wightianum Arn.	VU	LR	
	20.			
52.	Calophyllum inophyllum L.		LR	
53.	Garcinia fagraeoides A.Chev.			IIA
	21.			
54.	Diplopanax stachyanthus Hand.-Mazz.		VU	
55.	Mastixia arborea (Wight) C. B. Clarke		LR	
	22.			
56.	Gynostemma pentaphyllum (Thunb.) Makino	EN		
	23.			
57.	Tetrameles nudiflora R. Br.		LR	
	24.			
58.	Dipterocarpus gracilis Blume		CR	
59.	Dipterocarpus hasseltii Blume		CR	
60.	Dipterocarpus retusus Blume	VU	VU	
61.	Dipterocarpus turbinatus Gaertn. F.		CR	
62.	Hopea chinensis (Merr.) Hand.-Mazz.		CR	
63.	Hopea ferrea Pierre	EN	EN	
64.	Hopea hainanensis Merr. et Chun	EN	CR	
65.	Hopea mollissima C. Y. Wu	VU	CR	
66.	Hopea pierrei Hance	EN	EN	
67.	Hopea reticulata Tardieu		CR	
68.	Hopea siamensis Heim		CR	
69.	Vatica cinerea King		EN	
70.	Vatica diospyroides Symingt.		CR	
71.	Vatica subglabra Merr.	EN		
	25.			
72.	Diospyros apiculata Hiern.		LR	
73.	Diospyros mollis Griff.	EN		
	2			
74.	Euphorbia tirucalli L.		LC	
75.	Homonoia riparia Lour.		LC	
	2			
76.	Alysicarpus bupleurifolius (L.) DC.		LC	
77.	Crotalaria assamica Benth.		LC	
78.	Dalbergia assamica Benth.		LC	
79.	Dalbergia cochinchinensis Pierre	EN	VU	
80.	Dalbergia oliveri Gamble ex Prain	EN	EN	IIA
81.	Dalbergia ovata Grah. ex Benth.		LC	
82.	Dalbergia tonkinensis Prain		VU	IA
83.	Parochetus communis Buch.-Ham. ex D. Don		LC	
84.	Phyllodium elegans (Lour.) Desv.		LC	
85.	Pongamia pinnata (L.) Merr.		LC	
86.	Pterocarpus macrocarpus Kuzs	EN		IIA
87.	Spatholobus harmandii Gagnep.			
88.	Spatholobus pottingeri Prain		LC	
	28.			

		200	2013	32
89.	<i>Castanopsis ferox</i> (Roxb.) Spach	VU		
90.	<i>Castanopsis hystrix</i> Hook. F & Thoms. ex A. DC.	VU		
91.	<i>Castanopsis lecomtei</i> Hickel et A. Camus	VU		
92.	<i>Fagus longipetiolata</i> Seemen	EN	VU	
93.	<i>Lithocarpus bacgiangensis</i> (Hickel et. A. Camus) A. Camus	VU		
94.	<i>Lithocarpus fenestratus</i> (Roxb.) Rehd.	VU		
95.	<i>Lithocarpus hemisphaericus</i> (Drake) Barnett	VU		
96.	<i>Quercus glauca</i> Thunb	VU		
97.	<i>Quercus langbianensis</i> Hickel et. A. Camus	VU		
	29.			
98.	<i>Bennettiodendron cordatum</i> Merr.		VU	
99.	<i>Hydnocarpus annamensis</i> (Gagnep) Lescot et Sleum.		VU	
100.	<i>Hydnocarpus hainanensis</i> (Merr.) Sleum.		VU	
101.	<i>Hydnocarpus kurzii</i> (King) Warb.		DD	
	30.			
102.	<i>Rhodoleia championii</i> Hook.		LR	
	31.			
103.	<i>Cratoxylum cochinchinense</i> (Lour.) Blume		LR	
104.	<i>Cratoxylum formosum</i> (Jack) Benth. et hook.f. ex Dyer)		LR	
	32.			
105.	<i>Illicium tenuifolium</i> (Ridl.) A. C. Smith.		LR	
106.	<i>Illicium ternstroemioides</i> A. C. Smith		VU	
	33.			
107.	<i>Annamocarya sinensis</i> (Dode) J.Leroy	EN	EN	
108.	<i>Engelhardtia spicata</i> Lesch. ex Blume		LR	
	34.			
109.	<i>Actinodaphne ellipticibacca</i> Kosterm.	VU		
110.	<i>Cinnamomum glaucescens</i> (Nees) Drury			IIA
111.	<i>Cinnamomum mairei</i> Levl.		EN	
112.	<i>Cinnamomum parthenoxylon</i> (Jack) Meisn.	CR	DD	IIA
113.	<i>Endiandra hainanensis</i> Merr. & Metc. ex Allen	EN		
114.	<i>Phoebe macrocarpa</i> C. Y. Wu	VU		
115.	<i>Strychnos cathayensis</i> Merr.	VU		
116.	<i>Strychnos nitida</i> G. Don	EN		
	35.			
117.	<i>Magnolia liliifera</i>		LR	
118.	<i>Manglietia dandyi</i> (Gagnep.) Dandy in S. Nilsson.	VU		
119.	<i>Michelia balansae</i> (DC.) Dandy	VU		
120.	<i>Michelia coriacea</i> H. T. Chang & B. T. Chen		EN	
121.	<i>Michelia hypolampra</i> Dandy		VU	
122.	<i>Paramichelia baillonii</i> (Pierre) S. Y. Hu	VU		
123.	<i>Paramichelia braianensis</i> (Gagnep.) Dandy	EN		
	3			
124.	<i>Aglaia elaeagnoidea</i> (A. Juss.) Benth.		LR	

		200	2013	32
125.	<i>Aglaia odorata</i> Lour.		LR	
126.	<i>Aglaia perviridis</i> Hiern		VU	
127.	<i>Aglaia silvestris</i> (M.Roem.) Merr.		LR	
128.	<i>Aglaia spertabilis</i> (Miq.) Jain et Bennet	VU		
129.	<i>Aglaia tomentosa</i> Teijsm. et Binn.		LR	
130.	<i>Aphanamixis polystachya</i> (Wlall.) R. N. Parker		LR	
131.	<i>Chukrasia tabularis</i> A. Juss.	VU	LR	
132.	<i>Dysoxylum alliaceum</i> (Blume) Blume		LR	
133.	<i>Dysoxylum loureiri</i> (Pierre) Pierre	VU		
134.	<i>Toona ciliata</i> Roem.		LR	
	3 .			
135.	<i>Coscinium fenestratum</i> (Gaertn.) Colebr.			IIA
136.	<i>Fibraurea tinctoria</i> Lour.			IIA
137.	<i>Stephania hernandiifolia</i> (Willd.) Spreng.			IIA
138.	<i>Stephania longa</i> Lour.			IIA
139.	<i>Stephania rotunda</i> Lour.			IIA
140.	<i>Stephania sinica</i> Diels			IIA
	38.			
141.	<i>Horsfieldia irya</i> (Gaertn.) Warb.		LR	
142.	<i>Horsfieldia longiflora</i> de Wilde		VU	
143.	<i>Knema globularia</i> (Lamk.) Warb.		LR	
144.	<i>Knema pierrei</i> Warb.		VU	
145.	<i>Knema poilanei</i> de Wilde		VU	
146.	<i>Knema squamulosa</i> de Wilde		VU	
147.	<i>Knema tonkinensis</i> (Warb.) de Wilde		VU	
148.	<i>Myristica fragrans</i> Houtt.		DD	
149.	<i>Myristica iners</i> Blume		LR	
	39.			
150.	<i>Ardisia silvestris</i> Pitard	VU		
151.	<i>Embelia parviflora</i> Wall. ex A.DC.	VU		
	40.			
152.	<i>Acmena acuminatissimum</i> (Blume) Merr. & Perry.	VU		
	41.			
153.	<i>Ludwigia hyssopifolia</i> (G. Don) Exell		LC	
	42.			
154.	<i>Melientha suavis</i> Pierre	VU		
	43.			
155.	<i>Pittosporum pauciflorum</i> Hook. & Arn.	VU		
	44.			
156.	<i>Platanus kerri</i> Gagnep.	VU		
	45.			
157.	<i>Prunus arborea</i> (Blume) Kalkm.		LR	
	4 .			
158.	<i>Fagerlindia depauperata</i> (Drake) Tirveng.	VU		
159.	<i>Leptomischus primuloides</i> Drake	VU		
160.	<i>Rothmania vietnamensis</i> Tirveng.	VU		
	4 .			

		200	2013	32
161.	<i>Murraya glabra</i> (Guillaum.) Guillaum.	VU		
	48.			
162.	<i>Amesiodendron chinense</i> (Merr.) Hu		LR	
163.	<i>Nephelium lappaceum</i> L.		LR	
164.	<i>Sinoradlkofera minor</i> (Hemsl.) F.G. Mey.	EN	VU	
	49.			
165.	<i>Madhuca hainanensis</i> Chun & How		VU	
166.	<i>Madhuca pasquieri</i> (Dubard) H. J. Lam	EN	VU	
	50.			
167.	<i>Bacopa monnieri</i> (L.) Wettst.		LC	
168.	<i>Lindernia antipoda</i> (L.) Alston		LC	
169.	<i>Lindernia ciliata</i> (Colsm.) Penn.		LC	
	51.			
170.	<i>Sphenoclea zeylanica</i> Gaertn.		LC	
	52.			
171.	<i>Scaphium macropodium</i> (Miq.) Beume'c ex K. Heyne		LR	
172.	<i>Sterculia parviflora</i> Roxb.		LR	
	53.			
173.	<i>Styrax litseoides</i> J. E. Vidal	EN	VU	
	54.			
174.	<i>Adinandra integerrima</i> T. Anders. ex Dyer		LR	
175.	<i>Camellia fleuryi</i> (A. Chev.) Sealy	EN	VU	
	55.			
176.	<i>Aquilaria crassna</i> Pierre ex Lecomte	EN	CR	
	5 .			
177.	<i>Excentrodendron tonkinensis</i> (Gagnep.) Chang et Miau	EN		IIA
178.	<i>Schoutenia hypoleuca</i> Pierre	VU		
	5 .			
179.	<i>Gmelina racemosa</i> (Lour.) Merr.	VU		
180.	<i>Phyla nodiflora</i> (L.) Greene		LC	
.2.				
	58.			
181.	<i>Acorus calamus</i> L.		LC	
182.	<i>Acorus gramineus</i> Soland.		LC	
	59.			
183.	<i>Aglaonema simplex</i> Blume		LC	
184.	<i>Lasia spinosa</i> (L.) Thwaites		LC	
	0.			
185.	<i>Calamus nambariensis</i> Becc.	VU		
186.	<i>Calamus poilanei</i> Conrard	EN		
	1.			
187.	<i>Commelina diffusa</i> Burm.f.		LC	
188.	<i>Cyanotis papilionacea</i> Roem et Schult.f.		LC	
189.	<i>Floscopa scandens</i> Lour.		LC	

		200	2013	32
190.	<i>Murdannia spirata</i> (L.) Bruckn.		LC	
	2.			
191.	<i>Disporopsis longifolia</i> Craib			IIA
	3.			
192.	<i>Kyllinga nemoralis</i> (Forst. et Forst. f.) Dandy ex Hutch. & Dalz.		LC	
193.	<i>Mariscus compactus</i> (Retz.) Druce		LC	
	4.			
194.	<i>Hydrilla verticillata</i> (L. f.) Royle		LC	
	5.			
195.	<i>Anoetochilus annamensis</i> A.ver.			IA
196.	<i>Anoetochilus calcareus</i> Aver.	EN		IA
197.	<i>Anoetochilus elwesii</i> (C.B. Clarke ex Hook. f.) King & Pantl.			IA
198.	<i>Anoetochilus lylei</i> Rolfe ex Downie			IA
199.	<i>Anoetochilus setaceus</i> Blume	EN		IA
200.	<i>Bulbophyllum astelidum</i> Aver.	EN		
201.	<i>Dendrobium amabile</i> (Lour.) O'Brien	EN		
202.	<i>Dendrobium bilobulatum</i> Seidenf.	EN		
203.	<i>Dendrobium crystallinum</i> Reichb. f.	EN		
204.	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw.	EN		
205.	<i>Dendrobium nobile</i> Lindl.	EN		IIA
206.	<i>Dendrobium williamsonii</i> Day et Reichb. f.	EN		
207.	<i>Eria spirodela</i> Aver.	EN		
208.	<i>Flickingeria vietnamensis</i> Seidenf.	EN		
209.	<i>Nervilia aragoana</i> Gaudich.	VU		IIA
210.	<i>Nervilia crociformis</i> (Zoll. & Mor.) Seidenf.			IIA
211.	<i>Nervilia macroglossa</i> (Hook.f.) Schltr.			IIA
212.	<i>Paphiopedilum concolor</i> (Lindl.) Pfitz.	EN		IA
213.	<i>Paphiopedilum dianthum</i> Tang & F.T.Wang		EN	IA
214.	<i>Paphiopedilum godefoya</i> (God.-Lep.) Stein	EN		IA
215.	<i>Paphiopedilum malipoense</i> S.C.Chen & Z.H. Tsi			IA
	.			
216.	<i>Eleusine indica</i> (L.) Gaertn.		LC	
217.	<i>Eragrostis unioides</i> (Retz.) Nees ex Steud.		LC	
218.	<i>Panicum repens</i> L.		LC	
219.	<i>Paspalum conjugatum</i> Berg.		LC	
	.			
220.	<i>Smilax corbularia</i> Kunth	VU		
	8.			
221.	<i>Tacca chantrieri</i> Andre	VU		
222.	<i>Tacca plantaginea</i> (Hance) Drenth	VU		

There are 222 plant species of 2774 listed in Vietnam Red Data Book (2007), IUCN Redlist (2013) and Vietnam Government Decree No 32:

- IUCN (2013): 133 species, about 59.91% of the total threatened species, including 96 genera and 47 families as follows:
 - + CR - Critically endangered: 10 species, about 4.5 % of the total threatened species.
 - + EN - Endangered: 13 species, about 5.86% of the total threatened species.
 - + VU - Vulnerable: 30 species, about 13.51% of the total threatened species.
 - + LR - Lower Risk: species, about 18.92% of the total threatened species.
 - + DD - Data Deficient: 5 species, about 2.25% v
 - + LC - Least concern: 32 species, about 15.11% of the total threatened species.
 - + NT – Near threatened: 1 species, about 0.45% of the total threatened species.

- Vietnam Red Data Book (2007) lists 92 species, about 41.44% belong to 37 genera and 68 families as follows:
 - + CR: 2 species, about 0,9% of the total threatened species.
 - + EN: 41 species, about 18.47% of the total threatened species.
 - + VU: 49 species, about 22,07% of the total threatened species.

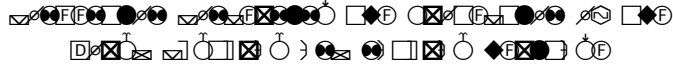
- Decree No 32/2006/NĐ-CP dated 30/3/2006 by Vietnam Government on threatened species including: Group IA - Strictly Prohibited exploitation and use for trading; Group IIA - Limited exploitation and use for trading. Thirty nine species are listed in Decree No 32, accounting 17.57% of the total plant species, belong to 15 genera and 21 families, as follows:
 - + Group IA includes 10 species.
 - + Group IIA includes 29 species.

REFERENCES

1. Akerele O, 1991. Medicinal Plants. Policies and priorities. In. O. Akerele. V. Heywood & H.Synge. The Conservation of Medicinal Plants. Cambridge University Press. p. 3 - 11.
2. Anon, 1993. Management plan of Phong Nha Nature Reserve Quang Binh province. Unpublished report to Ministry of Forestry – Hanoi (In Vietnamese).
3. Anutschin N.P, 1961. Forest mensuration. Moscow. USSR.
4. Aubréville A., M. L. Tardieu - Blot, J. E. Vidal et Ph. Mora (Reds.), 1960 - 1996. Flore du Cambodge, du Laos et du Vietnam, fasc, 1-29. Paris.
5. Averyanov L. V., 1994. Indentification guide to Vietnamse orchids (Orchidaceae Juss.) St. Peterburg. World & Family. Russian.
6. Averyanov L. V., 1994. Indentification guide to Vietnamse orchids (Orchidaceae Juss.) St. Peterburg. World & Family. Russian.
7. Brummitt R.K., C. E. Powell. 1992. Authors of Plant Names. Royal Botanic Gardens. Kew.
8. Crévost Ch. et A. Pételot, 1982. Catalogue des produits de l'Indo-chine. 5. Produits Médicinaux, Paris.
9. De Pedua L.S., N. Bunyaphatsara and R.H.M.J. Lemmens, 1999. PROSEA, No, 12(1), Medicinal poisonuos plants. Backhuys Publishers. Leiden.
10. Eschmeyer W. N., 1998. Catalog of Fishes. Academy of Sciences, California, USA.

11. Faridah Hamun I. and L.J.G. Van der Maesen, 1997. PROSEA, No, 11, Aucxilliary plants. Backhuys Publishers. Leiden.
12. Farnsworth N.R. and D.D. Soejarto, 1991. Global improtance of medicinal plants. In O. Akerele, V. Heywood & H.Synge. The conservation of Medicinal Plants. Cambridge University Press, 25 - 51.
13. Forest Inventory and Planning Institute, 1996. Viet Nam Forest Trees. Agricultural Publishing House. Ha Noi.
14. Husain A, 1991. Economic Aspects of Exploitation of medicinal plants. In O. Akerele, V. Heywood, H. Synge, *ibid.*, p, 125 - 140.
15. Islam A - S, 1991. Utilization of Indigenous Medicinal Plants and their conservation in Bangladesh. In. O.Kerele, V. Heywood, H. Synge. *I bid.*, p. 330 - 335.
16. Lecomte, H. et Humbert, et al, 1907 - 1952. Flore générale de l'Indo-chine. (I - VII) et suppléments. Masson et Cie, Editeurs, Paris.
17. Lemmens R.H.M.J., I. Soerianegara and W.C. Wong. 1995. Prosea, No. 5(2), Timber trees: Minor commercial timbers. Backhuys Publishers. Leiden
18. Leonid V. Averyanov, 2005. *Preliminary survey of orchids (Orchidaceae) in Phong Nha – Ke Bang NP*. FFI and Counterpart International, Hanoi, Vietnam.
19. Ly, T. L. 1986. Die Familie Apocynaceae Juss. in Vietnam. Teil 1-3. Feddes Repertorium. Vol. 97: 5 - 10.
20. Ministry of Science Technology and Environment, 2003. *Red Book of Vietnam, Part of Fauna*. The Publisher of Science and Technique, Hanoi.
21. Neville Kemp, Le Mong Chan and Michael Dilger, 1995. Vietnam Forest Research Program. Site Description and Conservation Evaluation: Pu Mat Nature Reserve, Con Cuong District, Nghe An Provine, Vietnam. Frontier - Vietnam Scientific Report No.5.
22. Nguyen Nghia Thin, 2006. Report on Flora in Phong Nha – Ke Bang National Park, Quang Binh province. Hanoi National University, Vietnam (In Vietnamese)
23. Nguyen Ngoc Chinh 1993. Proposing the Vietnamese Nature Reserves as the World Natural Heritage. Forestry Magazine N^o 10, 1993 (in Vietnamese)
24. Pételot, A. 1952 - 1954. Les plantes médicinales du Cambodge, du Laos et du Vietnam.. Archives des Recherches Agronomiques et Pastorales du Vietnam, Saigon.
25. Peter, P.P, 1988. Valuing the biodiversity of medicinal plants, Proc. Inter. Consult., 3, 79 - 124.
26. Pócs T, 1965. Analyse aire - géographique et écologique de la flora du Viet Nam Nord. Acta Acad, Aqrieus, Hungari. N.c.3/1965. Pp. 395-495.
27. RAS/93/102/WWF/UNDP, 1997. Le Xuan Canh et al. A report of field surveys on Biodiversity in Phong Nha Ke Bang forest (Quang Binh Province/central Vietnam). Unpublished
28. Raunkiaer C. 1934. Plant life form. Claredon. Oxford. Pp.104.
29. Soerianegara I. and R.H.M. J Leemmens, 1994. PROSEA, No. 5(1), Timber trees: Major commercial timber. Bogor, Indonesia.
30. Sosef M.S.M., Hong L.T. and Prawirohatmodjo S, 1998. Prosea, No. 5(3), Timber Tree: Lesser-known timbers. Backhuys Publishers. Leiden.

31. Thin, N. N, 1993. Preliminary study of ethnopharmacology in Luong Son - Ha Son Binh Province, Viet Nam, *Revue Pharmaceutique*, 51 - 69.
32. Thin, N. N, 1994. Diversity of the Cuc Phuong Flora. *Proceedings of NCST* 6(2): 77 - 82.
33. Thin, N. N, 1997. The vegetation of Cuc Phuong National Park Viet Nam. *Sida*, 17(4): 719 - 751.
34. Thin, N. N. & D.K. Harder, 1996. Diversity of Flora of Fansipan - The highest mountain in Vietnam. *Ann. Miss. Bot. Gard.* 83: 404 - 408.
35. Thin, N. N. 1994. Diversity of the Cuc Phuong Flora. *Proceedings of NCST* 6(2): 77 - 82.
36. Thin, N. N. 1997. The vegetation of Cuc Phuong National Park Viet Nam. *Sida*, 17(4): 719 - 751.
37. Thin, N. N., Nguyen Thi Hanh, Ngo Truc Nha, 2001. Traditional medicinal plants of Con Cuong district, Nghe An province, Vietnam. *J. Trop. Med. Pl. (Malaysia)*, 2: 107 - 131.
38. Thin, N.N, 1998. Diversity of Flora and Vegetation of Pu Mat natural reserve, Con Cuong district, Nghe An province.
39. Timin R.J., Do Tuoc, Trinh Viet Cuong, Hendrichsen D.K., 1999. A preliminary assessment of the conservation importance and conservation priorities of Phong Nha-Ke bang proposed national Park, Quang Binh province, Vietnam.
40. Van Valkenburg J.L.C.H. and Bunyaphatsara N, 2001. *PROSEA*, No, 12(2), Medicinal and poisonous plants. Backhuys Publishers. Leiden.
- 41.** Wu P. & P. Raven (Eds.). 1994 - 1996. *Flora of China*. 15 - 17. Beijing & St. Louis.



Appendix 2a THE BIODIVERSITY IN PHONG NHA - KE BANG NATIONAL PARK

(Part II: Fauna)

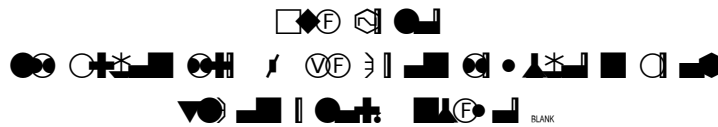
PHONG NHA - KE BANG NATIONAL PARK



LIST OF REPORT

- 1. Mammal in Phong Nha-Ke Bang National Park**
- 2. Bird in Phong Nha-Ke Bang National Park**
- 3. Reptile in Phong Nha-Ke Bang National Park**
- 4. Amphibian in Phong Nha-Ke Bang National Park**
- 5. Fish in Phong Nha-Ke Bang National Park**
- 6. Insects in Phong Nha-Ke Bang National Park**
- 7. Cave invertebrates in Phong Nha-Ke Bang National Park**

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT
FOREST INVENTORY AND PLANNING INSTITUTE



DO TUOC
DANG THANG Long



TABLE OF CONTENTS

SUMMARY	0
INTRODUCTION.....	2
1. Mammal in Phong Nha-Ke Bang National Park.....	2
1.1. History research situation of the regional mammal in Phong Nha-Ke Bang NP	2

1.2. <i>The regional mammal</i>	2
1.3. <i>Population situation</i>	9
1.4. <i>Conclusions</i>	11
1.5. <i>Literatures</i>	11
2. Bird in Phong Nha-Ke Bang National Park	13
2.1. <i>History research situation of the regional Bird in Phong Nha-Ke Bang NP</i>	13
2.2. <i>The regional Birds</i>	13
2.3. <i>Population situation</i>	27
2.4. <i>Conclusions</i>	27
2.5. <i>Literatures</i>	27
3. Reptile in Phong Nha-Ke Bang National Park	29
3.1. <i>History research situation of the regional Reptilia in Phong Nha-Ke Bang NP</i>	29
3.2. <i>The regional reptile</i>	29
3.3. <i>Conservation value</i>	33
3.4. <i>Conclusions</i>	33
3.5. <i>Literatures</i>	33
4. Amphibian in Phong Nha-Ke Bang National Park	35
4.1. <i>History research situation of the regional Amphibian in Phong Nha-Ke Bang NP</i>	35
4.2. <i>The regional Amphibian</i>	35
4.3. <i>Conclusions</i>	35
4.4. <i>Literatures</i>	38
5. Fish in Phong Nha-Ke Bang National Park	39
5.1. <i>History research situation of the regional fish in Phong Nha-Ke Bang NP</i>	39

5.2. <i>The regional fish</i>	39
5.3. <i>Conclusions</i>	47
5.4. <i>Literatures</i>	47
6. Insects in Phong Nha-Ke Bang National Park	48
7. Cave invertebrates in Phong Nha-Ke Bang National Park.....	59

ABBREVIATION/ACRONYMS

- **FIPI** **Forest Inventory and Planning Institute**
- **NP** **National Park**
- **PNKB:** **Phong Nha-Ke Bang**

SUMMARY

Based on 30 source of documents, recorded: 1.200 animals (including 773 vertebrates species, 427 species of invertebrates) for PNKB National Park (Table 1). Thereby, the fauna proved PN-KB National Park have high biological diversity

Table 1. Composition of Fauna in Phong Nha- Ke Bang NP

No.	Class	Number of order	Number of family	Number of species
I.	Vertebrates	38	141	773
1	Mammalia	10	32	147
2	Aves	15	51	314
3	Reptilia	2	16	117
4	Amphibia	1	8	58
5	Fish	10	34	137
II.	Invertebrates	34	40	427
6	Insects	12	40	369
7	Cave invertebrates	22	-	58
III.	Total	72	181	1.200

Among the species recorded in the PN - KB National park has 38 endemic species in Indochina and especially 29 species endemic to karst PNKB/Hinnamno (Table 2), with species of conservation concern in the global level, such as White-cheeked Gibbon (*Nomascus siki*), Red-shanked Douc langur (*Pygatharix nemaeus*), Ha Tinh langur (*Trachypithecus hatinhensis*), Indochinese Black Langur (*Trachypithecus elenus*), Annamite Striped Rabbit (*Nesolagus timminsii*), Truong Son muntjac (*Muntiacus truongsonensis*), Giant Muntjac (*Megamuntiacus vuquangensis*), Laotian Rock Rat (*Laonastes aenigmamus*), Sooty Babbler (*Stachyris herberti*) and many species endemic to the cave karst PNKB/Hinnamno .

Table 2. Numbers of endemic vertebrates in PNKB NP

No.	Taxon	Endemic to Vietnam (Indochina)	Endemic to karst PNKB/Hinnamno
1	Mammal	9	3
2	Bird	4	3
3	Reptile	5	4
4	Amphibian	2	-
5	Fish	18	17
6	Cave invertebrates	-	2
	Total	38	29

About ecosystem diversity and distinctiveness as the largest karst in Indochina created. It is the independent farming valley with river systems in addition

has created "Little Fish fauna " and at the same time rich cave system created cave fauna. The latest group recorded 58 species invertebrates and 14 species of cave fish.

In addition, the conservation value of rare animals of the park for Vietnam and Indochina Peninsula is quite high and have listed 106 species (Table 3) .

Table 3. Group of rare animals

No.	Class	Rare species	Decree No. 32	Vietnam Red Data Book 2007	IUCN Red Data Book 2013
1	Mammalia	49	42	42	20
2	Avec	19	17	8	-
3	Reptilia	26	14	20	11
4	Amphibia	7	-	4	4
5	Fish	4	-	3	1
6	Insects	1	-	1	-
	Total	106	73	78	36

Although the population of the endangered animal species in Vietnam are on a serious decline, but in the park PNKB important subjects still possible. Ha tinh Langur, Red-shanked Douc langur, White-cheeked Gibbon, Bear Macaque, Pig-tailed Macaque, Rhesus Macaque, Annamite Striped Rabbit ... still common in the PN-KB National park , and has the potential to restore populations in the future .

Based on the above data led the authors evaluated PN-KB NP has some outstanding features compared to other protected areas in Vietnam

- Total number of animals highest
- The highest number of endemic species, especially those endemic to the karst
- Number of species of rare animals highest
- And where there is a unique cave fauna

So, there are many reports emphasize thematic park is PNKB precious natural museum of Vietnam .

INTRODUCTION.

This document was compiled based on 30 existing studies on the regional mammals and the status of composition of some vertebrates' species of significant value for conservation of PNKB NP, Quang Binh province, Vietnam. That is the database for to evaluate the diversity and specific features of the regional vertebrates and to contribute to establish the document of the world natural heritage to submit to UNESCO for approval in the future.

The contents of this report consisting of 7 items including 5 major categories of vertebrate : Mammal, birds, reptiles, amphibians, cave fish. In addition, referring to the new record of the insect and cave invertebrates assess the importance of animal conservation system through 4 elements: diversity, richness, endangered species, endemic species and the data on the population status of important species.

1. Mammal in Phong Nha-Ke Bang National Park

1.1. History research situation of the regional mammal in Phong Nha-Ke Bang NP

There were 11 mammal studies in this park. Beginning since in 1993, for the first time Le Xuan Canh survey of vertebrate fauna in the shallow Forest Inventory and Planning Institute building the technical and economic feasibility study for Phong Nha Nature Reserve . That was the first recorded species of Hatinh Langur (*Trachypithecus hatinhensis*) in this karst region (Le Xuan Canh , 1993). After then, it was also the first time FIPI started an in-depth survey the mammals (Pham Nhat, Do Tuoc, 1995).

In parallel with the Forest Inventory and Planning Institute , Institute of Ecology and Biological Resources started 2 surveys of mammals in PNKB, supported by RAS/93/102 project (Le Xuan Canh *et al*, 1996), and project of FFI/Hanoi (Nguyen Xuan Dang *et al*, 1998). And as for foreign country, data on mammals of PNKB are available in Vietnam-Russia Tropical Center (Kouznetsov *et al*, 1999, Krushop, 1999), and Timmins *et al*, 1999). In particular , in 2011 , conservation projects and sustainable management of natural resources PNKB National Park has five thematic survey of animal for this park , and has added a number of new record of interesting fauna and interesting resource status .

Thus, fauna and population status Veterinary some important species were surveyed relatively perfect , mainly concentrated in the years 1998, 1999 and 2011 .

1.2. The regional mammal

From the above-mentioned data/information, until now 147 species , 32 families and 10 mammal orders were recorded in PNKB NP.

The endemic element of the regional mammal in PNKB is very high, up to 9 species endemic to the Annamite solution , and there are 3 of them endemic to the region 's limestone PNKB Ha Tinh langur (*Trachypithecus hatinhensis*), Indochinese Black Langur (*Trachypithecus elenus*) , Laotian Rock Rat (*Laonastes aenigmamus*) .

The conservation value of the mammals is of significant consideration. According to initial statistics, NP PNKB has 49 species of rare animals. Among them, there are 42 species in Decree 32/2006/ND-CP, 42 species in Red Book of Vietnam Nam.2007 and 20 species in Red list of Global.2013. These species are of conservation concern in Vietnam are 9 endemic species, and the Gaur (*Bos gaurus*), Tiger (*Panthera tigris*), Leopard (*Panthera pardus*) and Lesser Slow Loris (*Nycticebus pygmaeus*), Bear Macaque (*Macaca arctoides*), Assamese Macaque (*Macaca assammensis*), Pig-tailed Macaque (*Macaca nemestrina*), 2 species of bears (*Ursus thibetanus*, *Ursus malaynus*)

CHECKLIST 1

Mammal in Phong Nha-Ke Bang National Park

Mammal list of PNKB NP is arranged by the of Wilson and Reeder 2005, except for the primates - by Nadler *et al*, 2003 and Geismans *et al*, 2000; (in Vietnamese by Dang Huy Huynh *et al*, 1992, with the following notes:

- Source column, means source of document used:
 - + 1: By Pham Nhat, Do Tuoc, 1995
 - + 2: By Timmins, Do Tuoc, Trinh Viet Cuong and Hendrichsen, 1999.
 - + 3: By Kouznetsov G. V. *et al*, 1999.
 - + 4: By Nguyen Xuan Dang, 1998;2011
 - + 5: By Kruskop, 1999
 - + 6: By Vu Dinh Thong 2011 and 2012;
 - + 7: By Hendrichsen at all 2001.
- National Decree No 32/2006
 - + IB: exploitation is forbidden
 - + IIB: exploitation is limited
- Red Data Book column:
 - + VU: Vulnerable
 - + EN: Endangered
 - + CR: Critically Endangered

No.	Scientific name	English name	Dcr. 32 2006	Đ. 32 2007	IUCN 2013	Source
	1. Tupaiidae	Treeshrews				
1	<i>Tupaia belangeri</i>	Northern treeshrew				1, 2, 3, 4, 5, 6, 7
2	<i>Tupaia montana</i>	Northern smooth-tailed treeshrew				1, 2, 3, 4, 5, 6, 7

No.	Scientific name	English name	Dcr. 32 2006	EPB 2007	IUCN 2013	Source
	II.DERMOPTERA	FLYING LEMERS				
	2. Cynocephalidae	Flying Lemurs				
3	<i>Cynocephalus variegatus</i>	Malayan Flying Lemur	IB	EN		10
	III. PRIMATES	PRIMATES				
	3. Loridae	Loris				
4	<i>Nycticebus bengalensis</i>	Bangal Slow Loris	IB	VU	VU	10(MP)
5	<i>Nycticebus pygmaeus</i>	Pygmy Slow Loris	IB	VU	VU	10(MP)
	4. Cercopithecidae	Old-world Monkeys				
6	<i>Macaca leonia</i>	Northern Pig-tailed Macaque	IIB	VU		10(P)
7	<i>Macaca assamensis</i>	Assamese Macaque	IIB	VU		10(MP)
8	<i>Macaca mulatta</i>	Rhesus Macaque	IIB			10(MP)
9	<i>Macaca arctoides</i>	Stump-tailed Macaque	IIB	VU	VU	10(MP)
10	<i>Trachypithecus hatinhensis</i>	Hatinh Langur	IB	EN	EN	10(MP)
11	<i>Trachypithecus elenus</i>	Indochinese Black Langur	IB	VU		10
12	<i>Pygathrix nemaeus</i>	Red-shanked Douc Langur	IB	EN	EN	10(MP)
	5. Hylobatidae	Gibbons				
13	<i>Nomascus siki</i>	White-cheeked Gibbon	IB	EN	EN	10(MP)
	IV. LAGOMORPHA	RABBITS				
	6. Leporidae	Hares				
14	<i>Lepus peguensis</i>	Burmese Hare				10(MP)
15	<i>Nesolagus timminsii</i>	Annamite Striped Rabbit	IB	EN		10
	V. INSECTIVORA	INSECT – EATERS				
	7. Erinaceidae	Hedgehogs, etc.				
16	<i>Hylomys suillus</i>	Short-tailed Gymnure				10(MP)
	8. Soricidae	Shrews				
17	<i>Crocidura attenuata</i>	Asian Gray Shrew				10
18	<i>Crocidura fuliginosa</i>	Southeast Asian Shrew				10
19	<i>Suncus murinus</i>	House Shrew				10(MP)
	9. Talpidae	Moles				
20	<i>Blarina brevicauda</i>	Long tailed Mole				10
	VI. CHIROPTERA	CHIROPTERANS				
	10. Pteropodidae	Old World Fruit Bats				
21	<i>Rousettus leschenaulti</i>	Leschenault's Rousette				10
22	<i>Rousettus amplexicaudatus</i>	Geofroy's Rousette				10
23	<i>Cynopterus sphinx</i>	Short-nosed Fruit Bat				10
24	<i>Cynopterus brachyotis</i>	Lesser Short-nosed Fruit Bat		VU		10

No.	Scientific name	English name	Dcr. 32 2006	EP 32 2007	IUCN 2013	Source
25	<i>Eonycteris spelaea</i>	Cave Fruit Bat				
26	<i>Megaerops ecaudatus</i>	Temminck's tailless Fruit Bat				
27	<i>Megaerops niphanae</i>	Ratanaworabhan's fruit Bat				
28	<i>Macroglossus sobrinus</i>	Hill Long-tongued Fruit Bat				
29	<i>Sphaerias blanfordi</i>	Himalayan fruit Bat				
	11. Emballonuridae	Sheath-tailed bats				
30	<i>Taphozous melanopogon</i>	Black-Breaded Tomb Bat				
	12. Megadermatidae	False Vampires				
31	<i>Megaderma lyra</i>	Great False Vampire				
32	<i>Megaderma spasma</i>	Lesser False Vampire				
	13. Rhinolophidae	Horseshoe Bats				
33	<i>Rhinolophus thomasi</i>	Thomas Horseshoe Bat		VU		
34	<i>Rhinolophus affinis</i>	Intermediate Horseshoe Bat				
35	<i>Rhinolophus luctus</i>	Woolly Horseshoe Bat				
36	<i>Rhinolophus paradoloxophus</i>	Bouret's Horseshoe Bat		VU		
37	<i>Rhinolophus macrotis</i>	Big-eared Horseshoe Bat				
38	<i>Rhinolophus pearsoni</i>	Pearson's Horseshoe Bat				
39	<i>Rhinolophus pusillus</i>	Least Hoeseshoe Bat				
40	<i>Rhinolophus malayanus</i>	Malayan Horseshoe Bat				
	14. Hipposideridae	Old World Leaf-nosed Bats				
41	<i>Aselliscus stoliczkanus</i>	Stoliczka's Trident Bat				
42	<i>Hipposideros armiger</i>	Himalayan Leaf-nosed Bat				
43	<i>Hipposideros scutinares</i>	Shield-nosed leaf-nosed Bat				
44	<i>Hipposideros cineraceus</i>	Least Leaf-nosed Bat				
45	<i>Hipposideros larvatus</i>	Horsfield's Leaf-nosed Bat				
46	<i>Hipposideros pomona</i>	Andersen's Leaf-nosed Bat				
47	<i>Hipposideros pratti</i>	Pratt's leaf-nosed Bat				
48	<i>Hipposideros lylei</i>	Shield-faced leaf-nosed Bat				
	15. Vespertilionidae	Evening Bats				
49	<i>Hypsugo pulveratus</i>	Chinese pipistrelle				
50	<i>Ia io</i>	Great Evening Bat		VU		
51	<i>Murina cyclotis</i>	Round-eared Tube-nosed Bat				

No.	Scientific name	English name	Dcr. 32 2006	EPB 2007	IUCN 2013	Source
52	<i>Murina eleryi</i>	Split-nostril Bat				Ⓜ+
53	<i>Murina tiensa</i>	Fairy tube-nosed Bat				Ⓜ+
54	<i>Murina cineracea</i>	Ashy-gray Tube-nosed Bat				Ⓜ+
55	<i>Harpiocephalus harpia</i>	Hairy Winged Bat		VU		Ⓜ
56	<i>Harpiocephalus mordax</i>	Greater hairy-winged Bat				Ⓜ
57	<i>Myotis ater</i>	Peters's Myotis				Ⓜ
58	<i>Myotis chinensis</i>	Large Myotis				Ⓜ
59	<i>Myotis horsfieldii</i>	Horsefield's Bat				Ⓜ
60	<i>Myotis ricketti</i>	Rickett's Big-footed Bat				Ⓜ+
61	<i>Myotis caltetricraniatus</i>					Ⓜ
62	<i>Myotis siligorensis</i>	Himalayan Whiskered Myotis				Ⓜ
63	<i>Myotis mystacinus</i>	Whiskered Myotis				Ⓜ
64	<i>Myotis muricola</i>	Nepalese Whiskered Myotis				Ⓜ
65	<i>Scotomanes ornatus</i>	Harlequin Bat				Ⓜ
66	<i>Tylonycteris robustula</i>	Greater Bamboo Bat				Ⓜ
67	<i>Miniopterus schreibersii</i>	Schreibers's Long-fingered Bat				Ⓜ
68	<i>Miniopterus leucogaster</i>	Greater Tube-nosed Bat				Ⓜ
69	<i>Miniopterus magnater</i>	Western bent-winged Bat				Ⓜ+
70	<i>Pipistrellus javanicus</i>	Javan pipistrelle				Ⓜ
	VII. PHOLIDOTA	PANGOLINS				
	16. Manidae	Pangolins				
71	<i>Manis javanica</i>	Sunda Pangolin	IIB	EN	EN	Ⓜ
72	<i>Manis pendactyla</i>	Pangolin	IIB			Ⓜ
	VIII. CARNIVORA	CARNIVORES				
	17. Canidae	Dogs and foxes				
73	<i>Canis aureus</i>	Golden Jackal	IIB			Ⓜ
74	<i>Cuon alpinus</i>	Dhole	IB	EN	EN	Ⓜ
	18. Ursidae	Bears				
75	<i>Ursus thibetanus</i>	Asiatic Black Bear	IB	EN	VU	Ⓜ
76	<i>Ursus malayanus</i>	Sun Bear	IB	EN		Ⓜ
	19. Mustelidae	Weasels and Martens				
77	<i>Martes flavigula</i>	Yellow-throated Marten				Ⓜ
78	<i>Arctonyx collaris</i>	Hog-badger				Ⓜ
79	<i>Melogale moschata</i>	Small-tooth Ferret-badger				Ⓜ
80	<i>Melogale personata</i>	Large-tooth Ferret-badger				Ⓜ
81	<i>Lutra lutra</i>	Eurasian Otter	IB	VU		Ⓜ

No.	Scientific name	English name	Dcr. 32 2006	EN 2007	IUCN 2013	Source
82	<i>Lutrogale perspicillata</i>	Smooth-coated Otter	IB	EN	VU	■
83	<i>Aonyx cinerea</i>	Oriental Small-clawed Otter	IB	VU	VU	■
84	<i>Mustela kathiah</i>	Yellow-bellied Weasel				Ⓜ
	20. Viverridae	Civets				
85	<i>Viverricula zibetha</i>	Large Indian Civet	IIB			■ Ⓜ
86	<i>Viverricula megaspila</i>	Large-spotted Civet	IIB	VU		Ⓜ
87	<i>Viverricula indica</i>	Small Indian Civet	IIB			■ Ⓜ
88	<i>Prionodon pardicolor</i>	Spotted Linsang	IIB	VU		Ⓜ
89	<i>Paradoxurus hermaphroditus</i>	Common Palm Civet				■ Ⓜ
90	<i>Paguma larvata</i>	Masked Palm Civet				■ Ⓜ
91	<i>Arctictis binturong</i>	Binturong	IB	EN	VU	Ⓜ
92	<i>Arctogalidia trivirgata</i>	Small-toothed Palm Civet				■ Ⓜ
93	<i>Chrotogale owstoni</i>	Owston's Banded Civet	IIB	VU	VU	Ⓜ
	21. Herpestidae	Mongoose				
94	<i>Herpestes javanicus</i>	Small Asian Mongoose				■ Ⓜ
95	<i>Herpestes urva</i>	Crab-eating Mongoose				■ Ⓜ
	22. Felidae	Cats				
96	<i>Prionailurus bengalensis</i>	Leopard Cat	IB			■ Ⓜ
97	<i>Prionailurus viverrinus</i>	Fishing Cat	IB	EN	EN	■ Ⓜ
98	<i>Catopuma temmincki</i>	Golden Cat	IB	EN		■ Ⓜ
99	<i>Pardofelis marmorata</i>	Marbled Cat	IB	VU	VU	■ Ⓜ
100	<i>Pardofelis nebulosa</i>	Clouded Leopard	IB	EN	VU	■ Ⓜ
101	<i>Panthera pardus</i>	Leopard, Panther	IB	CR		■ |
102	<i>Panthera tigris</i>	Tiger	IB	CR	EN	■ |
	IX. ARTIODACTYLA	EVEN – TOED HOOFED				
	23. Suidae	Pigs				
103	<i>Sus scrofa</i>	Wild Boar				■ Ⓜ
	24. Tragulidae	Mouse-deer				
104	<i>Tragulus javanicus</i>	Lesser Malay Mouse-deer	IIB	VU		■ Ⓜ
	25. Cervidae	Deer				
105	<i>Cervus unicolor</i>	Sambar		VU		■ Ⓜ
106	<i>Muntiacus muntjak</i>	Indian Muntjac				■ Ⓜ
107	<i>Megamuntiacus vuquangensis</i>	Giant Muntjac	IB	VU		■ Ⓜ
108	<i>Muntiacus truongsongensis</i>	Anamite Muntjac				■ Ⓜ
	26. Bovidae	Cattle, antelopes, etc				
109	<i>Bos gaurus</i>	Gaur	IB	EN	VU	■ Ⓜ
110	<i>Naemorhedus sumatraensis</i>	Southern Serow	IB	EN		■ Ⓜ

No.	Scientific name	English name	Dcr. 32 2006	EP 2007	IUCN 2013	Source
111	<i>Pseudoryx nghetinhensis</i>	Saola	IB	EN	CR	i (M)
	X. RODENTIA	RODENTS				
	27. Sciuridae	Non-flying Squirrels				
112	<i>Ratufa bicolor</i>	Black Giant Squirrel	IIB	VU		i (MP)
113	<i>Callosciurus erythraeus</i>	Pallas's squirrel				i (MP)
114	<i>Callosciurus inornatus</i>	Inornate Squirrel				i (M)
115	<i>Callosciurus pygerythrus</i>	Irrawaddy squirrel				(M)
116	<i>Tamiops rodolphii</i>	Cambodian Striped Squirrel				i (M)
117	<i>Tamiops maritimus</i>	Hainam striped tree squirrel				i (M)
118	<i>Dremomys rufigenis</i>	Red-cheeked squirrel				i (MP)
	28. Pteromyidae	Flying Squirrels				
119	<i>Belomys pearsonii</i>	Hairy-footed Flying Squirrel				(M)
120	<i>Hylopetes alboniger</i>	Particoloured Flying Squirrel	IIB	VU		i
121	<i>Petaurista elegans</i>	Spotted Giant Flying Squirrel				(M)
122	<i>Petaurista philippensis</i>	Indian Giant Flying Squirrel	IIB	VU		i (MP)
	29. Muridae	Mice and Rats				
123	<i>Berylmys bowersi</i>	Berylmys				(M)
124	<i>Chiropodomys gliroides</i>	Indomalayan Pencil-tailed tree Mouse				(M)
125	<i>Mus musculus</i>	House Mouse				i (MP)
126	<i>Mus cervicolor</i>	Fawn-coloured Mouse				(MP)
127	<i>Mus caroli</i>	Ryukya Mouse				(MP)
128	<i>Mus pahari</i>	Indochinese Shrewlike Mouse				(M)
129	<i>Rattus nitidus</i>	White-footed Indochinese Rat				(MP)
130	<i>Rattus argentiventer</i>	Ricefield Rat				(MP)
131	<i>Rattus andamanensis</i>	Indochinesis Forest Rat				(M)
132	<i>Rattus tanezumi</i>	House's Rat				i (MP)
133	<i>Bandicota indica</i>	Large Bandicoot-rat				i (M)
134	<i>Bandicota savilei</i>	Lesser Bandicoot-rat				i (M)
135	<i>Niviventer tenaster</i>	Indochinese Mountain Niviventer				(MP)
136	<i>Niviventer fulvescens</i>	Chestnut Rat				(MP)
137	<i>Niviventer langbianis</i>	Indochinese Arboreal Niviventer				(M)
138	<i>Niviventer brahma</i>	Brahman Niviventer				(MP)

No.	Scientific name	English name	Dcr. 32 2006	ĐB 2007	IUCN 2013	Source
139	<i>Leopoldamys sabanus</i>	Noisy Rat				(MP)
140	<i>Leopoldamys edwardsi</i>	Edwards's Leopoldamys				(M)
141	<i>Maxomys surifer</i>	Indomalayan Maxomys				(MP)
142	<i>Maxomys moi</i>	Moi's Rat				(MP)
	30. Rhizomyidae	Bamboo Rats				
143	<i>Rhizomys pruinosus</i>	Hoary Bamboo Rat				(MP)
144	<i>Rhizomys sumatrensis</i>	Large Bamboo Rat				(M)
	31. Laonestidae					
145	<i>Laonastes aenigmamus</i>	Laotian Rock Rat			EN	(M)
	32. Hystricidae	Old-world Porcupines				
146	<i>Hystrix brachyura</i>	Malayan Porcupine				(M)
147	<i>Atherurus macrourus</i>	Asiatic Brush-tailed Porcupine				(MP)

CHECKLIST 2 Endemic Mammal species

No.	Scientific name	English name	Endemic to Vietnam (Indochina)	Endemic to karst PNKB/Hinnamno
1	<i>Trachypithecus hatinhensis</i>	Hatinh Langur	x	x
2	<i>Trachypithecus elenus</i>	Indochinese Black Langur	x	x
3	<i>Pygathrix nemaeus</i>	Red-shanked Douc Langur	x	
4	<i>Nomascus siki</i>	White-cheeked Gibbon	x	
5	<i>Megamuntiacus vuquangensis</i>	Giant Muntjac	x	
6	<i>Pseudoryx nghetinhensis</i>	Saola	x	
7	<i>Muntiacus truongsongensis</i>	Anamite Muntjac	x	
8	<i>Laonastes aenigmamus</i>	Laotian Rock Rat	x	x
9	<i>Nesolagus timminsii</i>	Annamite Striped Rabbit	x	

1.3. Population situation

1.3.1. General evaluation

According to results of mammal survey in 1998, the composition of several mammal species in PNKB NP was fairly abundant comparing to other NP and nature reserves in Vietnam (Nguyen Xuan Dang *et al*, 1998). Of which 35 popular species they are carnivore species of Civets (*Vinerridae*), **Weasels and Martens** (*Mustelidae*), Bear Macaque (*Macaca arctoides*), Rhesus Macaque (*M. maulatta*), Assamese Macaque (*M. assammensis*), Asiatic Black Bear (*Ursus thibetanus*), Sun Bear (*U. malaynus*), Hatinh Langur (*Trachypithecus hatinhensis*), Red-shanked Douc langur (*Pygathirix nemaeus*), Wild Boar (*Sus scrofa*), Southern Serow (*Naemorhedus*

sumatraensis), Sambar (*Cervus unicolor*), Muntjac (*Muntiacus muntjak*). On the other hand, 9 other mammal species become rare. They are Tiger (*Panthera tigris*), Golden Cat (*Catopuma temmincki*), Oriental Small-clawed Otter (*Aonyx cinerea*), Eurasian Otter (*Lutra lutra*), Smooth-coated Otter (*Lutra personata*), Lesser Malay Mouse-deer (*Tragulius javanicus*), Giant Muntjac (*Megamuntiacus vuquangensis*), Anamite Muntjac (*Muntiacus truongsongensis*), Saola (*Pseudoryx nghetinhensis*) and 1 other mammal species are probably extinct: and Elephant (*Elephas maximus*).

1.3.2. The situation of composition of some of important mammal species

Gaur (Bos gaurus)

There may be 2 groups of Bß tât (*Bos gaurus*): 1 group is in U Bo area and other one is in Ba Zang, of 10-12 individuals.

Tiger (Panthera tigris)

In 1997 – 1998, local people of Tan Trach still met Tiger (Nguyen Xuan Dang *et al.*, 1999). Tiger's manure trace was discovered in Co Khu, or footprints also seen in south of Co Khu, Truong So commune. Information on Tiger footprint in Rao Thuong, or Tiger was trapped in Ban Doong area...

Red-shanked Douc langur (Pygathrix nemaeus)

Is endemic to eastern and western slopes of the Annamite Mountains. Currently, Red-shanked Douc langur species are common in the park PNKB an estimated 445-2137 individuals (Haus *et al.*, 2007)

Hatinh Langur (Trachypithecus hatinhensis)

Is endemic to the limestone areas of central Indochina. In 2002, according to Pham Nhat estimated 800 individuals for PNKB NP. In 2009, with 4 regional scale survey estimated 1670-2610 individuals (Haus *et al.*, 2009).

White-cheeked Gibbon (Nomascus siki)

Endemic to North Truong Son , located along the border of Vietnam - Laos . Large population has 37 groups, 101 individuals in hilly areas PNKB U Bo Park is recognized (Le Trong Dat *et al .* , 2009), and nearly 20 other groups in Hoa Thuong area . Thus, we can say the park is home PNKB number of White-cheeked Gibbon most concentrated approximately 50 - 60 groups.

Laotian Rock Rat (Laonastes aenigmamus)

According to locals , the species commonly caught in Thuong Trach caves . In the survey , we had 5 stones in a mouse model of Yen Hop village , Thuong Trach .

Annamite Striped Rabbit (Nesolagus timminsii)

Three striped rabbit was observed local people were trapped in the field and 1 times observed in the wild in Hoa Son commune . The resulting data is only collected in a 2011 survey in the Hoa Son area .

1.4. Conclusions

- Till now, 147 mammal species are recorded in PNKB NP. That proves the diversity of highest species composition in the system of special use forests in Vietnam.

- The endemic element of the mammal is rather remarkable, 9 endemic species. Among the endemic species including 3 species endemic to karst PNKB / Hinamno.

- Conservation value of PNKB NP is very high due to the diversity of species composition, up to 49 species (only species at CR, EN, VU). In this rare animal species, 18 species have been the focus leading conservation in Vietnam and internationally.

- Number of individuals of some populations of rare and endemic species is relatively high enough to ensure recovery and subsequent development of populations.

1.5. Literatures

1 . R. Timmins J., Due stripping, Trinh Viet Cuong, D. K. hendrichsen, 1999. A preliminary assement of the conservatian Importance and Conservation Priorities of the Phong Nha - Ke Bang proposed National Park, Quang Binh Province, Vietnam .

2 . Mikhail V. Kalykin, 1999. Pnithological studies. In compled resiltes of the Zoological - Botanical expedition to the Ke Bang Area .

3 . Le Xuan Canh, Truong Van La et al, 1996. report the results of a field survey in the woods Phong Nha - Ke Bang National Park in Quang Binh Province). Ras/93/102 project .

4 . Pham, Do Deprivation, 1995. Topical Forest Animals Phong Nha - Ke Bang. Project to expand Phong Nha - Ke Bang , Quang Binh Province .

5 . J. Eames C., Lambert, F. R. and Nguyen Cu 1995. A survey of the Annamese Lowlands, Vietnam, and its implication foe the Conservation of Vietnamese and Imperial Pheasants *Lophura hatinhensis* and *L. Imperialis*. Bird consertion international 4: 343-382 .

6 . J. Eames C., Lambert, F. R. and Nguyen Cu 1995. Rediscovery of the Sooty Babbler *Stachyris herberti* in central Vietnam. Bird Conservation International 5: 129-135 .

7 . Ovel C. and Nguyen Thi Dao, 1998. LINC : Linking Him through parallel Namno and Phong Nha conservation: Phase I of Phong Nha - Ke Bang Nature Reserve, Vietnam. WWF Indochina Programme, Hanoi .

8 . IUCN, 2013. 2013 IUCN Red list of Threatened specie <www.redlist.org>.

9 . Government of the Socialist Republic of Vietnam , 2006 . Government's Decree No. 32/2006/ND-CP dated 30/3/2006 of forest vegetation management, endangered animals, endangered .

- 10 . Ministry of Science and Technology, 2003 . Vietnam Red List 2003, part animal .
- 11 . Le Trong Trai, Pham Tuan Anh, Nguyen Cu, Ngo Xuan Tuong, 2011. Survey avifauna basically an extension of the National Park Phong Nha Ke Bang, Quang Binh, Vietnam .

Phong Nha-Ke Bang National Park

2.1. History research situation of the regional Bird in Phong Nha-Ke Bang NP

Like the mammals the studies of birds in PNKB NP was so thriving in the 90s of the last century. FIPI was the first to formulate an investment project in PNKB NP in 1995 (Pham Nhat, Do Tuoc, 1995). These 2 authors observed 200 bird species. After there data made by Vietnam-Russia Tropical Center (Mikhail V. Kalykim, 1999), data made by FFI/Indochia Programme (Timmins *et al*, 1999) and data of the conservation project for Pheasant an endemic species (Birdlife International) in the Central Vietnam (Eames *et al*, 1995).

In addition, there are other synthetic materials leads research projects on the Birds of Conservation PN-KB. In particular, in 2011, a number surveys bird by Le Trong Trai, Nguyen Cu (BirdLife International) in the expansion of PN-KB National Park

2.2. The regional Birds

From data said above, 314 species, 51 families and 15 orders for PNKB NP were recorded. All of them were observed or having specimen in this area.

The endemic element of the bird in PNKB NP is rather high, there are 3 endemic to karst PNKB/Hinamno , and 4 species endemic to Vietnam. The endemic bird species typical of karst PNKB and Hinamno is: Bare-faced Bulbul (*Pycnonotus hualon*) , Limestone Leaf-warbler (*Phylloscopus calciatilis*) , Sooty Babbler (*Stachyris herberti*)

Conservation value is of great significance. According to initial statistics, PNKB NP has 19 rare bird species out of which 17 species are listed in Decree No. 32/2006/ND-CP, 8 species in Vietnam Red Data Book. These species are of conservation concern in Vietnam are 4 endemic Brown hornbill (*Anorrhinus tickelli*), Great Hornbill (*Buceros bicornis*), Crested Argus (*Rheinardia ocellata*), Siamese Fireback (*Lophura diardi*)

CHECKLIST 3

Phong Nha-Ke Bang National Park

The list of bird in PNKB (Latin name and Vietnamese name) by Nguyen Van Cu *et al*, 2000, with the following notes:

- Source column:
 - + 1: According to data from nature conservation project PNKB. Cologne Zoological Garden carried out this project is by in Phong Nha-Ke Bang NP
 - + 2: Data of Timmin R. J., *et al* 1999.
 - + 3: Data of Mikhail V. K., 1991.
 - + 4: Data of Eames *et al*, 1989.
 - + 5: Data of Le Xuan Canh, 1996. Report of field survey results in PNKB forest area, Quang Binh province, RAS/93/102.

- + 6: Data of Le Trong Trai 2012
- Decree column 32/2006
 - + IB: harvest forbidden
 - + IIB: harvest limited
- Red data Book column:
 - + VU: Vulnerable: 3 (IUCN)
 - + EN: Endangered: 3 (IUCN)
 - + CR: Critical Endangered (IUCN)

No.	Scientific name	English name	Dcr. 32 2006	VN Red List 2007	IUCN 2013	Source
	I. GALLIFORMES					
	1. Phasianidae	Quail, Partridges, Pheasants				
1	<i>Francolinus pintadeanus</i>	Chinese Francolin				156
2	<i>Arborophila brunneopectus</i>	Bar-backed Partridge				2456
3	<i>Arborophila charltonii</i>	Chestnut - necklace Partridge	IIB			2456
4	<i>Gallus gallus</i>	Red Junglefowl				16
5	<i>Lophura nycthemera</i>	Silver Pheasant	IB			1456
9	<i>Lophura diardi</i>	Siamese Fireback	IB	VU		1456
10	<i>Polyelectron bicalcaratum</i>	Grey Peacock-pheasant	IB	VU		2456
11	<i>Rheinardia ocellata</i>	Crested Argus	IB	VU		125
12	<i>Pavo muticus</i>	Green Peafowl	IB	EN		15
	II. PICIFORMES					
	2. Picidae	Woodpeckers				
13	<i>Sasia ochracea</i>	White-browed Piculet				13
14	<i>Dendrocopos canicapillus</i>	Grey-capped Pygmy Woodpecker				123
15	<i>Picus chlorolophus</i>	Lesser Yellownape				123
16	<i>Picus flavinucha</i>	Greater Yellownape				12345
17	<i>Picus vittatus</i>	Laced Woodpecker				14
18	<i>Picus rabieri</i>	Red-collared Woodpecker				1234
19	<i>Picus canus</i>	Grey-headed Woodpecker				6

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
20	<i>Dinopium javanense</i>	Common Flameback				15
21	<i>Chrysocolaptes lucidus</i>	Greater Flameback				145
22	<i>Blythipicus pyrrhotis</i>	Bay Woodpecker				12345
23	<i>Celeus brachyurus</i>	Rufous Woodpecker				1
	3. Capitonidae	Barbets				
24	<i>Megalaima lagrandieri</i>	Red-vented Barbet				12345
25	<i>Megalaima lineata</i>	Lineated Barbet				6
26	<i>Megalaima faiostricta</i>	Green-eared Barbet				1225
27	<i>Megalaima franklinii</i>	Golden-throated Barbet				134
28	<i>Megalaima asiatica</i>	Blue-throated Barbet				15
29	<i>Megalaima australis</i>	Blue-eared Barbet				14
	III. CORACIIFORMES					
	4. Bucerotidae	Hornbills				
30	<i>Anthracoceros albirostris</i>	Oriental Pied Hornbill				1456
31	<i>Buceros bicornis</i>	Great Hornbill	IIB	VU		123456
32	<i>Anorrhinus tickelli</i>	Brown Hornbill	IIB	VU		123456
	5. Upupidae	Hoopoe				
33	<i>Upupa epops</i>	Common Hoopoe				156
7	6. Coraciidae	Rollers				
34	<i>Coracias benghalensis</i>	Indian Roller				156
35	<i>Eurystomus orientalis</i>	Dollarbird				1356
	7. Alcedinidae	Kingfishers				
36	<i>Alcedo atthis</i>	Common Kingfisher				123456
37	<i>Alcedo meninting</i>	Blue eared Kingfisher				135
38	<i>Alcedo hercules</i>	Blyth's Kingfisher				6
39	<i>Ceyx erithacus</i>	Oriental Dwarf Kingfisher				1345
40	<i>Lacedo pulchella</i>	Banded Kingfisher				13
41	<i>Halcyon smyrnensis</i>	White-throated Kingfisher				16
42	<i>Halcyon pileata</i>	Black-capped Kingfisher				16
43	<i>Megaceryle lugubris</i>	Crested Kingfisher		VU		1456

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
44	<i>Ceryle rudis</i>	Pied Kingfisher				156
	8. Meropidae	Bee-eaters				
45	<i>Nyctyornis athertoni</i>	Blue-bearded Bee-eater				1456
46	<i>Merops viridis</i>	Blue-throated Bee-eater				1456
47	<i>Merops philippinus</i>	Blue-tailed Bee-eater				156
	IV. TROGONIFORMES					
	9. Trogonidae	Trogons				
48	<i>Harpactes oreskios</i>	Orange-breasted Trogon				16
49	<i>Harpactes erythrocephalus</i>	Red-headed Trogon				123456
	V. CUCULIFORMES					
	10. Cuculidae	Cuckoos				
50	<i>Clamator coromandus</i>	Chestnut Winged Cuckoo				1356
51	<i>Hierococcyx sparverioides</i>	Large Hawk Cuckoo				156
52	<i>Cuculus canorus</i>	Eurasian Cuckoo				136
53	<i>Cuculus micropterus</i>	Indian Cuckoo				156
54	<i>Cuculus saturatus</i>	Oriental Cuckoo				136
55	<i>Cacomantis sonneratii</i>	Banded Bay Cuckoo				156
56	<i>Cacomantis merulinus</i>	Plaintive Cuckoo				1346
57	<i>Chrysococcyx maculatus</i>	Asian Emerald Cuckoo				1456
58	<i>Chrysococcyx xanthorhynchus</i>	Violet Cuckoo				156
59	<i>Surniculus lugubris</i>	Drongo Cuckoo				1346
60	<i>Eudynamis scolopacea</i>	Asian Koel				156
61	<i>Phaenicochaetus tristis</i>	Green-billed Malkoha				123456
	11. Centropodidae	Coucals				
62	<i>Centropus sinensis</i>	Greater Coucal				123456
63	<i>Centropus bengalensis</i>	Lesser Coucal				123456
	VI. PSITTACIFORMES					
	12. Psittacidae	Parrots				
64	<i>Loriculus vernalis</i>	Vernal Hanging-Parrot	IIB			1236
65	<i>Psittacula eupatria</i>	Alexandri Parakeet	IIB			16

No.	Scientific name	English name	Dcr. 32 2006	VN Red List 2007	IUCN 2013	Source
66	<i>Psittacula finschii</i>	Grey-headed Parakeet	IIB			156
67	<i>Psittacula roseata</i>	Blossom-headed Parakeet	IIB			156
68	<i>Psittacula alexandri</i>	Red-breasted Parakeet	IIB			156
	VII. APODIFORMES					
	13. Hemiprocnidae	Treeswifts				
69	<i>Hemiprogne coronata</i>	Crested Treeswift				16
	14. Apodidae	Swifts				
70	<i>Collocalia brevirostris</i>	Himalayan Swiftlet				1356
71	<i>Cypsiurus balasiensis</i>	Asian Palm Swift				1456
72	<i>Apus pacificus</i>	Fork-tailed Swift				12456
73	<i>Apus affinis</i>	House Swift				136
	VIII. STRIGIFORMES					
	15. Tytonidae	Barn Owls				
74	<i>Tyto alba</i>	Barn Owl	IIB			1456
	16. Strigidae	Owls				
75	<i>Otus spilocephalus</i>	Mountain Scops-owl				1346
76	<i>Otus sunia</i>	Oriental Scops Owl				136
77	<i>Otus bakkamoena</i>	Collared Scops-owl				1346
78	<i>Strix leptogrammica</i>	Brown Wood Owl				1456
79	<i>Glaucidium brodieri</i>	Collared Owlet				1246
80	<i>Glaucidium cuculoides</i>	Asian Barred Owlet				123456
81	<i>Ninox scutulata</i>	Brown Hawk Owl				135
	IX. CAPRIMULGIFORMES					
	17. Caprimulgidae	Nightjars				
82	<i>Caprimulgus macrurus</i>	Large-tailed Nightjar				13456
	X. CULUMBIFORMES					
	18. Columbidae	Pigeons, Doves				
83	<i>Streptopelia orientalis</i>	Oriental Turtle Dove				1456
84	<i>Streptopelia chinensis</i>	Spotted Dove				123456
85	<i>Streptopelia tranquebarica</i>	Red Collared Dove				1456

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
86	<i>Macropygia unchall</i>	Barred Cuckoo-Dove				1256
87	<i>Chalcophas indica</i>	Emerald Dove				123456
88	<i>Treron curvirostra</i>	Thick-billed Green Pigeon				123456
89	<i>Treron apicauda</i>	Pin-tailed Green Pigeon				12356
90	<i>Treron seimundi</i>	Yellow-vented Green Pigeon				126
91	<i>Treron sphenura</i>	Wedge-tailed Green Pigeon				126
92	<i>Treron vernans</i>	Pink-necked Green Pigeon				6
93	<i>Ducula aenea</i>	Green Imperial Pigeon				156
94	<i>Ducula badia</i>	Mountain imperial Pigeon				1356
	XI. GRUIFORMES					
	19. Turnicidae	Buttonquail				
95	<i>Turnix susciator</i>	Barred Buttonquail				1356
	20. Rallidae	Rails, Crakes, Coot				
96	<i>Gallirallus striatus</i>	Slaty-breasted Rail				156
97	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen				13456
	XII. CHARADRIIFORMES					
	21. Scolopacidae	Snipe				
98	<i>Actitis hypoleucos</i>	Common Sandpiper				36
	22. Charadriidae	Plovers				
99	<i>Vanellus indicus</i>	Red wattled Lapwing				6
	XIII. PALCONIFORMES					
	23. Accipitrinae	Kites, Hawks, Eagles, Vultures				
100	<i>Aviceda leuphotes</i>	Black Baza				12456
101	<i>Pernis ptilorhyncus</i>	Oriental Honey-buzzard				13456
102	<i>Elanus caeruleus</i>	Black-shouldered Kite				1356
103	<i>Ichthyophaga humilis</i>	Lesser Fish Eagle		VU		156
104	<i>Spilornis cheela</i>	Crested Serpent-eagle	IIB			123456
105	<i>Accipiter trivirgatus</i>	Crested Goshawk				123456
106	<i>Accipiter badius</i>	Shikra				156

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
107	<i>Accipiter gularis</i>	Japanese Sparrowhawk				126
108	<i>Ictinaetus malayensis</i>	Black Eagle				12456
109	<i>Hieraaetus kienerii</i>	Rufous-bellied Eagle				126
110	<i>Spizaetus nipalensis</i>	Mountain Hawk Eagle				156
	24. Falconidae	Falcons				
121	<i>Microhierax melanoleucos</i>	Pied Falconet				1256
122	<i>Falco tinnunculus</i>	Common Kestrel				156
123	<i>Falco severus</i>	Oriental Hobby				156
124	<i>Falco peregrinus</i>	Peregrine Falcon				1456
	XIV. COCONIIFORMES					
	25. Ardeidae	Herons, Egrets, Bitterns				
125	<i>Egretta garzetta</i>	Little Egret				156
126	<i>Bubulcus ibis</i>	Cattle Egret				16
127	<i>Ardeola bacchus</i>	Chinese Pond Heron				156
128	<i>Butorides striatus</i>	Little Heron				156
129	<i>Ixobrychus cinnamomeus</i>	Cinnamon Bittern				1356
	XV. PASSERIFORMES					
	26. Pittidae	Pittas				
130	<i>Pitta soror</i>	Blue-rumped Pitta				123456
131	<i>Pitta cyanea</i>	Blue Pitta				1236
132	<i>Pitta phayrei</i>	Blue/Eared Pitta				1236
133	<i>Pitta elliotii</i>	Bar-bellied Pitta				123456
134	<i>Pitta moluccensis</i>	Blue-winged Pitta				146
	27. Eurylaimidae	Broadbills				
135	<i>Serilophus lunatus</i>	Silver-breasted Broadbill				1236
136	<i>Psarisomus dalhousiae</i>	Long-tailed Broadbill				1246
	28. Irenidae	Leafbirds				
137	<i>Irena puella</i>	Asian Fairy Bluebird				12356
138	<i>Chloropsis cochinchinensis</i>	Blue-winged Leafbird				123456
139	<i>Chloropsis aurifrons</i>	Gold-fronted Leafbird				1356

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
140	<i>Chloropsis hardwickii</i>	Orange-bellied Leafbird				12356
141	<i>Aegithina tiphia</i>	Common Iora				6
142	<i>Aegithina lafresnayei</i>	Great Iora				6
	29. Laniidae	Shrikes				
143	<i>Lanius cristatus</i>	Brown Shrike				136
144	<i>Lanius collurioides</i>	Burmese Shrike				156
145	<i>Lanius schach</i>	Long-tailed Shrike				12456
146	<i>Lanius tephronotus</i>	Grey-backed Shrike				36
	30. Corvidae					
147	<i>Urocissa erythrorhyncha</i>	Redbilled blue Magpie				136
148	<i>Urocissa whiteheadi</i>	White-winged Magpie				1236
149	<i>Dendrocitta vagabunda</i>	Rufous Treepie				156
150	<i>Crypsirina temia</i>	Racket-tailed Treepie				123456
151	<i>Cissa chinensis</i>	Common Green Magpie				1456
152	<i>Cissa hypoleuca</i>	Eastern Green Magpie				6
153	<i>Temnurus temnurus</i>	Ratched-tailed Treepie				123456
154	<i>Corvus macrorhynchos</i>	Large-billed Crow				1256
	31. Artamidae	Wood-swallows				
155	<i>Artamus fuscus</i>	Ashy Wood-swallow				12356
	32. Oriolidae	Orioles, Minivets				
16	<i>Oriolus xanthornus</i>	Black-hooded Oriole				1236
157	<i>Oriolus traillii</i>	Maroon Oriole				1456
	33. Campephagidae	Cuckoo Shrikes				
158	<i>Tephrodormis gularis</i>	Brown-tailed Wood Shrike				13456
159	<i>Coracina macei</i>	Large Cuckoo-shrike				1346
160	<i>Coracina melaschistos</i>	Black-winged Cuckooshrike				12356
161	<i>Pericrocotus solaris</i>	Grey-chinned Minivet				1236
162	<i>Pericrocotus flammeus</i>	Scarlet Minivet				123456
163	<i>Hemipus picatus</i>	Bar-winged Flycatcher- shrike				123456

No.	Scientific name	English name	Dcr. 32 2006	VN Red List 2007	IUCN 2013	Source
	34. Monarchidae	Monarchs				
164	<i>Rhipidura albicollis</i>	White-throated Fantail				1456
165	<i>Terpsiphone paradisi</i>	Asian Paradise-flycatcher				6
166	<i>Terpsiphone atrocaudata</i>	Japanese Paradise-flycatcher				6
	35. Dicruridae	Drongos				
167	<i>Dicrurus macrocercus</i>	Black Drongo				1456
168	<i>Dicrurus leucophaeus</i>	Ashy Drongo				123456
169	<i>Dicrurus annectans</i>	Crow-billed Drongo				136
170	<i>Dicrurus aeneus</i>	Bronzed Drongo				123456
171	<i>Dicrurus remifer</i>	Lesser Jacket-tailed Drongo				1236
172	<i>Dicrurus hottentottus</i>	Spangled Drongo				1256
173	<i>Dicrurus paradiseus</i>	Greater Racked-tailed Drongo				123456
	36. Turdinae	Trushes				
174	<i>Luscinia sibilans</i>	Rufous-tailed Robin				156
175	<i>Luscinia cyane</i>	Siberian Blue Robin				1356
176	<i>Copsychus saularis</i>	Oriental Magpie Robin				123456
177	<i>Copsychus malabaricus</i>	White-rumped Shama	IIB			13456
178	<i>Enicurus schistaceus</i>	Slaty-blacked Forktail				126
179	<i>Enicurus leschenaulti</i>	White-crowned Forktail				12356
180	<i>Saxicola torquata</i>	Common Stonechat				156
181	<i>Saxicola ferrea</i>	Grey Bushchat				156
182	<i>Saxicola caprata</i>	Pied Bushchat				6
183	<i>Monticola solitarius</i>	Blue Rock Thrush				12356
184	<i>Myophonus caeruleus</i>	Blue Whistling-Thrush				123456
185	<i>Zoothera citrina</i>	Orange-headed Thrush				126
186	<i>Zoothera sibirica</i>	Siberian Thrush				126
187	<i>Zoothera dauma</i>	Scaly Thrush				36
188	<i>Turdus boulboul</i>	Grey-winged Blackbird				36
189	<i>Turdus merula</i>	Eurasian Blackbird				156

No.	Scientific name	English name	Dcr. 32 2006	VN Red List 2007	IUCN 2013	Source
	37. Muscicapidae					
190	<i>Muscicapa sibirica</i>	Dark-sided Flycatcher				156
191	<i>Muscicapa dauurica</i>	Asian brown-flycatcher				1356
192	<i>Ficedula parva</i>	Red-throated Flycatcher				1356
193	<i>Ficedula westermanni</i>	Little Pied Flycatcher				6
194	<i>Eumyias thalassina</i>	Verditer Flycatcher				156
195	<i>Niltava davidi</i>	Fujian Niltava				1356
196	<i>Hypothymis azurea</i>	Black-naped Monarch				6
197	<i>Cyornis concretus</i>	White -tailed Flycatcher				12356
198	<i>Cyornis hainanus</i>	Hainan Blue Flycatcher				1356
199	<i>Cyornis unicolor</i>	Pale Blue Flycatcher				126
200	<i>Cyornis rubeculoides</i>	Blue-throated Flycatcher				6
201	<i>Culicicapa ceylonensis</i>	Grey-headed Flycatcher				1236
	38. Sturnidae	Starlings, Mynas				
202	<i>Sturnus malabaricus</i>	Chestnut-tailed Starling				6
203	<i>Sturnus sinensis</i>	White-shouldered Starling				1456
204	<i>Sturnus nigricollis</i>	Black-collared Starling				12456
205	<i>Acridotheres tristis</i>	Common Myna				12456
206	<i>Acridotheres cinereus</i>	White-vented Myna				1356
207	<i>Acridotheres cristatellus</i>	Crested Myna				12456
208	<i>Acridotheres fuscus</i>	Jungle Myna				6
209	<i>Amelices coronatus</i>	Golden-crested Myna				1456
210	<i>Gracula religiosa</i>	Hill Myna	IIB			6
	39. Sittidae	Nuthatches				
211	<i>Sitta frontalis</i>	Velvet-fronted Nuthatch				156
	40. Paridae	Typical Tits				
212	<i>Parus major</i>	Great Tit				1456
213	<i>Melanochlora sultanea</i>	Sultan Tit				13456
	41. Hirundinidae	Swallows				
214	<i>Hirundo rustica</i>	Barn Swallow				456

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
215	<i>Hirundo daurica</i>	Red-rumped Swallow				156
216	<i>Delichon urbica</i>	Northern House Martin				6
217	<i>Delichon nipalensis</i>	Nepal House Martin				126
	42. Pycnonotidae	Bulbuls				
218	<i>Pycnonotus melanicterus</i>	Black-crested Bulbul				1456
219	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul				123456
220	<i>Pycnonotus cafer</i>	Red-vented Bulbul				156
221	<i>Pycnonotus aurigaster</i>	Sooty-headed Bulbul				12456
222	<i>Pycnonotus finlaysoni</i>	Stripe-throated Bulbul				13456
223	<i>Pycnonotus flavescens</i>	Flavescent Bulbul				156
224	<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul				16
225	<i>Pycnonotus hualon</i>	Bare-faced Bulbul				6
226	<i>Alophoixus pallidus</i>	Puff-throated Bulbul				123456
227	<i>Iole propinqua</i>	Grey-eyed Bulbul				12456
228	<i>Hypsipetes leucocephalus</i>	Black Bulbul				123456
	43. Zosteropidae	White-eyes				
229	<i>Zosterops palebrosus</i>	Oriental White-eye				156
	44. Sylviidae	Warblers				
230	<i>Tesia olivea</i>	Slaty-bellied Tesia				126
231	<i>Urosphena squameiceps</i>	Asian Stubtail				126
232	<i>Cettia diphone</i>	Japanese Bush Warbler				156
233	<i>Locustella lanceolata</i>	Lanceolated Warbler				1236
234	<i>Acrocephalus bistrigiceps</i>	Black-browed Reed Warbler				136
235	<i>Orthotomus sutorius</i>	Common Tailorbird				1346
236	<i>Orthotomus atrogularis</i>	Dark-necked Tailorbird				12346
237	<i>Phylloscopus fuscatus</i>	Dusky Warbler				156
238	<i>Phylloscopus schwarzi</i>	Raddes' Warbler				136
239	<i>Phylloscopus inornatus</i>	Yellow-browed Warbler				12356
240	<i>Phylloscopus borealis</i>	Arctic Warbler				156
241	<i>Phylloscopus trochiloides</i>	Greenish Warbler				136

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
242	<i>Phylloscopus coronatus</i>	Eastern Crowned Warbler				16
243	<i>Phylloscopus reguloides</i>	Blyth's Leaf Warbler				126
244	<i>Phylloscopus davisoni</i>	White-tailed Leaf Warbler				156
245	<i>Phylloscopus ricketti</i>	Sulphur-breasted Warbler				156
246	<i>Phylloscopus calciatilis</i>	Limestone Leaf-warbler				6
247	<i>Seicercus burkii</i>	Golden-spectacled Warbler				126
248	<i>Seicercus poliogenys</i>	Grey-cheeked Warbler				126
249	<i>Seicercus castaniceps</i>	Chestnut-crowned Warbler				6
250	<i>Prinia atrogularis</i>	Hill Prinia				1356
251	<i>Prinia rufescens</i>	Rufescent Prinia				156
252	<i>Prinia hodgsonii</i>	Grey-breasted Prinia				1356
253	<i>Prinia flaviventris</i>	Yellow bellied Prinia				126
254	<i>Prinia inornata</i>	Plain Prinia				6
255	<i>Megalurus palustris</i>	Striated Warbler				6
	45. Timaliidae	Laughingthrushes				
256	<i>Garrulax perspicillatus</i>	Masked Laughingthrush				1456
257	<i>Garrulax leucolophus</i>	White-crested Laughingthrush				123456
258	<i>Garrulax monileger</i>	Lesser Necklaced Laughingthrush				123456
259	<i>Garrulax pectoralis</i>	Greater Necklaced Laughingthrush				156
260	<i>Garrulax maesi</i>	Grey Laughingthrush				126
261	<i>Garrulax chinensis</i>	Black-throated Laughingthrush				123456
262	<i>Garrulax canorus</i>	Hwamei				1236
263	<i>Malacocincla abbotti</i>	Abbott's Babbler				1456
264	<i>Pellorneum tickelli</i>	Buff-breasted Babbler				12456
265	<i>Pellorneum albiventre</i>	Spot-throated Babbler				12456
266	<i>Pellorneum ruficeps</i>	Puff-throated Babbler				12456
267	<i>Malacoteron cinereum</i>	Scaly-crowned Babbler				6
268	<i>Pomatorhinus hypoleucos</i>	Large Scimitar-babbler				123456
269	<i>Pomatorhinus schisticeps</i>	White-browed Scimitar				1356

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
		Babbler				
270	<i>Pomatorhinus ruficollis</i>	Streak-breasted Scimitar Babbler				6
271	<i>Jabouilleia danjoui</i>	Shoft-tailed Scimitar Babbler				1256
272	<i>Napothera crispifrons</i>	Limestone Wren Babbler				156
273	<i>Napothera brevicaudata</i>	Streaked Wren Babbler				12456
274	<i>Napothera epilepidota</i>	Eyebrowed Wren Babbler				12356
275	<i>Stachyris rufifrons</i>	Rufous-fronted Babbler				126
276	<i>Stachyris ruficeps</i>	Rufous-capped Babbler				156
277	<i>Stachyris chrysaee</i>	Golden Babbler				156
278	<i>Stachyris herberti</i>	Sooty Babbler				123456
279	<i>Stachyris nigriceps</i>	Grey-throated Babbler				126
280	<i>Stachyris striolata</i>	Spot-necked Babbler				123456
281	<i>Macronous gularis</i>	Striped Tit-babbler				126
282	<i>Gampsorhynchus rufulus</i>	White-hooded Babbler				156
283	<i>Alcippe rufogularis</i>	Rufous-throated Fulvetta				156
284	<i>Alcippe poiocephala</i>	Brown-cheeked Fulvetta				6
285	<i>Alcippe peracensis</i>	Mountain Fulvetta				12356
286	<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta				6
287	<i>Alcippe castaneiceps</i>	Rufous-winged Fulvetta				6
288	<i>Pnoepyga pusilla</i>	Pygmy Wren Babbler				6
289	<i>Yuhina castaniceps</i>	Striated Yuhina				12456
290	<i>Yuhina zantholeuca</i>	White-bellied Yuhina				123456
	46. Alaudidae	Larks				
291	<i>Mirafra javanica</i>	Australian Bushlark				156
292	<i>Alauda gulgula</i>	Oriental Skylark				15
	47. Dicaeidae	Flowerpeckers				
293	<i>Dicaeum agile</i>	Thick-billed Flowerpecker				126
294	<i>Dicaeum chrysorrheum</i>	Yellow-vented Flowerpecker				146
295	<i>Dicaeum concolor</i>	Plain Flowerpecker				136

No.	Scientific name	English name	Dec. 32 2006	VN Red List 2007	IUCN 2013	Source
296	<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker				156
	48. Nectariniidae	Sunbirds, Spiderhunters				
297	<i>Anthreptes singalensis</i>	Ruby-cheeked Sunbird				156
298	<i>Hypogramma hypogrammicum</i>	Purple-naped Sunbird				12456
299	<i>Nectarinia sperata</i>	Purple-throated Sunbird				16
300	<i>Nectarinia jugularis</i>	Olive-backed Sunbird				156
301	<i>Aethopyga christinae</i>	Fork-tailed Sunbird				123456
302	<i>Aethopyga siparaja</i>	Crimson Sunbird				123456
303	<i>Arachnothera longirostra</i>	Little Spiderhunter				156
304	<i>Arachnothera magna</i>	Streaked Spiderhuter				12346
	49. Passeridae	Sparrows				
305	<i>Ploceus manyar</i>	Streaked Weaver				56
306	<i>Passer montanus</i>	Eurasian Tree Sparrow				6
	50. Motacillidae	Wagtails, Pipits				
307	<i>Motacilla alba</i>	White Wagtail				123456
308	<i>Motacilla flava</i>	Yellow Wagtail				156
309	<i>Motacilla cinerea</i>	Grey Wagtail				123456
310	<i>Anthus rufulus</i>	Paddyfield Pipit				1456
311	<i>Anthus hodgsoni</i>	Olive-backed Pipit				1356
	51. Estrildidae	Munias				
312	<i>Lonchura striata</i>	White-rumped Munia				13456
313	<i>Lonchura punctulata</i>	Scaly-breasted Munia				1356
314	<i>Emberiza rutila</i>	Chestnut Bunting				156

CHECKLIST 4
Endemic bird species

No.	Scientific name	English name	Endemic to Vietnam (Indochina)	Endemic to karst PNKB/Hinnamno
1	<i>Rheinardia ocellata</i>	Crested Argus	x	
2	<i>Stachyris herberti</i>	Sooty Babbler	x	x
3	<i>Pycnonotus hualon</i>	Bare-faced Bulbul	x	x

4	<i>Phylloscopus calciatilis</i>	Limestone Leaf-warbler	x	x
---	---------------------------------	------------------------	---	---

2.3. Population situation

There have been enough data on the situation of the composition of bird species of important conservation value. However, in all documents, bird species of conservation value are noted. First of all, Silver Pheasant (*Lophura nycthemera*), Green Peafowl (*Pavo muntiacus*), Bar-backed Partridge (*Arborophila brunneopectus*), Wreathed Hornbill (*Aceros undulates*), Great Hornbill (*Buceros bicornis*), Brown Hornbill (*Anorrhinus tickelli*), Sooty Babbler (*Stachylis herberti*), Short-tailed Scimitar Babbler (*Jabouilleia d'noui*), Red-collared Woodpecker (*Picus rabieri*), Chestnut-necklace Partridge (*Arborophila charltonii*), etc... are commonly seen in the surveyed area. Although some of species as Brown hornbill (*Anorrhinus tickelli*), Siamese Fireback (*Lophura diardi*) are difficult to meet in the field, only specimen are seen in the local hunters' house.

As observation made by Rob Timins, 1999, of about 45% of bird species are often seen, and the rare species account for 3%. So, the composition of birds in Phong Nha - Ke Bang NP is fairly diverse.

2.4. Conclusions

- By now, 314 bird species in PNKB NP are recorded. This is a biggest figure in the special use forest system of Vietnam. It shows high diversity of birds in PNKB NP.
- The endemic element of birds is fairly remarkable with 4 species. In which there are three species: Sooty Babbler (*Stachylis herberti*), Bare-faced Bulbul and Limestone Leaf-warbler are species typical or characteristic of karst PNKB/Hinamno.
- The population of birds is relatively abundant (up to 19 species group). So Bird conservation value Phong Nha - Ke Bang is also important.

2.5. Literatures

1. Timmins R. J., Do Tuoc, Trinh Viet Cuong, D. K. hendrichsen, 1999. A preliminary assement of the conservatian importance and conservation priorities of the Phong Nha – Ke Bang proposed National park, Quang Binh Province, Vietnam.
2. Mikhai V. Kalykin, 1999. Ornithological studies. In results of the Complex Zoological – Botanical expedition to the Ke Bang Area.
3. Lê Xuân Cảnh, Trương Văn Lã và cộng sự, 1996. báo cáo kết quả khảo sát thực địa tại khu rừng Phong Nha – Kẻ Bàng tỉnh Quảng Bình). Dự án Ras/93/102.
4. Phạm Nhật, Đỗ Tước, 1999. Chuyên đề Động vật rừng VQG Phong Nha – Kẻ Bàng. Dự án đầu tư mở rộng VQG Phong Nha – Kẻ Bàng, tỉnh Quảng bình.
5. Eames J. C., Lambert F. R. and Nguyen Cu, 1995. A survey of the Annamese lowlands, Vietnam, and its implication foe the Conservation of Vietnamese and

Imperial Pheasants *Lophura hatinhensis* and *L. Imperialis*. *Bird conservation international* 4: 343 – 382.

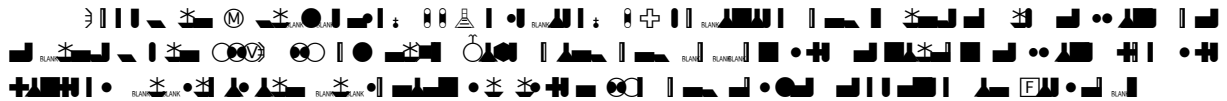
6. Eames J. C., Lambert F. R. and Nguyen Cu, 1995. Rediscovery of the Sooty babbler *Stachyris herberti* in central Vietnam. *Bird conservation international* 5: 129 – 135.
7. Ovel C. and Nguyen Thi Dao, 1998. LINC: Linking Hin Namno and Phong Nha through parallel conservation: Phase I Phong Nha – Ke Bang Nature reserve, Vietnam. WWF Indochina programme, Hanoi.
8. 2006 IUCN Red list of threatened Species. www.redlist.org.
9. Chính phủ Cộng hoà xã hội chủ nghĩa Việt Nam, 2006. Nghị định của Chính phủ số 32/2006/NĐ-CP ngày 30/3/2006 về quản lý thực vật rừng, Động vật rừng nguy cấp, quý hiếm.
10. Bộ khoa học và công nghệ, 2003. Danh lục Đỏ Việt Nam 2003, phần Động vật.
11. Le Trong Trai, Pham Tuan Anh, Nguyen Cu, Ngo Xuan Tuong, 2011. Bird Survey extension of the National Park Phong Nha Ke Bang, Quang Binh, Vietnam

Phong Nha-Ke Bang National Park

3.1. History research situation of the regional Reptilia in Phong Nha-Ke Bang NP

Comparing to birds and mammals, the survey of the regional reptiles in this NP is late. While formulating the investment projects, or investment project for the expansion of PNKB NP, reptile is disregarded and only the Mammalogists or Ornithologists did the surveys them. Even the Vitnam-Russia Tropical Center, in 1999, only Boris D. Vasiliev did the survey for a fortnight and recorded 18 species only for this NP. Fortunately, from June 2003 to the end of 2005 there happens a project of nature conservation of PNKB. This project is the cooperation between Cologne and CRES. They focused on research of Reptiles. Therefore till 2005, they discovered 6 new species for science and notified some of new species for regional reptile of Vietnam, and set up a full list of reptiles for PNKB NP (Ziegler *et al*, 2004). In 2011, Nguyen Quang Truong additional surveys extension of the National Park PN- KB, 107 species recorded.

3.2. The regional reptile



CHECKLIST 5

Reptile in Phong Nha-Ke Bang National Park

Nguyen Van Sang et al, 2005, arranged the list of reptiles of PNKB NP (Vietnamese name and Latin name) with the following legends:

Source column, means source of documents used:

- + 1: Data by Nguyen Van Sang et al, 2005.
- + 2: Data by Ziegler et al, 2004.
- + 3: Data by Nguyen Quang Truong, 2012.
- Decree column 32/2006
 - + IB: exploitation forbidden
 - + IIB: exploitation limited
- Red data Book column:
 - + VU: Vulnerable
 - + EN: Endangered
 - + CN: Critically Endangered

No.	Scientific name	English name	Dcr. 32 2006	IUCN 2007	IUCN 2013	Source
	REPTILE					
	I. Squamata					
	1. Agamidae					

No.	Scientific name	English name	Dec. 32 2006	2007	IUCN 2013	Source
1.	<i>Acanthosaura lepidogaster</i>					12
2.	<i>Calotes emma</i>					12
3.	<i>Calotes versicolor</i>					12
4.	<i>Draco maculatus</i>					12
5.	<i>Physignathus cocincinus</i>			VU		12
6.	<i>Leiolepis belliana</i>					1
	2. Gekkonidae					
7.	<i>Cyrtodactylus cryptus</i>					12
8.	<i>Cyrtodactylus phongnhakebangensis</i>					12
9.	<i>Cyrtodactylus roesleri</i>					12
10.	<i>Gehyra mutilata</i>					12
11.	<i>Gekko gecko</i>			VU		12
12.	<i>Gekko palmatus</i>					12
13.	<i>Gekko scientiadventura</i>					12
14.	<i>Hemidactylus frenatus</i>					12
15.	<i>Hemidactylus garnoti</i>					12
16.	<i>Hemidactylus karenorum</i>					1
	3. Lacertidae					
17.	<i>Takydromus hani</i>					12
18.	<i>Amphiesma andreae</i>					12
19.	<i>Takydromus sexlineatus</i>					12
	4. Scincidae					
20.	<i>Eutropis longicaudatus</i>					12
21.	<i>Eutropis macularius</i>					12
22.	<i>Eutropis multifasciatus</i>					12
23.	<i>Lygosoma boehmei</i>					1
24.	<i>Lygosoma quadrupes</i>					12
25.	<i>Plestiodon elegans</i>					12
26.	<i>Plestiodon quadrilineatus</i>					12
27.	<i>Scincella melanosticta</i>					12
28.	<i>Scincella rufocaudata</i>					14
29.	<i>Sphenomorphus indicus</i>					12
30.	<i>Sphenomorphus tetradactylus</i>					1
31.	<i>Sphenomorphus buenloicus</i>					1
32.	<i>Tropidophorus cocincinensis</i>					12
33.	<i>Tropidophorus noggei</i>					12
	5. Anguidae					
34.	<i>Dopasia gracilis</i>					1
	6. Varanidae					
35.	<i>Varanus salvator</i>		IIB	EN		12
	7. Typhlopidae					
36.	<i>Ramphotyphlops braminus</i>					12
37.	<i>Typhlops diardi</i>					12
	8. Xenopeltidae					
38.	<i>Xenopeltis hainanensis</i>					12
39.	<i>Xenopeltis unicolor</i>					12

No.	Scientific name	English name	Dec. 32 2006	Đánh giá 2007	IUCN 2013	Source
	9. Pythonidae					
40	<i>Python molurus</i>		IIB	CR		12
41	<i>Python reticulatus</i>		IIB	CR		12
	10. Colubridae					
42	<i>Ahaetula prasina</i>					12
43	<i>Amphiesma andreae</i>					12
44	<i>Amphiesma boulengri</i>					1
45	<i>Amphiesma leucomystax</i>					1
46	<i>Amphiesma stolatum</i>					12
47	<i>Amphiesma khasiense</i>					1
48	<i>Boiga bourreti</i>					12
49	<i>Boiga guangxiensis</i>					12
50	<i>Boiga multomaculata</i>					12
51	<i>Calamaria pavementata</i>					12
52	<i>Calamaria septentrionalis</i>					12
53	<i>Calamaria thanhi</i>					12
54	<i>Chrysopelea ornata</i>					12
55	<i>Coelognathus radiatus</i>		IIB	VU		12
56	<i>Cyclophiops major</i>					12
57	<i>Cyclophiops multicinctus</i>					12
58	<i>Dendrelaphis ngansonensis</i>					12
59	<i>Dinodon rufozonatum</i>					1
60	<i>Dinodon septentrionalis</i>					12
61	<i>Dinodon rosozonatum</i>					1
62	<i>Dinodon pictus</i>					1
63	<i>Dryocalamus davisonii</i>					12
64	<i>Enhydriis plumbea</i>					12
65	<i>Fimbrios smithi</i>					1
66	<i>Gonyosoma prasinum</i>			VU		1
67	<i>Gonyosoma frenatum</i>					1
68	<i>Liopeltis frenatus</i>					1
69	<i>Lycodon fasciatus</i>					1
70	<i>Lycodon futsingensis</i>					1
71	<i>Lycodon paucifasciatus</i>					1
72	<i>Lycodon ruhstrati</i>					1
73	<i>Oligodon chinensis</i>					1
74	<i>Oligodon taeniatus</i>					1
75	<i>Oreocryptophis porphyraceus</i>			VU		1
76	<i>Orthriophis moellendorffi</i>					1
77	<i>Orthriophis taeniurus</i>					1
78	<i>Pareas carinatus</i>					12
79	<i>Pareas hamptoni</i>					12
80	<i>Pareas macularius</i>					12
81	<i>Pareas margaritophorus</i>					12
82	<i>Parahelicops annamensis</i>					14
83	<i>Psammodynastes pulverulentus</i>					12

No.	Scientific name	English name	Dec. 32 2006	Đánh giá 2007	IUCN 2013	Source
84	<i>Pseudoxenodon macrops</i>					1
85	<i>Ptyas korros</i>			EN		12
86	<i>Ptyas mucosa</i>		IIB	EN		12
87	<i>Rhabdophis chrysargos</i>					12
88	<i>Rhabdophis subminiatus</i>					12
89	<i>Sibynophis collaris</i>					1
90	<i>Sinonatrix percarinata</i>					12
91	<i>Xenochrophis flavipunctatus</i>					12
	11. Elapidae					
92	<i>Bungarus candidus</i>		IIB			12
93	<i>Bungarus fasciatus</i>		IIB	EN		12
94	<i>Naja atra</i>		IIB	EN		1
95	<i>Ophiophagus hannah</i>		IB	CR	VU	12
96	<i>Sinomicrurus maccllellandi</i>					12
	12. Viperidae					
97	<i>Cryptelytrops albolabris</i>					12
98	<i>Protobothrops cornutus</i>					12
99	<i>Protobothrops mucrosquamatus</i>					12
100	<i>Protobothrops sieversorum</i>					12
101	<i>Viridovipera truongsonensis</i>					12
102	<i>Viridovipera vogeli</i>					1
103	<i>Viridovipera stejnegeri</i>					1
	II. Testudines					
	13. Platysternidae					
104	<i>Platysternon megacephalum</i>		IIB	EN	EN	12
	14. Geoemydidae					
105	<i>Cuora bourreti</i>			EN		12
106	<i>Cuora cyclornata</i>		IB	CR		12
107	<i>Cuora mouhotii</i>				EN	12
108	<i>Cyclemys oldhami</i>					12
109	<i>Heosemys grandis</i>		IIB	VU	VU	12
110	<i>Mauremys mutica</i>				EN	12
111	<i>Mauremys sinensis</i>				EN	12
112	<i>Malayensis subtrijuga</i>					1
113	<i>Sacalia quadriocellata</i>				EN	12
	15. Testudinidae					
114	<i>Indotestudo elongata</i>		IIB	EN	EN	12
115	<i>Manouria impressa</i>		IIB	VU	VU	12
	16. Trionychidae					
116	<i>Palea steindachneri</i>			VU	EN	12
117	<i>Pelodiscus sinensis</i>				VU	12

CHECKLIST 6 Endemic reptile list

TT	Tên khoa học	Tên Việt Nam	Endemic to Vietnam (Indochina)	Endemic to karst PNKB/Hinna mno
1	<i>Cyclornata</i>	Ống sống	x	x
2	<i>Indotestudo</i>	Ống sống	x	x
3	<i>Ophiophagus</i>	Ống sống	x	x
4	<i>Varanus</i>	Ống sống	x	x
5	<i>Python</i>	Ống sống	x	

3.3. Conservation value

The regional reptile in PNKB NP has an important conservation value. First of all, in PNKB NP 117 reptile species were recorded, out of which 4 species are of narrow endemic and 26 rare species which noted in Decree No. 32/2006/N§-CP (14 species), in Vietnam Red Data Book in 2007 (20 species) and IUCN Red Data Book in 2013 (11 species).

The reptile species to be prioritized for protection in Vietnam are: Cyclornated Box Turtle (*Cuora cyclornata*), Elongated Tortoise (*Indotestudo elongata*), King Cobra (*Ophiophagus hannah*), Water Monitor (*Varanus salvator*), Reticulated Python (*Python reticulatus*), và Burmese Python (*Python molurus*).

3.4. Conclusions

- By now 117 species of reptile were recorded in PNKB NP.
- The endemic element of the regional reptile is high, which manifests the mammal endemic of the regional reptile in the North Truong Son area.
- The conservation value of the regional reptile in PNKB NP is high as the diversity in numbers of species, in endemic element and in the many rare reptiles

3.5. Literatures

1. Nguyen van Sang, Ho Thu Cuc, Nguyen Quang Truong, 2005. Herpetofauna of Vietnam.
2. Ziegler T., Hermann. H., W.; Vu Ngoc Thanh, Le Khac Quyet, Nguyen Tan Hiep, Cao Xuan Chinh, Luu Minh Thanh and Dinh Huy Tri, 2004. The Amphibia and reptiles of the Phong Nha - Ke Bang National Park, Quang Binh Provice, Vietnam Hamadrgad, Tamil Nadu 28(1-2) : 19-42.
3. Pham Nhat, Do Tuoc, 1995. Report fauna of investment projects Phong Nha - Ke Bang, Forest Inventory and Planning Institute, Hanoi, Vietnam.

4. Ziegler T., Le Khac Quyet, 2005. A new species of (mountain range), Vietnam. *Zootaxa*. 1042: 27 – 38.
5. Rosler H., T. Ziegler, Vu Ngoc Thanh, Hans – Werner Hermann, and W. Bohe, 2005. A new lizard of genus *Gekko* Laurenti, 1768 (Squamata: Sauria: Gekkonidae) from the Phong Nha – Ke Bang National Park, Quang Binh province, Vietnam. *Bonner zoologist Beitrage* 53(1/2): 135 – 148.
6. Ziegler T., Vu Ngoc Thanh and Bui Ngoc Thanh, 2005. A new water skink of the genus *Tropidophorus* from the Phong Nha – Ke Bang National Park, central Vietnam (Squamata: Sauria: Scincidae). *Salamandra* 41(3) : 137 – 146.
7. Ziegler T., Herrmann H. W., P. Orlov, and O. S. G. Pauwels, 2000. *Triceratolepidophis sieversorum*, a new genus, and species of plover (Reptilia: Serpentes, Viperidae, Crotalinae) from Vietnam. *Russian Journal of Herpetology, Maskau* 7(3): 199 – 214.
8. Nguyen Quang Truong, 2011. Survey reptiles (Reptilia) and amphibians (Amphibia) in the extensions of Phong Nha Ke Bang National Park.

Amphibian in Phong Nha-Ke Bang National Park

4.1. History research situation of the regional Amphibian in Phong Nha-Ke Bang NP

Comparing to birds, mammals and reptiles the *Amphibian* is slightly disregarded. Therefore until 1999, the WWF project happened and the Vietnam and Russia Tropical Center implemented the project in Ke Bang (Vassiliev. B. D,1999). Shortly before that there were a few data on the *Amphibian* of the zoologists (Pham Nhat, Do Tuoc, 1995), (Le Xuan Canh *et al*, 1996). To this time the *Amphibian* only 20 species were recorded.

The survey of the regional *Amphibian* PNKB NP becomes more professional: Nature Conservation PNKB project in Quang Binh, Vietnam. This project thoroughly surveyed the regional *Amphibian* in PNKB NP (Ziegler at all, 2004), and one new species was announced for science that is *Rhacophorus orlovi*. Ziegler et Kohler, 2000. In 2011, There's data on amphibian Nguyen Quang Truong of projects to conserve and sustainably manage natural resources Phong Nha-Ke Bang National Park, Quang Binh Province, Vietnam.

4.2. The regional Amphibian

Recorded 58 species, 8 families, 1 order of *Amphibian* in PNKB NP. Therefore it is possible to say that the *Amphibian* species in PNKB can be highly ranked but not ranked firstly Hoang Lien NP (Lao Cai province) has more *Amphibian* species than PNKB NP. This can be explained that the limestone mountain area in PNKB is too large, on the other hand the area of hilly mountain is not much while the elevation of the hilly mountain is low, more or less 1,00 m asl.

Among the 7 species recorded rare species, 4 species listed in Vietnam's Red. 2007, 4 species in IUCN Red list in 2013 and has 2 endemic species.

4.3. Conclusions

- By now, 58 amphibian species are recorded. This area is of medium amphibian diversity in Vietnam.
- Only 2 endemic species and 4 species listed in Vietnam's Red. 2007, 4 species in IUCN Red list in 2013.
- And therefore, the conservation value of the regional amphibian is not very high, as the endemic and rare species in Phong Nha-Ke Bang is not so big.

CHECKLIST 7

Amphibian in Phong Nha-Ke Bang National Park


The list of Amphibia Phong Nha-Ke Bang NP is in the main arranged by Nguyen Van Sang *et al*, 2009, with the following legend:

- Source of document column:
- + 1: By Nguyen Van Sang at all, 2005.

- + 2: By Ziegler et al., 2004
- + 3: By Nguyen Quang Truong, 2012.
- Decree column 32/2006
 - + IB: Exploitation forbidden
 - + IIB: Exploitation limited
- Red Data Book column:
 - + VU: Vulnerable
 - + EN: Endangered
 - + CR: Critically Endangered

No.	Scientific name	English name	Dcr. 32 2006	IB IIB 2007	IUCN 2013	Source
	I. ANURA					
	1. Bufonidae					
1	<i>Duttaphrynus melanostictus</i>					13
2	<i>Ingerophrynus galeatus</i>			VU		13
3	<i>Ingerophrynus macrotis</i>					4
	2. Hylidae					
4	<i>Hyla simplex</i>					13
	3. Megophryidae					
5	<i>Brachytarsophrys intermedia</i>				VU	13
6	<i>Leptobrachium chapaense</i>					1
7	<i>Leptolalax pelodytoides</i>					1
8	<i>Ophryophryne hansii</i>					13
9	<i>Ophryophryne pachyproctus</i>					4
10	<i>Xenophrys major</i>					13
	4. Microhylidae					
11	<i>Kalophrynus interlineatus</i>					13
12	<i>Kaloula pulchra</i>					13
13	<i>Microhyla bedmorei</i>					13
14	<i>Microhyla butleri</i>					13
15	<i>Microhyla fissipes</i>					13
16	<i>Microhyla heymonsi</i>					13
17	<i>Microhyla marmorata</i>					13
18	<i>Microhyla pulchra</i>					13
19	<i>Micryletta inornata</i>					13
20	<i>Micryletta annamensis</i>					1
	5. Dicoglossidae					
21	<i>Fejervarya limnocharis</i>					13

No.	Scientific name	English name	Decr. 32 2006	Red Data Book 2007	IUCN 2013	Source
22	<i>Hoplobatrachus rugulosus</i>					13
23	<i>Limnonectes kuhlii</i> complex					13
24	<i>Limnonectes limborgi</i>					34
25	<i>Limnonectes poilani</i>					34
26	<i>Limnonectes hascheanus</i>					1
27	<i>Occidozyga lima</i>					13
28	<i>Occidozyga martensii</i>					13
	6. Ranidae					
29	<i>Amolops cremnobatus</i>					34
30	<i>Amolops ricketti</i>					1
31	<i>Babina chapaensis</i>					4
32	<i>Hylarana attigua</i>				VU	13
33	<i>Hylarana guentheri</i>					13
34	<i>Hylarana macrodactyla</i>					13
35	<i>Hylarana maasonensis</i>					13
36	<i>Hylarana nigrovittata</i>					13
37	<i>Hylarana taipehensis</i>					13
38	<i>Odorrana andersoni</i>			VU		13
39	<i>Odorrana chloronota</i>					13
40	<i>Odorrana tiannanensis</i>					13
41	<i>Rana johnsi</i>					13
	7. Rhacophoridae					
42	<i>Chiromantis vittatus</i>					13
43	<i>Gracixalus quyeti</i>					1
44	<i>Philautus banaensis</i>					13
45	<i>Philautus truongsongensis</i>					13
46	<i>Kurixalus verrucosus</i>					13
47	<i>Polypedates mutus</i>					13
48	<i>Polypedates leucomystax</i>					13
49	<i>Rhacophorus annamensis</i>				VU	13
50	<i>Rhacophorus dennysi</i>					13
51	<i>Rhacophorus exechopygus</i>					13
52	<i>Rhacophorus kio</i>			EN	VU	13
53	<i>Rhacophorus orlovi</i>					13
54	<i>Rhacophorus rhodopus</i>					13
55	<i>Theloderma asperum</i>					13
56	<i>Theloderma corticale</i>			EN		4
57	<i>Theloderma stellatum</i>					4

No.	Scientific name	English name	Dec. 32 2006	 2007	IUCN 2013	Source
	Gymnophiona					
	8. Ichthyophiidae					
58	<i>Ichthyophis sp.</i>					4

CHECKLIST 8
Endemic amphibian list

TT	Tên khoa học	Tên Việt Nam	Endemic to Vietnam (Indochina)	Endemic to karst PNKB/Hinn anno
1	<i>Philautus truongsoneensis</i>		x	
2	<i>Philautus banaensis</i>		x	

4.4. Literatures

1. Vassiliev B. D., 1999. Herpetological investigations: In Results of the complex Zoological – Botanical expedition to the Be Bang Area.
2. Nguyen van Sang, Ho Thu Cuc, Nguyen Quang Truong, 2005. Herpetofauna of Vietnam.
3. Ziegler T. and Ji. Kohler, 2001.
4. Ziegler T., Hermann. H., W.; Vu Ngoc Thanh, Le Khac Quyet, Nguyen Tan Hiep, Cao Xuan Chinh, Luu Minh Thanh and Dinh Huy Tri, 2004. The Amphibia and reptiles of the Phong Nha - Ke Bang National Park, Quang Binh Provice, Vietnam Hamadrgad, Tamil Nadu 28(1-2) : 19-42.
5. Ziegler T., and J. Kohler, 2001. Rhacophorus orlovi sp. n., Cin neuer Ruderfrosch aus Vietnam (Amphibia, Anura: Rhocoporidae). Saunia, Berlin 23(3): 37 – 46.
6. Pham Nhat, Do Tuoc, 1995. Report fauna of investment projects Phong Nha - Ke Bang, Forest Inventory and Planning Institute, Hanoi, Vietnam.

5. Fish in Phong Nha-Ke Bang National Park

5.1. History research situation of the regional fish in Phong Nha-Ke Bang NP

In the past, the regional fish in PN-KB National Park has never been surveyed. And the first to survey in PNKB is Dr. Nguyen Thai Tu in 1996, funded by RAS/93/103. He started his survey on 6/6/1996 to 21/6/1996, and recorded 61 fish species for PN-KB National Park. After that he continued his study on the regional fish more thoroughly from 3/2003 to 2005, on a territory of more than 4,000 km², in 4 districts namely Quang Ninh, Bo Trach, Tuyen Hoa and Minh Hoa, and recorded 162 fresh water fish species (Nguyen Thai Tu, 2005). However, within the territory of PNKB NP, only 124 species inhabit in this NP. These are most updated data. Finally in 2011, which the author also continued an additional survey of 50 species for the expansion of PN-KB National Park.

5.2. The regional fish

Recorded 170 taxon available in Phong Nha - Ke Bang. Of these, 137 species were identified.

The endemic element of the regional fish in PNKB NP is very high, of 17 species. Among them the most important is *Hemibagrus centrallus*. This is the most famous fish, delicious and best served in Hanoi.

According to Nguyen Thai Tu, (2005), The endemic element of the regional fish in PNKB NP is very high just because of 3 reasons below:

- The ground river of the limestone area generates the transection of the catchments. That is the condition for the formulation of narrow endemic species and form the micro-region of different composition species.
- Phong Nha-Ke Bang is situated closed to the sea so there are many sea fish invasion.
- Phong Nha-Ke Bang is situated in the North of Truong Son range, where many animal geographical factors as the Hoa Nam and Mekong factors, the factor of sea invasion and particularly is the indigenous factor.

Another character need to be considered is that there are 14 cave fish species and 17 sea invasion fish species of the regional fish in PN-KB National Park.

However, the rare fish group in PNKB NP is not so much, only 3 species namely *Anguilla marmorata*, *A. bicolor* and *Clupanodon thrissa* at the same time these 3 fish species have high food value. The rare fish species in PNKB NP are not so much, just because, most of the fish species living in streams or small rivers or in the cave are small size fish of low economic value, therefore they are over exploited

CHECKLIST 9


Fish in Phong Nha-Ke Bang National Park

The formulation of fish list for PNKB NP is based on the data from Nguyen Thai Tu (2005-2011), and follows the way of arrangement of this author. The way of coding in the column of rare species is as follow:

+ VU: Vulnerable

+ EN: Endangered

+ M: specimens

No.	Scientific name	Dec. 32 2006	 2007	IUCN 2013	Source
	I. Notopteriformes				
	1. Notopteridae				
1	<i>Notopterus notopterus</i>				**
	II. Anguilliformes				
	2. Anguillidae				
2	<i>Anguilla marmorata</i> Quoy & Gaimard		VU		**
3	<i>Anguilla bicolor</i> Smith		VU		**
	3. Moringuidae				
4	<i>Moringuia javanica</i> (Kaup)				**
	4. Clupeidae				
5	<i>Konorisus punctatus</i> (Tem. & Sch.)				**
6	<i>Clupanodon thrissa</i> Linn.		EN		**
	III. Cypriniformes				
	5. Cyprinidae				
	Danioninae				
7	<i>Aspidoparia morar</i> (Hamilton, 1822)				**
8	<i>Aspidoparia viridis</i>				**
9	<i>Leptobarbus</i> sp				**
10	<i>Opsarichthys bidens</i> (Gunther)				**
11	<i>Rasbora argyrotaenia</i> (Bleeker)				**
12	<i>Rasbora steimeri</i> N.&P.				**
13	<i>Rasbora (parasteineri)</i> sp1				**
14	<i>Rasbora</i> sp2				**
15	<i>Yaoshanicus macrocorpus</i>				**
16	<i>Yaoshanicus normalis</i> N.&P.				**
17	<i>Nicholsicypris nomalis</i>				**
	Leuciscinae				
18	<i>Ctenopharyngodon idellus</i> (C.&V.)				**

No.	Scientific name	Dec. 32 2006	2007	IUCN 2013	Source
19	Squaliobarbus curriculus (Richard.)				**
	Cultrinae				
20	Hemiculter leuisculus (Basil.)				**
21	Ischikauia macrolepis N.&P.				**
22	Pseudohemiculter serata (Koller)				**
23	Rasborinus albus Tu				**
24	Rasborinus hautus Tu				**
25	Rasborinus lineatus Pellegrin				**
26	Rasborinus sp				**
	Gobioninae				
27	Hemibarbus labeo (Pallas)				**
28	Microphysogobio kachekensis (osh.)				**
29	Sarcocheilithys nigripinnis N.&P.				**
30	Squalidus argentatus (Sauv.&Dab.)				**
31	Squalidus atromaculatus (N.&P.)				**
32	Acheilognathus lamus				**
	Acheilognathinae				
33	Acheilognathus lamus Tu				**
34	Chela chrysotaeniatus raobutensis nssp				**
35	Rhodeus sp.(Microcorpus)				**
36	Rhodeus vietnamensis ylengensis nssp				**
37	Rhodeus vietnamensis trunghoaensis nssp				**
38	Rhodeus sp.(phongnha)				**
	Barbinae				
39	Acrossocheilus albus				**
40	Acrossocheilus benasi vuha Tu				**
41	Acrossocheilus carongensis nsp				**
42	Acrossocheilus fissirostralis				**
43	Acrossocheilus kremphi (Pelleg. & Chev)				**
44	Acrossocheilus lineatus				**
45	Acrossocheilus logianalis				**
46	Acrossocheilus macrosquamatus (Yen)				**
47	Acrossocheilus kremphi hangenensis nssp				**
48	Acrossocheilus yeni				**
49	Neolissichilus benasi				**
50	Capoeta semifasciolata (Gunther)				**
51	Paraspinibarbus maculatus (P ^a lleg.&Chev)				**
52	Spinibarbus denticulatus (oshima)				**

No.	Scientific name	Decr. 32 2006	2007	IUCN 2013	Source
53	Spinibarbus hollandi(oshima)				**
54	Varicorhinus (Onychostoma) gerlachi (Pet).				**
55	Varicorhinus (S) laticeps (Gunther)				**
56	Varicorhinus (S) lepturus (Boulenger)				**
57	V. (S.) sp1 (macrostomus)				**
58	V. (S.) marionale Kottelat				**
59	Varicorhinus (S.) microstomus H & H				**
60	Varicorhinus (Scaphestes) np2				**
61	Henicorhynchus sp.				**
	Labeoninae				
62	Cirrhinus molitorella (C. & V.)				**
63	Garra obrurostris Yen				**
64	Garra pingi (Tchang)				**
65	Osteocheilus sp1 (longicorpus)				**
66	Osteocheilus sp2 (microstomus)				**
67	Osteocheilus salsburyi N.&P.				**
	Cyprininae				
68	Carassioides cantonensis (Hein.)				**
69	Carassioides phongnhaensis				**
70	Carassius auratus (Linnaeus)				**
71	Cyprinus melanes (Yen)				**
72	Cyprinus carpio (Linnaeus)			VU	**
73	Cyprinus hieni				**
74	Cyprinus quidatenis Tu				**
	6. Cobitidae				
75	Acanthopsoides yeni (Tu)				**
76	Misgurnus anguillicandatus (Cantor)				**
77	Misgurnus mizolepis Gunther				**
78	Neimacheilus pulcher Nichols				**
79	Neimacheilus sp				**
80	Schistura fasciolata (N.&P.)				**
81	Schistura inserta (Nichols)				**
82	Schistura sp (longicorpus)				**
83	Schistura sp1				**
84	Schistura sp2				**
85	Schistura sp3				**
86	Schistura sp4				**
87	Schistura sp5				**

No.	Scientific name	Dec. 32 2006	Đ. Đ. Đ. Đ. Đ. 2007	IUCN 2013	Source
88	Schistura sp6				**
89	Schistura sp7				**
90	Schistura sp8				**
91	Schistura sp9				**
92	Schistura sp10				**
93	Schistura sp11				**
94	Schistura sp12				**
95	Schistura sp13				**
96	Schistura sp14				**
97	Schistura sp15				**
98	Schistura sp16				**
99	Schistura sp17				**
100	Schistura sp18				**
101	Micronemacheilus pulcher (N. & P.)				**
	7. Homalopteridae				
102	Balitora sp (microbarbata)				**
103	Vanmanenia sp1 (hexalota)				**
104	Vanmanenia sp2 (multiloba)				**
105	Vanmanenia sp3 (raobutensis)				**
106	Vanmanenia sp4 (ylengensis)				**
	IV. Siuriformes				
	8. Siluridae				
107	Vanmanenia castorus L.				**
108	Parasilurus cochinchinensis (C.&V.)				**
109	Parasilurus asotus				**
	9. Clariidae				
110	Clarias fuscus (Lacepede)				**
	10. Cranoglanididae				
111	Cranoglanis sinensis Peters.				**
	11. Bagridae				
112	Hemibagrus centralus Yen				**
113	Hemibagrus vietnamicus Yen				**
114	Pelteobagrus vinhensis Tu				**
	12. Ariidae				
115	Arius sinensis (Lacepede)				**
	13. Sisoridae				
116	Euchiroglanis sp. (microdordalis)				**
117	Glythorax hongensis Li				**

No.	Scientific name	Dec. 32 2006	2007	IUCN 2013	Source
118	Glytothorax interspinalum Yen				**
119	Glytothorax sp. (Raobut)				**
	V. Cyprinodontiformes				
	14. Oryziatidae				
120	Aplocheilus laptipes (Term.& Schl.)				**
	VI. Beloniformes				
	15. Hemirhamphidae				
121	Hyporhamphus sinensis (Gunther)				**
	VII. Mugilliformes				
	16. Mugillidae				
122	Mugil strongylocephalus (Richardson)				**
123	Liza macrolepis (Smith)				**
	VIII. Symbranchiformes				
	17. Flutidae				
124	Monopterus albus (Zuiew)				**
	IX. Perciformes				
	18. Serranidae				
125	Caesio erythogaster (C. & V.)				**
126	Cephalopholis pachycentron C. & V.				**
127	Coreoperca whiteheadi (Boul.)				**
128	Pinjalo pinjalo (Bleeker)				**
	19. Centropomidae				
129	Ambassis commersoni C. & V.				**
130	Ambassis gymnocephalus (Lacepede)				**
131	Lates calcaarifer (Boch)				**
	20. Leiognathidae				
132	Leiognathus equulus (Forsk.)				**
	21. Gerridae				
133	Gerres lucidus Cuvier				**
134	Gerres filamentosus Cuvier				**
135	Gerres oyena (Forsk.)				**
	22. Scatophagidae				
136	Scatophagus argus Linn.				**
	23. Therapontidae				
137	Terapon oxyrhinchus (Tem. & Schl.)				**
138	Terapon theraps C. & V.				**
	24. Cichlidae				
139	Oreochromis mosambicus (Peters)				**

No.	Scientific name	Dec. 32 2006	2007	IUCN 2013	Source
	25. Platicephalidae				
140	Platicephalus indicus L.				**
	26. Psettidae				
141	Psettus argenteus (L.)				**
	27. Eleotridae				
142	Butis butis (Ham. & Buch.)				**
143	Eleotris fusca Tem. & Schl.				**
144	Eleotris melanosoma Bleeker				**
145	Odontobutis sp1				**
146	Odontobutis sp2				**
147	Percottus chalmersi (N. & P.)				**
148	Percottus tonkinensis Yen				**
149	Sineleotris namxamensis Chen & Kottelat				**
	28. Gobiidae				
150	Ctenogobius gympauchen (Bleeker)				**
151	Glossogobius giuris (Hamilton)				**
152	Glossogobius fasciato-punctatus (Richard.)				**
153	Oligolepis acutipinnis (C. & V.)				**
154	Oxyurichthys sp.				**
155	Parapogryptes macrolepis (Bleeker)				**
156	Rhinogobius hadropterus (Jord. & Sny.)				**
157	Rhinogobius hongensis Chen, Yang & Chen				**
158	Rhinogobius leavelli (Herre.)				**
159	Rhinogobius namnaensis Chen & Kot.				**
160	Rhinogobius vermiculatus Chen & Kot.				**
161	Tridentiger trigonocephalus (Gill)				**
162	Tripauchen vagina Block & Schneider				**
	29. Anabantidae				
163	Anabas testudineus (Bloch)				**
	30. Belonidae				
164	Macropodus opercularis Linnaeus				**
	31. Channidae				
165	Channa gachua Hamilton				**
166	Channa striata (Bloch)				**
	32. Mastacembelidae				
167	Mastacembelus aculeatus (Basilewsky)				**
168	Mastacembelus armatus (Lacepede)				**

No.	Scientific name	Dec. 32 2006	Đ. 32 2007	IUCN 2013	Source
	X. Pleuronectiformes				
	33. Pleuronectidae				
169	<i>Verasper variegatus</i> (T. & S.)				*
	34. Bothidae				
170	<i>Tephrinectes sinensis</i> (Lacepede)				*

CHECKLIST 10
Endemic fish species

TT	Tên loài	Endemic to Vietnam (Indochina)	Endemic to karst PNKB/Hinnamno
1	<i>Aspidoparia viridis</i>	+	+
1	<i>Yaoshanicus macrocorpus</i>	+	+
2	<i>Rasborinus albus</i> Tu	+	+
3	<i>Rasborinus hautus</i> Tu	+	+
4	<i>Acheilognathus lamus</i> Tu	+	+
5	<i>Acrossocheilus albus</i>	+	+
6	<i>Acrossocheilus benasi vuha</i> Tu	+	+
7	<i>Acrossocheilus carongensis</i>	+	+
8	<i>Acrossocheilus fissirostralis</i>	+	+
9	<i>Acrossocheilus lineatus</i>	+	+
10	<i>Acrossocheilus longianalis</i>	+	
11	<i>Acrossocheilus macrosquamatus</i> (Yen)	+	
12	<i>Acrossocheilus yeni</i>		+
13	<i>Garra obrurostris</i> Yen		+
14	<i>Acanthopsoidea yeni</i> (Tu)		+
15	<i>Carassioidea phonghaensis</i>		+
16	<i>Cyprinus melanes</i> (Yen)	+	
17	<i>Cyprinus hieni</i>		+
18	<i>Cyprinus quidatenis</i> Tu	+	+
19	<i>Glyptothorax interspinalum</i> Yen	+	
20	<i>Percottus tonkinensis</i> Yen	+	+
21	<i>Hemibagrus centralis</i> Yen	+	
22	<i>Hemibagrus vietnamicus</i> Yen	+	
		18	17



5.3. Conclusions

- The regional fish of PNKB NP is of high diversity as far as species concerned. At present 137 wild fish species are recorded. This is a biggest figure comparing to other NP in the system of special use forest in Vietnam
- The endemic element is very high of 23 narrow endemic species
- Two special groups, that are cave fish and sea invasion fish
- Although the rare fish species are low, only 3 species in Vietnam Red Data Book 2007, the dominant diversity on the region and endemic element, the regional fish in this NP is of great conservation value in the special use forest system of Vietnam.

5.4. Literatures



- 1 . Nguyen Thai Tu, 1996. Fish fauna , in reporting the survey results of the field in the forest of Phong Nha - Ke Bang National Park (Quang Binh province) . Ras/93/103 project, Hanoi.
- 2 . Nguyen Thai Tu, 2005. Preserve unique and precious biodiversity of karst Fish Phong Nha - Ke Bang. Unpublished .
- 3 . Nguyen Thai Tu, et al, 2000. Two new species of the genus *Lissochilus* Weber et de Beaufort, 1916. Basic Problems of research in Biology. Vietnam National University Publishing House, Hanoi .
- 4 . Nguyen Thai Tu et al, 2011. Survey diversity of fish species in the National Park Phong Nha - Ke Bang , Vietnam . Unpublished document .
- 5 . Mai Dinh Yen, 1973. The freshwater fish of the northern provinces of Vietnam. Science and Technology Publishing House, Hanoi .
- 6 . Ministry of Science and Technology, 2007 . Vietnam Red List 2007, part animal. Hanoi .
- 7 . Yiyu Chen et al, 1998. Fauna Sinica Osteichthyes Cypriniformes II . Fresh Science China Beijing , 531p (Chinese)
- 8 . Nguyen Van Hao, Ngo Van Sy, 2001. Freshwater fish Vietnam. Volume I. They carp (Cyprinidae). Agricultural Publishing House, Hanoi . tr.123 - 138
- 9 . Nguyen Van Hao , 2005 . Freshwater fish in Vietnam , Volume 2.3 . Agricultural Publishing House .
- 10 . Jorg Freyhof , Dmitri V. Serov , 2001. Nemacheiline loaches from Central Vietnam with description of a new genus and 14 new species (Cypriniformes: Balitoridae). Ichthyol . Explor . Freshwater , Vol.12 , No.2 , pp.133 - 191 , 57 fig.
- 11 . Maurice Kottelat , 1996. Fishes of the Nam Theun basins and Car Bangfai Lao.PDpp.9 - 31 .

6. Insects in Phong Nha-Ke Bang National Park

Insect fauna has not been studied much in PNKB National Park. According to the results of statistical surveys of 369 species, 12 , 40  (Among the species recorded has 1 species *Troides aeacus* located in Vietnam's Red Book 2007). Group endemic has not been determined because the Indochina insects have not been fully explored.

The number of butterfly species discovered in Phong Nha-Ke Bang fully reflect the relative composition of species in the park, with 270 species occupy 1/4-1/5 of total species of butterfly discovered in Vietnam. This is also a group of insects is considered more abundant in Phong Nha - Ke Bang.

CHECKLIST 11 Insects in Phong Nha-Ke Bang National Park

No.	Scientific name	Dec. 32/2006	 2007	
	I. Lepidoptera			
	1. Papilionidae			
1	<i>Chilasa slateri</i>			
2	<i>Chilasa paradoxa telearchus</i>			
3	<i>Graphium agamemnon</i>			
4	<i>Graphium agetes</i>			
5	<i>Graphium antiphates</i>			
6	<i>Graphium aristeus</i>			
7	<i>Graphium chironides</i>			
8	<i>Graphium doson</i>			
9	<i>Graphium eurypylus</i>			
10	<i>Graphium macareus</i>			
11	<i>Graphium megarus</i>			
12	<i>Graphium sarpedon</i>			
13	<i>Graphium xenocles</i>			
14	<i>Lamproptera curius</i>			
15	<i>Lamproptera meges virescens</i>			
16	<i>Papilio demoleus</i>			
17	<i>Papilio dialis doddsi</i>			
18	<i>Papilio helenus</i>			
19	<i>Papilio mahadeva</i>			
20	<i>Papilio memnon agenor</i>			
21	<i>Papilio nephelus chaon</i>			
22	<i>Papilio paris</i>			
23	<i>Papilio polyctor</i>			

No.	Scientific name	Decr. 32/2006	2007	
24	<i>Papilio polytes romulus</i>			
25	<i>Papilio protenor</i>			
26	<i>Papilio rhetenor</i>			
27	<i>Troides aeacus</i>		VU	
	2. Pieridae			
28	<i>Appias albina</i>			
29	<i>Appias indra</i>			
30	<i>Appias lalage</i>			
31	<i>Appias lalassis</i>			
32	<i>Appias lyncida</i>			
33	<i>Appias nero</i>			
34	<i>Appias olferna</i>			
35	<i>Castalius rosimon</i>			
36	<i>Catopsilia pomona</i>			
37	<i>Catopsilia scylla</i>			
38	<i>Cepora nadina</i>			
39	<i>Cepora nerissa</i>			
40	<i>Delias hyparete</i>			
41	<i>Dercas lycorias</i>			
42	<i>Dercas verhuelli</i>			
43	<i>Eurema andersoni</i>			
44	<i>Eurema blanda</i>			
45	<i>Eurema hecabe</i>			
46	<i>Eurema novapallida</i>			
47	<i>Gandaca harina</i>			
48	<i>Hebomoia glaucippe</i>			
49	<i>Ixias pyrene</i>			
50	<i>Leptosia nina</i>			
51	<i>Pieris canidia</i>			
52	<i>Pieris rapae</i>			
53	<i>Prioneris philonome</i>			
54	<i>Prioneris thestylis</i>			
	1. Danaidae			
55	<i>Danaus chrysippus</i>			
56	<i>Danaus genutia</i>			
57	<i>Euploea aglea</i>			
58	<i>Euploea camaralzeman</i>			
59	<i>Euploea core</i>			
60	<i>Euploea eunica</i>			
61	<i>Euploea klugii</i>			
62	<i>Euploea modesta</i>			

No.	Scientific name	Dcr. 32/2006	2007	
63	<i>Euploea mulciber</i>			
64	<i>Euploea radamanthus</i>			
65	<i>Euploea sylvester</i>			
66	<i>Euploea tulliolus</i>			
67	<i>Parantica aglea</i>			
68	<i>Parantica melaneus</i>			
69	<i>Trumala gautamei</i>			
70	<i>Tirumala limniacea</i>			
71	<i>Tirumala septentrionis</i>			
	2. Acraeidae			
72	<i>Acraea issoria</i>			
73	<i>Acraea violae</i>			
	3. Satyridae			
74	<i>Coelites nothis</i>			
75	<i>Elymnias casiphone</i>			
76	<i>Elymnias hypermnestra</i>			
77	<i>Elymnias patna</i>			
78	<i>Lethe confusa</i>			
79	<i>Lethe mekara</i>			
80	<i>Lethe verma</i>			
81	<i>Melanitis leda</i>			
82	<i>Melanites phedima</i>			
83	<i>Mycalesis annamitica</i>			
84	<i>Mycalesis deficiens</i>			
85	<i>Mycalesis inopia</i>			
86	<i>Mycalesis intermedica</i>			
87	<i>Mycalesis mystes</i>			
88	<i>Mycalesis siamica</i>			
89	<i>Mycalesis zonata</i>			
90	<i>Mycalesis spp.</i>			
91	<i>Orsotriaena medus</i>			
92	<i>Penthema darlisa</i>			
93	<i>Ragadia crisilda</i>			
94	<i>Ypthima baldus</i>			
95	<i>Ypthima huebneri</i>			
96	<i>Ypthima imitans</i>			
97	<i>Ypthima sp</i>			
	4. Amathusiidae			
98	<i>Aemona tonkinensis</i>			
99	<i>Faunis canens</i>			
100	<i>Faunis eumeus</i>			

No.	Scientific name	Decr. 32/2006	2007	
101	<i>Sticopthalma fruhstorferi</i>			
102	<i>Thaumartis diores</i>			
103	<i>Thauria lathyi</i>			
	5. Libytheidae			
104	<i>Libythea myrrha</i>			
105	<i>Libythea geoffroyi</i>			
	6. Nymphalidae			
106	<i>Athyma cama</i>			
107	<i>Athyma nefte</i>			
108	<i>Athyma ranga</i>			
109	<i>Athyma selenophora</i>			
110	<i>Cethosia biblis</i>			
111	<i>Cethosia cyane</i>			
112	<i>Charaxes bernardus</i>			
113	<i>Charaxes aristogiton</i>			
114	<i>Charaxes kahruba</i>			
115	<i>Charaxes marmax</i>			
116	<i>Chersonesia risa</i>			
117	<i>Cirrochroea tyche</i>			
118	<i>Cupha eurymanthis</i>			
119	<i>Cynitia cocytus</i>			
120	<i>Cynitia telchinia</i>			
121	<i>Cyrestsis cocles</i>			
122	<i>Cyrestsis themire</i>			
123	<i>Cyrestsis thyodamus</i>			
124	<i>Doleschallia bisaltide</i>			
125	<i>Eulacera osteria</i>			
126	<i>Euripus nyctelius</i>			
127	<i>Euthalia monina</i>			
128	<i>Herona marathus</i>			
129	<i>Hestina nama</i>			
130	<i>Hypolymnas bolina</i>			
131	<i>Junonia almana</i>			
132	<i>Junonia atlites</i>			
133	<i>Junonia hierta</i>			
134	<i>Junonia iphita</i>			
135	<i>Junonia lemonias</i>			
136	<i>Lassipa heliodore</i>			
137	<i>Lassipa monata</i>			

No.	Scientific name	Dec. 32/2006	2007	
138	<i>Lexias dirtea</i>			
139	<i>Lexias cyanipardus</i>			
140	<i>Neptis clinia</i>			
141	<i>Neptis hylas</i>			
142	<i>Neptis nata</i>			
143	<i>Neptis sappho astola</i>			
144	<i>Neptis soma</i>			
145	<i>Pantoporia sandaka</i>			
146	<i>Phaedyma columella</i>			
147	<i>Phalanta phalanta</i>			
148	<i>Polyura eudamippus</i>			
149	<i>Pseudoergolis wedah</i>			
150	<i>Rohana tonkiniana</i>			
151	<i>Stibochiona nicea</i>			
152	<i>Symbrenthia hypselis</i>			
153	<i>Symbrenthia lilaea</i>			
154	<i>Symbrenthia javanus</i>			
155	<i>Vagrans egista</i>			
156	<i>Vindula erota</i>			
	7. Riodinidae			
157	<i>Abirasa echerius</i>			
158	<i>Abirasa fylla</i>			
159	<i>Abirasa neophron</i>			
160	<i>Stiboges nymphidia</i>			
161	<i>Taxila dora</i>			
162	<i>Zemeros flegyas</i>			
	8. Lycaenidae			
163	<i>Acytolepis puspa</i>			
164	<i>Allotunis substrigosus</i>			
165	<i>Amblypodia anita</i>			
166	<i>Anthene emolus</i>			
167	<i>Anthene lycaenina</i>			
168	<i>Arhopala aida</i>			
169	<i>Arhopala ammonides</i>			
170	<i>Arhopala khamti</i>			
171	<i>Caleta elna</i>			
172	<i>Caleta roxus</i>			
173	<i>Catochrysops panormus</i>			
174	<i>Celastrina lavendularis</i>			
175	<i>Curetis bulisi</i>			
176	<i>Heliophorus kohimensis</i>			

No.	Scientific name	Dec. 32/2006	2007	
177	<i>Heliophorus sp</i>			
178	<i>Jamides alecto</i>			
179	<i>Jamides brochus</i>			
180	<i>Jamides celeno</i>			
181	<i>Jamides elpis</i>			
182	<i>Mahathala ameria</i>			
183	<i>Megisba malaya</i>			
184	<i>Miletus ancon</i>			
185	<i>Nacaduba berenice</i>			
186	<i>Nacaduba beroe</i>			
187	<i>Nacaduba kurava</i>			
188	<i>Nacaduba hermus</i>			
189	<i>Neopithecops zalmora</i>			
190	<i>Petrelaea dana</i>			
191	<i>Pithecops fulgens</i>			
192	<i>Prosotas nora</i>			
193	<i>Prosotas pia</i>			
194	<i>Rapala sp</i>			
195	<i>Sinthusa nasaka</i>			
196	<i>Spindasis lohita</i>			
197	<i>Spindasis syama</i>			
198	<i>Surendra quercetorum</i>			
199	<i>Tajuiria maculata</i>			
200	<i>Thaduka multicaudata</i>			
201	<i>Ticherra acte</i>			
202	<i>Udara dilecta</i>			
203	<i>Udara placidula</i>			
204	<i>Yasoda tripunctata</i>			
205	<i>Zeltus amasa</i>			
206	<i>Zizeeria maha</i>			
	9. Hesperiidae			
207	<i>Abraximorpha davidii elfina</i>			
208	<i>Ancistroides nigrita</i>			
209	<i>Arnetta atkinson</i>			
210	<i>Asticopterus jama olivascens</i>			
211	<i>Baoris penicillata chapmani</i>			
212	<i>Bibasis jaina margana</i>			
213	<i>Badamia exclamationis</i>			
214	<i>Borbo cinnara</i>			
215	<i>Caltoris cormasa</i>			
216	<i>Celaenorrhinus incestus*</i>			

No.	Scientific name	Dec. 32/2006	2007	
217	<i>Celaenorrhinus kuznetsovi*</i>			
218	<i>Celaenorrhinus putra putra</i>			
219	<i>Celaenorrhinus nigricans nigricans</i>			
220	<i>Celaenorrhinus vietnamicus</i>			
221	<i>Choaspes plateni stigmata</i>			
222	<i>Coladenia agni agni</i>			
223	<i>Cupithea purreea</i>			
224	<i>Darpa pteria dealbata</i>			
225	<i>Darpa striata striata</i>			
226	<i>Erionota thrax thrax</i>			
227	<i>Erionota torus</i>			
228	<i>Halpe pelethronix pagaia</i>			
229	<i>Halpe porus</i>			
230	<i>Hasora chromus chromus</i>			
231	<i>Hasora taminatus bhavara</i>			
232	<i>Hasora malayana</i>			
233	<i>Hasora vitta indica</i>			
234	<i>Hyarotis adrastus praba</i>			
235	<i>Iambrix salsala salsala</i>			
236	<i>Isma bononia idyalis</i>			
237	<i>Koruthaialos butleri</i>			
238	<i>Koruthaialos rubecula hector</i>			
239	<i>Koruthaialos sindu sindu</i>			
240	<i>Lotongus sarala</i>			
241	<i>Mooreana trichoneura pralaya</i>			
242	<i>Notocrypta clavata theba</i>			
243	<i>Notocrypta curvifascia curvifascia</i>			
244	<i>Notocrypta feistamelii alysos</i>			
245	<i>Ochus subvittatus subvittatus</i>			
246	<i>Odontoptilum angulata angulata</i>			
247	<i>Parnara bada bada</i>			
248	<i>Pelopidas agna agna</i>			
249	<i>Pelopidas assamensis</i>			
250	<i>Pintara pinwilli pinwilli</i>			
251	<i>Pirdana hyela rudolphii</i>			
252	<i>Pithauria murdava</i>			
253	<i>Polytremis lubricans lubricans</i>			
254	<i>Potanthus ganda ganda</i>			
255	<i>Potanthus mingo ajax</i>			
256	<i>Poethanthus palnia palnia</i>			
257	<i>Poethanthus pava pava</i>			

No.	Scientific name	Dcr. 32/2006	2007	
258	<i>Poanthus trachala tytleri</i>			
259	<i>Pseudocoladenia dan fabia</i>			
260	<i>Pyroneura margherita miriam</i>			
261	<i>Scobura cephaloides kinka</i>			
262	<i>Seseria sp</i>			
263	<i>Stimula swinhoei swinhoei</i>			
264	<i>Suastus minuta aditia</i>			
265	<i>Tagiades litigiosa litigiosa</i>			
266	<i>Tagiades menaka menaka</i>			
267	<i>Telicota besta</i>			
268	<i>Telicota ohara jix</i>			
269	<i>Zographetus doxus</i>			
270	<i>Zographetus satwa</i>			
	II. Coleoptera			
	10. Chrysomelidae			
271	<i>Aspidomorpha dorsata</i>			
272	<i>Aspidomorpha fuscopunctata</i>			
273	<i>Aulacophora femoralis</i>			
274	<i>Basilepta bicolor</i>			
275	<i>Chiridopsis punctata</i>			
276	<i>Chlamisus sp</i>			
277	<i>Haltica cyanca</i>			
278	<i>Lacoptera quadrimaculata</i>			
279	<i>Lema cyanea</i>			
280	<i>Lema perplexa</i>			
281	<i>Lema sp1</i>			
282	<i>Lema sp2</i>			
283	<i>Monolepta signata</i>			
284	<i>Phaedon fulvescens</i>			
	11. Scarabaeidae			
285	<i>Anomala cuprea</i>			
286	<i>Anomala viridis</i>			
287	<i>Catharsius molossus</i>			
	12. Tenebrionidae			
288	<i>Cnodanonini spp</i>			
289	<i>Eucyrlus annulipes</i>			
290	<i>Gonocnemis sp</i>			
291	<i>Uloma sp</i>			
	13. Coccinellidae			
292	<i>sp</i>			
	14. Cerambycidae			

No.	Scientific name	Dcr. 32/2006	2007	
293	<i>Anoplophora chinensis macularia</i>			
	III.Orthoptera			
	15. Acrydiidae			
294	<i>Acrida chinensis</i>			
295	<i>Atractomorpha crenulata</i>			
296	<i>Chondracris rosea</i>			
297	<i>Oxya chinensis</i>			
298	<i>Oxya diminuta</i>			
299	<i>Phlaeaba antennata</i>			
300	<i>Phlaeaba infumata</i>			
301	<i>Phlaeaba panteli</i>			
302	<i>Plemoscirla sp</i>			
303	<i>Pseudores sp</i>			
304	<i>Spathosternum parmi</i>			
305	<i>Spathosternum prasiniferum</i>			
306	<i>T.O. szetschuansis</i>			
307	<i>Tagasta indica</i>			
308	<i>Tonkinacris decoratus</i>			
309	<i>Traulia orientalis</i>			
310	<i>Trilopphidia annulata annulata</i>			
311	<i>Tristria pisciforme</i>			
312	<i>Tulotropidius sp</i>			
	16. Tettigoniidae			
313	<i>Ducetia sp</i>			
314	<i>Euconocephalus thunbergii</i>			
	17. Gryllidae			
315	<i>Gryllotalpa sp</i>			
	IV.Dermaptera			
	18. Labiduridae			
316	<i>Anisolabis annulipes</i>			
317	<i>Anisolabis cavaleriei</i>			
	V.Hemiptera			
	19. Pentatomidae			
318	<i>Dalpada oculata</i>			
319	<i>Gonopsis coccinea</i>			
320	<i>Gonopsis sp</i>			
321	<i>Nezara viridula</i>			
	20. Nepidae			
322	<i>Laccotrephes ruber</i>			
	21. Plataspidae			
323	<i>Coptosoma cribrarium</i>			

No.	Scientific name	Decr. 32/2006	2007	
324	<i>Ponsina montana</i>			
	22. Lygaeidae			
325	<i>Lygaeus hospes</i>			
	VI.Homoptera			
	23. Jassidae			
326	<i>Petaloccephala sp</i>			
327	<i>Tettigoniella ferruginea</i>			
	24. Cercopidae			
328	<i>Clovia sp</i>			
329	<i>Periaman sp</i>			
330	<i>Ptyelus sexvittatus</i>			
	VII.Odonata			
	25. Agrionidae			
331	<i>sp</i>			
	26. Libelulidae			
332	<i>Crocothemis sp</i>			
333	<i>Orthetrum sabina</i>			
	VIII.Hymenoptera			
	27. Formicidae			
334	<i>Polyphacrys mayvi</i>			
335	<i>Oecophylla smaragdina</i>			
	28. Ichneumonidae			
336	<i>sp</i>			
	29. Halictidae			
337	<i>Halictus sp</i>			
338	<i>Nomia sp</i>			
	IX.Phasmaptera(Phasmatodea)			
	30. Phasmidae			
339	<i>sp</i>			
	X.Isoptera			
	31. Kalotermitidae			
340	<i>Cryptotermes domesticus</i>			
341	<i>Glyptotermes fuscus</i>			
	32. Rhinotermitidae			
342	<i>Coptotermes ceylonicus</i>			
343	<i>Coptotermes formosanus</i>			
344	<i>Reticulitermes chinensis</i>			
	33. Termitidae			
345	<i>Microtermes bugioni</i>			
346	<i>Odontotermes angustisnathus</i>			
347	<i>Odontotermes hainanensis</i>			

No.	Scientific name	Dcr. 32/2006	2007	
	XI. Diptera			
	34. Muscidae			
348	<i>Atherigona atripalpis</i>			
349	<i>Bdellolarynx snguinolentus</i>			
350	<i>Graphomyia maculata</i>			
351	<i>Gymnodia tonitruui</i>			
352	<i>Lispe orientalis</i>			
353	<i>Lyperosia irritans</i>			
354	<i>Musca domestica vicina</i>			
355	<i>Orthellia claripnensis</i>			
356	<i>Stomoxys calcitrans</i>			
	35. Calliphoridae			
357	<i>Acheatandrus rufifacies</i>			
358	<i>Chrysomyia bezziana</i>			
359	<i>Chrysomyia megacephala</i>			
360	<i>Lucilia bazini</i>			
	36. Drosophilidae			
361	<i>Drosophilla melanogaster</i>			
	37. Culicidae			
362	<i>Aedes aegypti</i>			
363	<i>Aedes albopictus</i>			
364	<i>Aedes laniger</i>			
365	<i>Anopheles aconitus</i>			
366	<i>Anopheles minimus</i>			
367	<i>Armigeres flavus</i>			
368	<i>Armigeres subalbatus</i>			
	XII. Mantoptera			
	38. Mantidae			
369	<i>Mantis religiosa</i>			

7. Cave invertebrates in Phong Nha-Ke Bang National Park

In 2011, the first time the fauna of cave invertebrate surveys. Group recorded 58 species, belonging to 7 classes, 22 of the 21 caves (Pham Dinh Sac, 2011). Of these, 31 taxa new to science: Araneae: 3 species, Pseudoscorpion: 4 species, Acarina: 2 species, Insecta: 8 species, Myriapoda: 12 species and Scorpionoides: 2 species. Due to time limitations, only the 31 taxa described just announced a new 1 - Vietbocap with 2 new species: Species Scorpion paradise - *Vietbocap thienduongensis* Lourenco & Pham and Scorpion Species scene - *Vietbocap canhi* Lourenco & Pham. Two species of scorpion is they Pseudochactidae, here are endemic area PN - KB caves and also the typical species.

CHECKLIST 12

Cave invertebrates in PN-KB National Park

No.	Class	Order	Family/species
1.	Arachnida	Araneae	Oonopidae
2.			Sparassidae
3.			Amaurobiidae
4.			Araneidae
5.			Ctenidae
6.			Gnaphosidae
7.			Pholcidae
8.			Linyphiidae
9.			Lycosidae
10.			Leptonetidae
11.			Symphytognathidae
12.			Telemidae
13.			Tetrablemmidae
14.			Theridiidae
15.		Scorpionida	<i>Vietbocap thienduongensis</i>
16.			<i>Vietbocap canhi</i>
17.		Opiliones	Stylocellidae
18.			Triaenonychidae
19.		Pseudoscorpionida	Chernetidae
20.			Chthoniidae
21.		Schizomida	Hubbardiidae
22.		Acarina	Uropodida
23.			Trombidoidea
24.	Crustacea	Isopoda	Armdillidae
25.			Philosciidae
26.			Styloniscidae
27.		Decapoda	Brachyura
28.	Mollusca	Gastropoda	Subulinidae

No.	Class	Order	Family/species
29.			Pupilloidea
30.	Insecta	Collembola	Entomobryidae
31.			Isotomidae
32.			Neanuridae
33.			Oncopoduridae
34.			Neelidae
35.		Orthoptera	Rhaphidophoridae
36.		Coleoptera	Carabidae
37.			Pselaphidae
38.			Staphylinidae
39.			Leiodidae
40.		Blattodea	Blattellidae
41.		Hemiptera	Cixiidae
42.		Psocoptera	Psilopcosidae
43.		Heteroptera	Reduviidae
44.		Lepidoptera	Tinaeidae
45.		Hymenoptera	Formicidae
46.		Diptera	Brachycera
47.	Entognatha	Diplura	Campodeidae
48.	Myriapoda	Diplopoda	Sinocallipodidae
49.			Cambalopsidae
50.			Haplodesmidae
51.			Polydesmidae
52.			Opisotretidae
53.			Paradoxosomatidae
54.			Glomeridae
55.			Pyrgodesmidae
56.		Chilopoda	Scutigerae
57.	Oligochaeta	Haplotaxida	Megascolecidae
58.			Octochaetidae



2013 2025

2012

2013 2025

Pursuant to the Law on Organizing People's Council and People's Committee
Pursuant to the Law on Forest Protection and Development dated 26 November 2003;

Pursuant to the Decree N° 23/2006/ND-CP dated 03 March 2006 by the Government of Vietnam enforcing the Law on Forest Protection and Development;

Pursuant to the Decree N° 117/2010/ND-CP dated 24 December 2010 by the Government of Vietnam on organization and management of special use forest system;

Pursuant to the Decision N°186/2006/QĐ-TTg dated 14 August 2006 by the Prime Minister regulating the forest management regulations;

Pursuant to the International Convention on World Natural and Cultural Heritage Sites and Operational Guidelines for implementing the International Convention on World Heritage by UNESCO's World Heritage Center dated November 2011;

Pursuant to the Decision N° 18/2007/QĐ-UBND dated 16 August 2007 by Quang Binh Provincial People's Committee regulating the management regulations of Phong Nha Ke Bang National Park;

Pursuant to the Decision N° 36/2012-UBND dated 28 December 2012 by Quang Binh Provincial People's Committee regulating functions, mandates, rights and organizational structure of Phong Nha Ke Bang National Park;

Pursuant to the Decision N° 263/QĐ-UBND dated 14 February 2012 by Quang Binh Provincial People's Committee approving the Annual Work-plan and Budget Plan 2012 for KfW Component, Nature Conservation and Sustainable Natural Resources Management in Phong Nha Ke Bang National Park Region Project;

At the request of the Department of Agriculture and Rural Development in the Decision N° 369/SNN-KL dated 22 March 2013,

1. Approve the Strategic Management Plan 2013 – 2025 for Phong Nha Ke Bang National Park with the basic content as follows:

1. Name of plan: Strategic Management Plan 2013 – 2025 for Phong Nha Ke Bang National Park, World Heritage Site

2. Objectives: Provide foundations for management of Phong Nha Ke Bang National Park and its buffer-zone in theory and guidelines for development of management

prescriptions in accordance with the World Heritage Convention and Operational Guideline for implementation of this Convention.

3. Introduction on the Strategic Management Plan

- Purpose of the Strategic Management Plan
- Preparation and planning process
- World heritage background
- Ownership and control
- World Heritage Management Obligations
- World Heritage Values
- Other Heritage Values
- Management Background and Regional Setting
- Threats and Challenges
- Necessity of management planning

4. Management strategies

a. Overall management objectives

b. Main issues

- Protecting geo-diversity
- Conserving biodiversity
- Protecting historical and cultural values
- Protecting and enhancing integrity
- Appropriate presentation of heritage and tourism management
- Addressing livelihood issues
- Developing capacity and supporting management

2. Assign Phong Nha Ke Bang National Park Management Board to cooperate with local authorities and relevant agencies/entities to implement the Strategic Management Plan as per regulations as well as assign the Project Management Unit of “Nature Conservation and Sustainable Natural Resources Management in Phong Nha Ke Bang National Park Region Project” to support Phong Nha Ke Bang National Park Management Board to implement the Strategic Management Plan within the framework of the project.

3. Head of the Provincial People’s Committee’s Headquarter, Director of Phong Nha Ke Bang National Park Management Board, Director of Nature Conservation and Sustainable Natural Resource Management in Phong Nha Ke Bang National Park Region Project Management Unit and Directors/Leaders from line departments, local authorities and relevant agencies/entities should be responsible for enforcing this Decision ./.

To:

- As per the Article 3;
- PPC Chairman and Vice-chairmen
- Leaders of PPC’s Headquarter
- For files: VT, CVKTN.

(Signed and Stamped)

ABBREVIATIONS

BZDP	Buffer Zone Development Plan
CBT	Community Based Tourism
CBfT	Community Benefit Tourism
CPC	Commune Peoples' Committee
DARD	Department of Agriculture and Rural Development
DPC	District Peoples' Committee
EIA	Environmental Impact Assessment
GTZ	Gesellschaft für Technische Zusammenarbeit
HCMC	Ho Chi Minh City
HRD	Human Resource Development
IUCN	World Conservation Union (formerly the International Union for Conservation of Nature)
KfW	Kreditanstalt für Wiederaufbau
LAC	Limits of Acceptable Change
Lao PDR	Lao Peoples' Democratic Republic
MARD	Ministry of Agriculture and Rural Development
MCST	Ministry of Culture, Sports and Tourism
NBCA	Lao PDR National Biodiversity Conservation Area
NTFP	non-timber forest product
ODA	Overseas Development Assistance/Agency
PNKB	Phong Nha - Ke Bang
PNKB NP	Phong Nha - Ke Bang National Park
POMP	Park Operational Management Plan (POMP)
PPC	Provincial Peoples' Committee
SEDP	Socio-Economic Development Plan
SEIA	Strategic Environmental Impact Assessment
STDP	Sustainable Tourism Development Plan
SUF	Special Use Forest
TOR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WHS	World Heritage Site



THE MANAGEMENT VISION

That the world heritage values and other natural, cultural and historical values of Phong Nha - Ke Bang National Park are promoted and conserved with integrity; local communities' lives are improved; tourism to the park region satisfies international standards; and park management meets the requirements of a World Heritage Site.

TABLE OF CONTENT

1. INTRODUCTION.....	7
1.1 PURPOSE OF THE STRATEGIC MANAGEMENT PLAN	8
1.2 PREPARATION AND PLANNING PROCESS	9
1.3 WORLD HERITAGE BACKGROUND	10
1.4 OWNERSHIP AND CONTROL.....	10
1.5 WORLD HERITAGE MANAGEMENT OBLIGATIONS	11
1.6 WORLD HERITAGE VALUES	11
1.7 OTHER HERITAGE VALUES	13
1.8 MANAGEMENT BACKGROUND AND REGIONAL SETTING.....	14
1.8.1 Regional Context.....	14
1.8.2 Land Tenure and Use Rights.....	15
1.8.3 Land Use	16
1.8.4 Administration	17
1.8.5 Legal Basis.....	18
1.9 THREATS AND CHALLENGES	19
1.10 NECESSITY OF MANAGEMENT PLANNING	17
2. MANAGEMENT STRATEGIES.....	18
2.1 OVERALL MANAGEMENT OBJECTIVES.....	18
2.2 MAIN ISSUES.....	19
2.2.1 Protecting geodiversity	20
2.2.2 Conserving biodiversity and evolutionary processes.....	22
2.2.3 Protecting historical and cultural values	25
2.2.4 Protecting and enhancing integrity	27
2.2.5 Appropriate presentation of heritage and tourism management.....	30
2.2.6 Addressing livelihoods issues	33
2.2.7 Developing capacity and supporting management.....	36
SELECTED REFERENCES	40
ANNEXES	41

Annex I.	Brief history of Phong Nha- Ke Bang National Park	42
Annex II.	Recognized World Heritage Values: Geomorphology and Earth history.....	43
Annex III.	Potential World Heritage Values: Evolutionary Processes and Biodiversity	44
Annex IV.	Other Heritage Values	47
Annex V.	Institutional Framework	52
Annex VI.	Organisation and management.....	53
Annex VII.	Human Population.....	54
Annex VIII.	Inholdings	56
Annex IX.	Relevant Laws and Regulations	57
Annex X.	Environmental Impact Assessment Process.....	59
Annex XI.	Analysis of Threats.....	60
Annex XII.	Regulations for Sub-Zones of the National Park.....	65
Annex XIII.	Guidelines for a Visitor Management Plan for PNKB NP WHS	68
Annex XIV.	Cave Management and Cave Management Prescriptions	69
Annex XV.	UNESCO Man and the Biosphere Program and Biosphere Reserves	72
Annex XVI.	Considerations for review of all tourism plans	73
Annex XVII.	Forest Conservation and Investment Contracts	74
Annex XVIII.	Training Plan Summary	77
Annex XIX.	Design of Monitoring Protocols	78
Annex XX.	Monitoring Plan Summary.....	79
	List of key contributors and participants in the planning process	82
	PROJECT SUPPORT	84



The entrance to Phong Nha Cave. Photo: Graeme L. Worboys.

1. INTRODUCTION

This Strategic Management Plan covers the complete Phong Nha – Ke Bang National Park (PNKB NP) Region. The PNKB NP Region comprises an area that includes the entirety of the PNKB NP (the World Heritage Site (WHS) and Extension Area) as well as 13 communes in three districts that border the National Park boundaries (the Buffer Zone).

The area managed by the PNKB National Park Management Board covers 123,326¹ hectares (ha), which is divided into three functional areas: a) Strictly Protected Area: 102,466 ha, b) Ecological Restoration Area: 17,449 ha and c) Administrative and Service Area: 3,411 ha. Of this area, 85,754 ha was recognized as a National Park by the Vietnamese government in 2001 and as a World Heritage Site by the UNESCO World Heritage Committee in 2003. An extension of 37,572 ha, already protected and zoned as Strictly Protected Area, has been proposed as an addition to the National Park and World Heritage Site.

World Heritage listing is the highest level of international recognition that may be afforded to an area, acknowledging its outstanding universal values and global significance. PNKB was inscribed on the list of World Heritage sites on the basis of its outstanding natural values. The karst formation of Phong Nha-Ke Bang National Park has evolved since the Paleozoic (some 400 million years ago) and so is believed to be the oldest major karst area in Asia. The vast karst area, extending across the border into the Lao People's Democratic Republic, contains spectacular formations including over 104 km of caves and underground rivers, making it one of the most outstanding limestone karst ecosystems in the world. Karst formation processes have led to the creation of a variety of cave types, including underground rivers, dry caves, terraced caves, suspended caves, dendritic caves and intersecting caves.

PNKB Park and adjacent forest land support an enormous number of species, including over 2,851 vascular plant species and over 755 vertebrate species, including 113 mammals, 302 birds, 81 reptiles and amphibians, and 72 fish. Over 70 of these vertebrate species are considered globally threatened, and ten primate species and subspecies are known from the Park. The region supports a large number of endemic and relict species, such as Soala, Giant- Antlered Muntjac and Annamite Striped Rabbit. Several of these species are specialists on karst or cave ecosystems, such as the Laotian Rock Rat, Hatinh Langur, Sooty Babbler, Annamite Flying Frog and two species of blind cave scorpions (the first discovered in mainland Asia). These endemic and relict species are the result of evolutionary processes that are still ongoing in the region.

Phong Nha – Ke Bang region has major historical significance because of the role that it played during the long war with America. Many routes of the Ho Chi Minh Trail and Victorious Road 20 run through the Park, and its caves and forests served as strategic bases and refuges during the war. The region is rich in stories, both tragic and heroic, and has deep meaning for the people of Vietnam.

¹ Letter dated 16 Feb. 2012 from the Quang Bihn Provincial People's Committee to the PNKB National Park Management Board.

1.1 PURPOSE OF THE STRATEGIC MANAGEMENT PLAN

This Strategic Management Plan has been prepared to assist in meeting Vietnam's international responsibilities under the World Heritage Convention. It will ensure that appropriate consideration is given to the PNKB National Park World Heritage site's Outstanding Universal Values by government authorities when making decisions and by managers when developing management prescriptions for the Park and the surrounding area. It will also ensure that these actions are taken in a coordinated way, consistent with the mission of the Park. This document also serves as a commitment of the management agencies to the long-term survival of PNKB National Park and the protection of its values.

The Strategic Management Plan is part of an overall planning framework for the World Heritage Site and surrounding region. It does not attempt to provide details of background and management actions. Detailed management prescriptions and process for implementation are provided in other documents, particularly the three planning documents developed in parallel with the Strategic Management Plan: The National Park Operational Management Plan (POMP), The Sustainable Tourism Development Plan (STDP) and the Buffer Zone Development Plan (BZDP). Diagram 1 provides a summary.

The Strategic Management Plan outlines strategies proposed for protection and compatible development of the entire PNKB region over the next 12 years. Under this framework, the National Park Management Board will undertake routine management of the National Park, while local government will promote development and regulate activities in the Buffer Zone, all under the supervision of the Quang Binh Provincial People's Committee. The strategic management plan can serve as a foundation and guide for developing the operational management plan and other plans that affect the National Park. The Plan will ensure a greater level of consistency with the mission of the World Heritage Site, and improve coordination between the Park and relevant government agencies in the Province. The Strategic Management Plan is not a legal document in its own right, but by agreeing to the content of this document, relevant agencies make a commitment to abide by its principles and to implement the strategies as outlined.

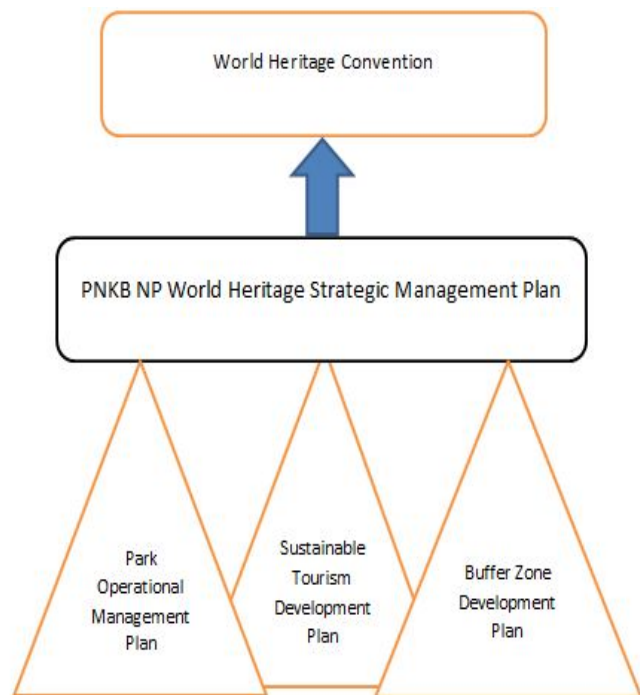


Figure 1: A summary of PNKN National Park Strategic Plan structure

1.2 PREPARATION AND PLANNING PROCESS

The Strategic Management Plan is designed to ensure that management within the National Park and development activities within the surrounding region are complementary, coordinated and consistent with the mission of the World Heritage Site. It has been prepared with the funding of the Nature Conservation and Sustainable Management of Natural Resources for the Phong Nha Ke Bang National Park Region Project, acting as a foundation for the Provincial People's Committee to instruct and guide Phong Nha - Ke Bang National Park Management Unit and other government agencies to issue appropriate policies and formulate management activities.

Preparation of the Strategic Management Plan has been guided by the World Heritage Convention and the Statements of Outstanding Universal Values prepared for World Heritage nomination, as well as all relevant government decrees, decisions and circulars. The Strategic Management Plan is based on information in plans already developed or under development by the Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha - Ke Bang National Park Region Project, particularly the Sustainable Tourism Development Plan (completed), the National Park Operational Management Plan and the Buffer Zone Development Plan (under development as of 2012). These three plans are the result of extensive and intensive surveys and consultation, with participation of representatives of local government and members of the communities living in the Park and Buffer Zone (summarized in the BZDP), participation of representatives of stakeholders from private enterprise (in the STDP), and participation of line staff of the National Park (in the POMP).



Stalactite and stalagmite grow towards each other inside Paradise Cave, one of the most popular sites in Phong Nha – Ke Bang National Park World Heritage Site.

The Strategic Management Plan will be current until 2025 and will be reviewed periodically. This timeframe has been chosen as a realistic medium-term planning horizon that provides a realistic period within which the identified management responses can be implemented, and their impacts and effectiveness evaluated.

1.3 WORLD HERITAGE BACKGROUND

The World Heritage Convention was established under the auspices of the United Nations in 1972. It aims to promote cooperation among nations to protect the world's natural and cultural heritage. By ratifying the Convention on 19 October 1987, Vietnam became one of the 189 countries to commit to the identification, protection, conservation and suitable presentation of World Heritage sites.

The World Heritage Convention is administered by the World Heritage Committee, composed of 21 member nations elected from among the state parties to the Convention. Under the Convention, a list of "properties" having outstanding universal value has been established; the World Heritage List. Only the national government of a country that is a party to the Convention may nominate an area within its jurisdiction for World Heritage listing. The World Heritage List included 962 sites worldwide at the time of writing, including 745 cultural, 188 natural and 29 mixed properties in 157 States Parties. The list only includes sites of global importance, such as the Pyramids of Egypt, the Grand Canyon in the USA, the Great Barrier Reef in Australia and Mount Everest, the highest mountain in the world. There are currently seven World Heritage sites in Vietnam.

In order to qualify for World Heritage listing, a nominated site must meet specific natural and/or cultural criteria that demonstrate outstanding universal value. The site must also possess sufficient integrity, meeting strict conditions before it can be listed. A listed site may be assigned to the list of Sites in Danger or even removed from listing if it loses its integrity or no longer meets the criterion for which it was listed².

1.4 OWNERSHIP AND CONTROL

World Heritage listing does not affect ownership rights or control of World Heritage properties. In the case of Phong Nha-Ke Bang National Park, the Park remains under the jurisdiction of the Provincial People's Committee of Quang Binh Province and is managed by government agencies in accordance with relevant decrees, decisions and circulars.

The government agency in Vietnam directly responsible for management of the National Park is the PNKB National Park Management Board, which reports directly to the People's Committee of Quang Binh Province.

² For more information, see <http://whc.unesco.org/>

1.5 WORLD HERITAGE MANAGEMENT OBLIGATIONS

The government of Vietnam recognizes its duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of all of its cultural and natural World Heritage sites. Through Article 5 of the World Heritage Convention, the government has made an international commitment to do all it can to this end, to the utmost of its own resources.

In order to ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory, each State Party to this Convention shall endeavor, in so far as possible, and as appropriate for each country:

- (a) to adopt a general policy which aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programs;
- (b) to set up within its territories, where such services do not exist, one or more services for the protection, conservation and presentation of the cultural and natural heritage with an appropriate staff and possessing the means to discharge their functions;
- (c) to develop scientific and technical studies and research and to work out such operating methods as will make the State capable of counteracting the dangers that threaten its cultural or natural heritage;
- (d) to take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage; and
- (e) to foster the establishment or development of national or regional centers for training in the protection, conservation and presentation of the cultural and natural heritage and to encourage scientific research in this field.

1.6 WORLD HERITAGE VALUES

World Heritage Values of PNKB NP are outstanding universal values that are directly related to the criteria for which an area is included on the World Heritage List.

PNKB National Park World Heritage Site was inscribed on the World Heritage List in 2003 because it satisfies World Heritage Natural Criterion viii Geomorphology and Earth History as

- an outstanding example representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features (Criterion vii).

Phong Nha – Ke Bang, together with Hin Namno karst (in Lao PDR) is probably one of the finest and most distinctive examples of a complex karst landform in Southeast Asia. The karst formation of PNKB NP WHS has evolved since the Paleozoic (some 400 million years ago) and so is believed to be the oldest major karst area in Asia. The vast karst area contains spectacular formations including over 104 km of caves and underground rivers, making it one of the most outstanding limestone karst ecosystems in the world. The karst formation processes have led to the creation of a variety of cave types, including underground rivers, dry caves, terraced caves, suspended caves, dendritic caves and intersecting caves.

Phong Nha-Ke Bang NP WHS has other outstanding values that have the potential to qualify for World Heritage listing in their own right. It has recently been proposed that PNKB National Park, in its extended form, should also be nominated for World Heritage listing under World Heritage Natural Criterion ix as

- an outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

PNKB National Park protects a large portion one of the best preserved tracks of limestone forest in the central Truong Son range, which has been recognized as a critical landscape of the Greater Annamites Global 200 Bioregion. Many endemic and near-endemic vertebrates are associated with this ecoregion, which has been identified as one of the greatest concentrations of endemic species in a continental setting found anywhere³. PNKB is the key protected area in the Central Indochina Limestone Landscape, the most extensive limestone area holding the most distinctive limestone community in the Greater Annamites Ecoregion. This area is critical for the conservation of primate species and limestone specialist species. The persistence of more primitive or relict species could be attributed to long-term habitat stability in the region, the effect of a stable climate and of regular uplifts over a long period maintaining a suitable distribution of habitat types. Central Vietnam's uplands and associated lowland areas appears to be a focal point or hotspot of endemism within mainland Southeast Asia. Cave fauna in particular show the striking effect of isolation on species divergence.

PNKB NP WHS should also be recognized for its global importance in *in-situ* conservation of biological diversity under World Heritage Natural Criterion x as

- containing the most important and significant natural habitats for *in-situ* conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

Of perhaps the greatest conservation significance are several species found at the site that are endemic to this part of central Vietnam and Laos. Almost 94% of the property is forested, and 84% of this is old-growth forest. The property is also recognized as part of a Global 200 priority ecoregion, an Indo-Burma global biodiversity hotspot and an Endemic Bird Area that is not otherwise represented on the World Heritage List.

³WWF (2012) About the Annamites Ecoregion. http://wwf.panda.org/what_we_do/where_we_work/project/projects_in_depth/greater_annamites_ecoregion/about_the_area/ Downloaded 18 August 2012.

1.7 OTHER HERITAGE VALUES

Apart from the features which are recognized as having World Heritage value, Phong Nha – Ke Bang has numerous other outstanding values that complement and interface with its World Heritage values. Protection of all of these values is an integral part of managing PNKB NP WHS and the greater PNKB region.

Historic and Archeological Values: PNKB NP WHS includes numerous places of great historic and archeological significance. A long history of human occupation has left many archeological relicts, such as Cham inscriptions inside caves, PNKB became a key theatre during the US-Vietnam War. The Ho Chi Minh trail, including Road 20 to Lao PDR and associated trails in and near the Park, were key transportation routes for the war effort.

Indigenous Culture and Cultural Diversity: Approximately 11,000 inhabitants of the Phong Nha - Ke Bang region are from ethnic minorities. Much of their traditional way of life is linked with the use of natural resources from the forests of Phong Nha- Ke Bang, and these communities still retain significant indigenous knowledge about the caves, the forest and the uses of its species.

Recreation and Tourism: Because of the intrinsic beauty of its caves and of the forested karst landscape, all easily accessible from major population centres in Vietnam, PNKB has outstanding recreational values. PNKB provides opportunities for quality recreation and tourism experiences that are increasingly in demand, and rare by world standards.

Social and Economic: The regional economy surrounding PNKB is receiving increasing support from tourism. The Park has considerable social and economic value and contributes directly and indirectly to employment, to income and to government revenue in the region. Visitation to the PNKB NP Region has increased considerably recently from approximately 80,582 in 1999 to over 366,753 in 2011 reflecting the Park's increasing importance as a destination for both day trips and longer stays..

Research and Education: The complexity of its geomorphology and the richness of its biodiversity and ecosystems make the PNKB NP WHS an ideal area for research and education.

Scenic, Aesthetic, Inspirational and Existence: The dramatic karst landscape of PNKB WHS provides a scenic landscape of extraordinary beauty full of inspiring wonders. Simply knowing that wild areas such as these exist and are protected forever is a value for many people throughout the world, even among those who may never be fortunate enough to visit the WHS.



Inside Son Doong Cave, the world's largest cave by volume.
Photo: Carsten Peter for National Geographic.

1.8 MANAGEMENT BACKGROUND AND REGIONAL SETTING

1.8.1 Regional Context

The PNKB NP World Heritage Site property as currently gazetted consists of 85,754 ha, with a total contiguous protected area covering 123,326 ha. The PNKB NP Region is located in the western part of the Quang Binh Province, about 45 km by road from the provincial capital Dong Hoi City, 370 km south of Hanoi and 765 km north of Ho Chi Minh City as the crow flies.

The PNKB NP WHS is situated in the narrowest portion of Vietnam between Laos and the Tonkin Gulf, making it possible to visit the Park in the morning and return to the coastal beach by evening. The Ho Chi Minh West Highway traverses the Park from northeast to southwest. While not heavily travelled, this is an important security road for use in cases of flooding or other interruptions to roads in the lowlands. National Road 20, a narrow road northeast to southwest through the middle of the Park, connects Dong Hoi directly with Savanakhet in Lao PDR. This road is considered important for regional development by provincial authorities. These all-season roads provide access for tourists to most of the open tourist sites in the Park.

Most visitors to PNKB arrive via the provincial capital Dong Hoi or from nearby Hue, which are served by train and bus service along the major north- south transportation corridor. Dong Hoi and Hue also have airports that receive daily flights from Hanoi and Ho Chi Minh City. The region is one of the most popular tourist destinations in central Vietnam. Over the past decade, visitor numbers to Quang Binh Province have grown significantly from approximately 135,000 in 1999 to nearly 961,425 in 2011. Domestic visitors make up the majority of these visitors and only approximately 2.7% were of international origin.

The PNKB NP is contiguous along its north-western boundary with Hin Namno National Biodiversity Conservation in Khammoune Province Lao PDR. Together, these two protected areas comprise the largest area of contiguous protected karst habitat in mainland Southeast Asia, protecting a critical part of the Central Indochinese Limestone Landscape. The Buffer Zone surrounds PNKB NP on all other sides. The extended Buffer Zone includes 11 communes adjacent to the National Park and two additional communes, one of which is adjacent to Hin Namno NBCA in Lao PDR (and thus important for connectivity of PNKB habitats).

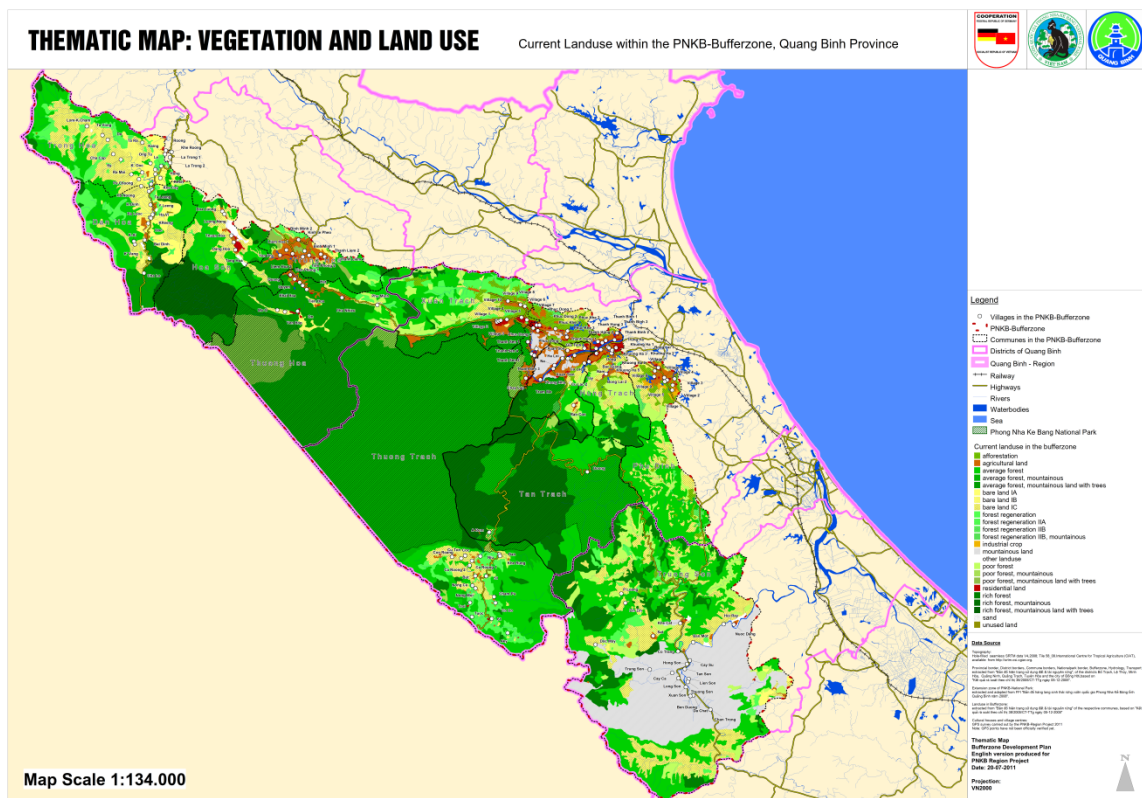
1.8.2 Land Tenure and Use Rights

The PNKB Region is made up of the PNKB National Park and a surrounding Buffer Zone. The extended Buffer Zone of 13 nearby communes covers a total area of 220,950.77 ha and supports over 65,483 people, most of whom are small-hold farmers.

The PNKB NP area, including the World Heritage Property and the newly added extension, is all managed as “special-use forest” land, protected under Vietnamese forest law and managed by the National Park Management Board. In the Buffer Zone, except for a few small minority communities practicing shifting cultivation, usufruct for all designated agricultural land is allocated to households through land use certificates. Several State Forest Enterprises operate in the Buffer Zone and have forest use rights.

There are currently two villages with 78 households and 444 ethnic minority people living inside the PNKB NP WHS property. Nothing in this document is intended to diminish in any way their land rights or user rights, either legally recognized or customary.

A Tourism Area within the NP WHS Ecological Restoration Area has been leased to a private company on a 50 year lease until 2061. The area provided includes 55 hectares of protected forest land and the entire karst of the Paradise Cave and Mother Embracing Child Cave.



1.8.3 Land Use

The total perimeter of PNKB National Park and extension area is over 200 km long. With the exception of the boundary contiguous with Hin Namno NBCA in Lao PDR, this perimeter is adjacent to lands that are used by local people. The activities of these people have the potential to significantly impact the values of PNKB NP WHS and its Outstanding Universal Values.

The dominant resource and land use throughout the Buffer Zone around the National Park and extension area is forest land and forestry, covering 202,972 ha. Of this total, more than half (108,791 ha) is under the management of state forest enterprises and Protection Forest Management Boards, and the remainder (94,181 ha) is managed by the communes of the Buffer Zone.

As of 2012, the Buffer Zone included 154 villages and hamlets in 13 communes in three districts, with 14,114 households comprising 64,243 people. The total area of agricultural land in the PNKB NP Region is about 7,074 ha, resulting in major constraints for local livelihoods. Only a fourth (1,255 ha) of this is irrigated land, explaining the generally low productivity. The average agricultural land per household is 0.50 ha. Unused land (barren forest land and fallow agricultural land) and other land amounts to an estimated 8,230 ha.

Kinh settlers in the lowlands of the Buffer Zone rely on an agricultural base of intensive irrigated rice production combined with livestock, home gardens and a small upland component. Ethnic minorities in the region used to generate their income mainly from shifting cultivation and forest resources extraction in the hilly areas. However, due to sedentarisation programmes, this livelihood strategy has become less important and now only involves about 2,000 households in the greater PNKB Region. Still, these households typically continue to rely on forest resources as their primary year-round food and income source. Ethnic minority groups often receive rice subsidies sometime associated with annual forest protection contracts.

Both intensive and shifting livelihood systems are under serious pressure due to high population growth and medium to poor soil fertility, as well as very limited availability of agricultural and forest land in general. The latter point is partly a result of land reallocation during the creation of the National Park. As a result there is a high poverty rate in some communes of the Buffer Zone. With few alternatives, many people in the PNKB Region rely on illegal logging, hunting, and collection of forest products to supplement their incomes, creating a significant threat to the World Heritage values of the Park, particularly its forests and their biodiversity.

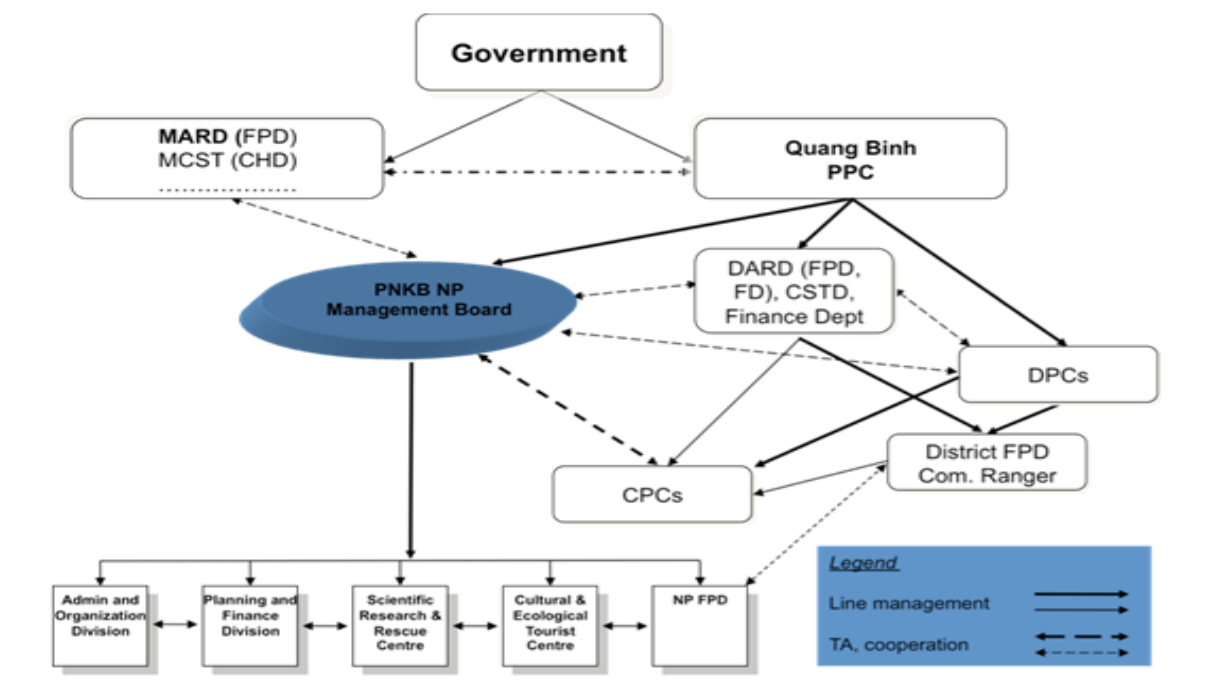
Local people hunt, log and collect medicinal plants in part to sell forest products to middlemen and traders. This is difficult for the Park to control, because many local people have few alternative means of earning income. Some isolated and cash-poor minority communities have traditionally relied on hunting, fishing and collection in the forest to provide for their subsistence needs. Most communities living adjacent to the Park rely on the forest for fuel wood, lumber, and grazing land.

1.8.4 Administration

The Provincial People’s Committee of Quang Binh Province has the highest level of authority and responsibility for managing and monitoring activities in the PNKB NP Region. PNKB NP Management Board is a unit directly under the PPC of Quang Binh. The Director of the Park is also the Director of the National Park Management Board. Management of the National Park and the Extension Area is carried out by the National Park staff, who are line staff under the Ministry of Agriculture and Rural Development.

The institutional framework for management and monitoring of the PNKB NP Region is complex and relies upon close inter-agency cooperation for effectiveness. A summary is provided in Annex V.

Figure 2 illustrates the general institutional framework for the PNKB NP Region.



- MARD – Ministry of Agriculture and Rural Development
- MCST – Ministry of Culture, Sports and Tourism
- PPC – Provincial People’s Committee
- FPD – Forest Protection Department
- DARD – Department of Agriculture and Rural Development
- CSTD – Department of Culture, Sports and Tourism
- DPC – District People’s Committee
- CPC – Commune People’s Committee

1.8.5 Legal Basis

Phong Nha Ke Bang National Park was created by Decree 189 of the Prime Minister in 2001, and is regulated through Decision No. 18/2007 of the Quang Binh Provincial People's Committee and other relevant laws and regulations.

The National Park came into existence with the upgrading Phong Nha- Ke Bang Nature Reserve to National Park status by the Prime Minister. The Park was subsequently expanded to its current size.

From its inception, the Park was assigned the following objectives and tasks:

- Organize to protect forest resources and the abundant and diverse forest ecosystem within the planned boundary of the Park;
- Conserve scientific value of typical fauna & flora species of the central area, especially primate species and the newly described species;
- Establish and develop national park infrastructure facilities and create favorable condition for research, conservation of typical fauna & flora in the Core Zone as well as strengthening domestic and international scientific research cooperation and hosting trainings and study tours;
- Exploit the strength and potential of beautiful spots by developing eco-tourism and providing guidelines and job creation for local communities and in addition encouraging them to participate in tourist activities for improvement of their living standards, environmental and ecological protection and local socio- economic development.

The management of the land and natural resources of the National Park and Buffer Zone are governed by relevant laws and regulation on National Parks and special use forest, as well as laws on environmental protection, land use, tourism development and law enforcement. Important laws, decrees, decisions and circulars are listed in Annexes VI and VII.



1.9 THREATS AND CHALLENGES

In common with many protected areas, PNKB NP WHS faces a range of external threats to its immediate and long-term integrity. The threats vary in their scale and scope, from localized pressures created by tourism and road development to threats to biodiversity from widespread hunting and timber poaching. Internal constraints also limit the Park's ability to respond effectively and counter these threats.

The strategic threats fall into 10 categories, listed in order of their seriousness and the severity of their impacts on the values of PNKB NP WHS:

1. Wildlife hunting and trapping
2. Illegal logging
3. Non-timber forest product exploitation
4. Destructive tourism
5. Infrastructure developments inside the Park
6. Invasive and alien species
7. Firewood collection
8. Cattle grazing in the Park
9. Fishing
10. Forest land encroachment
11. Cinnamomum oil extraction
12. Forest fire
13. Natural disasters

Each of these issues is considered a substantial threat to the on-going integrity of PNKB NP and its recognized or proposed World Heritage values (see Annex VIII).

The size of PNKB and the inaccessibility of much of its forests provide some measure of protection against these threats. Any increase in accessibility of the interior of the Park, however, may compound the impact of these threats.

Several serious internal constraints prevent the Park from responding effectively to these and other threats. During the development of this management plan a number of issues emerged regarding capacity of PNKB Park for conservation, protection and management during the last five years. Weaknesses included:



A young gibbon *Nomascus siki* rescued from the wildlife trade and sent to the Phong Nha –Ke Bang National Park Wildlife Rescue Center.

1. Annual funds allocated to the National Park were much less than the planned budget in the investment plan requested by the PNKB NP Management Board;
2. A lack of human resources in terms of both number and capacity of staff;
3. Weak inter-agency coordination in forest law enforcement;
4. A lack of funding for buffer zone projects; and
5. A lack of good governance.

1.10 NECESSITY OF MANAGEMENT PLANNING

In order for the National Park Management to overcome constraints, respond effectively and counter threats, all within the limits of the budgetary support at its disposal, careful planning is required.

Article 108-109 of the Operational Guidelines for the Implementation of the World Heritage Convention make clear that “Each nominated property should have an appropriate management plan or other documented management system which must specify how the Outstanding Universal Value of a property should be preserved, preferably through participatory means. The purpose of a management system is to ensure the effective protection of the nominated property for present and future generations.”

According to Decree 117 of the Government of Vietnam, the National Park management unit must make 5-year plans and submit them to the Forestry Directorate for approval, covering public information activities; forest management, protection, construction, development and use; nature conservation; scientific research and experimentation; rescue of wild fauna and flora; service activities; labour management and use; construction investment; and finance. The Operational Management Plan is designed to fulfil this requirement. Required information about Ecotourism Development and planning for Buffer Zone Development are covered in the Sustainable Tourism Development Plan and Buffer Zone Development Plan respectively.



Cryptotadactylus crispus, a gecko recently discovered inside Phong Nha – Ke Bang National Park World Heritage Site. Numerous new species have been discovered in the region, underscoring its global significance for biodiversity.

This Strategic Management Plan and accompanying operational plans are designed as an integrated set covering all aspects of management of the PNKB NP WHS region. They are designed not only to fulfil the requirements of the World Heritage Convention and Vietnam law, but also to guide the management of the Park until 2025 to insure the continued integrity and protection of the outstanding values the Park protects, while arranging for fair livelihoods for local people and appropriate presentation of those values to the people of Vietnam and the world.

2. MANAGEMENT STRATEGIES

2.1 OVERALL MANAGEMENT OBJECTIVES

World Heritage status is the highest level of recognition that may be afforded to any protected area. It places an important responsibility on the government of Vietnam to apply the highest possible standards of management practice.

A set of key strategic objectives for the PNKB NP WHS, which provides a philosophical basis for the management of the PNKB region and guidance in the formulation of operational management strategies, has been derived from the World Heritage Convention and its Operational Guidelines. These objectives are consistent with World Heritage management principles and with the laws and policies of Vietnam.

Strategic objectives for management of the PNKB NP WHS are to:



- Identify, protect, conserve, present, transmit to future generations and, where necessary, rehabilitate the World Heritage values of PNKB NP WHS;
 - Integrate the protection for the PNKB NP WHS into a comprehensive planning program for the entire PNKB Region;
 - Give the PNKB NP WHS a function in the life of the community of Vietnam;
 - Strengthen appreciation and respect for the PNKB's World Heritage values, particularly through education and information programs, keeping the community broadly informed about the condition of the World Heritage values of PNKB NP WHS;
 - Take the appropriate scientific, technical, legal, administrative and financial measures necessary for implementing these principles;
 - Provide for continuing community and technical input in management of PNKB NP WHS; and
- Manage the broad range of values, both World Heritage and non-World Heritage, ensuring that achieving the long-term conservation of the PNKB's World Heritage values is the over-riding principle.

In order to achieve these objectives, a number of key management issues need to be addressed. The remainder of this document outlines the proposed management objectives and responses to achieve desired outcomes by 2025.

2.2 MAIN ISSUES

The management strategies and actions outlined below address those threats and issues that are considered strategic priorities for the overall integrity of PNKB NP WHS and the protection of its outstanding universal values.

The key management issues have been grouped in the following categories

1. Protecting geodiversity
2. Conserving biodiversity
3. Protecting historical and cultural values
4. Enhancing integrity
5. Appropriate presentation
6. Addressing livelihoods issues
7. Developing capacity and professionalism for management

The management strategies below provide strategic directions for both proactive management and responsive adaptive management, through active enforcement, awareness building, community outreach, alternative livelihoods, and tourism development. Through community consultation and involvement, appropriate presentation and education, and interagency cooperation, the Park will also seek the cooperation and support of the Park's neighbours and the broader community to achieve the World Heritage objectives. Finally, building the capacity and professionalism of the Park staff and a knowledge base through scientific monitoring and research are critical to effective implementation of all other management activities.



Two cavers are dwarfed by the cavern inside Son Doong Cave, the world's largest cave by volume. Photo Carsten Peter through National Geographic.

2.2.1 Protecting geodiversity

Management Objective

To effectively manage Phong Nha - Ke Bang National Park's recognized world natural heritage, including its scenery; karst environments; karst hydrology; karst processes; geology; geomorphology; soils; and caves with all their formations and speleothems, natural air quality, meteorology, biodiversity and cave ecosystems⁴.

Background

The outstanding universal value of PNKB's karst and caves has been recognized worldwide. This in turn has brought ever increasing numbers of visitors to the Park. While presentation of World Heritage values is one of the recognized missions of World Heritage sites, planners and managers need to assess and respond to potential and current impacts of tourism and supporting infrastructure development, both inside the National Park and in the surrounding environment, on the features of outstanding universal value in the karst landscape and caves.

The National Park Management has authority to control use of surface natural resources within the National park, thus protecting most surface features of the karst landscape. The National Park also controls access to the entrances to all of the caves inside the World Heritage Site. Currently, the legal authority for protection inside caves in Vietnam is unclear and management authority of the National Park may be too weak. The provincial Department of Natural Resources and Environment has authority over development of all sub-surface resources in the province. Additional legal protection may be needed for sub-surface features in a karst landscape (i.e., the caves). For example some protected areas in Australia are dedicated to the centre of the Earth, and this provides effective protection of subsurface features such as caves.

Desired Outcomes

- Protection planning, management measures and monitoring systems for protection of World Heritage caves and karst landforms in PNKB NP WHS are in place and operating effectively.
- The effects of human activities on karst landforms and caves in PNKB NP WHS are compatible with long-term protection of karst and caves, both inside the World Heritage property and in the surrounding Buffer Zone; quarries and earth mining are not destroying vulnerable karst landforms; surface development is not degrading the karst hydrological regime; catchments of underground rivers are not polluted; tourism is not damaging karst and caves and their features of outstanding universal value.

Management Response

- Identify needs for and effectively manage the protection of the entire surface and sub-surface Karst catchments and Karst hydrological regimes.
- Regularly monitor for any non-natural disturbance to any part of the Karst surface and sub-surface catchments as a basis for rapid response to threats.
- Assess the risk of threats and plan for and respond to any impacts to Karst surface and sub-surface environments, especially from petroleum or chemical pollution.
- Work with researchers to identify the nature of cave biodiversity and cave ecosystems as a basis for effective management.
- Actively manage to retain intact the large areas of the Park in all management zones, including protecting the natural forest, restoring disturbed sites, removing weeds, and preventing additional disturbance.

⁴This is the Overall World Heritage OUV Management Objective for Criterion (viii)

- Promote and encourage conservation management in the Buffer Zone and especially areas above and upstream of cave rivers so as to encourage protection of soils and watersheds and to discourage incompatible development.
- Understand and monitor the natural atmosphere and meteorology of caves as a basis for effectively conserving cave environments.
- For all existing and proposed tourist caves inside the World Heritage property, which are all World Heritage Karst sites, prepare individual Tourist Cave Management Plans that facilitate the protection, restoration and professional presentation of the caves.
- Work with researchers and speleologists in the development of a Wild Cave Protection, Access and Conservation Management Plan for the National Park, based on the approach of management prescriptions (see Annex XI).
- Prepare legal agreements for any tourism operations within the World Heritage property so that they recognise and are compliant with the provisions of the PNKB Management Plan and associated supplementary specific plans.

Monitoring for this Objective will focus on threat reduction, water quality, air quality, presence/absence of key indicator species populations, and the condition of speleothems and other key cave features.



The entrance to an undeveloped wild cave inside Phong Nha – Ke Bang National Park World Heritage Site. Over 350 cave entrances have been discovered inside the Park. Most are unexplored.

2.2.2 Conserving biodiversity and evolutionary processes

Management Objective

To conserve and understand the Phong Nha - Ke Bang National Park World Heritage fauna and flora, habitats and supporting natural ecological and biological processes to help ensure ecological viability, the on-going development of terrestrial and aquatic ecosystems and on-going evolution of species, both surface and sub-surface⁵.

Background

To conserve the values of PNKB for biodiversity and evolutionary processes, management aims to protect and conserve *in-situ* natural ecosystems and their associated ecological processes, species populations and genetic diversity. This includes terrestrial, subterranean, and aquatic ecosystems and their interrelationships.

Key to achieving these goals is a reduction in the unsustainable harvesting of wild flora and fauna. This will be achieved through a three-pronged approach, (i) awareness building to encourage behavioral change, targeting those who harvest, the consumers who create the demand and the middle-men and, (ii) providing alternatives to local people who are dependent on harvesting the Park's forest resources for their subsistence or income, and (iii) effective enforcement of laws and regulations designed to protect wildlife and habitats.

Ecosystem conservation requires the protection of forests from habitat degradation and destruction through firewood collection, grazing and encroachment of agricultural land. This will also require alternatives for those community members who currently have no alternative sources of fuel, pasture or agricultural land. This issue is dealt with in the 4th Objective.

Maintaining ecosystems, biodiversity, and ecological and evolutionary processes also depends directly on the integrity of the Park and its habitats, their overall size and connectivity. This is dealt with in the 3rd Objective.

Desired Outcomes

- Hunting and illegal logging activities are reduced substantially, with zero tolerance towards illegal activity.
- Collection of Non-timber Forest Products (NTFPs) and fishing is reduced to ecologically sustainable levels.
- Firewood collection, grazing and clearance of forest in and around the Park by villagers who still depend on these activities is reduced and controlled so that it does not damage the Park's World Heritage Values.

Management Response

Awareness raising for behavioral change

- Awareness raising among villagers: This effort will focus on changing behaviors in order to reduce unsustainable hunting, particularly of species of high conservation concern. Awareness raising for indigenous people will emphasize the availability of alternative medicines and meat (see below).
- Awareness raising among visitors and tourists: A key cause of hunting in the Park is the brisk market for wild meat, medicines and live wild animals that has grown up around the Park. While the Park must rely on other actors to stem the loss of wildlife to consumers

⁵This would be the Overall World Heritage OUV Management Objective for Criterion (ix) and Criterion (x) when they are approved. It also overlaps with the first two Objectives for PhongNha-Ke Bang National Park as set out in Article 3 of the Decision of the Prime Minister dated 12 December 2001.

throughout Vietnam, it can focus efforts on increasing awareness among visitors to the Park. Key messages will include the fact that purchasing wildlife is contributing to the loss of species and the degradation of the Park threatening its status as a World Heritage Site. The message will also include information about regulations, including the consequences of being caught with illegal wildlife purchases.

- Awareness raising among consumers of timber: The market for high value timber from the National Park is driven by a network of traders that bring these products to consumers. The Park will participate in national campaigns to stop the illegal harvest and trade of protected timber species, and can also target visitors and local people with campaigns to increase awareness and stop purchases of protected species. (Logging for household use is dealt with separately below.)
- Awareness raising among local loggers: Many local villagers harvest timber from the Park on behalf of outsiders. The Park will target loggers and potential loggers with information about which species are protected, how the Park is enforcing the laws, and what the consequences are for forest crime.
- Awareness raising among wildlife traders and restaurant owners: This target group is a key actor in the decimation of wildlife in the Park through hunting. The Park will enlist the support of local government and enforcement authorities to pressure this group into commitments to stop their illegal activities.



- Awareness raising among collectors and suppliers of NTFPs: Collectors and suppliers are key actors in the decimation of wildlife in the Park through hunting. In addition to the awareness raising campaign described above, the Park will seek the support of local government and enforcement authorities to pressure this group into making commitments to stop illegal activities.
- Awareness raising among consumers of NTFPs: A key reason for collection of NTFPs is for use as traditional medicines. Awareness raising for this target group will therefore emphasize the availability of alternative medicines. Target groups include both local people and visitors and tourists. Key messages will include the fact that purchasing protected species degrades the Park, threatening its status as a World Heritage Site. The message will include information about regulations, including which species are protected and the consequences of wildlife crime.

Provision of alternatives to communities dependent on the Park's natural resources

This is vital to reducing consumption of natural resources inside the Park. See the Fourth Objective below for details.

Effective Law enforcement to end illegal hunting and logging

- Strengthen law enforcement to stop sales and consumption of wildlife: This highest priority activity will focus on patrolling and guarding to deter hunters and to catch habitual offenders. Patrolling Plans for each Guard Station will be designed to optimize effectiveness of the anti-hunting impact of patrolling, using the approach already piloted by the Park Forest Protection Department⁶.
- Strengthen law enforcement to stop illegal logging of high value timber species: This high priority activity will focus on patrolling and guarding to deter timber poachers and to catch those transporting timber out of the Park. In addition to improving the scope and effectiveness of patrolling, vigilance and supervision at Guard Posts on all key exit points from the Park will be upgraded. This will increase the cost and difficulty for those attempting to transport timber out of the Park.
- Develop specific regulations regarding NTFP collection inside the Park and Forest Protection Staff will receive training on their interpretation and implementation. Collection will gradually be restricted to designated NTFP Sustainable Exploitation Areas (see below).
- Foster cooperation among relevant agencies: Since the market for wildlife and illegal wood is largely outside the Park, where the Park Forest Protection Department does not have jurisdiction, it is important to obtain the cooperation of police, army, and all local authorities to stem the wildlife trade. A responsibility assessment will further define the key actors in enforcement. Support and coordination by the Provincial Forest Protection Department for this purpose will be solicited by the Park Management Board. Specific goals include developing regulations jointly and improving the capacity for enforcement of laws protecting high value species. A joint training workshop will be organized to promote implementation.

Monitoring for this Objective will focus on threat reduction, ecosystem health and forest connectivity, and trends in populations of key indicator species.

⁶ This was the result of key technical and financial support from Cologne Zoo and Frankfurt Zoological Society.

2.2.3 Protecting historical and cultural values

Management Objective

Ensure that the National Park's important historical and cultural heritage values are protected and conserved.

Background

The Phong Nha – Ke Bang region contains a valuable record of Vietnam's history, which is important to the nation. The ancient Champa people, who played an important role in central Vietnam, left inscriptions in the caves of PNKB. The region, strategically poised just north of the Demilitarized Zone, played a critical role in the long and tragic US-Vietnam War, and was a key transit for troops and supplies to support the war effort of the People's Army of Vietnam. PNKB NP also supports great cultural diversity, particularly in the numerous minority cultures of the people who live in and around the Park.

Key historical and cultural sites include Phong Nha Cave, Eight Heroic Volunteers Cave and nearby Nurses' Cave, Victorious Road 20 and the Ho Chi Minh trail network, the Ho Chi Minh Museum and the Arem Minority Village on Road 20 (see Annex IV). The Park must prepare to counteract any dangers that threaten or may endanger these sites and any of its cultural and historical heritage. Problems and risks to be considered include vandalism, theft, looting, road building, other construction activities, pollution and inappropriate tourism.

Desired Outcomes

- Protection planning, management measures and monitoring systems for protection of historical and cultural heritage in PNKB NP WHS are in place and operating effectively.
- The effects of human activities on historical and cultural features, including the trails, caves and artefacts in PNKB NP WHS, are compatible with long-term protection, both inside the National Park and in the surrounding Buffer Zone;
- Road construction, quarries and mining, and construction of infrastructure for tourism are not destroying vulnerable historical features; tourism is not damaging cultural and historical features and their outstanding heritage value.

Management Response

- Design appropriate interpretation, including informational signs, museums of artifacts, and guided tours.
- Inventory historical and cultural heritage, mapping each site or feature and describing the context, importance and current status of the feature.
- Identify needs for and effectively manage the protection of the entire surface and sub-surface Karst catchments and Karst hydrological regimes.
- Strengthen measures to protect historical heritage values, especially the values of historical trails associated with Ho Chi Minh trail network and Road 20 through PNKB NP.

- Develop detailed site management plans for historical tourism sites, including environmental management systems for waste collection and disposal, visitor-monitoring systems to assess site-specific tourism flows, and controls such as signage, guards, and hardening, fences and barriers to prevent visitors from damaging sites or stealing artifacts.
- Strengthen measures to protect cultural heritage values, especially the values of indigenous culture in minority villages in and adjacent to the Park.
- Work with historians and anthropologists to document the historical and cultural heritage features as a basis for effective management.

- For all existing and proposed tourist and pilgrimage sites inside the National Park, prepare individual Tourist Site Management Plans that facilitate the protection, restoration and professional presentation of the historical features.
- Prepare legal agreements for any tourism operations within the World Heritage property that recognise and are compliant with the provisions of the PNKB Management Plan and associated supplementary specific plans

Monitoring for this Objective will focus on threat reduction and the condition of historic trails and other key historical features.



Visitors view a memorial at the Eight Heroic Volunteers Cave in Phong Nha – Ke Bang National Park World Heritage Site.

2.2.4 Protecting and enhancing integrity

Management Objective

Ensure that the Park has sufficient size and contains all the necessary elements to demonstrate the key aspects of World Heritage geomorphological features and to maintain geological and ecological processes that are essential for the long term conservation of ecosystems and biodiversity, and contains all habitats in sufficient amount needed for maintaining the diverse fauna and flora characteristic of the Central Indochina Limestone Priority Landscape.

Background

Integrity and its maintenance is a key issue for all World Heritage Sites. It requires the property to be of adequate size to ensure the complete representation of features and processes which make up the outstanding universal values.

For integrity of World Heritage values under Criterion (viii), the area must contain all or most of the key interrelated and interdependent elements in their natural relationships, including the karst flora, and invertebrate and vertebrate fauna of caves and their ecological relationships⁷. For heritage values included under Criterion (ix), the area must have sufficient size and contain all the necessary elements to demonstrate the key aspects of processes that are essential for the long term conservation of the ecosystems and the biological diversity they contain. For Criterion (x), the area must contain all habitats in quantities sufficient for maintaining the diverse fauna and flora characteristic of the bio-geographic province and the ecosystems featured in the World Heritage site.

Key to maintaining integrity of the World Heritage Site and the biological connectivity of its ecosystems is the need to counter pressures for unsuitable infrastructure development inside the Park. Tourism development needs to be designed with great care so as not to damage the integrity of any of the site's World Heritage values or other values. Linear infrastructure, such as roads, power lines and cable ways, can be particularly disruptive to biological connectivity, cutting migratory routes and gene flow of fastidious species such as amphibians and gibbons.

There is currently an opportunity in the PNKB Region to capitalize on the support provided by foreign donors to establish appropriate and institutionalized mechanisms that encourage cooperation and appropriate management of lands adjacent to the Park. These adjoining lands could be managed not only to be compatible with protection of the Core Zone of the Park, but also to add value to the Park, improving its ecological security and promoting appropriate sustainable approaches to development in the Buffer Zone. This might be best achieved by adopting the Biosphere Reserve approach, a concept to which adjacent land managers could subscribe (see Annex XII).

Special attention is needed to protect the catchments of all of PNKB's many underground rivers. The sources of several of these rivers lie outside the Park boundaries, and so are vulnerable to impacts of development, including siltation from land clearance, pollution from pesticides, herbicides and petrochemicals spills, and diversions and impoundments for hydroelectric or irrigation purposes. Any of these activities in the catchment could permanently damage PNKB's World Heritage caves downstream.

⁷ Operational Guidelines for World Heritage Sites (2011), Article 93. The following points refer to Articles 94 and 95.

Phong Nha - Ke Bang World Heritage Site and the Extension Area shares over 50 km of its boundaries with Hin Namno National Biodiversity Conservation Area (HNN-NBCA) in Lao PDR, increasing the integrity of both protected areas. Effective control of cross border illegal trafficking, however, is an essential condition for the stabilization of biodiversity status in both protected areas. Regular and functioning cross border collaboration between the authorities in Laos and Vietnam is therefore key.

Invasive alien species are a threat to the integrity of the WHS because they can prevent habitat regeneration and degrade natural habitats if uncontrolled. Campaigns to eradicate invasive species can be expensive and ineffective if not carefully planned and researched.

Fire represents a particularly pernicious threat to the integrity of PNKB's forest ecosystems. Climate change has the potential to affect the integrity of the WHS in many ways, such as increasing the risk of fires. The World Heritage Committee has identified climate change as one of the most significant threats to World Heritage properties. Climate change is already affecting the Park. Monitoring local climate, anticipating possible impacts of climate change and planning responses will be key to adaptive management that can respond appropriately.

Desired Outcomes

- Connectivity, migratory routes and the intactness of large natural areas of the PNKB NP WHS managed, conserved, and retained for the conservation and benefit of native species.
 - Construction projects within the Park and near the Park are all subject to rigorous EIA that considers the World Heritage values of the WHS, implement effective mitigation plans, and do not cause any impacts on World Heritage biodiversity values in the Park over specified limits.
- Disturbed habitats in key areas restored and further disturbance prevented.
 - All tourism in the Park is ecologically sustainable and environmentally friendly.
 - The threat of invasive alien species in the Park is well understood and their spread is being controlled.
 - Wild fire is prevented or controlled; floods, windstorms and other natural disasters are anticipated and planned for, and research and planning have prepared the Park management for the potential impacts of Climate Change.
- Additional areas adjacent to PNKB NP WHS are brought under coordinated protective management to insure their essential ecological functions, such that watersheds and natural habitats of high conservation value are conserved.
 - All key areas upstream of the World Heritage underground rivers are placed under legal protection and effective management for conservation.
 - High conservation value habitats in the Buffer Zone are identified and conserved.
 - Vietnam and Lao PDR initialize a common knowledge base, sharing key available information about Hin Namno NBCA and PNKB NP.

Management Response

- Control construction of infrastructure, roads, buildings, etc.: Environmental Impact Assessment is required for all construction inside the National Park or that impacts the National Park. The Park Management Board will participate actively in the EIA development and review process.
- Strategic Plans for the Buffer Zone, such as Construction Master Plan and the Buffer Zone Development Plan, require Strategic Environmental Impact Assessment (SEIA) according to law. The Park Management Board will participate actively in the SEIA process and review the plans.
- Strengthen monitoring and management of invasive species and conduct research on prevention methods.

- EIAs ensure that constructions projects adopt measures to limit the introduction and spread of invasive species.
- Demarcate newly added areas and other key areas including certain functional sub-zones of the Park on the ground⁸. With the participation of relevant government agencies and community leaders, the sites for boundary stones will be chosen at key locations on the boundaries of the Park. Clear, immovable markers will be erected. Informative signboards will be set up at all access points to the Park.
- Park leaders will lobby for gazetting key areas upstream of the Park's underground rivers as Watershed Protection Forest, in which strict controls limit deforestation and water pollution.
- Strengthen transboundary cooperation with Hin Namno NBCA in Lao PDR, introducing mechanisms for regular cross-border operations that support effective biodiversity conservation and livelihood development, including joint information and knowledge management and improved environmental awareness and education on biodiversity.
- Awareness building, warnings, strict enforcement and serious penalties introduced to prevent carelessness with fire by visitors.
- Build fire awareness and develop capacity for prevention and response among communities, targeting communities from which the risk of fire spread to the Park is high.
- Support and train a fire prevention management board for the Park and consolidate joint fire prevention teams in key villages.
- Introduce climate monitoring constructing weather stations and a climate disaster database in the Park.
- Conduct vulnerability assessments of the National Park focused on its World Heritage values. Use scenario planning as a science-based decision-making framework⁹.

Monitoring for this Objective will focus on threat reduction, forest cover and condition, and connectivity of habitat.

⁸This essential task will be carried out with the assistance of the Forestry Institute of Planning and Investment (FIPI), as per regulations. According to the Decision No 3013/1997/QĐ-BNNPTNT, the chapter 3 (implementation arrangement of demarcation) – article 12, “the forest area that have ownership then the forest owners conduct boundary define and demarcation in the field. This activity must ... have participation of local authority government (commune/district), forest rangers/ FPD; land survey agency / DoNRE and other relevant agencies.”

⁹ For introduction to its application in protected area management, see United States National Park Service (2007) Summary: Climate Change Scenario planning workshop Joshua Tree National Park and Kaloko-Honkohau National Historical Park.

2.2.5 Appropriate presentation of heritage and tourism management

Management Objective

Ensure that the conservation of the Park's important heritage values is supported through tourism development that emphasizes research, learning and awareness-raising about the unique natural and cultural heritage of the World Heritage Site, and the importance of the conservation of this heritage.

Background

All States Parties to the World Heritage Convention have the responsibility to ensure the appropriate presentation of the cultural and natural heritage identified within their territory, Presentation of the PNKB NP World Heritage Values should aim for the objectives above, while enhancing the function of World Heritage in the life of the community; and increasing the participation of local and national populations in the protection and presentation of heritage.

At its best, tourism can provide an outstanding opportunity to increase the understanding of natural and cultural heritage, while providing long-term financial support for site management, local communities and tourism providers. Poorly managed tourism on the other hand can pose major threats to World Heritage values and degrade the quality of the visitor experience. The State Party and its partners must ensure that use does not impact adversely on the Outstanding Universal Value of the property. For some sites human use would not be appropriate at all. All forms of tourism development in the PNKB NP WHS region must compliment, conserve and enhance the Park's cultural and natural heritage values and must not detract from or diminish these values. Conservation of World Heritage values and other natural and cultural heritage values must be well supported by education, information and awareness raising efforts linked to, and supported by, tourism development and operations.

Tourism development throughout the PNKB Region must be sustainable in the sense that the overall quality and quantity of natural and cultural resources are maintained and enhanced, and natural processes for regeneration are not compromised. Tourism must also be sustainable in the sense that tourism products are of a high quality and provide a high level of satisfaction for visitors. Finally, quality tourism is only possible if tourism is also economically sustainable, so tourism products and activities developed must be assessed and approved based on sound market justification and financial operating capacity. Economic sustainability requires that reasonable profits to service providers are achieved, along with an equitable sharing of benefits and costs amongst relevant stakeholders and affected groups, including communities living in and around the PNKB NP WHS.

All caves in PNKB NP are part of its World Heritage values. Caves are particularly sensitive environments. Any damage to caves may be irreversible and should therefore be strictly avoided. Visitors inside caves must be carefully controlled and tourism development must be rigorously supervised in order to conserve the cave for future generations.

Desired Outcomes

- Tourism growth is monitored and supervised to ensure that it preserves the World Heritage values and other heritage values of the PNKB NP. Resource exploitation for tourism development is managed so that tourism is ecologically sustainable and environmentally sensitive.
- Tourism development is of a high standard and based on market research with equitable sharing of benefits. Tourism contributes to local economic development, particularly for the poor, and to sustainable livelihoods, maximizing opportunities for people living in the

Park and Buffer Zone to effectively and equitably partake in tourism development, management, operations and economic benefits.

- Effective and efficient planning, management and operations of tourism reflects relevant higher-level policies and plans and are well integrated and coordinated with other relevant local development plans and activities.
- Tourism growth supports quality tourism experiences and a high standard of tourism products, receiving higher yields in economic returns per volume of visitors. Tourism growth is tailored to target markets and aimed to maximise economic return (yield) rather than sheer volume.
- Tourism growth contributes to an appropriate geographical spread of development where higher impact activities are concentrated in appropriate locations for effective management and lower impact activities that generate local benefits are suitably expanded throughout the region.
- Tourism growth uses management systems to control site visitor volumes to levels that do not compromise the World Heritage values and the ecological, historical and cultural integrity of the PNKB Region.

Management Response

- Referring to relevant guidance from the World Heritage Committee¹⁰, the PNKB NP Management Board will work to ensure that design and management of National Park facilities available on site for visitors are appropriate in relation to the protection and management requirements of the WHS and its values, and that the facilities and services provide effective and inclusive presentation of the WHS to meet the needs of visitors, including in relation to the provision of safe and appropriate access.
- PNKB NP Management Board will design and initiate a comprehensive information and interpretation strategy to raise awareness of the Outstanding Universal Values and the other heritage values of the Park, and of the need to preserve World Heritage, and particularly to ensure that World Heritage status is adequately marked and promoted on-site.
- Design and produce engaging interpretation tailored to reach the various audiences that visit the World Heritage property, including day trip visitors, tourists, school children and local people, using appropriate materials (signage, trails, notices or publications, guides, etc.), and promoting the World Heritage status of the Park.¹¹
- Construct a visitor interpretation centre devoted to the PNKB NP WHS and presentation of its World Heritage Values.
- The PNKB NP Management Board will take a leading role in participating in tourism planning for the PNKB Region, reviewing all tourism plans, EIAs, SEIAs, concession agreements and leasing arrangements for tourism in the National Park (See Annex XIII for details of considerations to be reviewed).

Specific management prescriptions related to tourism will include the following:

- Organizational restructuring will institutionally separate tourism/visitor management and tourism operations in the PNKB NP to avoid conflicts of interest.
- The PNKB NP Management Board will carefully consider any tourism development proposals in the Park, drafting binding concession agreements between the PNKB NP and business sector operators for tourism activities in the PNKB NP.
- The PNKB NP Management Board will organize development of a complete Visitor Management Plan for the National Park (see Annex X for outline).

¹⁰ Pedersen, A. (2002) *Managing Tourism at World Heritage Sites: a Practical Manual for World Heritage Site Managers*, World Heritage Paper No. 1, UNESCO, World Heritage Centre, Paris 2002.

¹¹ Interpretation, refers to the full range of potential activities intended to heighten public awareness and enhance understanding of a site. (UNESCO 2012 *Managing World Heritage*.)

- Before opening any cave to visitors, a professional assessment study of the carrying capacity of the cave in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., will be done by reputable cave experts.
- Site specific management planning will also be a requirement, including Identifying indicative visitor carrying capacity and setting up key management regulations. Management measures will comply with relevant IUCN and UNESCO international regulations and guidelines for World Heritage and for karst and caves.
- Strict supervision of tourists in caves by PNKB NP WHS staff to protect caves and their features, and to ensure a safe and high quality visitor experience at all times.
- An environmental and social impact assessment and mitigation plan must precede any tourism development in the NP and particularly the opening of any cave to visitors. Such an assessment and plan should cover the environment inside the cave, the access roads, and other tourist facilities outside the cave.
- Supervision of all visitors and visitor groups by competent cave guides. In turn, cave guides will be supervised by PNKB NP staff for strict compliance to regulations and behaviour codes. Towards this end, the PNKB NP will organize a competency check and issuing of certifications, only allowing certified guides knowledgeable about cave protection and safety to lead groups into the caves.



Tourism will be monitored site specifically using the approaches of limits of acceptable change and the UNESCO World Heritage guidelines.

2.2.6 Addressing livelihoods issues

Management Objective

Ensure that areas in the Buffer Zone that are of high value for conservation of biodiversity and protection of World Heritage values are protected through development of alternative livelihoods and provide opportunities in the Park for buffer zone communities which do not jeopardize conservation, so as to gradually replace and halt harmful livelihood activities that create pressures on the heritage values of PNKB NP WHS.

Background

A few villages are located inside the National Park and World Heritage Site, while several others use land or resources from the Park for their subsistence or their income. Protecting and restoring the ecosystems, biodiversity and ecological will depend on controlling and reducing human use of natural resources.

Providing livelihood assistance and other benefits can reduce local dependence on unsustainable exploitation of natural resources and harvesting of protected species. Article 119 of the World Heritage Operational Guidelines states that World Heritage properties may support a variety of on-going and proposed uses that are ecologically and culturally sustainable and which may contribute to the quality of life of communities concerned. However, the government and its partners must ensure that such sustainable use does not impact adversely on the Outstanding Universal Values of the property. For most sites inside the World Heritage Site, human use involving harvesting would not be appropriate at all, so most activities for livelihoods improvement will occur in the Buffer Zone, outside the National Park.

Much of the current conflict between the National Park and local communities may have been created when the Park was formed and extended by grants of management authority over land and resources that were traditionally used by local communities and to which they may have had legal rights. Addressing the actual or perceived inequities created by this transfer of rights is a precondition to promoting and encouraging the cooperation and active participation of communities in the sustainable protection of the National Park and its World Heritage values.

By taking on a positive role in community economic development, the National Park can do much to defuse conflicts over resource and land use. According to Decree 117 and Decision 24, PNKB National Park management is responsible for formulating investment projects in the Buffer Zone and acting as their investor under law. The Park must involve local communities in these investment projects. The National Park can also link its investments in community development to forest protection, creating incentives for better forest management¹². The World Heritage Convention calls on all World Heritage Sites to promote and encourage the active participation of communities and stakeholders concerned with the property as necessary conditions to its sustainable protection, conservation, management and presentation¹³.

The Buffer Zone of the PNKB NP Region is affected by a number of planning mechanisms, and its development and fate is not always under the direct influence of the Park Management Board. Even the Core Zone of the World Heritage Site may be affected by

¹² According to Decree 24, expenditures shall be linked to each village's forest protection plan and commitment. In the case that poor performance in forest protection is recognized in a certain village, the Management Board is allowed to shift the funding to another village.

¹³ Operational Guidelines for World Heritage Sites (2011), Article 119

regional development plans that involve linear infrastructure or construction inside the Park. It is therefore essential that regional planning fully take into account the needs for protection of the World Heritage Site. Socioeconomic development in the region surrounding the National Park/World Heritage site must fully consider and accounts for the needs for protection of the World Heritage values, so as to fulfil Vietnam's obligations under the World Heritage Convention. The Buffer Zone Development Plan and Sustainable Development Plan for PNKB NP region must be fully integrated with commune and district socio-economic development planning, construction plans and all plans for sustainable tourism development, and all of these plans must accommodate and support the protection of the World Heritage Site.

Desired Outcomes

- Legislations, policies and strategies affecting the PNKB World Heritage Site and Buffer Zone ensure the protection of the Outstanding Universal Values and support the wider conservation of natural and cultural heritage.
- Communities and stakeholders concerned with the property, and particularly those living in the greater PNKB NP Region, actively participate in its sustainable protection, conservation, management and presentation.
- Communities living in the Buffer Zone and inside the Park have alternative sources of income, and this reduces conflicts and decreases their incentives to participate in illegal logging, hunting and collecting NTFPs for market.
- Indigenous communities have sufficient sources of meat, medicines, and fuel to meet their needs, and this reduces their incentives to hunt, fish or collect NTFPs from the Park for subsistence needs.
- Grazing and clearance of forest for pasture and agriculture in and around the Park by villagers who are still dependent on these activities is reduced and controlled so that it does not damage the Park's World Heritage Values.
- The Park shares benefits with local communities. In particular, tourism to the Park contributes to local economic development and sustainable livelihoods, particularly for the poor.

Management Response

- Provide alternative means of income generation that reduce dependence on natural resources and that are not damaging to the Park. This is a key goal of the Buffer Zone Development Plan. The exact means of income generation will be chosen as part of the participatory process used to develop Green Village Development Plans¹⁴.
- Normalize the situation of those people who are living within the National Park by demarcating "internal buffer zones" within the Core Zone, with sufficient land for their current needs. Negotiate Forest Protection Contracts with these villages.
- Develop models of raising domestic animals: In key villages where availability of meat is a constraint to the end of hunting, the Park will provide extension training in raising domestic animals. For those activities implemented inside the Park, environmental assessment will insure that the project provides more benefit to protection than pressures on the Park's resources.

¹⁴ In line with Decision 24, this process is a mechanism for village members to be directly involved in planning for village investments contributed by the Park and the Project. This is necessary so that the solutions supported will be appropriate for local livelihoods, conditions and customs.

- Provide additional forest land to communities and encourage local people to manage and use their own forests sustainably: For key villages where lack of community forest land is a constraint to conservation, the project will promote Community Forest Management in State Forest Enterprises to increase the quantity and improve quality of timber that can be harvested.
- Support afforestation in key areas of the Buffer Zone to increase the sustainability of community forest use and increase the amount of land in forest adjacent to the Park.
- Plant high value trees: The market for high value timber from the Park is fueled in part by high prices resulting from scarcity elsewhere. The Park will promote indigenous knowledge in how to plant certain native high value timber species for those species that can be legally traded. (This activity must be accompanied by a strict and independently supervised certification scheme to prevent the “laundering” of illegally obtained timber.)



A Van Kieu minority person harvests palm leaves from Phong Nha – Ke Bang National Park World Heritage Site. Many local residents living in or near the Park depend on its resources for their livelihoods.

- Carry out a survey on NTFP use with NTFP user-groups in key villages within the Park and in the adjacent Buffer Zone area. On the basis of these surveys, develop sustainable harvesting plans for key NTFPs (but not for legally protected species).
- Based on the results of the NTFP surveys, and in consultation with villagers, draw up plans and maps for designated NTFP Exploitation Areas in the Buffer Zone, Administrative and Services Area and Ecological Restoration Area. (Exploitation in the Strictly Protected Area is not allowed by law).
- According to Decree 117 and Decision 24, the National Park management is responsible for involving people from buffer zone communities in managing the forests of the national park. This will be done through Forest Protection Contracts and Joint Protection Patrols with villages inside and adjacent to the Park.
- Create opportunities for people living in the Park and Buffer Zone to effectively and equitably partake in tourism development, management, operations and economies, through concession contracts that require local hiring, vocational skills training and transfer payments for forest ecological services (PFES) from tour operators or visitors.
- Provide and encourage vocational training, improvements in agro-forestry and small-scale industry, provision of seeds, breeding animals, equipment, supplies and funding, to support stable, long-term sustainable development.
- Supervision, monitoring and law enforcement to prevent deforestation, cultivation, animal grazing and other damaging activities inside the World Heritage Site.

2.2.7 Developing capacity and supporting management

Management Objective

Develop the managerial and professional capacity in forest protection and management, biodiversity conservation, forest fire prevention and control, tourism development and management for the National Park's officers and staff and other stakeholders and support the equipment, funding, institutions and policies needed for the National Park Management Board to manage the heritage site well.

Background

Secure and uninterrupted support is vital to the success of a World Heritage site, and indeed to its very existence. Support must come in many forms; the support and participation of local communities, administrative and legislative support that creates an enabling legal environment for management, and dependable financial support that enable management to turn plans into reality.

Building the capacity and professionalism of the Park staff is also critical to effective implementation of all other management activities. Most of the staff of PNKB NP have been trained in Forestry or related fields and many have several years of experience. Managing a World Heritage site, however, confronts managers with challenges that require the skills needed to professionally manage an organization of over 200 staff and protect ecosystems and complex features that are dispersed in space across over 200,000 remote hectares. In addition to standard skills sets needed for adequate staff performance in any forest protected area¹⁵, several special skills are needed for managing Natural World Heritage sites, related to the World Heritage Convention and protection of the Outstanding Universal Values.

Only if the organization is professionally managed in all its aspects can staff meet the targets for management of the National Park and the World Heritage Objectives. For this, a knowledge base accumulated through scientific monitoring and research is also an essential resource to guide management. Planning for sustainable financing is also a major need, to guide fund raising and also to make efficient and effective use of the funds obtained.

Desired Outcomes

- Support built among the public, scientists and leaders for protection of Phong Nha – Ke Bang National Park and conservation of its Outstanding Universal Values; Good habits fostered among local children, who feel pride in the Park, appreciate its values, , creating a bridge between the Park and their families,
- Skills, knowledge and attitudes needed for implementation of the Management Plan and routine management exists among the Park staff;
- Equipment, facilities and infrastructure needed for implementation of the Management Plan and routine management are available;
- Financial management and administrative processes needed for implementation of the Management Plan are in place in the National Park;
- Information needed for adaptive management is provided in a timely manner through monitoring and scientific research;
- Financial support needed for management and protection is available sustainably.

¹⁵ See Appleton, M. R., Texon, G.I. &Uriarte, M.T. (2003) Competence Standards for Protected Area Jobs in South East Asia. ASEAN Regional Centre for Biodiversity Conservation, Los Baños, Philippines. 104pp.<http://mekongtourism.org/website/wp-content/uploads/downloads/2011/02/ASEAN-Competence-Standards-for-Staff-Working-in-Protected-Area.pdf>

Management Response

Building support

- Set up an interpretation centre and displays at popular tourist sites, with the objective of raising awareness among visitors about the World Heritage values of the Park. creating interest and increasing enjoyment.
- Train tourist guides to increase their knowledge of the Park's Outstanding Universal Values and other heritage values.
- Support local Conservation Clubs to organize study tours, camping, exhibitions, painting competitions, role playing, etc.
- Train for teachers using the World Heritage Educational Resource Kit for teachers: "World Heritage in Young Hands"
- Develop close cooperation between the Park and judiciary and build the political will for prosecution of forest and wildlife crimes.
- Lobby to raise understanding and support among decision-makers, with the focal message that "the Park has high value."

Building skills and competencies

- Train staff of the National Park to support the activities in the Management Plan (See Annex XIII for more details.)
- Complete zonation and regulations of the Park, design and demarcate designated Plant Exploitation Sub-Areas and various tourism sub-areas;¹⁶ upgrade demarcation where needed.
- Develop a Patrolling Plan and Patrolling Manual with detailed measures for handling each type of violation specified.
- Training of community members in the Buffer Zone for sustainable management of community forests and NTFP exploitation zones, and fire prevention
- Extension training for local communities to support alternative incomes, alternative fuels and alternative livelihoods.

Building organizational capacities

- Operationalize a 5-year cycle of management within the Park based on the IUCN Framework, reviewing the context of existing values and threats, planning responses, allocating resources (inputs), implementing management actions (processes), recording outputs, and monitoring impacts and outcomes¹⁷. Develop 5-year Operational Management plans by 2015, 2020 and 2025.
- Develop tactical level plans for Business Planning and Law Enforcement Management; and Operational Level Plans for Patrolling, Visitor Management, Cave Management, Community Outreach and Cooperation, Training, Monitoring and Research, and Annual Operational Work Plans.
- Procure equipment needed for implementation of the Management Plan and routine management.
- Construct infrastructure needed to improve working conditions and visitor services, including guard stations, an Interpretation Centre and a Botanical Garden.

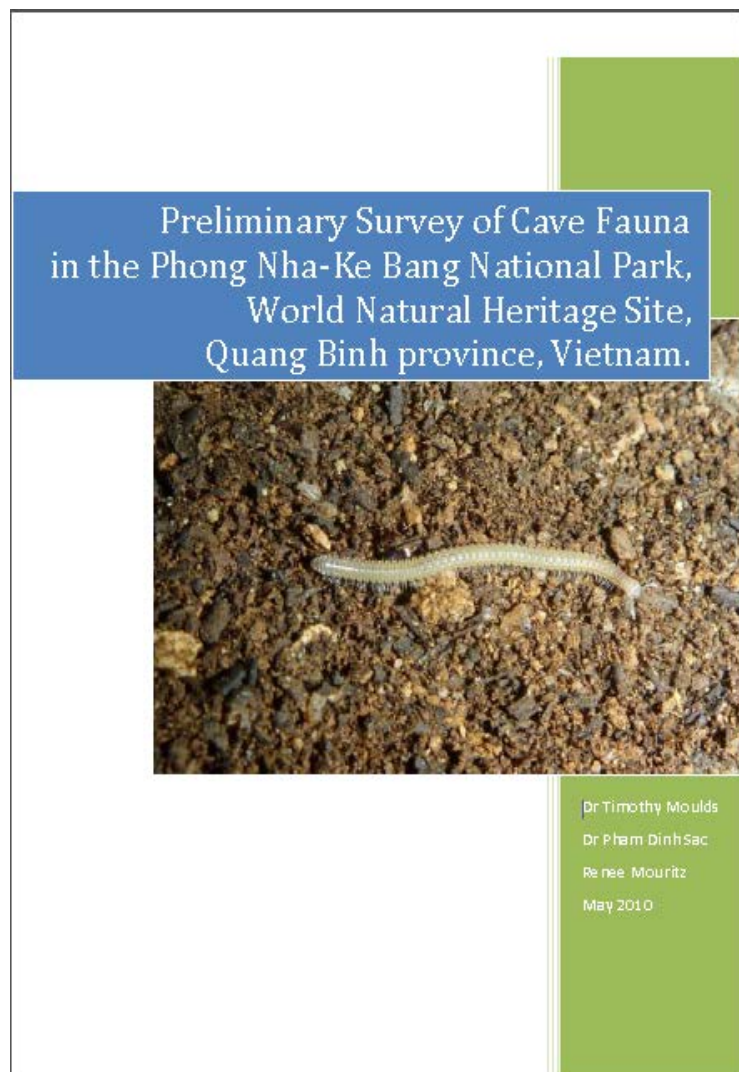
¹⁶ The task of demarcation is generally out-sources to experts from the Forest Inventory and Planning Institute, and so no training is recommended here.

¹⁷ Hockings, M., Stolton, S., Leverington, F., Dudley, N. and Courrau, J. (2006) Evaluating Effectiveness: A framework for assessing management of protected areas, (2nd edn) World Commission on Protected Areas, IUCN; Gland, Switzerland. <http://data.iucn.org/dbtw-wpd/edocs/PAG-014.pdf>

- Establish and develop capacity and facilities so as to make PNKB a regional centre for scientific research that can strengthen domestic and international scientific research cooperation, hosting research expeditions, trainings and study tours¹⁸.
- Carry out the routine professional financial management and administration needed for implementation of the Management Plan and management of the World Heritage Site.
- Revise the Strategic Management Plan for the PNKB region in 2025.

Monitoring, research and knowledge management for adaptive management

- Develop, test and review detailed monitoring protocols to ensure the quality and credibility of information.
- Repeat the METT assessment with full participation of Park staff and begin using the Enhancing our Heritage (EoH) Toolkit in 2013, repeating the process every 5 years.
- Design, establish and maintain a database to record details on all violations in the Park.
- Repeat the participatory Threat Reduction Assessment every year.
- Monitor tourism following UNESCO guidelines and complete the UNESCO Periodic Reporting every year.
- Monitor impacts of Management Action on reducing poaching of protected species by tracking indices of key indicator species using transects, fixed plots and camera traps, as well as the indices of numbers of traps and snares in a fixed plot and numbers encountered per kilometer by patrollers.



Phong Nha – Ke Bang National Park World Heritage Site could become a global hotspot for research on karst and caves.

¹⁸ The Park's Centre for Scientific Research, which manages a botanical garden and wildlife rescue centre, may be a foundation on which to develop and implement a collaborative, interdisciplinary and strategic approach to research and education in the region.

- Monitor impacts of Management Action on reducing illegal logging with repeated forest resource inventory in fixed plots and through satellite image interpretation.
- Monitor collection of NTFPs and fire wood by interviewing harvesters (focal group surveys) to track change in harvest per day of effort.
- Monitor tourism impacts, tracking water pollution, solid waste and noise pollution at popular tourist sites.
- Monitor tourism impacts on cave micro climate and CO² concentrations at tourist caves. Implement photo-monitoring to track damage to speleothems.
- Closely monitor all construction projects inside the World Heritage property to track compliance with mitigation plans and short-term and long-term impacts to heritage values.
- Monitor invasive species in fixed plots, beginning with inventory of selected invasive species in key areas where this has been identified as a problem.
- Develop and implement a plan for scientific and technical studies and research on operating methods to counteract the dangers that threaten the Park's natural and cultural heritage.

Sustainable financial support

- Prepare and track annual operational workplan budgets.
- Draw up sustainable financing strategies for management and engage in business planning, based on *Business Planning for Natural World Heritage Sites – A Toolkit*.
- Plan for and participate in various proposed Payment for Ecological Services schemes for transfer of payments from: tourism operators, visitor fees, downstream water users and REDD+ carbon credits, etc., both to the National Park/World Heritage site and for support of relevant activities in the Buffer Zone.
- Organize corporate sponsorships and solicit support from ODA and charitable foundations.
- Prepare to fully implement Decision 24, piloting the investments in selected villages, and eventually applying for all eligible villages in the Buffer Zone.

Monitoring for this Objective will utilize the Management Effectiveness Tracking Tool and Enhancing Our Heritage Toolkits.

SELECTED REFERENCES

- Anon. (2008) *Greater Blue Mountains World Heritage Area Strategic Plan*. Department of Environment and Climate Change (New South Wales); Sydney. 58pp.
- Apel, U., Maxwell, O.C., Nguyen Trong Ninh, Nurse, M., Puri, R.K. and Trieu Van Co (2002) *Collaborative Management and Conservation: A Strategy for Community Based Natural Resource Management of Special Use Forest in Vietnam*. Fauna & Flora International/World Bank; Cambridge, UK. (Summary in Vietnamese).
- Appleton, M. R., Texon, G.I. &Uriarte, M.T. (2003) *Competence Standards for Protected Area Jobs in South East Asia*. ASEAN Regional Centre for Biodiversity Conservation: Los Baños, Philippines. 104pp.
- Hockings, M., Stolton, S., Leverington, F., Dudley, N. and Courrau, J. (2006) *Evaluating Effectiveness: A framework for assessing management of protected areas*, (2nd edn) World Commission on Protected Areas, IUCN; Gland, Switzerland.132 pp.
- Hockings, M., James, R., Stolton, S., Dudley, N., Mathur, V., Makombo, J., Courrau, J. and Parrish, J. (2008) *Enhancing our Heritage Toolkit: Assessing management effectiveness of natural World Heritage sites*. UNESCO World Heritage Centre; Paris, France.
- Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage (2011) *Operational Guidelines for the Implementation of the World Heritage Convention*. Heritage Centre: UNESCO World Heritage Centre: Paris. 173pp.
- Pedersen, A. (2002) *Managing Tourism at World Heritage Sites: a Practical Manual for World Heritage Site Managers*, World Heritage Paper No. 1, UNESCO, World Heritage Centre, Paris 2002.
- Stolton, S. Dudley, N. and Shadie P., coordinating authors (2012) *Managing Natural World Heritage*. UNESCO / ICCROM / ICOMOS / IUCN, 2012. 101pp.
- Toomey, R.S. (2009) 'Geological monitoring of caves and associated landscapes', in Young, R. and Norby, L. Geological Monitoring, Geological Society of America; Boulder, Colorado pp 27-46
- Williams, P. (2008). *World Heritage Caves and Karst*. IUCN: Gland, Switzerland. 57pp.
UIS Department of Karst and Cave Protection (2012) Recommended management guidelines for show caves. *In litt.*6 pp.

ANNEXES

The area of today's PNKB NP has been a place of note since the 1920s when the Phong Nha Cave was first discovered and visitors started to travel to the area. In 1937, the Bureau of Tourism of the French Resident Superior in Hue issued a brochure to introduce tourists to Quang Binh Province and the Phong Nha Cave. During periods of war, the forests and caves around the PNKB NP area in general and the Phong Nha Cave in particular were used as military quarters and weapon storages by the Vietnamese Army. PNKB NP and the area surrounding the National Park were also an important transport corridor for goods and for supporting military operations. A key route of the Ho Chi Minh Trail travels along the current National Park borders. National Road 20, which was an important access route to Lao PDR during the war, crosses the National Park property.

After the periods of war, local authorities organised and carried out surveys to protect the region around PNKB. In 1986, a strictly protected forest area in PNKB was established with an area of 5,000 ha. More people began visiting the area and in 1990 the first guesthouse was built at Xuan Son Ferry offering the first boat tours to Phong Nha Cave. In 1993, the PNKB Nature Reserve was established with an area of 41,132 ha and in 2001 the Vietnamese Government issued a Decision to upgrade the PNKB Nature Reserve to the PNKB NP. In 2003 the PNKB NP was officially listed as a UNESCO WHS. An extension to the National Park land was granted in 2008 which included 31,070 ha of land in the area of Thuong Hoa and Hoa Son communes (Minh Hoa District).

Table 1 and Map 1 provide a summary of functional zones of the PNKB NP WHS and communes in the Buffer Zone as of 2012.

1

Strictly Protected Area inside World Heritage property	68,894	
Strictly Protected Area outside World Heritage property	37,572	
Ecological Restoration Area (also in World Heritage property)	17,449	
Administrative and Service Area (also in World Heritage property)	3,411	
	123 32	221 200
	344 52	

World Heritage values are outstanding universal values that are directly related to the criteria for which an area is included on the World Heritage List. PNKB National Park World Heritage Site was inscribed on the World Heritage List in 2003 because it satisfies one of the criteria for natural values of outstanding universal significance as an outstanding example representing major stages of earth's history, including significant on-going geological processes (World Heritage Criterion viii).

Phong Nha displays an impressive amount of evidence of earth history. It is a property of very great importance for increasing our understanding of the geologic, geomorphic and geo-chronological history of the region. Phong Nha is part of a larger dissected plateau, which also encompasses the Ke Bang and Hin Namno karst (in Lao PDR). The plateau is probably one of the finest and most distinctive examples of a complex karst landform in Southeast Asia. The karst formation of Phong Nha-Ke Bang National Park has evolved since the Paleozoic (some 400 million years ago) and so is believed to be the oldest major karst area in Asia. Subject to massive tectonic changes, the park's karst landscape is extremely complex with many geomorphic features of considerable significance. The vast karst area, extending across the border into the Lao People's Democratic Republic, contains spectacular formations including over 104 km of caves and underground rivers, making it one of the most outstanding limestone karst ecosystems in the world.

The karst formation processes have led to the creation of a variety of cave types on the property, including underground rivers, dry caves, terraced caves, suspended caves, dendritic caves and intersecting caves. The centerpieces of the site are the Phong Nha Cave, through which an underground river flows 44.5 km, and Paradise Cave, recently opened to the public. The Park protects the Son Doong Cave, believed to be the world's largest dry cave. These and the hundreds of other caves discovered to date demonstrate discrete episodic sequences of events, leaving behind various levels of fossil passages, formerly buried and now uncovered karst from previous, perhaps very ancient, periods; evidence of major changes in the routes of underground rivers; changes in the solutional regime; and other unusual features.



A speleothem in the undeveloped portion of Paradise Cave.

Phong Nha-Ke Bang NP WHS has other outstanding values that have the potential to qualify for World Heritage listing in their own right.

On-going Evolutionary Processes: PNKB should be globally recognized as an outstanding example of significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, and subterranean ecosystems and communities of plants and animals (World Heritage Criterion ix).

PNKB National Park protects a large portion of one of the best preserved tracks of limestone forest in the central Truong Son range (Annamites), which has been recognized as a critical landscape of the Greater Annamites Global 200 Bioregion. Many endemic and near-endemic vertebrates are associated with this ecoregion, which has been identified as one of the greatest concentrations of endemic species in a continental setting found anywhere¹⁹. PNKB NP is a key protected forest within the Central Indochina Limestone Priority Landscape (NA6), which is ranked as globally critical for biodiversity conservation. It hosts numerous limestone specific taxa, including a number of Annamite endemics—more so than the Northern Indochina Limestone Landscape (NA1), - making the Central Indochina Limestone the most extensive limestone area holding the most distinctive limestone community in the Greater Annamites Ecoregion. This area is critical for the conservation of primate species and limestone specialist species.

Of particular note are several primitive or relict species that have been recently discovered in PNKB which have few or no close relatives, including the Saola (*Pseudoryx nghentinhensis*), Annamite Striped Rabbit (*Nesolagus timmins*), and Laotian Rock Rat (*Laonastes aenigmamus*). The last of these, in particular, has been identified as a 'Lazarus species', the only representative of a lineage (Diatomyidae) that was previously only known from fossils that date to at least 11 million years bp. The persistence of more primitive or relict species such as these could be attributed to long-term habitat stability in the region, the effect of a stable climate and of regular uplifts over a long period maintaining a suitable distribution of habitat types.

“Although it is difficult to quantify rates of endemism and compare them among areas and groups of organisms, these observations suggest that central Vietnam’s uplands and associated lowland areas may be a focal point or hotspot of endemism within mainland Southeast Asia. If true, a possible explanation is that the Truong Son Range remained climatically and ecologically stable as the surrounding forests and other habitats contracted, expanded, or turned over during long-term climate fluctuations. Its forests may have served as refuge for forest-dwelling species during cooler, drier periods when their evergreen forested habitats disappeared from lower elevations. Under these long-term, stable conditions, older species were preserved and the evolution of new species may have been facilitated²⁰.”

Several ongoing evolutionary processes may have resulted in the high rate of endemism and unusual faunal features of PNKB: The development of a stable, warm tropical high rainfall

¹⁹ WWF (2012) About the Annamites Ecoregion.

http://wwf.panda.org/what_we_do/where_we_work/project/projects_in_depth/greater_annamites_ecoregion/about_the_area/ Downloaded 18 August 2012.

²⁰ pp. 223-224 in EJ Sterling, MM Hurley, Le Duc Minh (2006) *Vietnam: A Natural History*. Yale University Press; New Haven.

monsoon weather system since the Pleistocene cold period may have accelerated evolutionary development within the karst landscape. Many endemic taxa found in the Park, such as the two similar langurs - the Hatinh Langur (*Trachypithecus hatinhensis*) and the Indochinese Black Langur (*T. ebenus*), have overlapping but distinct range boundaries. This patchy distribution may be due to climatic, geographic, or ecological barriers, or interspecific competition that prevented effective dispersal out of the patches. It could also be that these taxa have not yet recolonized other areas since the last glacial maximum 18,000 years ago, even though they may be capable of doing so. The episodic uplift of the limestone landscape from (at least) the Tertiary and the successive karst development, rejuvenation and ongoing evolutionary karst development has created specialist habitats. These specialised habitats that have fostered evolutionary development in the karst landscape continue to exist, including within caves (troglotic species), at cave entrances (cave nesting volant vertebrates and the invertebrate communities that they support; low light specialist vegetation species), and within dolines (refugia for relict types dependent on the high humidity and colder air temperatures generated by caves).

Cave fauna in particular show the striking effect of isolation on species divergence. A preliminary study of the cave fauna from the PNKBNP WHS found at least 41 species of invertebrates among 248 individual specimens collected from the three cave systems surveyed. Only five species were common across the three caves. The discovery of two species of blind scorpions in PNKB is highly significant, as there are currently only about 20 described cave dwelling scorpions in the world that exhibit troglomorphic characteristics. The new species, *Vietbocap thienduongensis* and *V. canhi*, were the first troglotic scorpions found in mainland Asia.

Biodiversity: PNKB NP WHS should also be recognized for its global importance in *in-situ* conservation of biological diversity, including species of outstanding universal value from the point of view of science or conservation (World Heritage Criterion x).

The PNKB NP WHS property is of global significance for the conservation of biodiversity because its forest ecosystems, both karst and non-karst, support a high diversity of plants and animals, including a number of karst specialist species, many endemic species and a number of species that are globally threatened. Its rich diversity of endangered species still includes large mammals such as Asiatic Black Bear (*Selenarctos thibetanus*), Malayan Sun Bear (*Ursus malayanus*), Binturong (*Arctictis binturong*), Large-antlered Muntjac (*Muntiacus vuquangensis*), Saola (*Pseudoryx nghentinhensis*), Gaur (*Bos gaurus*, a small population of which still exists immediately south of the Park), and Tiger (*Panthera tigris*, of which there are recent provisional unconfirmed records from the Park). Living in PNKB specifically are many endemic and restricted range species, including charismatic representatives such as the Red-shanked Douc (*Pygathrix nemaeus*), Southern White-cheeked Gibbon (*Nomascus siki*), Large-antlered Muntjac (*Muntiacus vuquangensis*), Crested Argus Pheasant (*Rheinardia ocellata*), and Annam Flying Frog (*Rhacophorus annamensis*).

PNKB supports four of seven restricted range species of the Annamese Lowland Endemic Bird Area. The Park's fauna includes a number of recently discovered karst endemics, including vertebrates such as Hatinh Langur (*Trachypithecus hatinhensis*), Sooty Babbler, (*Stachyris herberti*), Bare-faced Bulbul (*Pycnonotus hualon*) and Limestone Leaf-Warbler (*Phylloscopus calciatilis*). Of particular note is a 'Lazarus taxon': the Laotian Rock Rat (*Laonastes aenigmamus*), which is the only living species in a family that disappeared from the fossil record for 11 million years but was recently rediscovered by science.

The limestone forest ecosystem at Phong Nha-Ke Bang supports a high diversity of plant species as well. Of perhaps the greatest conservation significance are several species found at the site that are endemic to this part of central Vietnam and Laos. The site supports 419

plant species that are endemic to Vietnam. In addition, one genus and nine species were recently discovered that all appear to be new for science (Avervanov et al. 2011).

Almost 94% of the PNKB NP WHS property is forested, and 84% of this is old-growth forest. The property is also recognized as part of a Global 200 priority ecoregion, an Indo-Burma global biodiversity hotspot and an Endemic Bird Area that is not otherwise represented on the World Heritage List. The Park hosts more than 2,851 species of vascular plants, including 419 that are endemic to Vietnam, and 755 species of vertebrates, of which 69 are globally threatened. As of 2012, 12 species of plants recorded in the Park were considered globally Critically Endangered, and 11 were globally Endangered, The Park possesses 39 mammals that are included in the IUCN List of globally threatened species. Seven of the nine primate species occurring in the park are globally threatened, and the Park is the most important refuge for three of them. The Park probably has the largest remaining populations of the globally endangered Southern White-cheeked Gibbon and Hatinh Langur, a primate that is specialized for karst forest and is endemic to Vietnam and Lao PDR.



Figure 3–6. *Viatrocap caezhi* sp. n., male holotype and female paratype, dorsal and ventral aspects. Scale bar = 10 mm.

A figure from the formal description of a new species of blind cave scorpion, one of many new species recently discovered in Phong Nha – Ke Bang National Park World Heritage Site. The Park is a natural laboratory for the study of evolutionary and ecological processes.

Apart from the features which are recognized as having World Heritage value, PNKB has numerous other outstanding values that complement and interface with its World Heritage values. Protection of all of these values is an integral part of managing Phong Nha - Ke Bang National Park WHS and the greater Phong Nha-Ke Bang region.

Historic Values

PNKB NP WHS includes numerous places of great historic significance. In addition to a long history of human occupation, PNKB became a key theatre during the US-Vietnam War. The Ho Chi Minh trail, including Road 20 to Lao PDR and associated trails in and near the Park, were key transportation routes for the war effort. In some ways, this is where the outcome of the war was decided.



Pilgrims pay their respects to the war dead at the Eight Heroic Volunteers Cave in Phong Nha – Ke Bang National Park World Heritage Site.

During periods of war, the forests and caves around the PNKB NP area in general and the Phong Nha Cave in particular were used as military quarters, weapon storage depots, shelters, theatres, and hospitals by the People's Army of Vietnam. PNKB NP and the area surrounding the National Park were an important transport corridor for goods and for supporting military operations during the US-Vietnam

War. Key parts of the Ho Chi Minh Trail traveled along the current National Park borders, and Road 20, which became the key to a critical by-pass route through Lao PDR during the war, crosses the National Park property. Through heroic efforts, these critical transport routes were maintained in the face of "a campaign of air interdiction that dwarfs anything in military history before or since." Quang Binh Province is said to have the distinction of having been one of the most bombed areas on earth. In mid-1965 the number of bombing sorties being flown here reached a peak of 1,000 sorties per month. Maintaining the transport of men and materials from north to south, despite this all-out effort by a far greater military power, was key to the eventual success of the People's Army of Vietnam from the north and the National Front for the Liberation of South Vietnam in the south. More than just a supply route cut through the heart of Indochina, the Ho Chi Minh Trail was in essence the heart of the war efforts. According to the United States National Security Agency's official history of the war, the Trail system was "one of the great achievements of military engineering of the 20th century..."

Historical sites in the PNKB NP WHS include:

- Phong Nha Cave, which was an important military quarters and hospital during the war, The Phong Nha Cave is the iconic site for the region. The cave has become a high volume, mass tourism site, currently receiving approximately 250,000 visitors per year. In the high season visitor numbers can easily exceed 2,000 in a day.
- The Eight Heroic Volunteers Cave and nearby Nurses' Cave are important spiritual and historical sites inside the PNKB NP on Road 20. The Eight Heroic Volunteers Cave, where volunteers were buried alive during a bombing raid, together with the Nurses' Cave have taken on great significance as memorial sites for all the sacrifices made during the war. They have become pilgrimage destinations for all Vietnamese and for veterans from both sides of the former conflict. The Eight Heroic Volunteers Cave is a high volume tourism site and it has been estimated that more than 150,000 visitors travel to this site each year.
- Victorious Road 20 and the Ho Chi Minh trail network are important historical routes that played key roles in the US-Vietnam War. The Ho Chi Minh Highway West is the only portion of the Trail in the Park that is now paved, and it has become a popular scenic route for bikers. Other sections of the Trail network remain undeveloped, and still present the visitor with the experience of these rough wartime troop and supply routes, climbing up and down the karst hills, hidden from the bombers by a dense forest canopy.
- The Ho Chi Minh Museum is planned at the junction of the Ho Chi Minh Highway and Victorious Road 20 in the PNKB NP. The Museum will present the historical significance of the region, and is planned to be of regional and national historical importance.

Indigenous Culture and Cultural Diversity

Phong Nha - Ke Bang area was inhabited for centuries. Champa inscriptions have been found inside caves in the park, including Phong Nha Cave.

The Park and Buffer Zone together have a population of over 62,000 people in 13 communes. The majority ethnic group is Kinh, but there is a significant proportion that follow the Catholic faith and traditions introduced by European missionaries beginning in the 17th century. The total population also includes 19% ethnic minorities, belonging to the Bru-Van Kieu group (including Van Kieu, Khua, Macoong and Tri sub-groups) and Chut group (including Sach, May, Ruc, Arem and Ma Lieng sub-groups). Most ethnic minority communities inhabit the more remote, steeper parts of the Buffer Zone. Today, approximately 11,000 inhabitants of the Phong Nha - Ke Bang region are from ethnic minorities.

As of 2012, there were two ethnic minority groups with 78 households and 444 peoples living in the Core Zone of the PNKB NP, with about 150-200 ha of agricultural land. Until the 1990s, the Arem people lived in caves inside what is now the Park, but they have been resettled in village No. 39 of Tan Trach Commune which is located along the National Road 20 near the Western border of the National Park. The Van Kieu people have settled in Doong Village in Tan Trach commune located near the Southern border of the National Park.

The cultural traditions of the Arem, Van Kieu, Ruc and other minority people living in the PNKB region are still apparent there, but are at great risk of being lost. Indigenous people have lived in the area for hundreds of years, and much of their traditional way of life is linked with the use of natural resources from the forests of Phong Nha- Ke Bang. These communities still retain significant indigenous knowledge about the caves, the forest and the uses of its species.

Recreation and Tourism

PNKB has outstanding recreational values because of the intrinsic beauty of its caves and of the forested karst landscape, all easily accessible from major population centres in Vietnam. PNKB provides opportunities for quality recreation and tourism experiences that are increasingly in demand, and rare by world standards.

PNKB NP WHS offers a wide range of recreational opportunities, and is receiving increasing attention from both national and international visitors. The Park contains a wealth of potential tourist attractions and offers abundant recreational opportunities, many of which have national or regional significance because of their rarity elsewhere. Among the many sites open to tourists, three notable sites have already been developed and are exceptionally popular:

Phong Nha Cave is a water cave and the feature attraction of the PNKB NP Region. It is located in the administration and service area approximately 30 minutes by boat from Phong Nha Township center. It is usually accessed by rented boats operated by local people. Phong Nha became a place of note in the 1920s when the Phong Nha Cave was first discovered and visitors started to travel to the area. Since the periods of war, and especially since the designation of PNKB as a World Heritage Site in 2003, Phong Nha Cave has become a high volume/mass tourism site. The cave received approximately 250,000 visitors in 2010, and in the high season visitor numbers can easily exceed 2,000 in a day. The Phong Nha Cave is the iconic site of the region and the vast majority of the visitors visit the cave during their stay.

Paradise Cave (Hang Thien Duong) presents an outstandingly beautiful collection of speleothems and cave features of many types that are still very well preserved and in an original state. The entrance to the cave is in the Ecological Restoration Area of PNKB NP, about 70 km northwest of Dong Hoi and 4.7 km west of the West Ho Chi Minh Highway. The cave has already demonstrated high potential as a stand-alone tourism product and as



Adventure tourism in the wild portion of Paradise Cave. Phong Nha – Ke Bang National Park has vast untapped tourism potential for adventure tourism, nature tourism and cultural tourism.

a very exclusive adventure tourism product. Truong Thinh Corporation, which has invested to develop tourism at the site, is the first private enterprise permitted by Quang Binh Province to invest in tourism development in the Park.

The Eight Heroic Volunteers Cave is an important spiritual and historical site inside PNKB NP WHS. It is easily accessible through the road network inside the PNKB NP, located on National Road 20 about 40 minutes driving from Phong Nha Township. The Eight Heroic Volunteers Cave is very popular with domestic visitors and is managed as a high volume tourism site. In 2010, it was estimated that 150,000 visitors travelled to this site in one year, and the numbers are probably much more today.

Social and Economic Values

The regional economy surrounding PNKB is receiving increasing support from tourism. The Park has considerable social and economic value and contributes directly and indirectly to employment, to income and to revenue in the region. Visitation to PNKB Park is growing rapidly, reflecting the Park's increasing importance as a destination for both day trips and longer stays.

The noticeable growth in visitors to Quang Binh Province over recent years can be attributed largely to the UNESCO WHS listing of PNKB NP. Visitation to the PNKB NP Region has increased considerably recently from approximately 80,582 in 1999 to over 366,753 in 2011. Although there is no comprehensive estimate of the economic value of this visitation, in 2011 the government of Quang Binh Province reported receipt of 24.5 billion Vietnamese Dong (about \$1.2 million USD) in total tourism revenue from PNKB NP entrance tickets and service taxes. The Park and associated tourism operations have also been taking on an increasing role in providing quality employment to local people in what is otherwise a poor area entirely dependent on forestry and traditional agriculture.

Research and Education

The complexity of its geomorphology and the richness of its biodiversity and ecosystems make the PNKB NP WHS an ideal area for research and education.

Information arising from scientific research and exploration conducted so far were the basis for the World Heritage nomination, however, current knowledge about the World Heritage values of the Park is far from complete. The high scientific value of the Park reflects not only what has already been discovered, but also what remains to be discovered. Further research and exploration is a critical need. Large gaps in knowledge remain, particularly that needed to better understand the geological and biological processes that gave rise to the spectacular geomorphology of the area and the outstanding and unique biodiversity.

Since many species, communities and geological phenomenon are found only in this region, there will certainly be ongoing scientific interest in PNKB. This interest should be fostered, since effective management of the Park relies on adequate understanding of its resources and the threats that they face. Allowing and facilitating relevant scientific research is directly related to one of the obligations under the World Heritage Convention to encourage scientific research into the identification, conservation and rehabilitation of the World Heritage Site's Outstanding Universal Values, as well as to foster best management processes and abatement of threatening processes.

The educational value of PNKB is heightened by its accessibility to many institutions of higher learning, particularly universities in Hue and Dong Hoi. The Park's Center for Scientific Research, which manages a botanical garden and wildlife rescue center, is a foundation on which to develop and implement a collaborative, interdisciplinary and strategic approach to research and education in the region.

Scenic, Aesthetic, Inspirational and Existence

The dramatic karst landscape of PNKB World Heritage Site provides a scenic landscape of extraordinary beauty full of inspiring wonders.

The stunning spectacle of PNKB's caves has attracted visitors since the earliest days of modern tourist activity in Vietnam. The breath-taking beauty, magnificent size and awe-inspiring age of its cave formations; the rugged landscapes with row on row of karst mountains receding into the distance; the verdant green vegetation of its old-growth forests abounding with species, many of them yet to be discovered; the solitude of its foot paths and streams; All in all, a visit to PNKB NP WHS can be an experience of the sublime. These and other attributes of PNKB excite a sense of wonder and also promote serenity and reflection in the minds of visitors. Such feelings are valued by individuals and society, inspiring writers, painters, photographers and other artists to create, and rejuvenating the human mind, battered by a crowded, busy modern world.

Looking down from a scenic overlook on the vast karst landscape covered with old-growth forests and knowing that there are gibbons and monkeys in those trees somewhere and that a tiger may still prowl the forest floor below is inspiring, even if most visitors will never see these animals in the wild. The massive size and unexpected wonders of Son Doong Cave, known as the world's largest cave, have inspired millions of people all over the world through the media of photography and video. There is pleasure in knowing that places such as this exist and are protected, even though we may never be able to visit them. The value that society ascribes to this pleasure is technically called existence value. Simply knowing that wonders such as these exist and are protected forever is a value for many people throughout the world, even among those who may never be fortunate enough to visit the WHS.



The entrance to Son Doong Cave. Closed to tourists, the cave has been seen by millions of people through photographs and video.
Photo: Carsten Peter through National Geographic.

The Provincial People's Committee (PPC) of Quang Binh has the highest level of authority and responsibility for managing and monitoring activities in the PNKB NP Region. PNKB NP Management Board has direct responsibility for managing the National Park and World Heritage Site. It is a unit directly under the PPC of Quang Binh. The most relevant Departments in the PPC include the Department of Culture, Sports and Tourism, the Department of Planning and Investment, and the Department of Agriculture and Rural Development.

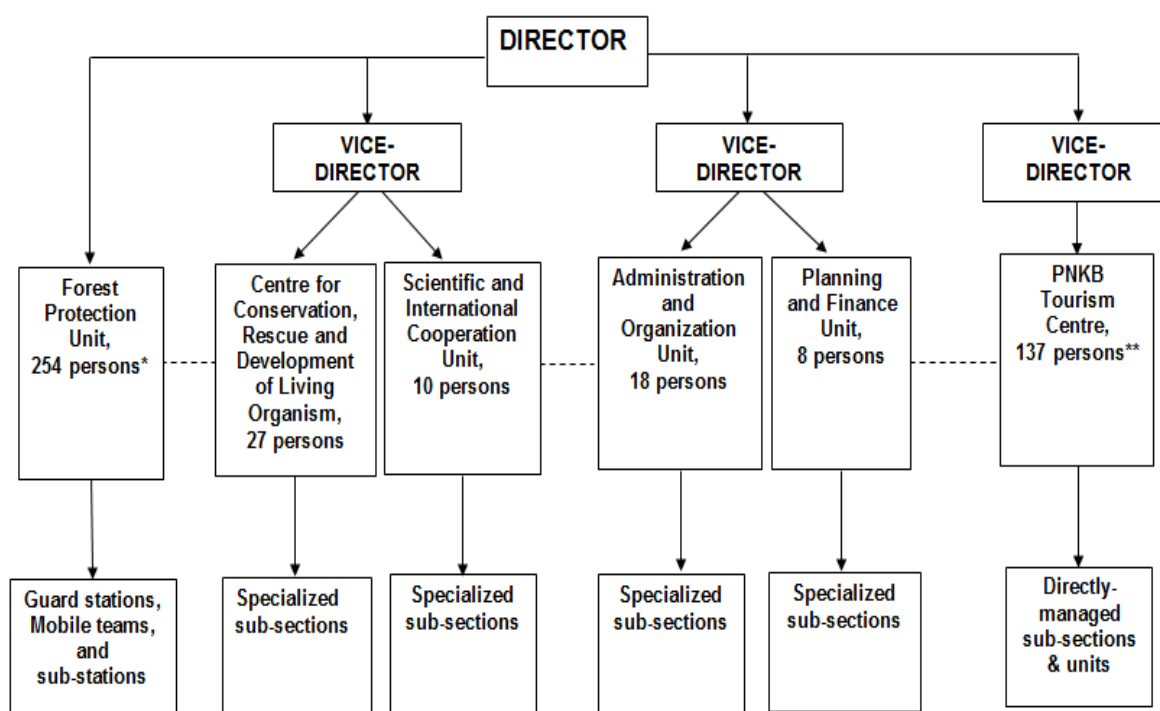
The institutional framework for management and monitoring of the PNKB NP Region is described as follows:

- The Department of Planning and Investment has the responsibility to advise the Provincial People's Committee for directing the investment and implementation of infrastructure plans and activities delivered at the District and Commune levels.
- The Department of Agriculture and Rural Development through its Provincial Forest Protection Department have the responsibility for monitoring activities of forest resource management in both the Core Zone and Buffer Zone.
- The Department of Natural Resources and Environment has the responsibility for monitoring activities of land, rock, karst, mine and water resource management in the Park and surrounding region.
- The Department of Science and Technology has responsibility for monitoring activities relevant to science and technology in the Park.
- The Department of Culture, Sports and Tourism has responsibilities for monitoring activities relevant to cultural conservation and development as well as tourism in both the Core Zone and Buffer Zone.
- District Forest Protection Departments have responsibilities for monitoring activities of forest management and protection in the Buffer Zone. The National Park has its own Forest Protection Department with the same responsibility for the Core Zone.
- The Department of Police has responsibility for all law enforcement in the Buffer Zone and Core Zone.
- The regional military authorities have responsibility for patrolling the international border.
- District Peoples' Committees (DPC) and Commune Peoples' Committees (CPC) have responsibilities for cooperating and mobilising local people to participate in forest protection in both the Core Zone and Buffer Zone.
- Communities in the Core Zone and Buffer Zone are able to participate in monitoring activities of natural resource management in their areas.

The PNKB NP has a management board with one director and two vice-directors and is organised in three units (Scientific Research and Rescue Centre, Cultural and Eco-tourism Centre, National Park Forest Protection Unit) and two functional offices (Administration – Organization and Planning - Finance). It is planned that the Cultural and Eco-tourism Centre will be reorganized as a joint-stock company partly owned by .

The PNKB NP currently employs a total of 220 state officials and civil servants. According to a restructuring proposal submitted for approval in 2012, the future organization will include an Executive of a Director and 3 Vice-Directors, a National Park Forest Protection Unit with 254 permanent staff for protection and management of natural resources of the PNKB NP, the Centre for Conservation, Rescue and Development of Living Organisms with 27 permanent staff involved in rescuing and displaying wildlife and plants, a Unit for Scientific and International Cooperation with 10 fulltime staff for scientific research, an Administration and Organization Unit with 18 fulltime staff, and a Planning and Finance Unit with 8 fulltime staff. Finally, the National Park Management Board currently supervises the Phong Nha – Ke Bang Tourism Centre which has 137 permanent staff who are tasked with sustainable management and development of cultural, geological and ecological values and presentation and promotion of the heritage values of PNKB NP. It has been proposed that the Tourism Centre will become a joint-stock company, co-owned by the National Park and private investors. If this comes to pass, the protection functions of the Tourism Center (guards in the caves and at other sites) should be turned over to the National Park.

Figure 3 illustrates the organisational structure of the PNKB NP



* Quota to be filled.

** Reorganization into a joint-stock company may be pending.

Average population density of the communes in the Buffer Zone of Phong Nha – Ke Bang NP is low (19.0 people/km²), however it is unequally distributed among communes. The communes with high population density are Phuc Trach (178.7 people/km²), Hung Trach (116.7 people/km²) and Son Trach (105.1 people/km²). Meanwhile, the communes of Thuong Trach and Tan Trach have very low population density, with 3.39 and 1.22 people/km² in respective, but all 443 people living in Tan Trach live inside the National Park and World Heritage Site.

Table 2: Overview of Population of the Buffer Zone communes in 2011

					2
	Hung Trach	11104	9515.0		116.7
	Phuc Trach	10761	6022.4		178.7
	Son Trach	10653	10138.7		105.1
	Tan Trach	443	36281.0	443	1.2
	Thuong Trach	2461	72572.5		3.4
	Phu Dinh	2719	15360.2		17.7
	Xuan Trach	5727	17716.9		32.3
	Trung Hoa	5751	9453.9		59.7
	Dan Hoa	3491	17652.0		19.8
	Trong Hoa	3568	18885.2		18.8
	Hoa Son	1616	18030.7		9.0
	Thuong Hoa	3168	35470.0		8.9
	Truong Son	4021	77427.9		5.2
		5483	34452 .3	443	19.0

Source: Statistical Yearbooks of districts, 2011

Ethnic minority people

The ethnic minority people living in the Buffer Zone and Core Zone of the National Park belong mainly belong to the Bru - Van Kieu ethnic minority group (including Van Kieu, Khua, Ma Coong and Tri sub-groups) as well as Chut (Ma Lieng, May, Sach, Ruc, and Arem sub-groups). About 22.31 percent of the population of the Buffer Zone belongs to ethnic minorities. Table 3 shows the number of ethnic minorities per commune in 2009.

Table 3: Ethnic minorities by commune in 2009

	Hung Trach	2602	11071	0	0	0%
	Phuc Trach	2369	10713	0	0	0%
	Son Trach	2454	10571	32	146	1%
	Tan Trach	78	444	74	437	98%
	Thuong Trach	469	2464	469	2464	100%
	Phu Dinh	655	2713	0	0	0%
	Xuan Trach	1249	5701	0	0	0%
	Trung Hoa	1037	5122	15	94	2%
	Dan Hoa	669	3342	651	3323	99%
	Trong Hoa	641	3463	641	3463	100%
	Hoa Son	318	1547	247	1107	72%
	Thuong Hoa	654	3065	172	757	25%
	Truong Son	919	4027	528	2542	63%
		14114	4243	2829	14333	22

There are currently two ethnic minority groups with 78 households and 444 peoples living in the Core Zone of the PNKB NP. The Arem people have settled in village No. 39 of Tan Trach commune which is located along the National Road 20 near the Western border of the National Park in the Ecological Restoration Area. A small number of Van Kieu people have settled in Doong village in Tan Trach commune located within the Strictly Protected Area near the Southern border of the National Park. The Doong villagers were in the process of being resettled, but the law also allows them to remain on site if granted a short-term forest conservation contract supervised by the PNKB National Park.



Arem people living inside Phong Nha – Ke Bang National Park World Heritage Site. Over 400 minority people currently live inside the protected area.

The International Convention and Operational Guidelines for World Heritage Sites guide the management of all World Heritage Sites.

- International Convention on Cultural and Natural Heritage Protection dated November 16th 1972;
- Operational Guidelines for the Implementation of the World Heritage Convention, UNESCO World Heritage Centre, 2005.

Of particular relevance to the management of PNKB NP WHS are the Law, Decrees and Decisions that regulate management of protected forests (“Special Use Forests”) in general and Phong Nha - Ke Bang National Park in particular:

- Law on Forest Protection and Development, dated December 3rd, 2004;
- Decree No. 23/2006/NĐ-CP on implementation of the Law on Forest Protection and Development;
- Decision No. 186/2006/QĐ-TTg on promulgating the Regulations on Forest management;
- Decree No. 117/2011 of the Government of Vietnam on special-use forest organization and management;
- Circular No: 78/2011/TT-BNNPTNT of the Ministry of Agriculture and Rural Development guiding implementation of Decree 117.
- Decision No.: 24/2012/QĐ-TTg of the Prime Minister On investment policy for development of special – use forests in 2011 – 2020.
- Decision No. 189/2001/QĐ-TTg of the Prime Minister on upgrading Phong Nha – Ke Bang Nature Reserve to National Park dated December 12th, 2001;
- Decision No. 18/2007 of the Quang Binh Provincial People’s Committee issuing regulations on management of Phong Nha - Ke Bang National Park;
- Decision No. 442 /UBND of the Quang Binh PPC ref. agreement for investment project and opening a specially-used road to Paradise Cave dated March 3, 2010.
- Decision No. 2235/QĐ-TTg of the Prime Minister on approval of development of a construction master plan for Phong Nha - Ke Bang National Park until 2025;
- Decision No 857/QĐ-UBND dated 20th April 2007 by the Quang Binh Provincial People’s Committee approving planning 2006-2010 for three forest types
- Decision No 1678/QĐ-UBND dated 14th July 2008 by the Quang Binh Provincial People’s Committee on land allocation to Phong Nha Ke Bang National Park Management Board

Decision No. 18/2007 sets out the regulations for the various Sub-Zones of PNKB National Park (“the Core Zone”) and the surrounding Buffer Zone (see Annex IX).

In addition to the laws and regulations on forest protection and environmental protection listed above, other relevant national and regional level government laws, decrees and regulations include:

- Law on Organising People’s Council and People’s Committee, dated November 26th, 2003;
- Law on Biodiversity, dated November 13th , 2008;
- Law on Tourism, dated June 14th, 2005;
- Law on Cultural Heritage, dated June 29th , 2001;
- Law on Land, dated November 26th, 2003;
- Law on Investment, dated November 29th, 2005
- Decree 32_30_March_06 on protection of endangered species
- Decree No. 92/2007/NĐ-CP of Government on detailing the implementation of some articles in the Law on Tourism;

- Decision No. 104/2007/QĐ-BNN promulgating regulations on Management of Ecotourism activities in National Parks and Nature Reserves;
- Decree No. 92/2002/NĐ-CP of Government on detailing the implementation of some articles in the Law on Cultural heritage;
- Decree No 181/2004/ND-CP on implementation of the Land Law;
- Decree No. 108/2006/NĐ-CP of Government on detailing the implementation of some articles in the Law on Investment;
- Decree No 34/2000/ND-CP by the Government on Regulations for Border Areas of Socialist, Republic of Vietnam;
- Circular No. 179/2001/TT-BQP by the Ministry of National Defense on implementation guidelines of Decree No 34/2000/ND-CP by the Government on Regulations for Border Areas of Socialist, Republic of Vietnam (SRV);
- Coordination Regulations on management of national territories and border lines in the province of Quang Binh (issued with attached Decision No 59/2006/QĐ-UBND by Quang Binh PPC)



Proposals for infrastructure construction, works, and other development activities within and adjacent to the PNKB NP WHS are assessed using the normal environmental assessment processes applied by Quang Binh Province and Vietnam under relevant legislation.

Article 110 of the Operational Guidelines for the Implementation of the World Heritage Convention make clear that “impact assessments for proposed interventions are essential for all World Heritage properties.”

In Vietnam, any project that uses part or all of the land area of or causes an adverse impact in a world heritage site or national park protected under decision of a Provincial People’s Committees is required to prepare a full Environmental Impact Assessment Report. The Provincial-level environmental protection agency must review, approve and certify the environmental protection schemes and examine and inspect the environmental protection work (Decree No. 80/2006/NĐ-CP and Decree No. 21/2008/ NĐ-CP)²¹.

The following legislation is relevant and binding:

- Law on Environmental Protection, dated November 29th, 2005;
- Decree No. 80/2006/NĐ-CP on detailing and guiding the implementation of a number of Articles of the law on environmental protection;
- Decision No. 02/2003/QĐ-BTNMT of Ministry of Natural Resources and Environment promulgating regulations on Environmental protection on the field of tourism;
- Decision No. 22/2006/QĐ-BTNMT of the Ministry of Natural resources and environment on applying Vietnamese standards on the environment;
- Decision No. 104/2007/QĐ-BNN promulgating regulations on Management of Ecotourism activities in National Parks and Nature Reserves;
- Decree No. 59/2007/NĐ-CP on managing solid waste;
- Decree No. 21/2008/ NĐ-CP amending and supplementing a number of articles of the Government’s Decree No. 80/2006/ND-CP, detailing and guiding the implementation of a number of articles of the Law on Environmental Protection.

²¹ It has been suggested that the Quang Binh PPC should define a special process for any developments (including Park operations) that may impact the PNKB World Heritage Property, as part of the EIA decision-making process. This process would include identification of the types of developments or proposals that are subject to a special EIA or SEIA. For example, a lease for a tourism development or a tourism service in the National Park would be subject to a special EIA, while a regional development plan would be subject to a special SEIA. The EIA or SEIA must describe the World Heritage Outstanding Universal Value that might be impacted and the measures to minimise any impact. Process steps to consider are:

1. Identification that the proposed development or activity is consistent with the World Heritage Convention and the National Park Management Plan;
2. Opportunity for review and input by outside independent parties, such as the national UNESCO World Heritage office;
3. Process sign-off by the Director of the National Park, assuring that the World Heritage values will not be significantly impacted.

The following summaries provide more details on the nature of the threats that are putting pressure on the Park's outstanding universal values and other values. These are listed in order of priority, based on their seriousness and severity of their impacts. Many constraints and weaknesses of the Park management that hamper its ability to effectively respond to these threats. These are not dealt with here, but are considered in the Strategic planning and resulting actions as detailed in the Operational Management Plan.

Wildlife hunting and trapping Illegal exploitation of wildlife is the greatest threat to the biological integrity of PNKBNP. The majority of threatened species in PNKBNP are primates and large mammals. In addition, other animal species are also hunted from the Park, including wild pig, civets, porcupines, turtles, and snakes. Hunting is widespread all over the region and all year round. Large and medium-sized animals, including primates, are mainly hunted in the Core Zone of the Park; while only small animals like rats and squirrels can still be found and trapped in the Buffer Zone. The peak hunting season is from August to March. Local hunters (coming from Buffer Zone communes) mainly comprise amateur opportunists who hunt during their spare time as a hobby; a tradition and a way for them to appreciate the forest and its natural specialties. Hunters coming from outside the Buffer Zone (e.g. from Bo Trach, Quang Trach, Tuyen Hoa and Minh Hoa districts of Quang Binh province) are mainly professionals, who are very skillful, know the forest very well, often hunt during the best hunting season and conduct long hunting trips in the forest. Information from consultation meetings and interviews in Thuong Hoa and Hoa Son communes revealed that those professional hunters also often collect other forest products during their hunting trips.



A sack of bones in a hunters' camp includes the skull of a serow, *Capricornis milneedwardsii*. Illegal hunting and timber poaching have been major threats to the biodiversity of Phong Nha – Ke Bang National Park World Heritage Site. Photo: Le Trong Dat

In the past, hunters and trappers used both guns and wire snare traps to catch mammals, but now mainly traps made of steel cable are used. Sometimes, trained hunting dogs are also used to search and chase certain kinds of hunted animals, such as mammals, pangolins, turtles and cobras. However, for small mammal species like rats, a kind of small bamboo trap (locally called “*bay sap*”) is used.

Hunting practice is related to a number of root causes, as follows:

- Bushmeat is of high market demand and high commercial value
- There still exist the need and the habit of using bushmeat for food in some areas.
- Hunting is a traditional custom/habit of local communities living near the forests.
- Local households lack jobs and alternative source of income.
- There is a low level of conservation awareness and limited knowledge of laws and regulations on the protection of this wildlife and the National Park.

Hunting activity is a principal threat to the survival of wildlife species in the region, especially for species that feed and move on the ground (e.g. civets and galliform birds). A bird biodiversity survey conducted by BirdLife International in 2011 in the Park’s extension area pointed out that a number of pheasant species, namely Green Peafowl *Pavo muticus*, Silver Pheasant *Lophora nycthemera*, Crested Argus *Rheinardia ocellata*, have been extirpated in the surveyed area. Turtle species also have become very rare.

Illegal logging Despite major efforts by the Park to curtail it, illegal logging does still happen in the Park, targeting a number of species of high commercial or utility values such as: *Dalbergia tonkinensis* (Hue/Trac) *Diospyros mun* (Mun), *Vatica* spp. (Tau), *Erythrophloeum fordii* (Lim), *Michelia* spp. (Gioi), Huynh *Tarrietia javanica*, Chua *Embelia ribes*, etc. Timber species of high commercial value were extracted in the Core Zone of the Park, including the newly extended area, whilst timber for domestic use by local communities was mainly extracted in the Buffer Zone forests which are now under the management of forest companies. Hoa Son commune is an exception, where so far no timber extraction was observed in the Core Zone of the extension area of the Park. Logging happens all year round, but is most intensive during low agricultural season (i.e. after the harvest seasons of agricultural products).

Logging is conducted by both local people and people from other districts in Quang Binh Province, and for both domestic use and commercial purposes.

Illegal logging is driven by a number of causes as follows:

- The timber resources in the Buffer Zone forests are considerably depleted and therefore timber in the Core Zone of the Park is now targeted for logging.
- There are not enough jobs and alternative sources of income for local households.
- Many households in Buffer Zone communities do not have enough forest land for their household needs or to develop agro-forestry/plantations.
- Awareness raising among local communities on the conservation importance of the Park and laws and regulations regarding the protection and conservation of the World Heritage Site are still low.

As a result of illegal logging, many big timber species has become extremely rare or have even been locally extirpated due to prolonged overexploitation, such as *Dalbergia tonkinensis* (Hue) and *Aquilaria crassna* (Tram huong).

Non-timber forest product exploitation Non-timber forest products (NTFPs) have been extracted from the Park for many years. These consist of rattan (tribe Calameae), medicinal plants, orchids such as *Anoectochilus setaceus* (Lankimtuyen), *Ardisia silvestris* (La khoi/Com nguoi rung), palm leaves, bamboo shoots, bee honey, etc. This activity is carried

out by communities inside and outside the Buffer Zone of the Park. NTFPs extraction activities are carried out all year round, except for bamboo shoots and bee honey that have to be collected in the right season. NTFP extraction is widespread and its intensity depends on the availability and richness of NTFPs in each region.

Unsustainable harvesting practices have resulted in the rarity of some NTFPs such as *Anoectochilus setaseus* orchids and rattan within the Park and Buffer Zone.

Cinnamomum oil extraction is still being carried out in PNKB region, but has declined considerably. This activity is often observed in the Core Zone or Buffer Zone of the Park where forest quality is still good. This activity is carried out by local people from outside the Buffer Zone (e.g. Ron commune of Quang Trach District) with participation of local villagers. Cinnamomum oil extraction not only depletes Cinnamomum species, which are of conservation concern, but also damages the habitats around extraction camps (as trees around those camps were felled to be used as fire-wood) and pollutes nearby streams.

Fishing is a direct threat to the Park's biodiversity. The Park's dominant topography is limestone karst, so there are very few above-ground streams and rivers in the Core Zone. Local people still fish in the Buffer Zone, normally using nets, but sometimes using electroshock devices and poison made from tree bark. Harvested fish are used for consumption in families and sold to market. Fishing happens also all year round, except for the two flooding months of September and October. Fishing using electric devices and poisons has widespread destructive impact on fish species and other aquatic life.

One exceptional NTFP appears to be wild honey collected by indigenous people in the Phong Nha - Ke Bang region. This was considered to be a very sustainable collection practice, which could be encouraged so as to be widely shared and replicated.

A number of root causes create incentives for unsustainable collection of NTFPs:

- High market demand
- Subsistence needs of local communities
- For the many local people who lack jobs and alternative income sources, NTFP collection provides a ready source of supplementary household income

Destructive tourism PNKB NP has very high potential for cave and exploration tourism. The number of national visitors to the Park increased from 115,000 visitors in 2001 to 329,000 visitors in 2004, and the numbers continue to climb. The number of international visitors is also increased from 1,000 in 2001 to 11,800 visitors in 2007, and visitation by international travellers seems to be increasing even more quickly.

Mass tourism with low environmental awareness may cause disturbance to both local human communities and wildlife. There is already heavy pressure on certain popular touristic sites, resulting in noise and litter. Some villagers in Phuc Trach commune (near Paradise Cave) observed that tourism activities cause noise that disturbs non-human primates, air pollution and water pollution. Currently there very few sign posts, information boards with conservation guidance and messages and garbage bins in popular tourist locations in the Park, such as Phong Nha Cave, Paradise Cave, and popular streams.

Caves are particularly fragile environments, and tourism to these sites can leave permanent damage if not carefully planned and supervised. Tourism facilities installed inside the caves and the over-crowded tourist masses during summer months also cause negative impacts on the cave features and rare cave wildlife. Lighting systems can allow the growth of algae (lamp flora), which can discolour and permanently damage cave features.

To date, there has been no study on the impacts of tourism on the conservation of the Park or its World Heritage values. As tourism is developed and expanded, with plans to allow increase of tourism numbers and spread tourism to other parts of the park, there are bound to be further threats both to the tourist experience itself as well as to geomorphology and endemic biodiversity of the World Heritage site.

Infrastructure developments inside the Park The West branch of Ho Chi Minh Highway is a national project serving economic development and national defence purposes. The road lies along the boundary of much of the Park, and crosses through the Park’s Ecological Restoration Area. The construction of the road caused some disturbance to the Park.

Road 20 crosses directly through the park from north to south. This road was constructed before 1965 and goes through PNKBNP. This is the only road for Thuong Hoa and Tan Trach communes to access Phong Nha. Currently, Road 20 is being upgraded. From an economic development perspective, upgrading the road will help Tan Trach and Thuong Trach communes access the outside world and market. It will also make the Park more accessible, therefore the Park’s guard station at 39th Km and the check-point at 27th Km shall need to step up their enforcement and patrols. Attention should also be paid to raising the conservation awareness of local communities in Thuong Trach and Tan Trach communes.



Forest Protection Station on the edge of Phong Nha – Ke Bang National Park. Forest and wildlife protection is major functions of the Park’s management.

Invasive alien species

Invasive alien species in the Park are mainly comprised of herbaceous and lianoid plants, such as Co lao (*Chromolaena odorata*), Trinh Nu moc (*Mimosa diplotricha*), Thom oi (*Lantana camara*), Co tranh (*Imperata cylindrica*). The issue of invasive alien species has not been considered in the management of the Park previous to this.

Some alien species have been introduced to the region in the process of infrastructure construction (road and other infrastructure works). Some weeds and vine species were observed to be invasive, slowing down the natural rehabilitation/re-growth of forest adjacent to the Buffer Zone and along new roads.

Firewood collection

Extraction-Firewood collection in the Park is a common practice among local communities in the Buffer Zone.

Sometimes, firewood collected is also sold to “middle-men” for sale to further localities in the

region. Firewood is an important source of fuel for households, due to their increasing fuel/firewood demand and the declining area of forest available to meet that demand.

Currently, there is not yet any study on the firewood demand of local communities as well as the impacts of firewood collection on biodiversity in the region. Some projects have piloted distributing fuel-saving stoves that use firewood replacement materials such as sawdust and rice husks, but those stoves are not popular, as the collection and use of firewood is much easier, faster and more convenient for local communities. In the longer term, without alternatives, this firewood collection practice will negatively impact the quality of natural forests.

Cattle grazing in the Park Cattles grazing in the forest is a traditional practice of Buffer Zone communities. For example, 100 oxen belonging to households in Tan Trach commune graze in the Core Zone of the Park.

Main causes of the situation are:

- Allowing cattle to graze freely in the forests is a traditional practice in local communities.
- The need for pasture was not taken into account in land-use planning in the buffer zone communes.

Uncontrolled cattle grazing as it occurs today may negatively impact the enrichment planting of native species in the area targeted for this activity.

Forest land encroachment: According to information obtained from the consultation meetings with villagers and local authority in Arem village, Tan Trach commune, 70 households of Tan Trach commune are living inside the Core Zone, with about 150-200 ha of agricultural land. In addition, inside the Core Zone there is also 1 ha of agricultural land, used for growing maize and peanuts, which belongs to people from Chay Trai village, Phuc Trach commune.

Causes of encroachment are:

- Park planning did not adequately consider the land-use demand of Tan Trach commune;
- Subsistence needs of a growing population;
- Lack of agricultural land for buffer zone communities outside of the Core Zone;
- Low level of conservation awareness and awareness on forest protection laws and regulations.

Forest fire, floods, natural disasters and Climate Change Forest fire seldom happens in Phong Nha – Ke Bang region. However, sometimes there are small fires in forest near agricultural land. There does exist the risk of forest fire due to slash and burn practice, infrastructure developments, wild bee honey collection and negligence by tourists and other visitors. Anthropogenic climate change, bringing with it erratic and unpredictable shifts in weather patterns, may increase the risk of severe drought and major fires in the future.

Every year, the PNKB region suffers from floods for 2-3 weeks during September and October. This natural seasonal flooding interrupts tourism activities each year. Occasional severe floods cause negative impacts on wildlife and habitats and have obvious destructive impacts on tourism infrastructure.

The frequency and severity of forest fires, floods, windstorms and other natural disasters may be intensified by change due to anthropogenic climate change (“global warming”).

Article 7 and 8 of Decision No. 18/2007/Decision of the Quang Binh Provincial People's Committee sets out the following proscriptions for the various Sub-Zones of the National Park ("the Core Zone") and the surrounding Buffer Zone.

Natural resources, historical and cultural relics, and landscapes in the functional zones of Phong Nha - Ke Bang National Park have to be protected intact and sustainably developed.

1. In the Strictly Protected Area and Ecological Restoration Area of the Park, the following activities are banned:

- Activities that can change natural habitat of the forest except activities has been done according to the regulation on forest management, mentioned in Point 2b, Article 22, attachment with Decision No.186/2006/TTg of Prime Minister on 14th August 2006.
- Activities that can impact to environment, natural habitat of fauna and flora or species that are being conserved.
- Keeping and raising animals or growing animals/plants which are not native species located in Quang Binh province. In the special cases, they need to be decided / approved by the Minister of Agriculture and Rural Development or Primer Minister.
- Exploit biological, mineral resources and others; change natural habitat and forest accession; negative impact to wildlife/wilderness.
- Domestic cattle and fowl husbandry
- Make environment polluted such as solid garbage, daily garbage and other activities
- Bringing poison chemical, explosive, inflammable into forests, fire on forests and edge of forests or use means of transport are threatened to natural environment.
- Activities make damage, destroy, illegal occupy historical, cultural relics and landscapes; writing or painting on the caves, trees, historical sites and natural landscapes.
- Building houses, stores, pagodas, tempers, stations, mine exploitation or tourism facilities; except activities mentioned according to the regulation on forest management, Point 2b, Article 22, attachment with Decision No.186/2006/TTg of Prime Minister on 14th August 2006.
- Superstition acts, putting up statues and altars on the caves, mountains, rivers and impolite behaviors at the tourism sites or on the vehicles.
- Establish repair bases, shops/restaurants, photo shops or other services are not permitted by the authority.
- Use land and forest have been planned that belong to Strictly Protected Sub-zone for rent or cooperation which can change natural evolution of the forests.

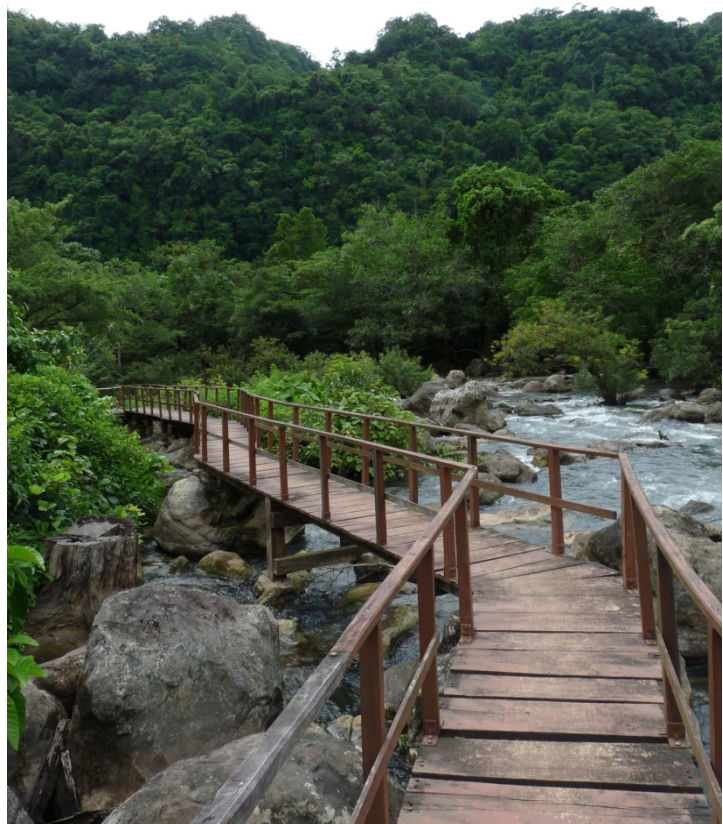
2. In the Administration Area, the activities mentioned below are banned

- Activities that can change natural habitat of the forest, activities can impact to environment, natural habitat of fauna and flora.
- Keeping and raising animals or growing flora which are not native species located in Quang Binh province. In the special cases, the need to be decided by Minister of Agriculture and Rural Development.
- Exploiting endangered, rare floral species are banned (except dead or collapsed wood-trees and trees located in ground for construction sites according to the planning) based on Decree No. 32/2006/ND-CP of Government on endangered, rare forest fauna and flora management and category of both endangered, rare forest fauna and flora has been issued attachment.
- Illegal hunting, trapping wildlife and other exploitation activities involved in biological resources that to be banned by law provisions
- Natural resources exploitation such as stone, stalactites, war-weapons and other resources.
- Making environment polluted

- Bringing poison chemical, explosive, inflammable into forests, fire on forests and edge of forests or use means that threatened to damage natural environment.
- Activities make damage, destroy, illegal occupy historical, cultural relics and landscapes; writing or painting on the caves, trees, historical sites and natural landscapes.
- Building new facilities change or destroy the buildings that they have been negative impacted to forest ecology, growth and development of biological organism when not yet approved by authority.
- Superstition acts

3. In the Buffer Zone, the following apply:

- Buffer Zone is bordering with natural forest and slope in the side of Phong Nha - Ke Bang National Park. It needs protect in accordance with law on forest protection and development. In the bare land and hills, it needs plan for native species forestation and building sustainable forest garden.
- The Management Board of Phong Nha - Ke Bang National Park organizes activities for local community in Buffer Zone can participate in protection, conservation, forest product use and other natural resources, eco-tourism services in order to improve income and livelihood of community.
- Master plan is needed for local residence. All organization and individual buildings have to be approved by functional authority such as architectures, designs, border marks and permit for construction. It is sure that not make polluted and negative impacts to natural landscapes of Phong Nha - Ke Bang National Park.



On the Ngoc Mooc Ecotrail inside Phong Nha – Ke Bang National Park World Heritage Site.

- Services of hotels, guesthouses, shops, restaurants, ships, boats, and sport and entertainment complexes have to provide solutions for waste, garbage; prevent direct or indirect pollution to landscapes and natural environment.
- If the proposals of building industrial, economic zones and construction sites can be risked affect to protected area of Phong Nha - Ke Bang National Park. It is necessary to carefully consider and find solutions to minimize negative impacts and handle.
- The Management Board of Phong Nha - Ke Bang National Park is responsible for coordinating with local authority, relevant departments and agencies to implement measures of management and protection according to the government regulations on historical and cultural relics, landscapes protection.
- Wildlife and wilderness as well as other resources of Phong Nha - Ke Bang National Park are banned trading.

Article 15 of the same Decision deals with settlements of local community in the functional zones of the National Park.

1. It is not allowed to immigrate into Phong Nha - Ke Bang National Park
2. The Management Board of Phong Nha - Ke Bang National Park assists the Provincial People's Committee in building plans for resettlement to submit to state authority for approval. This programme is to remove people who are located in the Strictly Protected Area of National Park from this area.
3. If people who live in the Strictly Protected Area but not yet removed, local individuals and households can be allocated forest in short term for protection by the Management Board of Phong Nha - Ke Bang National.
4. In the Ecological Restoration Area, the Management Board of Phong Nha - Ke Bang National can directly allocate forests to local individuals and households for protection and development.

Tourism activities in PNKB NP are regulated under Decision No 104/2007/QĐ/BNN of the Ministry of Agriculture and Rural Development regarding the regulations on eco-tourism activities and management in national parks and reserves.

Both, Decision No 104/2007/QĐ/BNN and the draft 'Regulatory framework for management of tourism activities in Phong Nha - Ke Bang National Park' address the management of tourism activities inside the National Park.

Decision No 104/2007/QĐ/BNN allows the PNKB NP to be land managers, but also to be tourism operators in the protected area environment. The tourism concession system could also be easily integrated with 'Regulatory framework for management of tourism activities in Phong Nha - Ke Bang National Park' and it would also align to the regulatory principles of Decision No 104/2007/QĐ/BNN.



Speleothem inside the developed part of Paradise Cave.

(Adapted from Eagles, P. et al., (2001) Guidelines for Tourism in Parks and Protected Areas of East Asia.)

A visitor management plan for PNKB NP WHS has been specifically requested by the UNESCO World Heritage Committee. The plan should be part of the Operational Management Plan, updated every five years. The process for development of the Visitor Management Plan involves 15 steps, with a review and revisions every five years:

- Step 1: State clearly the objectives for visitor management in the National Park.
- Step 2: Compile an inventory of natural and cultural features, as well as of existing visitor use and potential. Map and analyse the information.
- Step 3: Involve local people and local government in the planning. This is key.
- Step 4: Work in partnership with local government, tourism businesses and other regional and local organisations.
- Step 5: Map and demarcate Sub-sub-zones within the Sub-Zones of the National Park in areas where tourism impacts will not harm resources of ecological significance, including High Volume Tourism, Nature and Culture Tourism, Community Benefit Tourism and Strict Ecotourism Sub-areas and Tourism Infrastructure Sub-area.
- Step 6: Develop limits of acceptable use for all sub-zones and sub-sub-zones of the National Park. Set environmental standards and design mechanisms, including monitoring, to ensure that they are met.
- Step 7: Determine which tourism activities are compatible with the National Park's objectives and which are not. Develop related policies and regulations for the sub-sub-zones.
- Step 8: Assess the environmental, economic, social and cultural impacts of proposals for tourism development from businesses and local government.
- Step 9: Develop education and interpretation programs for visitors and local people that increase understanding and appreciation of the area's environment, culture, heritage and other important issues.
- Step 10: Design methods to 'channel' (meaning 'to direct' or 'to guide') visitors through desired areas and away from fragile areas, so that there are minimal negative impacts.
- Step 11: Survey and analyse tourist markets and visitors' needs and expectations.
- Step 12: Brainstorm potential tourism products to be developed so as to influence the types of visitors choosing to visit. Identify the values and image of the National Park on which to base sustainable tourism and outline a promotional strategy for the protected area. (Note: This step applies if the National Park's objectives include promotion of tourism. If the objective of the tourism management plan is simply to control tourism to ensure sustainability, then it is not needed.)
- Step 13: Plan a program for monitoring use by visitors and their impact on the national park. At appropriate intervals, evaluate the success of the plan in ensuring that tourism use maintains environmental standards and revise the Tourism Plan as needed.
- Step 14: Assess resource needs and potential sources, including provisions for training, recruiting staff, procuring equipment and budget.
- Step 15: Implement the plan.

Annex XIV. Cave Management and Cave Management Prescriptions

PNKB will use cave management prescriptions and Cave Management Plans to regulate development of tourism to caves so as to protect the Outstanding Universal Values of PNKB's caves and karst World Heritage²².

Cave management prescriptions are composed of a number of requirements that place restrictions on activities undertaken in caves and on the karst around them. The prescription for each cave is designed specifically for that cave, and thus may differ due to the differences between individual caves. The focus throughout is on conservation, with three general factors considered in each case:

1. The long term conservation needs of the cave and its speleothems and other heritage features;
2. The long term conservation needs of the cave flora and fauna;
3. The safety of visitors.

Achieving these three general factors is the overall goal, and cave management prescriptions can be developed by examining the specific features of each cave that contribute to these three general factors. Specific sub-factors need to be considered when determining that a cave or section of a cave should have a cave management prescription. These sub-factors include:

- Is the number of visitors to the cave high?
- Is the cave threatened by deliberate vandalism or collectors?
- Does cave contains delicate areas of speleothems?
- Does the cave contain flora or fauna that require protection?
- Is the cave the subject of significant research activities?
- Is the cave impacted by above ground or upstream land uses?
- Is the cave known to have high levels of CO²?
- Is visitor safety in the cave threatened by flashflood or rockfall?

In electing which caves should have management prescriptions, the specific sub-factors outlined above are reviewed for each cave, and those caves that one or more of these sub factors pertaining would be given priority for management prescriptions. If none of these sub-factors apply, then when experienced cavers and researchers apply to visit a cave, they would be encouraged to collect information about the cave during the visit. If a cave has little or no documentation, then managers should ask the cavers to provide a written report highlighting the features of the cave that they observe. If the visitors have any specific skills relating to the caves, such as the ability to map or to identify cave fauna, etc., then this additional information should be added to the report.

In this manner, features of caves that may otherwise be missed will eventually be identified. This may result in the application a new management prescription to the cave. For example, a management prescription may be applied to conserve newly identified cave species in one section of a cave.

In order to devise the actual cave management plan that details the prescription, the areas of concern are listed for each cave and then methods for minimizing caver impacts and/or ensuring safety are written into the prescription. If it is considered that cavers are such a threat to a specific cave or area of cave then they should be excluded. If the cave or section

²²Based on R. Webb (2012) Cave Mangement Prescription: An alternative to Cave Classification Systems. http://www.ackma.org/papers/cm_prescriptions.html

of cave is considered such a threat to visitor safety that it should be visited then that cave or section can be prescribed as closed. These are two extreme examples, with the majority of cave management prescriptions providing access to caves with only some restrictions applying.

The Cave Management Plan should have the following sections:

1. Applicable Sub-factors: A checklist of the answers to the questions above,
2. Issues: Details of the exact nature of the sub-factors that apply for this cave.
3. Proposed Management Interventions: Listed by Sub-factor
4. Proposed Restrictions²³

The Cave Management Plan should provide a concise summary of the management prescriptions, focusing on the sub-factors that may endanger the cave's heritage value or the safety of visitors. The Management Plan should always ensure that the three general factors are its overriding goal, taking all of the sub factors into consideration.

A Cave Management Plan, like any management plan, should not be considered as a final unchanging prescription. The cave management Plan should be an evolving document that changes as additional information or additional needs come to light. It should be modified on a regular basis as new information is obtained about the cave or as the sub factors are adjusted, always with the three general factors as the overriding goal.

Management prescriptions can be applied to other sites of heritage value in the World Heritage Site, such as dolines, springs or historical sites.

The Phong Nha - Ke Bang Management Plan has determined that a cave management plan should be developed for the Phong Nha Cave, Paradise Cave, Dark Cave, En Cave and all other existing tourist caves of the Park as a basis for protecting and professionally presenting the World Heritage OUV.

- a) The cave management plan should have regard to the management guidelines for show caves developed by the International Speleological Society. Cave formations are mostly a non-renewable resource and need to be protected.
- b) The cave management plan needs to include an environmental impact assessment process for any non-maintenance management intervention or change that may impact the World Heritage OUV (See section 4.11)
- c) For infrastructure to be placed within the cave, regard shall be had for minimising impacts. Crowd control infrastructure and within cave access facilities (such as fences, steps and elevated walkways) should not impact speleothems or other natural phenomena such as cave ecosystems. Cave lighting placement and use should be undertaken carefully and *lampenflora* removed and controlled. Cave lighting needs to be respectful of the natural phenomena (use of white light) and the placement of electricity cables needs to be very sensitively achieved. The placement of backlit sign-posting including World Heritage presentation information and emergency evacuation lighting needs to be carefully achieved.

²³ The Union Internationale de Speleologie (UIS) and IUCN in 2012 cooperated to produce Management Guidelines for Show Caves that should be referred to for management of any caves that are to be developed as show caves.
http://www.karstportal.org/sites/karstportal.org/files/Recommended_Management_for%20Show_Caves.pdf

- d) Any infrastructure present or installed in the cave should be professionally designed, of high quality and worthy of World Heritage presentation status. The materials used and the construction techniques applied need to be suitable for a cave environment. Wood or other organic material, for example, is not recommended by the International Union of Speleology and welding (with its associated waste-gas generation) would be a major impact to the cave.
- e) For World Heritage Presentation, the World Heritage status and OUV of Phong Nha-Ke Bang National Park and the particular cave is professionally presented for all visitors including through verbal presentations by guides, through signs and through printed information. Ideally, the World Heritage OUV presentation information would be designed to suit the unique characteristics for each cave, guides would be professionally trained and the cave presentation information provided in more than one language. The OUV information could be presented simply as well as technically (for more discerning visitors).
- f) The World Heritage cave experience for visitors is very important. It should be high quality and safe. This should usually include: 1) Pre-cave inspection literature, a safety briefing, a briefing about speleothem protection and the World Heritage status (and what this means) for individuals and groups; 2) Pre-departure logistic advice about how the group is to be managed, pre-visit comfort stops and advice about a non-smoking policy and the reasons for this; 3) Crowd control and strictly controlled group size and frequency of group use for all parts of the visit that is consistent with visitor use prescriptions provided by the cave management plan; 4) Quiet enjoyment of the visit and noise minimisation on the visit; and 5) The provision of a diversity of group experiences, from full technical karst explanations to lay-language presentations
- g) Impacts to the tourist cave's World Heritage OUV need to be minimised. The effective management of people is a key to achieving this. This includes:
- For groups: Designing a maximum group size, including an accompanying guide
 - Visitor ticketing and group management systems to, from, and within the cave that are organised so that groups receive an optimum World Heritage cave experience that minimises group interaction including orchestrated movements of groups that prevent chances of crowding
 - Financial return that is based on \$ yield rather than visitor volume and with return visitation targeted thanks to the provision of quality visitor experiences.
 - Group control and surveillance by guides to ensure visitors stay on the official pathways, don't touch or damage formations, do not steal speleothems nor leave any waste in the cave
 - Management of groups to minimise noise
 - Management of visitors to the cave (non-tourists such as electrical maintenance contractors) to minimise any potential impacts to the cave formations, cave atmosphere, cave hydrology or cave ecosystems through thorough pre-work briefings and within-cave operational guidelines
 - Management of within cave official functions to be respectful of the World Heritage status and to ensure they do not impact the cave in any way, especially the cave atmosphere from pollution (fireworks and the burning of hydrocarbons within the cave for example should never happen)
 - No solid or liquid pollution of the cave
 - Removal of all waste from the cave, undertake restoration work and, if appropriate, cave cleaning work.

There is currently an opportunity in the PNKB Region to capitalize on the support provided by foreign donors for planning and activities in the Buffer Zone of the Park by establishing an appropriate and institutionalized mechanism to encourage cooperation and appropriate management of adjoining lands. These lands could be managed not only to be compatible with protection of the Core Zone of the Park, but also to manage the Buffer Zone so as to add value to the Park and improve its ecological security and promote appropriate sustainable approaches to development in the Buffer Zone. This might be best achieved by adopting the Biosphere Reserve concept, to which adjacent land managers could subscribe.

In fact, over 30 World Heritage Natural Sites are also associated with UNESCO Biosphere Reserves, for example Uluru-Kata Tjuta National Park WHS and the Tasmanian Wilderness WHS in Australia, Serengeti National Park WHS in Tanzania, Mammoth Cave National Park WHS in the United States, and the Maolan National Nature Reserve site of the South China Karst Cluster WHS.

A Biosphere Reserve is a specific concept that includes one or more protected areas, such as a National Park, and surrounding lands that are managed as a unit, with coordinated management in designated Core, Buffer and Transition Zones to combine both conservation and sustainable use of natural resources. The Core Zone for a proposed Biosphere Reserve would be the PNKB NP WHS itself.

The main characteristics of biosphere reserves are:

- Achieving the three interconnected functions: conservation, development and logistic support;
- Outpacing traditional confined conservation zones, through appropriate zoning schemes combining core protected areas with zones where sustainable development is fostered by local dwellers and enterprises with often highly innovative and participative governance systems;
- Focusing on a multi-stakeholder approach with particular emphasis on the involvement of local communities in management;
- Fostering dialogue for conflict resolution of natural resource use;
- Integrating cultural and biological diversity, especially the role of traditional knowledge in ecosystem management;
- Demonstrating sound sustainable development practices and policies based on research and monitoring;
- Acting as sites of excellence for education and training;
- Participating in the World Network of Biosphere Reserves.

Vietnam currently has eight sites listed as UNESCO Biosphere Reserves.

All tourism plans and any related EIAs, SEIAs, concession agreements and leasing arrangements for tourism in PNKB National Park will be reviewed carefully by the PNKB NP Management Board, paying particularly close attention to the following considerations:

- The World Heritage values and other natural and cultural features with tourism development potential are not exploited solely for economic purposes in a way that damages or detracts from their value.
- Sustainable and efficient management of tourism in the PNKB Region is effectively integrated into tourism planning at the provincial, regional, national and appropriate global levels.
- Tourism plans and activities are linked and integrated to other conservation and socio-economic development plans and activities in order to achieve maximum efficiencies, while avoiding needless duplication and preventable gaps in the implementation.
- Tourism planning in the PNKB Region involves stakeholder consultation and supports efforts for collaborative planning to ensure that the interests and ideas of all relevant and affected parties are heard from and incorporated as effectively as possible into tourism planning, development and management. The Park Management Board itself will organize and facilitate processes and procedures for consultative planning and cooperative management.
- Tourism development fosters community participation and provides benefits to the communities in the Buffer Zone of the PNKB NP Region.
- Tourism development minimises infrastructure needs and infrastructure development in the PNKB NP and consolidates the infrastructure in the Buffer Zone of the PNKB NP Region.



The entrance stairway to the world famous Paradise Cave in Phong Nha Ke Bang National Park. The Park is expected to receive over 450,000 visitors per year by 2015.

Article 8 of the Prime Ministers Decision 24 issues in June 2012 provides support to the management boards of special use forest for investment in community development, to be disbursed on a village by village basis in the buffer zone surrounding the special use forest. Under the programme, the State's budget shall provide village communities in buffer zones with investment support, at a level of up to 40 million VND per village each year. These investment funding is to be linked to the community's performance in conservation of forest and biodiversity.

This funding shall be disbursed for items such as;

investment in production development capacity improvements:

- agriculture and forestry extension,
- seedlings,
- breeds,
- small size agriculture and forestry product processing equipment.

supporting the village with construction materials for public construction for the village, such as:

- fresh water supply,
- electric lighting system,
- communication,
- village transportation road,
- cultural hall

This list is not exclusive, but the items on the list can be considered in some sense "pre-approved" by higher authorities.

Planning is to be fully participatory. Detailed budget estimate for annual buffer zone investment shall be developed by village communities themselves. In other words, the village communities will choose their own projects, based on local conditions and needs. The Management Board of special - use forest shall take the lead, in collaboration with Communal People's Committee, in discussing the projects with each village community for co – approval. (Note that the Management Board does not take the lead in investment project development itself. That is for the village to do, with guidance and facilitation by the National Park.)

Finally, continuation of these community investments shall be directly linked to the special - use forest protection plan and commitment of the village.

Phong Nha – Ke Bang National Park World Heritage Site is in a position to prepare for the roll-out of Decision 24 community investments, thanks to the support of the Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha - Ke Bang National Park Region Project. The experience gained in developing and testing guidelines for implementation will insure rapid and sustainable implementation once full funding is released by the government.

The draft Five Step Process Framework below sketches out an approach to setting up the investment plans and linking them to forest protection performance. This is based the on experience from Pu Luong Nature Reserve (another karst limestone special use forest site in Vietnam), which piloted this Framework as part of a World Bank GEF project²⁴.

²⁴ Apel, U., Maxwell, O.C., Nguyen Trong Ninh, Nurse, M., Puri, R.K. and Trieu Van Co (2002) Collaborative Management and Conservation: A Strategy for Community Based Natural Resource Management of Special Use Forest in Vietnam. Fauna & Flora International/World Bank; Cambridge, UK. (Summary in Vietnamese).

Step 1: Threat Analysis

Since this programme is ultimately implemented in the service of conservation of the Park's outstanding heritage values, it is important to carry out a threat analysis to focus the programme where it will do the most good. Threat analysis has been carried out in some detail, through the Rapid Threat Assessment done by the GIZ component and the Conservation Needs Assessment carried out by the Management Planning Team. The essential points are summarized in the Strategic and Operational Management Plans for PNKB NP.

Step 2: Criteria and Village Selection

Although Decision 24 would seem to apply to all villages in the Buffer Zone, in fact the National Park has limited staff capacity and funds may be limited. It is therefore necessary to prioritize the villages in the Buffer Zone so as to choose those that are the greatest threat to the Park's heritage values for early interventions.

Key criteria for selection of villages might include:

- i) the level of dependence on natural resource extraction for the Park or from other high conservation value forest
- ii) the level of impact that the Park's restrictions on land use, hunting, logging and NTFP collection have had on the village.
- iii) Whether the village is inside, adjacent or near the Park.

In terms of scope, it is suggested that 16 villages in 8 communes could be targeted initially, reaching about 8 villages each year over the next two years.

Step 3: Resource Assessment and Village Appraisal

Once a village has been selected for the program, additional field survey work is necessary in order to understand the needs of the village, the status of its natural resources and the capacity of the villagers, and to set the stage for Participatory Planning in the village. A number of standard PRA and RRA and Participatory Planning tools can be used for this purpose, such as:

- Village data collection from village leaders;
- Participatory mapping to define patterns of forest use and boundaries;
- A transect walk with the villagers through the different land use areas in the village, to understand development options;
- A critical needs analysis, to understand the forest products needed for subsistence;
- A threat analysis, to gain a detailed understanding of the key threats to conservation at the village level;
- A problem analysis, to gain an understanding of the main development issues in the village;
- A feasibility matrix, to understand development activities that can solve these issues, and their feasibility, including their impacts on conservation;
- A forest and NTFP inventory, concentrating on these species under threat or required for critical needs.

If the inventory shows that sustainable use of NTFPs is possible, then a Forest Protection and Utilization Contract can be considered. The contract should be negotiated jointly and provide details such as the responsibilities, tasks, products involved, and technical prescriptions for a defined area of forest.

If sustainable utilization of NTFPs is not possible, then a standard Forest Protection Contract should be drafted with the community.

Step Four: Drafting Contract Negotiation

The outcome of the appraisal above should be a draft Forest Conservation and Community Investment Contract²⁵ (FCCIC), developed by the village with the help of the National Park staff and consulting team. This should detail the conservation and development objectives for the village and its forest resources, the management activities, the investment required (up to 40 million VD, and the roles and responsibilities of everyone involved in the partnership.

The draft proposal will be discussed at commune and district level, involving the National Park and the Project (during the Project's life). The finalized FCCIC should be approved by the Commune People's Committee and the National Park. For the first pilot FCCIC, it would also be appropriate to obtain approval from the District PPC and from DARD. Future FCCIC's may only require approval by at the Commune level.

Step Five: Annual Village Action Plans

The BCDC will provide the framework for more detailed annual village action plans, describing management actions, who does what, when, with performance indicators (financial, physical and social milestones) for monitoring progress.

Once co-approved by the National Park and the Commune, funds can be released directly to the village. According to Article 8 of Decision 24, the Management Board shall be assigned to manage the funding in accordance with existing regulations on management of public economics benefit funding.

Performance monitoring will be carried out by the village itself. Conservation monitoring is also necessary to measure the impacts of the programme. Monitoring will be fully participatory and involve elements that the villagers implement (based on simple records of harvesting, benefit distribution, financial data and decisions made). According to Article 8 of Decision 24, the village community shall arrange its monitoring of such activity in accordance with legal regulations on grassroots democracy.

The National Park may independently carry out monitoring of forest condition and other conservation related indicators. This is critical, since according to Article 8 of Decision 24, in cases where the village shows poor performance in its conservation tasks, the National Park Management Board has the authority to shift the funding to another village.

²⁵ These were called Biodiversity Conservation and Development Contracts under the Pu Luong Nature Reserve. The name proposed here may be more familiar, and corresponds to the wording in Decision 24.

Training staff of the National Park should provide them with the skills and competencies needed to support the activities in the Management Plan.

These include standard skills sets needed for adequate staff performance in any forest protected area,²⁶ and include:

- Law enforcement (including training on dealing with violations);
- Communication skills and awareness raising techniques needed to target harvesters, consumers and middlemen with appropriate messages to promote behaviour change.
- Approaches for working with local people, including awareness building, extension services to promote sustainable harvesting forest products, fire-prevention.
- Visitor management and especially for management of caves;
- Communication skills and interpretation and awareness raising techniques for targeting visitors, and training for cave guides;
- Training for cave guards (PNKB NP shall set up a Cave Protection Unit with specific responsibility for controlling visitors to the Park's caves, with the authority to supervise all activities of any concessions to operate within caves inside the WHS, and these staff will receive special training specifically relevant to cave conservation and safety);
- Senior management training in management planning, public use planning, integrating management with broader landscape management, sustainable development priorities
- Business Planning based on the UNESCO-sponsored training *Business Planning for Natural World Heritage Sites – A Toolkit*.
- Financial management and procurement, particularly on the specifics of various complex and unfamiliar donor requirements.
- Applied research and monitoring, especially as needed in order to begin monitoring caves, invasive species, and climate change.

In addition to these standard skills sets, several special skills are needed for managing Natural World Heritage sites:

- Understanding the World Heritage Convention and central World Heritage concepts such as Outstanding Universal Values;
- Interpreting and presenting the World Heritage site including communication and outreach;
- Understanding the logistical and organizational aspects of management and World Heritage reporting systems;
- Using monitoring systems that can track World Heritage values and site integrity;
- Managing the large pressure of tourism that World Heritage sites attract;
- Coping with climate change: Managers need to develop skills to understand the likely impacts of climate change as well as the potential of World Heritage sites to combat it.

²⁶ See Appleton, M. R., Texon, G.I. &Uriarte, M.T. (2003) Competence Standards for Protected Area Jobs in South East Asia. ASEAN Regional Centre for Biodiversity Conservation, Los Baños, Philippines. 104pp.<http://mekongtourism.org/website/wp-content/uploads/downloads/2011/02/ASEAN-Competence-Standards-for-Staff-Working-in-Protected-Area.pdf>

Detailed monitoring protocols will be developed to ensure the quality and credibility of the monitoring. This should ensure that monitoring is carried out consistently, data are suitable for comparative analysis, and any changes detected are real and not due to differences in sampling, for example if staff change. Monitoring protocols will be tested and provision for review built into the protocol.

Protocols should cover:

- Method: Approach or methods used (e.g. sampling, interviews, observation, line transect techniques, traps or strip census methodology).
- Procedures: Standardized procedures for collecting data, including area of monitoring, staffing requirements (e.g. numbers, required training, time allocated), equipment requirements (e.g. vehicles, binoculars, GIS, traps) and safety procedures.
- Frequency of data collection: Monthly, quarterly, annually, etc.
- Data collection: Indicators to be measured (e.g. species, number of sightings, fire frequency, average earnings of local communities).
- Data analysis: Advice regarding analysis and comparison (e.g. use of graphs, analysis software, comparisons, etc.)
- Data management: Records will include the monitoring results (data sets) and the history of monitoring development and revision.

Protocol adaptation

- Review: Monitoring activities will be regularly reviewed to ensure that not only are the right things being monitored, but that monitoring is carried out in the most effective way (resources are not being wasted on monitoring unnecessary things), and that the results are used to improve management.
- Revision: Although the aim will be to ensure standardization of monitoring, revision may need to take place due to changes in technology, gaps in data need, budget changes, and changing conditions on the ground, including new pressures and new management approaches.



A Northern Pig-tailed Macaque *Macaca leonina* in Phong Nha – Ke Bang National Park World Heritage Site. The Park hosts nine species of primates and is an important area for primate conservation. Photo: WV Bleisch/CERS

To track the effectiveness of management actions is critical in that it provides the information needed to track management success and adapt management as needed. Monitoring will rely both on subjective self-assessments, using various prepared tool-kits, and on field based monitoring of indicators.

- Monitoring management effectiveness: Park staff will repeat the METT assessment carried out in 2008 and 2012, using the same tool used in the past in order to insure comparability and allow assessment of progress. In addition, the Park will begin using the Enhancing our Heritage Toolkit, which uses the IUCN World Commission on Protected Areas framework to develop a range of more detailed assessment tools for managers of natural World Heritage sites. The toolkit will be used to develop comprehensive site-based systems for assessing management effectiveness.
- Monitoring threat reduction: Park staff will carry out a participatory Threat Reduction Assessment, comparing with the baseline Assessment carried out in 2012 using the same protocols to improve comparability.
- Monitoring tourism: The World Heritage nomination process requires tourism to be assessed (see section 5 of the nomination format); including visitor numbers and trends, and visitor facilities and services, such as interpretation / explanation, infrastructure, accommodation and rescue operations. The UNESCO Periodic Reporting format requires information on these aspects and includes rating of tourist facilities and capacity to manage tourism.
- Monitoring impacts of Management Action on reducing hunting: Monitoring of Hatinh Langur and Douc Langur according to transects. Repeat surveys according to fixed treks (applied for monitoring in 2000-2003). Survey of gibbon great calls: Listen for morning great calls in the early morning (4.30a.m - 5.00a.m in summer, 6.00a.m - 7.00a.m in winter). Training for responsible staff. Sampling in a fixed area at the same time (refer to report in 2007). Camera trap (Hatinh Langur) Put camera traps in sleeping caves. Count numbers of traps and snares in a fixed plot and on patrol. Sightings of hoofed animals (gaur, deer, muntjac) during patrols expressed as number/km (Index of Kilometric Abundance, IKA). The MIST management information system used in Uganda and Cambodia²⁷ will be introduced as a tool to integrate data collected by patrollers and produce information useful for Park managers.
- Monitoring impacts of Management Action on reducing illegal logging: Repeated forest resource inventory in fixed plots and through satellite image interpretation. Patrol staff will also count freshly cut Stumps on patrol. Research staff will track survival of known high-value trees in a fixed area, registering and securing all data to prevent theft.
- Collection of NTFPs: Survey on amount of high value species of NTFPs in priority areas in fixed plots. Interview harvesters (focal group surveys) to track change in harvest per effort.
- Fire wood use: Inventory of use per household by survey of sample in key villages.
- Tourism impacts: Water pollution. Chemical and physical measures (dissolved oxygen, water temperature, suspended solids, bacterial count), presence and abundance of sensitive species with a low tolerance to pollution. At springs (Ngoc Mooc) and sink-holes, and inside show caves. Solid waste: Measure solid waste outside rubbish bins at regular intervals (kg/person/ site/day). Noise pollution: dB meter. Impacts of light pollution (*lampenflora*).

²⁷Biodiversity and Protected Areas Management Project(BPAMP) (2006) Ranger-Based Data Collection, A Reference Guide and Training Manual for Protected Area Staff in Cambodia. Department of Nature Conservation and Protection, Ministry of Environment, Cambodia

- Monitoring tourism impacts in caves: Monitoring cave climate may be the single most important aspect of many caves for resource protection. Cave climate has profound impacts on many aspects of caves and their resources. Many cave processes are very sensitive to changes in cave climate parameters. People in a cave can significantly alter the microclimate of the cave. Automatic data loggers will be placed in key caves to record air temperature, humidity, airflow, etc. Monitoring of CO₂ concentrations may be needed in some remote enclosed sites within caves. Fixed point photo monitoring will also be used to track damage to speleothems from breakage, growth of lamp flora and impacts of changes in microclimate.
- Infrastructure impacts: Inventory number and scale of fixed construction works. Inventory of quantity of stone and sand excavated. Number of trucks crossing park boundaries during construction. Number of violation cases at construction sites.
- Invasive species: Inventory of species (*Chromolaena odorata*, *Mimosa diplotricha*, *Lantana camara*, *Mimosa diplotricha*, *Imperata cylindrica*, lang rung, san day rung, lau say, trinh nu, maiduong) in fixed plots in key areas that have many invasive species (villages: Cha Noi, Doong, Western Ho Chi Minh highway, Road 20).



Strategic Management Plan 2013 to 2025 Phong Nha - Ke Bang National Park-World Heritage Site ----o0o----

A Report of the Nature Conservation and Natural Resource Sustainable Management in
Phong Nha Ke Bang Region Project

Project director: Nguyen Trung Thuc

Project Chief Technical Advisor: Bas van Helvoort

Editor in Chief Luu Minh Thanh
Director of Phong Nha Ke Bang National Park

Compiled by: William V. Bleisch and Le Trong Trai and
contributions from Bas van Helvort &
Nguyen Van Tri Tin – AHT CO

Maps: Mai Ky Vinh and Nguyen Quang Quyet

Translator: Dang Thi Hoa

Editing laguages in Vietnames/English Nguyen Van Tri Tin

.	Phong Nha - Ke Bang National Park	Director
.	Vice- director, PNKB National Park	Head of PNKB National Park Management Plan Working Team (MPWT)
.	Head of Administration and Organization Department, PNKB National Park	PNKB NP MPWT member
.	Head of Finance and Planning Department, PNKB NP	PNKB NP MPWT member
.	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MPWT member
.	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MPWT member
.	Eco-Tourist Centre, PNKB NP	PNKB NP MPWT member
.	National Park Forest Protection Division, PNKB NP	PNKB NP MPWT member
.	Phong Nha - Ke Bang National Park	Director of PNKB Forest Protection Department
.	China Exploration & Research Society	Technical advisor for Management Planning
.	Bird Life International	Technical advisor for Management Planning; Author of the Operational Management Plan for the PNKB National Park
.	IUCN World Commission on Protected Areas (WCPA)	Vice Chair Mountains Biome Theme, Technical advisor for World Heritage requirements
.	PNKB Region Project (KfW Component)	Chief Technical Advisor
.	PNKB Region Project (KfW Component)	Deputy Chief Technical Advisor
.	PNKB Region Project (KfW Component)	Former Chief Technical Advisor
.	PNKB Region Project (GIZ Component)	Advisor and project liaison
.	PNKB Region Project (GIZ Component)	Advisor
.	Vice Director, Phong Nha - Ke Bang National Park	Head of the STDP Task Force Group
.	National Park and Protected Areas Association of Vietnam	Co-author of the Sustainable Tourism Development Plan (STDP) for the PNKB NP Region
.	Project Manager, Primates Reintroduction Programme, Frankfurt Zoological Society	Advisor
.	Project Manager, Kolner Zoo	Advisor

.	Tourism Resource Consultants New Zealand – TRC	Co-author of the STDP for the PNKB NP Region
.	Tourism Resource Consultants New Zealand – TRC	Co-author of the STDP for the PNKB NP Region
	Vietnam FIPI	Compiler of the Buffer Zone Development Plan for the PNKB NP Region
	Compilers of the Greater Blue Mountains World Heritage Area Strategic Plan	Template and Background materials on World Heritage Sites

Unless otherwise credited, photos
WVBleisch/CERS for the PNKB National Park Region Project Management Unit

PROJECT SUPPORT

The Strategic Management Plan 2013 – 2025 for the Phong Nha - Ke Bang National Park Region was an output of the Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha - Ke Bang Region Project and was prepared as a consultancy assignment for the Project Management Unit with the support of the Kreditanstalt für Wiederaufbau (KfW). The project is funded by the Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (BMZ).

The project is a joint cooperation between the Provincial Peoples' Committee (PPC) of Quang Binh from the Vietnamese side and Kreditanstalt für Wiederaufbau (KfW), GTZ, and Deutscher Entwicklungsdienst (DED) from the German side. The PPC is the executing agency and the Department of Planning and Investment (DPI) of the PPC acts as project owner and implementing body. GTZ and KfW support the project by means of financial and technical cooperation. A cooperation agreement between the PPC and GTZ was signed on 19th October 2007 and on the 23rd of January 2008 the agreement between the PPC and KfW was signed.

The overall objective of the project is to contribute to the conservation of the Central Annamite Region and its biodiversity and ecological services in close relation with a sustainable socio-economic development in the Core Zone (including Administration and Service Area, Ecological Restoration Area, and Strictly Protected Area, including the extension area) and Buffer Zone of the National Park. The project seeks to reduce the pressure on the natural resources of the National Park in part by support for the reorganising of legal income and alternative livelihood activities of the local population. The Project duration is eight years, six years for the implementation phase and the last two years for the aftercare phase.

The project prepared a Sustainable Tourism Development Plan for the PNKB NP Region in 2010 and it also supports the on-going preparation of a Buffer Zone Development Plan for the Buffer Zone of the National Park, and an Operational Management Plan for the National Park itself. This Strategic Management Plan is a comprehensive planning document that guides the development of all aspects of the region, integrating the intervention strategies and implementation programme of these other plans to achieve the objectives of the World Heritage.



Doline inside Son Doong Cave. Photo: Carsten Peter through National Geographic.

2013

2020



2012

2013 2020

Pursuant to the Law on Organizing People's Council and People's Committee
Pursuant to the Law on Forest Protection and Development dated 03 December
2004;

Pursuant to the Decree N° 23/2006/ND-CP dated 03 March 2006 by the Government
of Vietnam enforcing the Law on Forest Protection and Development;

Pursuant to the Decree N° 117/2010/ND-CP dated 24 December 2010 by the
Government of Vietnam on organization and management of special use forest system;

Pursuant to the Decision N°186/2006/QĐ-TTg dated 14 August 2006 by the Prime
Minister regulating the forest management regulations;

Pursuant to the Decision N° 18/2007/QĐ-UBND dated 16 August 2007 by Quang
Binh Provincial People's Committee regulating the management regulations of Phong Nha
Ke Bang National Park;

Pursuant to the Decision N° 36/2012-UBND dated 28 December 2012 by Quang Binh
Provincial People's Committee regulating functions, mandates, rights and organizational
structure of Phong Nha Ke Bang National Park;

Pursuant to the Decision N° 263/QĐ-UBND dated 14 February 2012 by Quang Binh
Provincial People's Committee approving the Annual Work-plan and Budget Plan 2012 for
KfW Component, Nature Conservation and Sustainable Natural Resources Management in
Phong Nha Ke Bang National Park Region Project;

At the request of the Department of Agriculture and Rural Development in the
Decision N° 369/SNN-KL dated 22 March 2013,

**1. Approve the Operational Management Plan 2013 – 2020 for Phong Nha Ke
Bang National Park with the basic content as follows:**

1. Name of plan: Operational Management Plan 2013 – 2020 for Phong Nha Ke
Bang National Park, World Heritage Site

2. Objectives: Provide foundations for effective law enforcement to prevent negative
activities, affecting forest resources, biodiversity conservation and conservation of
outstanding universal values in Phong Nha Ke Bang National Park recognized as a World
Heritage Site by UNESCO with the integrity

3. Action plan

a. Functional zone planning

b. Operational management programs

- Protection and conservation program

- Sustainable eco-tourism program

- Public awareness raising and education program

- Biodiversity research and monitoring program

- Capacity building program

- Buffer-zone development program

- Trans-boundary conservation coordination program
- 4. Implementation of the plan as per the road-map from 2013 to 2020
- 5. Source of funding: include the state budget and German contributions for “Nature Conservation and Sustainable Natural Resources Management in Phong Nha Ke Bang National Park Region Project”

2. Assign Phong Nha Ke Bang National Park Management Board to cooperate with local authorities and relevant agencies/entities to implement the Operational Management Plan as per regulations as well as assign the Project Management Unit of “Nature Conservation and Sustainable Natural Resources Management in Phong Nha Ke Bang National Park Region Project” to cooperate with relevant organizations and individuals to promptly and effectively use the budgetary categories expected in 2013 and following years for execution of programs as mentioned in the plan.

3. Head of the Provincial People’s Committee’s Headquarter, Director of Phong Nha Ke Bang National Park Management Board, Director of Nature Conservation and Sustainable Natural Resource Management in Phong Nha Ke Bang National Park Region Project Management Unit and Directors/Leaders from line departments, local authorities and relevant agencies/entities should be responsible for enforcing this Decision ./.

To:

- As per the Article 3;
- PPC Chairman and Vice-chairmen
- Leaders of PPC’s Headquarter
- For files: VT, CVKTN.

(Signed and Stamped)

TABLE OF CONTENT

Chapter 1: Background of the Phong Nha-Ke Bang National Park	7
1.1 Legislative basis for management: Relevant laws, decrees and regulations	7
1.2 History of the establishment of the National Park	8
1.3 Location	9
1.4 Physical features	9
1.4.1 Biogeography	9
1.4.2 Topography	9
1.4.3 Geology and geomorphology	9
1.4.4 Climate	10
1.4.5 Hydrology	10
1.5 Vegetation	10
1.6 Flora	11
1.7 Fauna	11
1.8 Social economic features	13
Chapter 2: Evaluation of the PNKBNP base on the Natural World Heritage Criteria	16
2.1 Geomorphology and Earth History	16
2.2 Potential World Heritage Values	16
2.2.1 On-going Evolutionary Processes	16
2.2.2 Biodiversity	18
Chapter 3: CONSTRAINTS AND THREATS TO PHONG NHA-KE BANG NATIONAL PARK	19
3.2 Constraint and weakness	19
3.3 Necessity of management planning	20
Chapter 4: MANAGEMENT ZONATION AND PRESCRIPTION	22
4.1 Management zoning and Regimes	22
4.2 Management Objectives and Actions	25
4.3 Management Objectives and Activities	25
4.3.1 Protection and Conservation Programme	25
4.3.2 Sustainable Ecotourism Programme	26
4.3.3 Public Awareness Raising and Education Programme	26
4.3.4 Biodiversity Research and Monitoring Programme	27
4.3.5 Capacity building programme	27
4.3.6 Buffer Zone Development Programme	28
4.3.7 Trans-boundary Conservation Coordination Programme	28
Chapter 5: Implementation Plan, Monitoring and Evaluation	29
5.1 Implementation plan	29
6.2 Monitoring and Evaluation	32
Chapter 6: Planning budget	34
6.1 Justification for budget allocation based on:	34
6.2 Summary of budget allocation	34
Chapter 7: Organizational and Administrative Management/Institutional Framework	38
7.1 Phong Nha-Ke Bang Organizational chart	38
Organizational Structure of the Phong Nha-Ke Bang National Park in accordance with Decree No: 36/2012/QĐ-UBND, Dated 28 December 2012	38
7.2 Human resources	39
7.3 Relevant stakeholders of the Operational Management Plan	39
Appendix 1: Estimated budget	41
Tables of estimated budget for PNKB NP in period of 2013-2020	41
Appendix 2: Maps	53
Appendix 3: Species recorded in PNKBNP in Vietnam Red Data Book and (2007)IUCN Red List of Threatened Species (2012)	56
Appendix 4: Existing and potential threats to PNKB NP	66
Phụ lục 5: Decision No: 18/2007 of Quang Binh Provincial People's Committee	71

ABBREVIATIONS

MPI	Ministry of Planning & Investment
MARD	Ministry of Agriculture&Rural Development
MoF	Ministry of Finance
BZDP	Bufferzone Development Plan
CPC	Commune Peoples' Committee
DARD	Department of Agriculture and Rural Development
DPC	District Peoples' Committee
GTZ	Gesellschaft für Technische Zusammenarbeit
IUCN	World Conservation Union (International Union for Conservation of Nature)
KfW	Kreditanstalt für Wiederaufbau
MARD	Ministry of Agriculture and Rural Development
MCST	Ministry of Culture, Sports and Tourism
MIST	Management Information System
NBCA	Lao PDR National Biodiversity Conservation Area
PNKB	Phong Nha - Ke Bang
PNKB NP	Phong Nha - Ke Bang National Park
OMP	Operational Management Plan
PPC	Provincial Peoples' Committee
SEDP	Socio-Economic Development Plan
STDP	Sustainable Tourism Development Plan
SUF	Special Use Forest
TOR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WHS	World Heritage Site
WWF	World Wild Fund for Nature
BirdLife	BirdLife International

INTRODUCTION

This operational management plan was prepared by Phong Nha-Ke Bang National Park with support from the Project for Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha Ke Bang National Park Region. This plan was consulted and incorporated comments from a workshop at provincial level before submitting to the Provincial People's Committee for approval. The plan is based on a series of consultations held between May and August 2012 with members of Management Plan Working Team of the national park management board, Forest Protection Department of the park and the Peoples Committees of five selected communes in the buffer zone and representatives of local communities.

This Operational Management Plan has been prepared to assist in meeting Vietnam's international responsibilities under the World Heritage Convention. It will ensure that appropriate consideration is given to the PNKB National Park World Heritage site's Outstanding Universal Values by government authorities when making decisions and by managers when developing management prescriptions for the Park and the surrounding area. It will also ensure that these actions are taken in a coordinated way, consistent with the mission of the Park. This document also serves as a commitment of the management agencies to the long-term survival of PNKB National Park and the protection of its values.

This Operational Management Plan (OMP) is part of an overall planning framework for the World Heritage Site and surrounding region. This is also closely linked with the Strategic Management Plan for the national park and other two planning documents developed in parallel with the Operational Management Plan: The Sustainable Tourism Development Plan (STDP) and the Buffer Zone Development Plan (BZDP). This OMP provides details of management actions organized in seven programmes. Estimated budget for each activity under each programme is also allocated in 8-year period of 2013-2020 and divided into two period: 2013-2016 and 2017-2020.

Based on a Conservation Needs Assessment and situation analysis the most burning issues have been identified and prioritized to be dealt with urgently and respective solutions and actions have been proposed. The implementation of this action plan will be regularly monitored and evaluated to measure progress towards expected outcomes and impacts. Adjustments and adaptations to this plan can thus be made to ensure the implementation process is relevant and suitable to the actual situation and context.

Within the limited framework, it is not expected that this action plan will be able to resolve all obstacles and challenges identified by the Management Plan Working Team in a short period of time; rather this action plan will serve as the first step to set out a comprehensive plan for effective and sustainable management for preservation and protection of the Phong Nha-Ke Bang National Park following best practice on effective heritage management.

This Operational Management Plan is organized in seven chapters as follows:

- Background chapter: summary of legal basic, park history, physical and socio-economic features;
- Evaluation of the PNKBNP base on the Natural World Heritage Criteria (viii, ix and x);
- Current and potential threats to conservation management and constraints and weakness of the park;
- Management prescription consisting of functional zonation, objectives and actions;
- Implementation plan;
- Evaluation and monitoring plan
- Projected budget for eight-year plan
- Organizational and Administrative Management

1.1

Legal documents referred to development of the Operational Management Plan for the Phong Nha-Ke Bang National Park include:

- Law on Forest Protection and Development, dated December 3rd, 2004;
- Decree No. 23/2006/NĐ-CP on implementation of the Law on Forest Protection and Development;
- Decision No. 186/2006/QĐ-TTg on promulgating the Regulations on Forest management;
- Decree No. 117/2011 of the Government of Vietnam on special-use forest organization and management;
- Circular No: 78/2011/TT-BNNPTNT of the Ministry of Agriculture and Rural Development guiding implementation of Decree 117.
- Decree No. 32/2006/ND-CP of the Prime Minister, dated 30 March 2006 on management of threatened species of wild flora and fauna
- Decision No. 189 of the Prime Minister, dated 12 December in 2001 on updating the Phong Nha-Ke Bang Nature Reserve to National Park.
- Decision No. 189/2001/QĐ-TTg of the Prime Minister on upgrading Phong Nha – Ke Bang Nature Reserve to National Park dated December 12th, 2001;
- Decision No. 2235/QĐ-TTg of the Prime Minister on approval of development of a construction master plan for Phong Nha Ke Bang National Park until 2025;
- Decision No. 57/QĐ-TTg of the Prime Minister, dated 9 February 2012 on approval of plan of forest protection and development in period of 2011-2020.
- Decision No. 24/QĐ-TTg of the Prime Minister, dated June 1st 2012 on Investment policy for development of Special-use Forests in period of 2011-2020.
- Interministerial Circular No. 03/2012/TTLT-BKHDT-BNNPTNT-BTC, dated 5 June 2012 on guideline for implementation of Decision No. 147/2007/QĐ-TTg and decision No. 66/2011/QĐ-TTg of the Prime Minister: on policy of development of forest production in period 2007-2015.
- Circular No. 97/2010/TT-BTC of Ministry of Finance, dated 6 July 2010, on the stipulation on expenses for business trips, workshops, meetings for government and public organisations.
- Decision No. 18/2007/QĐ-UBND of Quang Binh Provincial People's Committee, dated 16 August 2007, on management regulations of the Phong Nha-Ke Bang National
- Decision No. 36/2012/QĐ-UBND of Quang Binh Provincial People's Committee, dated 28 December 2012, Regulations on functions, tasks, responsibilities and administration of the Phong Nha-Ke Bang Management Board, Quang Binh Province.
- The International Convention and Operational Guidelines for World Heritage Sites guide the management of all World Heritage Sites.
- International Convention on Cultural and Natural Heritage Protection dated November 16th 1972;
- Operational Guidelines for the Implementation of the World Heritage Convention, UNESCO World Heritage Centre, 2005.
- Operational Guidelines for the Implementation of the World Heritage Convention, UNESCO World Heritage Centre, November 2011.
- International Union for Conservation of Nature (IUCN) *Managing Natural World Heritage*. UNESCO / ICCROM / ICOMOS / IUCN, 2012.

1.2

Phong Nha was included on Decision No. 194/CT of the Chairman of the Council of Ministers, dated 9 August 1986, which decreed the establishment of a 5,000 ha Cultural and Historical Site (MARD 1997).

In 1992, an investment plan was prepared for the site, which proposed the establishment of a 41,132 ha nature reserve (Anon. 1992). Following the approval of the investment plan, a nature reserve management board was established by Quang Binh Provincial People's Committee on 5 December 1993.

In 1999, an investment plan proposed extending the site to incorporate the Ke Bang limestone area to the north-west, and revising the management category from nature reserve to national park. Following the approval of this investment plan, the establishment of Phong Nha-Ke Bang National Park was decreed by Decision No. 189/TTg of the Prime Minister, dated 12 December 2001. According to the Prime Minister's decision, the total area of the national park is 85,754 ha, comprising a strict protection area of 64,894 ha, a forest rehabilitation area of 17,449 ha, and an administration and services area of 3,411 ha.

Following the revision of the establishment of Phong Nha-Ke Bang National Park, the nature reserve management board was restructured as a national park management board, by Decision No. 24/QD-UB of Quang Binh Provincial People's Committee, dated 20 March 2002. The management board currently has 220 members of staff, which are allocated among the Park's Administrative office (28 staff), Tourism Unit (137), Centre for Scientific Research and Wildlife Rescue (30), and Forest Protection Unit (128).

In 1998, the site was nominated as a UNESCO World Heritage Site. As well as its biodiversity values, the justification for inscription included the outstanding cave systems and limestone karst landscape at the site (Nguyen Ngoc Chinh *et al.* 1998). In 2003, Phong Nha-Ke Bang National Park was inscribed as Vietnam's fifth World Heritage Site under category viii: outstanding geological, geomorphic, and geographical values.

During 1998, Fauna and Flora International (FFI) implemented a two-part project at Phong Nha-Ke Bang. The first part consisted of a training course for national park staff, while the second part consisted of a survey of large mammals, bats and birds (Timmins *et al.* 1999).

Quang Binh Tourism Company have been operating at Phong Nha-Ke Bang since 1995, handling tourism to Phong Nha cave.

With funding from the UK Department for International Development and WWF-UK, the WWF Indochina Programme implemented a project entitled *Linking Hin Namno and Phong Nha through Parallel Conservation*. The first phase of this project ran from 1998 to 1999, and the second phase ran from 2000 to 2002. These phases focused on capacity building for national park staff, collecting baseline data and environmental education.

With funding from the British Environmental Fund and the Flagship Species Fund of the UK Department of Environment, Food and Rural Affairs, FFI implemented the *Phong Nha-Ke Bang Conservation Awareness Project* between 2001 and 2003. The focus of this project was primate surveys and awareness-raising for school children and visitors (Tordoff *et al.* 2004).

Ongoing project, namely "*The Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang Region Project, Vietnam (2008-2016)*", is managed by the Quang Binh Provincial People's Committee (PPC). The estimated total project cost is approximately EUR 15.77 million, including EUR 4.63 million of loan, EUR 8.0 million of financial contribution and approximately EUR 3.2 million of counterpart contribution.

The Phong Nha-Ke Bang project area consists of the core zone of the Phong Nha – Ke Bang National Park (PNKB NP) with an area of 116,824 ha (including the extension area of

31,070 ha) and a buffer-zone of 225,000 ha, consisting of parts of 13 adjacent communes in three districts of Bo Trach, Minh Hoa and Quang Ninh, in the west of Quang Binh Province. The project has two components: the KfW and GIZ ones. GIZ's responsibility is mainly in technical cooperation, and leading buffer-zone and tourism planning. KfW's responsibility is largely investment, complementing and scaling-up GIZ's pilot projects, in addition to leading the development and implementation of a management plan for PNKBNP and complementary technical assistance to improve management, in particular law enforcement.

1.3

Phong Nha-Ke Bang National Park is located in western Bo Trach district, close to the international border with Laos. The Park's headquarter is located in Son Trach commune, Bo Trach district, Quang Binh province, 50 km North East of Dong Hoi provincial town. The Park has coordinates bound within:

170 44.671'N; 105049.381'E to 170 22.334'N; 1060 04.555'E;
and 17027.002'N; 106023.250'E to 17040.522'N; 105046.731'E;

1.4

1.4.1

The Phong Nha-Ke Bang represents a large, essentially intact conservation sampling of Global 200 priority ecoregion (WWF). The Park lies within Indochinese Rainforest province in the Tropical Humid Forests biome of the Indomalayan realm (Udvardy 1975). Phong Nha-Ke Bang NP also lies within the Indo-Burma Biodiversity Hotspot (Djik et al. 1999). In addition, the Park covers territory of two Important Bird Areas: Phong Nha and Ke Bang and it also situated in the Annamese Lowlands Endemic Bird Area (Stattersfield et al. 1998), since it supports a number of the restricted-range bird species which characterise the Endemic Bird Area.

1.4.2

The national park is situated in one of the largest areas of contiguous limestone karst in Indochina which also includes Hin Namno National Protected Area in Laos (Central Indochinese Limestone). The limestone massif is located in a transitional zone between the northern and central Annamite mountains.

The topography of the national park is characterised by precipitous karst ridges, which rise to elevations of around 400 m. Scattered among these ridges are narrow valleys and pockets of igneous rock formations.

1.4.3

Phong Nha-Ke Bang National Park in the Northern Annamite Mountains and its bordering lowlands is in one of the largest and most distinctive tracts of karst topography in the world. With the neighbouring Ke Bang Conservation Area and karsts (extension area) it comprises a wide deeply dissected plateau of some 200,000 ha extending into Hin Namno, a similar area in Laos. Its geological history is traced back to the late Ordovician-early Silurian period around 460-400 million years ago. The limestone is discontinuous, being interblended with shales and sandstones and capped by schists and granites, rising to a number of unexplored peaks over 1,000m high. The extensive transitional landforms derive from an extremely complicated intercalation of limestone massifs and terrigenous terrain which has produced three distinctive types of topography. Two-thirds of the nominated site is Cenozoic karst. A smaller main area is of mainly Mesozoic karst. A third area is a non-karstic landscape of low round-topped mountains of intrusive rock with planation surfaces and

abrasion-accumulation terraces along the valleys of the Son, and Chay rivers and on the margins of the central limestone massif.

Since 2009 the Son Doong cave, on the Son river, running underground at least 5 km by 150 m wide and 200 m high is now famous as the world's largest cave, It possesses beautiful sand beaches and spectacular speleothems, but at present is open only to scientists and speleologists. Phong Nha cave, with a surveyed length of 7.73 km and 14 grottoes, is the best known. Its entrance is the last stretch of the underground Chay River, a tributary of the Son which itself flows underground for 20 km. Two beautiful caves, Thien Duong and Tien Son, are nearby. Other extensive caves include the Vom cave system, 15 km long, and the Hang Khe Rhy cave system 18,9 km long. Phong Nha–Ke Bang contains the catchment area of many but not all of the streams and rivers that feed the Gianh river. Flooding of the valleys occurs between September and November, but in the dry season from February to August almost all the streams dry up (UNESCO, Phong Nha-Ke Bang National Park, Updated May 2011).

1.4.4

The climate is tropical, hot and humid. The annual mean temperature ranges between 23^o and 25^oC, with a summer maximum of 41^oC and a winter minimum of 6^oC. The hottest months are from June to August, with a mean of 28^oC; the coldest months are from December to February with a mean of 18^oC. The high annual rainfall averages 2,000-2,500mm, 88% falling between July and December, though there is rain in every month and on more than 160 days a year. The mean annual relative humidity is 84%.

1.4.5

Because of the limestone topography, drainage is complex and there are few permanent water courses. There are, however, the Chay, Son and Trooc rivers, all of which are fed by underground streams, which emerge from the En, Vom, Toi and Phong Nha cave systems. All three rivers flow into the Gianh river, which empties into the East Sea. The whole catchment might be generated in Namno National Protected Area in Laos.

1.5

The results from the interpretation of remote sensing data and field surveys of the Forest Inventory and Planning Institute (2011) show that the forest cover of the Park is 99.63% of the total area of the Park. Based on Thai Van Trung (1998) classification of vegetation types in the Phong Nha – Ke Bang area, there are nine vegetation types and subtypes as follows:

- Tropical dense moist evergreen forest with major broadleaf species on limestone above 700m asl.
- Low tropical montane evergreen forest with major broadleaf species on hills above 700m asl.
- Tropical dense moist evergreen forest on hills under 700m asl.
- Tropical dense moist evergreen forest on limestone under 700m asl.
- Degraded evergreen forest on hills
- Tree and shrub savanna on limestone
- Tree and scrub savanna on hills
- Agriculture land
- Other land (plantation)

As a result, the limestone karst is almost entirely forested, apart from steep cliff faces. The only clearance of forest has been in flat valleys within the limestone massif, and in lowland areas bordering it. Natural forest covers the majority of the national park. The most widespread forest type is limestone forest but there are also significant areas of lowland

evergreen forest distributed on non-calcareous substrates in valleys among the limestone karst. Limestone karst of PNKBNP supports an area of 1000 ha of limestone forest above 700 m with dominant unique plant formation of *Calocedrus macrolepis* (EN), a large coniferous tree that is an endemic species to limestone areas of Vietnam (Averyanov *et al.* 2004).

1.

Up to date, 2851 species of vascular plants were recorded from the Park, of which 75 and 69 species at national and international threatened species respectively and additional 419 endemic plant species to Vietnam. A total of 183 orchid species were recorded in the Park, including two globally threatened *Gastrochilus calceolaris* (CR) and *Paphiopedilum dianthum* (EN) and seven nationally threatened *Anoectochilus calcareus* (EN), *Bulbophyllum astelidum* (EN), *Bulbophyllum tixieri* (EN), *Eria spirodela* (EN), *Nervilia aragoana* (VU), *Paphiopedilum dianthum* (EN) and *Paphiopedilum malipoense* (EN).

There are 12 species classified as globally Critical Endangered such as *Dipterocarpus gracilis*, *Dipterocarpus hasseltii*, *Dipterocarpus turbinatus*, *Hopea chinensis*, *Hopea hainanensis*, *Hopea mollissima*, *Hopea reticulata*, *Hopea siamensis*, *Diospyros mun*, *Aquilaria crassna*, *Gastrochilus calceolaris*.

1.

The fauna of the Park is typical of the limestone karst forests of the Annamite mountains. Up to date 755 vertebrate species have been recorded: 121 mammals, 303 birds, 161 reptiles and amphibians and 170 fish. In addition, 261 species of butterflies were recorded from the Park in an expedition (See Table 1). Of these, 62 species listed in Vietnam Red Data Book (2007), 73 species in IUCN Red List of Threatened Species (2012) and 35 species are endemic or restricted range species (Table 1).

			2012	
Mammal (including bats)	121	28	31	6
Bats	41		2	
Birds	303	6	10	4
Reptiles & Amphibians	161 (107&54)	24	15	9
Fish	170	3	15	16
Butterfly	261	1		
	1,016	62	73	35

Note: VNRDB= Vietnam Red Data Book (2007), IUCN 2012 = Red List of the Threatened Species, version 2012.1, Endemic/RRS = Endemic species/Restricted-range Species (global range under 50,000 km²).

A total of 121 species were recorded in the Park, of which 115 species have been confirmed to present inside the boundary of the Park. Other six species were provisional records, including Saola *Pseudoryx nghetinhensis* and Black Langur *Trachypithecus laotum* or current distribution outside of the Park (e.g. Gaur *Bos gaurus*). Of the total species recorded, Hatinh Langur, Laotian Rock Rat and 41 Bat species were confirmed to the Park and they are specialist of limestone karst. Six species are endemic to Vietnam and Truong Son Mountain; these include Hatinh Langur *Trachypithecus hatinhensis*, Red-shanked Douc langur *Pygathrix nemaeus*, Southern White-cheeked Gibbon *Nomascus siki*, Large-antlered Muntjac *Muntiacus vuquangensis*, Laotian Rock Rat *Laonastes aenigmamus* and Annamite

Striped Rabbit *Nesolagus timminsi*. A remarkable Globally Endangered Laotian Rock Rat *Laonastes aenigmamus* is a new record to the Park during survey in 2011 (Nguyen Xuan Dang *et al* 2011).

There are 33 species listed in international and national red data book whether they are threatened, near-threatened and data deficient (See Appendix 3).

The Park supported populations of nine primate species of 41 species in Vietnam or 43% of the total species of primate species of Vietnam.

The Park lies within the Annamese Lowlands Endemic Bird Area (Stattersfield *et al.* 1998) and it consist of two Important Bird Areas, which was identified by BirdLife International (2002, 2011).

Up to date, a total of 303 bird species were confirmed to occur in the Park (See Appendix). Of which, ten species are listed in the IUCN Red List of the Threatened Species (2012) and six species in Vietnam Red Data Book (2007) (Table 2). Four species found in the Park have a globally restricted-range such as Crested Argus *Rheinardia ocellata*, Short-tail Scimitar Babbler *Jabouilleia danjoui*, Sooty Babbler *Stachyris herberti* and Grey-faced Tit-babbler *Macronous kelleyi*. A Restricted-range bird species is a land bird that is judged to have had a breeding range of less than 50,000 km² throughout historical times (since 1800) (Stattersfield *et al.* 1998). Amongst the total species recorded for the Park, three species: Sooty Babbler, Bare-faced Bulbul and Limestone Leaf Warbler are typical or specialist of limestone karst. The first two species are nowhere to be found in the world.

2

		2012	200
Chestnut-necklaced Partridge	<i>Arborophila charltonii</i>	NT	VU
Siamese Fireback	<i>Lophura diardi</i>	NT	
Grey Peacock-pheasant	<i>Polyplectron bicalcaratum</i>		VU
Crested Argus	<i>Rheinardia ocellata</i>	NT, RRS	VU
Blyth's Kingfisher	<i>Alcedo hercules</i>	NT	
Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	NT	VU
Great Hornbill	<i>Buceros bicornis</i>	NT	
Wreathed Hornbill	<i>Aceros undulatus</i>		VU
Red-collared Woodpecker	<i>Picus rabieri</i>	NT	
Japanese Paradise-flycatcher	<i>Terpsiphone atrocaudata</i>	NT	
Short-tailed Scimitar-babbler	<i>Jabouilleia danjoui</i>	NT, RRS	
Sooty Babbler	<i>Stachyris herberti</i>	NT, RRS	VU
Grey-faced Tit-babbler	<i>Macronous kelleyi</i>	RRS	
Bare-faced Bulbul*	<i>Pycnonotus hualon</i>	NA	new species
Limestone Leaf Wabler*	<i>Phylloscopus calciatilis</i>	NA	new species

Notes: Global status: NT = Near Threatened as per BirdLife International (2011). National status: VU = Vulnerable as per Anon. (2007); RRS = Restricted-range Species (BirdLife International 2011); NA = Not Assessment; * = New species for science were found in the Park.

Herpetofauna of the PNKBNP was well study in comparison with other faunas. Up to date, a total of 161 species were recorded in the Park, including 107 reptile species and 54 amphibian species. Of these species recorded, 30 species are considered as global conservation concern and listed in the IUCN Red List of Threatened Species (2012.1), 26 species of reptile and amphibian were listed in the Red Data Book of Vietnam, including 22 reptile and 4 amphibian species. Amongst the total species confirmed to occur in the Park, nine species are endemic species for Vietnam and PNKBNP such as Phongnhakebang Bent-toed Gecko *Cyrtodactylus phongnhakebangensis*, Phongnhakebang Gekko *Gekko scientiadventura*, Annam Keelback *Parahelicops annamensis*, Horned Pitviper *Protobothrops cornutus*, Sievers' Three Horn-scaled Pitviper *Protobothrops sieversorum*, Four-fingered Skink *Sphenomorphus tetradactylus*, Nogge's Water Skink *Tropidophorus noggei*, Annam Flying Frog *Rhacophorus annamensis*, Tonkin Bug-eyed Frog *Theloderma corticale*. In addition, Asian Caecilian *Ichthyophis sp.* is to be new species for science, more materials is needed for confirmation.

A total of 170 species was recorded from the Phong Nha-Ke Bang Region, of which three and 15 species are listed in the Red Data Book of Vietnam (2007) and the IUCN Red List of Threatened Species (2012) respectively. In addition, 16 species are endemic to Vietnam and Truong Son mountain. Remarkably, nine species are described as new species to science such as: *Aspidoparia viridis*, *Yaoshanicus albus*, *Acrossocheilus albus*, *Acrossocheilus carongensis*, *Acrossocheilus fissirostris*, *Acrossocheilus lineatus*, *Acrossocheilus longianalis* and *Acrossocheilus*.

A total of 261 species of butterflies was recorded from the Park in 1999. Five new species were described by Devyatkin (2000-2002)) in the expedition: *Celaenorrhinus incestus*, *C. kuznetsoovi*, *Darpa inopinata*, *Coladenia tanya* and *Halpe paupera*. There is only one species of butterfly listed in Red Data Book Of Vietnam (*Troides aeacus*-VU).

As survey result in 2011, two new scorpion species of new genus () has been published. The first species was named scientifically *Vietbocap thienduongensis* Lourenco & Pham and was published in the C.R.Biologies. Vietnamese name of this scorpion species is *Thien Duong scorpion* (since they were found in Thien Duong cave). The second was found in Tien Son cave with scientific name of *Vietbocap canhi* Lourenco & Pham, which was published in Zookeys. Two of these species belong to the Pseudochactidae family. So far, in the world, for Pseudochactidae family, only 4 species of 3 genera (1 species of *Troglokhammouanus* genus found in Laos; 1 species of *Pseudochatas* genus found in Uzbekistan and Tajikistan and 2 species of *Vietbocap* genus found in Vietnam) have been found. They are specific species, adapting to the living environment inside caves. The isolation with outside environment and the special light condition and humidity condition have generated the endemic species in the area (Pham Dinh Sac *et al.* 2011).

1.8

Population inside the core zone

Tan Trach commune with two villages is located in the core zone of the Park. Ban Doong (Doong village) is the smallest village of six households and Doong community is belonging to ethnic Van Kieu group. The second village is of Arem community, Vietnam's smallest ethnic minority group, numbering some 307 individuals in 79 households and thus making up the smallest ethnic minority groups in the country.

Population in the Buffer Zone of Phong Nha - Ke Bang NP

According to the extension plan, the buffer zone of the Park consists of 13 communes, and is home of over 15 thousands households of 65,000 individuals. The population density is varied, along the main road, villages or communes are more populated than in the remote area adjacent to Vietnam-Laos's border (See Table 3).

3

	District/Comm.	Area (ha)	No. of household	No. of people	Density (people per sq.km)
I	<u>Minh Hoa</u>	98,605	3,831	17,154	32
1	Dan Hoa	17,697	834	3,519	19
2	Hoa Son	18,031	369	1,607	9
3	Thuong Hoa	34,634	706	3,105	9
4	Trong Hoa	18,789	693	3,636	19
5	Trung Hao	9,454	1,229	5,287	55
II	<u>Bo Trach</u>	167,606	10,279	43,829	190
6	Hung Trach	9,515	2,716	11,104	117
7	Phu Dinh	15,360	659	2,719	18
8	Phuc Trach	6,022	2,478	10,761	178
9	Son Trach	10,139	2,582	10,653	105
10	Tan Trach	36,281	72	401	1
11	Thuong Trach	72,572	461	2,457	3
12	Xuan Trach	17,717	1,311	5,734	32
III	<u>Quang Ninh</u>	77,384	929	3,972	5
13	Truong Son	77,384	929	3,972	5
		343 595	15 039	4 955	19

Source: Statistic Data of three Districts in 2011

All communes in the Buffer Zone area are listed as a priority for economic development programmes such as: 135 (infrastructure upgrading), 661 (forest plantation and regeneration), Central Poverty Reduction Project (supported by the ADB), etc. These programmes and projects support the local people in economic development and forest protection and regeneration. In particular the Vietnamese Government and the Germany Bank (KfW) are in the process of setting up a large project on Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha – Ke Bang NP Region.

Characteristics of ethnic groups at Phong Nha – Ke Bang

The Phong Nha – Ke Bang area is not only famous for its cave system, beautiful landscape and high biodiversity but it is also famous for the minority groups living in the area. Besides the Kinh (majority Vietnamese) ethnic group, there are two main ethnic groups: Van Kieu and Chut.

Bru - Van Kieu Ethnic Group:

+ The Bru - Van Kieu has the largest population of all the ethnic groups living in the Northern Annamite Mountain Range (except Kinh group). The Bru - Van Kieu belong to the Mon - Kho Me language group, a group native to Indochina, which includes groups such as the Van Kieu, Khua, Ma Coong, Tri and So.

+ Among the ethnic groups mentioned above, the Van Kieu is largest and most widely distributed in the Annamite Mountain Range. The Tri and the Ma Coong ethnic groups are distributed in Thuong Trach and Tan Trach Communes, Bo Trach District and Laos. The Khua ethnic group is mostly distributed in Dan Hoa Commune, Minh Hoa District.

Chut ethnic group:

Ha Van Tan and Pham Duc Duong in the article “About languages of Viet - Muong” in *Ethnology Magazine* volume 1 – 1997 wrote that the Chut language is the oldest one in the Viet - Muong language group and that this language split from the Viet - Muong language in the 10th or 11th century. The Chut ethnic group includes many ethnic sub-groups such as the Sach, May, Ruc and Arem.

Arem and Ruc people

In the language of the Chut ethnic group, the meaning of “Ruc” is the place that has an underground stream and “Arem” is defined as a rocky cave or rocky arch. The Arem are located inside the Park in Village 39, Tan Trach Commune while the Ruc are located in the Buffer Zone, Thuong Hoa Commune. The Arem and Ruc people are not only the smallest groups of the Chut ethnic minority but they are also two of smallest groups in Vietnam. They live isolated from other communities in the limestone karst area. In 2006, the Arem group consisted of only 202 people, and the Ruc group consisted of only 322 people.

The Arem and Ruc have their own distinct languages, which are parts of the Viet-Muong branch of the Mon-Khmer language family. Since 1992 the Arem and Ruc people started to live in houses. In the past they preferred to move around deep within the forest, dwelling in caves, trees, or temporary shacks. The Ruc and Arem were the last groups of people to start building houses in the 1960's.

Cultural heritage

The oldest evidence of human occupation of the area is the Neolithic axe heads and similar artifacts found in some caves. Currently the Arem ethnic group live in two villages in the core zone while the Ruc and Ma Coong people live in the Buffer Zone of Phong Nha – Ke Bang NP. Until 1962 these indigenous people lived in the forest in houses made of bamboo and leaves or in the caves, using forest products and hunting as a way of life. They used simple tools and their clothes were made from the bark of a toxic forest tree (*Antiaris toxicaria*) and lianas. Since 1992 the Government of Vietnam has set up two new settlements for these 475 people, who are the two smallest ethnic groups in Vietnam. These people are familiar with a number of economically valuable species, especially precious timber such as Mun and Hue (*Diospyros spp.* and *Dalbergia tonkinensis*), and oil-extraction from species such as Tau (*Hopea hainanensis*) and many medicinal plants. The Phong Nha Cave has long been a site of religious and touristic importance, with an old Cham Temple discovered in the cave and this was a site for worship in the 9th and 10th centuries. During the war with the USA the Phong Nha – Ke Bang forest and caves were a garrison and weapons store for the Vietnamese Army.

2.1

An outstanding example representing major stages of earth's history, including significant on-going geological processes (World Heritage Criterion viii).

Phong Nha displays an impressive amount of evidence of earth's history. It is a property of very great importance for increasing our understanding of the geologic, geomorphic and geo-chronological history of the region. Phong Nha is part of a larger dissected plateau, which also encompasses the Ke Bang and Hin Namno karst (in Lao PDR). The plateau is probably one of the finest and most distinctive examples of a complex karst landform in Southeast Asia. The karst formation of Phong Nha-Ke Bang National Park has evolved since the Palaeozoic (some 400 million years ago) and so is believed to be the oldest major karst area in Asia. Subject to massive tectonic changes, the park's karst landscape is extremely complex with many geomorphic features of considerable significance. The vast karst area, extending across the border into the Lao People's Democratic Republic, contains spectacular formations including over 104 km of caves and underground rivers, making it one of the most outstanding limestone karst ecosystems in the world.

The karst formation processes have led to the creation of a variety of cave types, including underground rivers, dry caves, terraced caves, suspended caves, dendritic caves and intersecting caves. The centerpieces of the site are the Phong Nha Cave, through which an underground river flows 44.5 km and Paradise Cave, recently open to the public. The Park protects the Son Doong Cave, believed to be the world's largest dry cave. These and the hundreds of other caves discovered to date demonstrate discrete episodic sequences of events, leaving behind various levels of fossil passages, formerly buried and now uncovered karst from previous, perhaps very ancient, periods; evidence of major changes in the routes of underground rivers; changes in the solutional regime; and other unusual features.

2.2

Phong Nha-Ke Bang WHS has other values that have the potential to be nominated for world heritage listing in their own right.

2.2.1

PNKB should be globally recognized as an outstanding example of significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, and subterranean ecosystems and communities of plants and animals (World Heritage Criterion ix).

PNKB National Park protects a large portion one of the best preserved tracks of limestone forest in the central Truong Son range (Annamites), which has been recognized as a critical landscape of the Greater Annamites Global 200 Bioregion. Many endemic and near-endemic vertebrates are associated with this ecoregion, which has been identified as one of the greatest concentrations of endemic species in a continental setting found anywhere¹. The Central Indochina Limestone Priority Landscape (NA6), which is ranked as globally critical for biodiversity conservation, hosts numerous limestone specific taxa, including a number of Annamite endemics—more so than the Northern Indochina Limestone Landscape (NA1), - making the Central Indochina Limestone the most extensive limestone area holding the most distinctive limestone community in the Greater Annamites Ecoregion. This area is critical for the conservation of primate species, and limestone specialist species such as the Sooty

¹ WWF (2012) About the Annamites Ecoregion.

http://wwf.panda.org/what_we_do/where_we_work/project/projects_in_depth/greater_annamites_ecoregion/about_the_area/
Downloaded 18 August 2012.

Babbler *Stachyris herberti*, Bare-faced Bulbul *Pycnonotus hualon* and Limestone Leaf Warbler *Phylloscopus calciatilis*. Of these species, two last species are new descriptions for science in 2009 and 2010 respectively.

The Park lies within Indochinese Rainforest province in the Tropical Humid Forests biome of the Indomalayan realm (Udvardy 1975). Phong Nha-Ke Bang NP also lies within the Indo-Burma Biodiversity Hotspot (Djik et al. 1999). In addition, the Park covers territory of two Important Bird Areas: Phong Nha and Ke Bang and it also situated in the Annamese Lowlands Endemic Bird Area (Stattersfield et al. 1998), since it supports a number of the restricted-range bird species which characterise the Endemic Bird Area.

Of particular note are several primitive or relict species that have been recently discovered in PNKB which have few or no close relatives, including the Large antlered Muntjac (*Muntiacus vuquangensis*), Annamite Striped Rabbit (*Nesolagus timminsi*), and Laotian Rock Rat (*Laonastes aenigmamus*). The last of these, in particular, has been identified as a 'Lazarus species', the only representative of a lineage (Diatomyidae) that was previously only known from fossils that date to at least 11 million years. The persistence of more primitive or relict species such as these could be attributed to long-term habitat stability in the region, the effect of a stable climate and of regular uplifts over a long period maintaining a suitable distribution of habitat types.

"Although it is difficult to quantify rates of endemism and compare them among areas and groups of organisms, these observations suggest that central Vietnam's uplands and associated lowland areas may be a focal point or hotpot of endemism within mainland Southeast Asia. If true, a possible explanation is that the Truong Son Range remained climatically and ecologically stable as the surrounding forests and other habitats contracted, expanded, or turned over during long-term climate fluctuations. Its forests may have served as refuge for forest-dwelling species during cooler, drier periods when their evergreen forested habitats disappeared from lower elevations. Under these long-term, stable conditions, older species were preserved and the evolution of new species may have been facilitated.²"

Many endemic taxa found in the Park, such as the two similar langurs - the Hatinh Langur, the Lao Langur/Black Langur, have overlapping but distinct range boundaries. This patchy distribution may be due to climatic, geographic, or ecological barriers, or interspecific competition that prevented effective dispersal out of the patches. It could also be that these taxa have not yet recolonized other areas since the last glacial maximum 18,000 years ago, even though they may be capable of doing so. Several ongoing evolutionary processes may have resulted in the high rate of endemism and unusual faunal features of PNKB: The episodic uplift of the limestone landscape from (at least) the Tertiary and the successive karst development, rejuvenation and ongoing evolutionary karst development and accompanying creation of specialist habitats. The development of a stable, warm tropical high rainfall monsoon weather system since the Pleistocene cold period has fostered evolutionary development within the karst landscape.

The specialised habitats that have fostered and continue to foster evolutionary development in the karst landscape, including within caves (troglobitic species), at cave entrances (cave nesting violent vertebrates and the invertebrate communities that they support; low light specialist vegetation species), within dolines (refugia for relict types dependent on the high humidity and colder air temperatures generated by caves).

Cave fauna in particular show the striking effect of isolation on species divergence. A preliminary study of the cave fauna from the PNKBNP found at least 41 species of invertebrates among 248 individual specimens collected from the three cave systems surveyed. Only five species were common across the three caves. The discovery of two

² pp. 223-224 in EJ Sterling, MM Hurley, Le Duc Minh (2006) Vietnam: A Natural History. Yale University Press; New Haven.

species of blind scorpions in PNKB is highly significant, as there are currently only about 20 described cave dwelling scorpions in the world that exhibit troglomorphic characteristics. The new species, *Vietbocap thienduongensis* and *V. canhi*, were the first troglobitic scorpions found in mainland Asia.

2.2.2

PNKB WHS should also be recognized for its global importance in in-situ conservation of biological diversity, including species of outstanding universal value from the point of view of science or conservation (World Heritage Criterion x).

The property is of global significance for the conservation of biodiversity because its forest ecosystems, both karst and non-karst, support a high diversity of plants and animals, including a number of karst specialist species, many endemic species and a number of species that are globally threatened. Its rich diversity of endangered species includes large mammals Giant Muntjac, Asiatic Black Bear, the Malayan Sun Bear, the Binturong and the Gaur. Living in PNKB specifically are many endemic and restricted range species, including charismatic representatives such as the Red-shanked Douc (*P. nemausus*), Southern White-cheeked Gibbon (*Nomascus siki*), Large-antlered Muntjac (*Muntiacus vuquangensis*), Crested Argus Pheasant (*Rheinardia ocellata*), and Annam Flying Frog (*Rhacophorus annamensis*).

The limestone forest ecosystem at Phong Nha-Ke Bang supports a high diversity of plant and animal species. Of perhaps the greatest conservation significance are several species found at the site that are endemic to this part of central Vietnam and Laos. The site supports 419 plant species that are endemic to Vietnam (Averyanov et al. 2011). In addition, one new Genus and nine species are to be new for science (Averyanov et al. (2011).

PNKB support four of seven restricted range species of the Annamese Lowland Endemic Bird Area (BirdLife International Vietnam Programme 2011). The Park's fauna includes a number of recently discovered karst endemics, including vertebrates such as the Hatinh Langur (*Trachypithecus hatinhensis*), the Sooty Babbler (*Stachyris herberti*), Bare-faced Bulbul (*Pycnonotus hualon*) and the Limestone Leaf-Warbler (*Phylloscopus calciatilis*). Of particular note is a 'Lazarus taxon': the Lation Rock Rat, which belongs to a genus that disappeared from the fossil record for 11 million years but was recently rediscovered by science. Almost 99% of the property is forested, and 84% of this is old-growth forest. The property is also recognized as part of a Global 200 priority ecoregion, an Indo-Burma global biodiversity hotspot and an Endemic Bird Area that is not otherwise represented on the World Heritage List. The Park hosts more than 2,851 species of vascular plants, including 419 that are endemic to Vietnam, and 755 species of vertebrates, of which 69 are globally threatened. As of 2012, 11 species of plants recorded in the Park were considered globally Critically Endangered, and 12 were globally Endangered, as were 17 species of vertebrates. Seven of the nine primate species occurring in the park are globally threatened, and the Park is the most important refuge for three of them. The Park probably has the largest remaining population of the globally endangered Ha Tinh langur, a primate that is specialized for karst forest and is endemic to Vietnam and Laos.

3.1

According to the investment plan for PNKB Park, the objectives of the park include conservation of: biological diversity, karst ecosystems, watershed protection of the Giang river to mitigate floods, scenic landscape and contribution to the livelihood of local people in the bufferzone. The following issues are considered the most pertinent threats to the objectives of Phong Nha-Ke Bang National Park. They were identified based on the findings from consultation meetings with a wide range of stakeholders including: the Management Plan Working Team of the Park, Forest Protection Department staff, authorities and communities from the buffer zone communes in Bo Trach and Minh Hoa Districts conducted in June 2012. At that workshop they were assessed, ranked and listed in order of severity (details of this assessment are presented in Appendix 4).

As result of threat assessment, 13 threats to the natural resources of the Park were identified and ordered in reducing. However, five major threats should be considered in the Park Management such as Wildlife hunting and trapping, Illegal logging, Non-timber forest product exploitation, Destructive tourism and Infrastructure developments inside the Park. Other eight lower threats are existing or potential threats to protection and conservation of the Phong Nha-Ke Bang National Park. All threats are assessed and ordered from high to low in term of threat level (See appendix 4).

- Wildlife hunting and trapping
- Illegal logging
- Non-timber forest product exploitation
- Destructive tourism
- Infrastructure developments inside the Park
- Invasive and alien species
- Firewood collection
- Cattle grazing in the Park
- Fishing
- Forest land encroachment
- Cinnamomum oil extraction
- Forest fire
- Natural disasters

3.2

Several serious internal constraints prevent the Park from responding effectively to these and other threats. During the development of this management plan a number of issues emerged regarding capacity of PNKB Park for conservation, protection and management during last five years. Weaknesses included:

- Annual funds allocated to the National Park were much less than the planned budget in the investment plan requested by PNKB NP's Management Board;
- A lack of human resources in terms of both number and capacity;
- Weak inter-agency coordination in forest law enforcement; and
- A lack of funding for buffer zone project.

These issues are discussed in more detail below.

Inadequate funding for the Park during the last few years

Funding for the Park has been mainly focused on infrastructure development. There has been a lack of funding for monitoring, survey and research programmes. There has been inadequate funding for patrolling activities, which was partly supported by foreign donors up until 2013.

Human resources and capacity

The results of the Conservation Needs Assessment in June 2012 indicated that the current number of the Park staff is in shortage as compared with Government regulations for protected areas (Decree 117/2010/ND-CP). For example, the current number of ranger of PNKBNP (125 person) is only about 50% of the allowable level specified in government regulations. Only one individual staff member is tasked with responsibility for awareness-raising and interpretation in the Park. Similarly, only one individual staff member is responsible for all community outreach activities.

In addition, the capacity of the current PNKB NP staff is low and does not meet the standards required to implement the protection and conservation work of the Park. At the time of writing, a full Training Needs Assessment has not been conducted yet, however, in general about 75% of Park rangers are capable in protected area law enforcement, but only 15% have received official training in key enforcement skills and competency areas. Enforcement equipment and other supporting tools are lacking. In addition, there is no or very limited operational budget for long patrols or regular (e.g. several times in a month) patrolling.

Most staff in the Park almost completely lack skills or knowledge relevant to conservation, for instance identification of species of conservation concern, wildlife law enforcement, and designing monitoring and applied research programmes. Most staff also lack the basic competencies necessary for effective performance of in their jobs, such as communications, planning and report writing. The gaps in capacity reflects a lack of funding for staff training and the absence of a capacity building component in the investment plan for the park in the 2001-2006 period. These limitations have resulted in low effectiveness of protection and conservation.

Coordination with relevant agencies

The key stakeholders related to forest protection and management in the area surrounding PNKB NP includes the authorities of Bo Trach, Quang Ninh and Minh Hoa Districts, the authorities of the buffer zone communes and other State Forestry Companies. In the last few years, the National Park management board has also received some support from the police, border army and district FPDs of Bo Trach and Minh Hoa. However, these collaborations have only been set-up and implemented after a period of particularly intense illegal activities, notably illegal timber exploitation. These coordinated activities regarding forest law enforcement need to be strengthened and institutionalized through carefully planned development of coordination regulations between the National Park and all relevant stakeholders, followed by awareness building among all relevant stakeholders and forest management units in the buffer zone.

3.3

Article 108-109 of the Operational Guidelines for the Implementation of the World Heritage Convention make clear that “Each nominated property should have an appropriate management plan or other documented management system which must specify how the Outstanding Universal Value of a property should be preserved, preferably through participatory means. The purpose of a management system is to ensure the effective protection of the nominated property for present and future generations.”

According to Decree 117 of the Government of Vietnam, the National Park management board established by provincial people's committee which must make a annual and 5-year plans in accordance with the provincial guideline. The key elements in the content of plan are public awareness; forest management, protection, construction, development and use; nature conservation; scientific research and experimentation; rescue of wild fauna and flora: service activities; labour management and use; construction investment; and finance.

Circular No: 78 constructs to implement Decree 117 of the Government of Vietnam which indicated that main contents of the plan must clearly mention objectives, effective solutions for implementation of the following fields: forest, marine, wetland ecosystems protection, conservation; forest fire prevention and fighting; biodiversity conservation and monitoring, scientific research; rescue and sustainable development of living organism; ecotourism development; implementation of forest ecosystems service; training, human resource development; informing, storage, management of database; propaganda, education, awareness raising on legislation and biodiversity; investment and development on the buffer zone.

4.1

Total area of the park: 123,326 ha

The current boundary of the park, including the extension area (30, 570 ha) in the northwest will:

- contain all Outstanding Universal Values (natural and social features) of the Phong Nha-Ke Bang Region;
- safety conserve all biodiversity attributes and their habitats within the park and a surrounding landscape;
- safety conserve and maintain all ecosystem values of geology and geomorphology (cave systems, under and surface streams and rivers in/around the park);
- sustainable linking in the natural landscape conservation of the Central Indochina Limestone and Great Annamite Mountain between Vietnam and Laos.

According to management regulations for the three categories of forests, Government issued decision No: 186/2006/QD-TTg and decree No: 117/2010/ND-CP on administration and management of Special-use Forests. The PNKBNP is zoned into three different zones and summarised as follows:

The total of Phong Nha-Ke Bang National Park is of 123,326 ha, including extension area (31,070 ha). The Park was zoned into three administrative areas, with each area having a different management regime: a Strict Protection Area, a Forest Rehabilitation Area and an Administration and Services Area. In order to facilitate more effective management and protection, the Strict Protection and Forest Rehabilitation Areas are zoned into sub-areas (See Appendix 2).

The Strict Protection Area covers 102,416 ha or 83.04% of the total area of the park. The Strict Protection Area is zoned into four sub-areas:

- (a) Strict Protection Sub-area I.
- (b) Strict Protection Sub-area II.
- (c) Strict Protection Sub-area III
- (d) Strict Protection Sub-area IV

Logging	Forest fragmentation, habitat loss, loss of animal and plant species	Strictly prohibited
Charcoal production	Forest fragmentation, habitat loss, loss of animal and plant species, air and ground pollution	Strictly prohibited
Fragrant wood/oil distilling	Forest degradation, habitat loss, loss of plant species, disturbance to natural regeneration	Strictly prohibited
Mining	Forest and habitat loss, pollution, loss of animal and plant species	Strictly prohibited
Construction of roads, houses, other infrastructure	Forest and habitat loss, disturbance to wildlife, pollution	Strictly prohibited
Hunting and trapping	Loss of animal species, disturbance to wildlife	Strictly prohibited
Fishing with poison or dynamite	Habitat loss, loss of animal species, pollution	Strictly prohibited
Ornamental plant collecting	Unknown but could threaten plant populations	Strictly prohibited
Livestock grazing	Disturbance to natural regeneration, habitats and wildlife	Strictly prohibited
Fire	Forest and habitat loss	Strictly prohibited
Rattan collecting	Habitat loss, disturbance to wildlife	Strictly prohibited
Medicinal plant collecting	Loss of plant species, potential disturbance to habitat	Permitted but sustainable exploitation in accordance with guideline
Honey collecting	Possible fire hazard	Permitted but awareness raising among local communities is needed
Tourism development	Habitat loss and disturbance to wildlife	It is allowed to build trail/path, rest area and signboards for patrolling and tourism purposes.

Follows: (i) Government Decision No: 186/2006/QĐ-TTg, Dated 14/8/2006; (ii) Decision No. 18/2007, of the Quang Binh Provincial People's Committee, dated 16 August 2007, issuing regulations on management of Phong Nha - Ke Bang National Park;

The Forest Rehabilitation Area covers 19,619 ha or 16.00% of the total area of the park. The aim of the Forest Rehabilitation Area should be to restore areas of degraded forest to their natural condition by natural or assisted rehabilitation, in order to increase the total area of habitat available for wildlife populations. The management regime should permit limited human activities that are consistent with this aim (Table 5).

Logging	Forest fragmentation, habitat loss, loss of animal and plant species	Strictly prohibited
Fragrant wood/oil distilling	Forest degradation, habitat loss, loss of plant species, disturbance to natural regeneration	Strictly prohibited
Reforestation with alien species	Habitat loss, loss of plant and animal species	Strictly prohibited
Hunting and trapping	Loss of animal species, disturbance to habitat	Strictly prohibited
Mining	Forest and habitat loss, pollution, loss of animal and plant species	Strictly prohibited
Construction of roads, houses and public facilities	Forest and habitat loss, disturbance to wildlife, pollution	Strictly prohibited
Livestock grazing	Disturbance to natural regeneration, habitats and wildlife	Strictly prohibited
Fire	Forest and habitat loss	Strictly prohibited
Converting forest to cultivation	Forest and habitat destruction, loss of animal and plant species	Strictly prohibited
Honey collecting	Possible fire hazard	Permitted
Exploitation of non-timber forest products	Over-exploitation may lead to loss of plant species and habitat loss	Limited and regulated
Reforestation with local indigenous tree species	Habitat expansion, maintenance of biodiversity	Encouraged
Forest protection contracts	Habitat protection, maintenance of biodiversity	Encouraged
Tourism development	Habitat loss and disturbance to wildlife	It is allowed to build main roads and infrastructure for forest protection, development for serving tourism and services.

Follows:(i) Government Decision No: 186/2006/QD-TTg, Dated 14/8/2006; (ii) Decision No. 18/2007, of the Quang Binh Provincial People's Committee, dated 16 August 2007, issuing regulations on management of Phong Nha - Ke Bang National Park;

The administration and services area should comprise the headquarters of Phong Nha-Ke Bang National Park in Son Trach commune. This area is located outside of the Strict Protection and Forest Rehabilitation Areas and covering 3,411 ha.

Buffer zone of the park is being proposed and designed into two kinds of buffer zones: external and internal buffer zones.

External buffer zone

Buffer zone will be designed the following Government law and regulations: Law on Forest Protection and Development (2003), Regulations in Decision 186/2006/QD-TTg and Decree No: 117/2010/ND-CP. Based on these legal documentations, buffer zone of the park to be encompassed administrative land-use of 13 communes.

The Ban Doong and Ban A Rem are two villages belonging to Tan Trach commune that located inside the core zone the park. Of these villages, A Rem is proposed as an internal buffer zone. Currently, A Rem village has a total of 79 households with 307 individuals. The following this proposed planning, a total of 200 ha of natural land to be planned for this village, it includes 50 ha for habitant and 150 ha of plantation, scrubs and agriculture land (Extension Planning Plan for the PNKBNP. 2012). The following the extention planning, seven households in Ban Doong will move out and relocate in Ban Ploang, Truong Son Commune, Quang Ninh District.

4.2

The overall objective of PNKB NP is to ensure the sustainable management and conservation of the World Heritage's geology and geomorphology attributes, as well as its ecological processes and globally threatened fauna and flora. Ecotourism developed based on the outstanding global values of the site must be carried out in a sustainable way to improve the economic benefits and wellbeing of local communities and Quang Binh province.

4.3

The Park's eight-year management objectives for the period 2013-2020 were developed based on the assessment and analysis of the challenges and threats it is facing to manage and preserve its globally outstanding world-heritage values.

This eight-year Operational Management Plan comprises of seven programmes, which in turn includes specific solutions/activities, in order to achieve the set-out objectives.

4.3.1

Objective:

Establish a basis and mechanisms to insure that the globally outstanding word-heritage values of PNKB National Park as defined under UNESCO Criteria (viii), (ix) and (x) (the two latter are being proposed for recognition) are preserved in perpetuity through the completion of the Park extension process, effective law enforcement to stop illegal hunting and logging activities, tourism management, and other essential management measures.

Activities:

- Quang Binh Provincial People's Committee approves the park extension plan
- Organize a boundary workshop on the Park's extension area after provincial approval
- Demarcate the Extension Area and upgrade demarcation where needed
- Development of management regulation and turn it in force on Forest Protection and Management and Biodiversity conservation.
- Strengthen law enforcement to reduce and stop illegal activities (hunting, logging and overexploitation of NTFPs)
- Develop coordination mechanism between the Park and local authorities, district forest protection department and arm-forces (police and military units) based in the region.
- Implementation of the coordination mechanism
- Develop guidelines, regulations, and village agreements and commitment with local communities on forest protection.

- Support the preparation and signing of agreements/Request local restaurants to commit not to use wildlife products
- Build an informant network in villages to support law enforcement.
- Carry out internal buffer zone planning for Tan Trach commune (clearly define the boundary between the Park and Tan Trach commune)
- Put up sign posts/boards and Park information/regulation boards throughout the Park.
- Strengthening fire prevention and Forest Protection Team through training exercises. Continue infrastructure construction: Guard stations
- Continue infrastructure construction: Botanical Garden
- Oversee development and implementation of detailed Construction Environmental Management Plan (CEMP) for Road 20, and long term post construction management plan for all roads inside the Park and the buffer zone
- Forest restoration and enrichment in Rehabilitation zones.
- Continue activities with rescue.

4.3.2

Objective:

Insure that ecotourism is sustainably developed to ensure the preservation and development of the outstanding values of PNKB World Heritage site, following UNESCO's Guidelines on Caves Management.

Activities:

- Development of a Tourism Monitoring and Management Programme
- Develop and implement Site Visitor Management Plan for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre
- Carry out visitor monitoring survey for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre
- Upgrade and refurbish Phong Nha Visitor Centre
- Site Visitor Management Plan for Eight Volunteers Cave
- Water-based tourist product development in the PNKB NP and Bufferzone
- Concept development for the Botanical Garden
- Concept development for a tourism operation at Bamboo Valley
- Concept development for tourism in the Gao Forest
- Concept development for tourism at U Bo Peak
- Development of interpretation material for the Phong Nha Visitor Centre
 - Site specific conceptual interpretation plan and material for priority sites
 - Develop a sustainable tourism development project for the Park, working towards the privatization of the Park's Tourism Centre in accordance with Decision 24/QĐ-TTg, dated 1/6/2012 by the Prime Minister.

4.3.3

Objective:

Raise public awareness among all relevant audiences including tourists, school children and community members in the buffer zone, and decision makers at all levels.

Activities:

- Development of strategical communication and implementation of publish awareness programme.
- Maintain, establish and operate conservation groups in 13 communes (50 Village Conservation Groups)

- Produce and design, publish and disseminate communication materials (e.g. posters, leaflets, booklets)
- Develop a logo for the Park
- Upgrade the Park's website
- Maintain the Park's website
- Conduct village meetings (157 villages)
- Produce and distribute awareness raising films (on DVD, VCD)
- Radio programme at commune and provincial levels
- Conduct awareness raising in schools in the buffer zone
- Conduct communication events together with provincial tourism

4.3.4

Objective:

Improve biodiversity knowledge and information of the Park to ensure that all outstanding world-heritage values of the Park will be conserved properly.

Activities:

- Develop biodiversity monitoring programme and pilot
- Design and implementing a monitoring programme for key species: 3 primates, 2 ungulates and all pheasant species.
- More surveys of cave biodiversity and fish communities in the Park's cave system
- Develop species action plans for key species/group of species: large mammals, primates and restricted range bird species
- Develop a database for the Park, using the MIST/SMART software
- Conduct more study on the geology and geomorphology of cave systems
- Conduct a survey on use of NTFPs, including medicinal herbs
- Conduct a survey on invasive and alien species in the Park and develop measures to control them

4.3.5

Objective:

Provide Park staff with technical and managerial skills to effectively manage and conserve this world heritage site; and to provide the Park with necessary equipment and facilities (including guard station infrastructure) needed to effectively carry out the operational programme set out in this Operational Management Plan.

Activities:

- Provide training on enforcement skills such as patrolling, dealing with violation cases, use of enforcement equipment and weapons, etc.
- Provide training on communication skills (presentation and interpretation skills, community liaison skills, etc.)
- Provide training on biodiversity survey and monitoring skills
- Develop capacity for visitor management, especially for management of caves
- Training on management skills of the World Heritage site for key staff of the Park
- Provide adequate patrol and enforcement equipment and facilities to rangers (e.g. GPS, binoculars, cameras, video cameras etc.)
- Organize additional GIS mapping
- English language training for key staff
- Organize in-country study tours and exchange visits for Park staff to improve their management and conservation skills

- Organize overseas study tours and exchange visits for Park staff to improve their management and conservation skills

4.3.

The buffer zone development programme should not form part of the investment plan for PNKBNP but should be formulated and implemented by the Park management board, together with relevant districts and provincial departments, following the establishment of the Park. However, it will be necessary to coordinate implementation of the buffer zone development programme and the Park management programmes. In the buffer zone of the Park, GIZ component was developed a Buffer Zone Development Plan. In this OMP, only some activities are proposed; those which have already been piloted by the GIZ component or through which PNKBNP supports buffer zone communes to take part in protection of the World Natural Heritage site

Objective:

Promote and support local communities to develop local/household economies, mobilize the support and participation of local communities in the protection of the Park's world-heritage values and sustainable ecotourism to reduce pressures on the natural resources within the Park.

Priority activities in this plan (taken from Buffer zone Project):

- Develop fruit gardens (858 ha)
- Support models of growing fresh vegetables (26 ha)
- Support models of growing high yield Casava (130 ha)
- Support models of growing high yield hybrid maize (316 ha)
- Rubber plantation (450 ha)
- Support plantation of "economic forest" (keo Acacia spp.) (2982 ha)
- Plant native trees with high values (3612 ha)
- Support planting bamboo for bamboo shoot (274 ha)
- Forest protection contract with A Rem village
- Explore the feasibility of additional Payment for Ecological Services (PES) schemes that would provide additional benefits to buffer zone villages

4.3.

Objective:

Strengthen transboundary cooperation to preserve the outstanding landscape and biodiversity attributes of the central Indochina Karst region/ global biodiversity hot-spot, the integrity, continuity and the linkage between PNKB National Park of Vietnam and Hin Namno National Biodiversity Conservation Area of Laos, through the development of a trans-boundary conservation coordination mechanism.

Activities:

- Develop a coordination mechanism with Hin Namno National Biodiversity Conservation Area in Laos for information sharing and forest protection.
- Develop guidelines and procedures
- Implementation of coordination mechanisms: Coordinated surveys, patrols, reports, sharing of information and experience, regular meetings, seminars, workshop and study tours.

5.1

Implementation plan was formed in accordance with provincial and national planning schedule up to 2020. Duration of this plan covers eight years and starting year in 2013.

(2013-2020)

	2013	2014	2015	201	201 2020
1.					
Quang Binh PPC approve Strategical and Operational Manament Plans for the Park	X				
Organize a boundary workshop on the Park's extension area	X				
Demarcate the Extension Area and upgrade demarcation where needed		X	X	X	
Development of management regulation and turn it in force on Forest Protection and Management and Biodiversity conservation.	X				
Strengthen law enforcement to reduce and stop illegal activities (hunting, logging and overexploitation of NTFPs)	X	X	X	X	X
Develop coordination mechanism between the Park and local authorities, district forest protection department and arm-forces (police and military units) based in the region.	X				
Implementation of the coordination mechanism	X	X	X	X	X
Develop guidelines, regulations, and implementing with local communities on forest protection.	X	X	X	X	X
Support the preparation and signing of agreements/Request local restaurants to commit not to use wildlife products	X	X			
Build an informant network in villages to support law enforcement.	X	X	X	X	X
Carry out internal buffer zone planning for Tan Trach commune (clearly define the boundary between the Park and Tan Trach commune)	X				
Put up sign posts/boards and Park information/regulation boards throughout the Park.		X	X	X	
Strengthening fire prevention and Forest Protection Team through training exercises.	X	X	X	X	X
Continue infrastructure construction: Guard stations	X	X			
Continue infrastructure construction: Botanical Garden	X	X			
Forest restoration and enrichment in Rehabilitation zones.	X	X	X	X	X
Continue activities with rescue.	X	X	X	X	X

	2013	2014	2015	201	201 2020
2.					
Develop and implement Site Visitor Management Plan for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre	X	X			
Carry out visitor monitoring survey for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre	X	X	X	X	X
Phong Nha Visitor Centre redevelopment and upgrade	X				
Site Visitor Management Plan for Eight Volunteers Cave	X				
Water-based tourist product development in the PNKB NP/ Bufferzone			X		
Concept development for Botanical Garden			X		
Concept development for a tourism operation at the Bamboo Valley			X	X	X
Concept development for Gao Forest			X		
Concept development for U Bo Peak				X	
Development of a Tourism Monitoring and Management Programme	X				
Development of interpretation material for the Phong Nha Visitor Centre	X	X	X	X	X
Site specific conceptual interpretation plan and material for priority sites	X				
3.					
Develop communication strategy for the Park	X				
Maintain, establish and operate conservation groups in 13 communes (50 Village Conservation Groups)	X	X	X	X	X
Produce and design, publish and disseminate communication materials (e.g. posters, leaflets, booklets)	X	X	X	X	X
Develop a logo for the Park	X				
Upgrade the Park's website	X				
Maintain the Park's website	X	X	X	X	X
Conduct village meetings (157 villages)	X	X	X	X	X
Produce and distribute awareness raising films	X	X	X	X	X
Radio programme at commune and provincial levels	X	X	X	X	X
Organize communication events together with provincial tourism sector	X	X	X	X	X
4.					
Develop biodiversity monitoring programme and pilot	X	X			
Design and implementing a monitoring programme for key species	X	X	X	X	X

	2013	2014	2015	201	201 2020
More surveys of cave biodiversity and fish community in the Park's cave system	X	X	X	X	X
Develop species action plans for key species/group of species: big mammals, primates and restricted range bird species.		X			
Develop database for the Park, using the MIST/SMART software.	X				
Conduct more study on the geology and geomorphology of cave system		X			
Conduct a study on NTFPs, including medicinal herbs			X		
Conduct study on invasive and alien species in the Park and develop measures to control them;				X	
5.					
Provide training on enforcement skills such as patrolling, dealing with violation cases, use of enforcement equipment and weapons, etc.	X	X	X	X	X
Provide training on communication skills (presentation and interpretation skills, community liaison skills, etc.)	X	X	X	X	X
Provide training on biodiversity survey and monitoring skills	X	X	X	X	X
Visitor management and especially for management of caves	X	X			
Training on management skills of the World Heritage site for key staff of the Park		X			
Provide adequate patrol and enforcement equipment and facilities to rangers (e.g. GPS, binoculars, cameras, video cameras, etc.)	X	X	X	X	X
Organize GIS, mapping.	X	X			
English language training	X	X	X	X	X
Organize in-country study tours and exchange visits for Park staff	X	X	X	X	X
Organize overseas study tours and exchange visits for Park staff			X		
.					
Develop fruit gardens (858 ha)	X	X	X	X	X
Support models of growing fresh vegetables (26 ha)	X	X	X	X	X
Support models of growing high yield Casava (130 ha)	X	X	X	X	X
Support models of growing high yield hybrid maize (316 ha)	X	X	X	X	X
Rubber plantation (450 ha)	X	X	X	X	X
Support plantation of "economic forest" (keo <i>Acacia</i> spp.) (2982 ha)	X	X	X		
Plant native trees with high values (3612 ha)	X	X	X		
Support planting bamboo for bamboo shoot (274 ha)	X	X	X	X	X

	2013	2014	2015	201	201 2020
Forest protection contract with A Rem village	X	X	X	X	X
Explore the feasibility of additional Payment for Ecological Services (PES) schemes	X	X			
.					
Develop a coordination mechanism with Hin Namno National Biodiversity Conservation Area in Laos for information sharing and forest protection.					
Develop guidelines and procedures	X				
Implementation of coordination mechanisms: Coordinated surveys, patrols, reports, sharing of information and experience, regular meetings, seminars, workshop and study tours.	X	X	X	X	X

.2

It is critical to track the effectiveness of management actions, since it provides the information needed to track management success and adapt management as needed. Monitoring will rely both on subjective self-assessments, using various prepared tool-kits, and on field based monitoring of indicators.

- Monitoring management effectiveness: In 2017, park staff will repeat the METT assessment carried out in 2008 and 2012, using the same tool used in the past in order to insure comparability and allow assessment of progress. In addition, the Park will begin using the Enhancing our Heritage Toolkit, which uses the IUCN World Commission on Protected Areas framework to develop a range of more detailed assessment tools for managers of natural World Heritage sites. The toolkit will be used to develop a comprehensive site-based system for assessing management effectiveness.
- Monitoring threat reduction: In 2017, park staff will carry out a participatory Threat Reduction Assessment, comparing with the baseline Assessment carried out in 2012 using the same protocols to insure comparability.
- Monitoring tourism: The World Heritage nomination process requires tourism to be assessed (see section 5 of the nomination format); including visitor numbers and trends, and visitor facilities and services, such as interpretation / explanation, infrastructure, accommodation and rescue operations. The UNESCO Periodic Reporting format requires information on these aspects and includes rating of tourist facilities and capacity to manage tourism. This information will be tallied each year and will also be used internally to track and adjust tourism management.
- Monitoring impacts of management action on reducing hunting: Monitoring of Hatinh Langur and Douc Langur will be carried out using repeat surveys according to fixed transects used for monitoring in 2000-2003. In 2017, survey of gibbons will be carried out by triangulating and mapping morning great calls in the early morning (4.30a.m - 5.00a.m in summer, 6.00a.m - 7.00a.m in winter).. Camera traps will be used to monitor Ha Tinh Langur, by setting up camera traps in their sleeping caves. Sightings of hoofed animals (gaur, deer, and muntjac) during patrols will be expressed as number/km (the Index of Kilometric Abundance or IKA) for monitoring these hunting sensitive species. Patrol staff will also count the numbers of traps and snares in fixed plots and while on patrol. The MIST management information system used in Uganda

and Cambodia³ will be introduced as a tool to integrate data collected by patrollers and produce information useful for Park managers.

- Monitoring impacts of Management Action on reducing illegal logging: Forest resource inventory will be carried out in fixed plots and through satellite image interpretation, repeated every year. Patrol staff will also count and map freshly cut stumps found on patrol. Research staff will track survival of known high-value trees in a fixed area, registering and securing all data to prevent theft.
- Monitoring collection of NTFPs: surveys will be conducted on the amount of high value species of NTFPs in priority areas in fixed plots. Interview harvesters (focal group surveys) to track change in harvest per effort.
- Fire wood use: Inventory of use per household by survey of sample in key villages will be carried out in 2013 and repeated in 2017.
- Tourism impacts: At springs (Ngoc Mooc) and sink-holes, and inside show caves, water pollution will be monitored by tracking chemical and physical measures (dissolved oxygen, water temperature, suspended solids, bacterial count), and presence and abundance of sensitive species with a low tolerance to pollution. Solid waste will be monitored by measuring solid waste outside rubbish bins at regular intervals (kg/person/ site/day). Noise pollution will be measured with a dB meter. Monitoring results will be tallied and compared each year.
- Monitoring tourism impacts in caves⁴: Automatic data loggers will be placed in key caves to record air temperature, humidity, airflow, etc. Monitoring of CO² concentrations may be needed in some remote enclosed sites within caves. Fixed point photomonitoring will also be used to track damage to speleothems from breakage, growth of lamp flora and impacts of changes in microclimate. Results will be tallied and compared each year.
- Infrastructure impacts: Inventory will be carried out each year of the number and scale of fixed construction works. Inventory of quantity of stone and sand excavated. Number of trucks crossing park boundaries during construction. Number of violation cases at construction sites.
- Invasive species: Inventory of species *Chromolaena odorata*, *Mimosa diplotricha*, *Lantana camara*, *Mimosa diplotricha*, and *Imperata cylindrica* (lang rung, san day rung, lau say, trinh nu, mai duong respectively) in fixed plots in key areas that have many invasive species (Cha Noi and Doong Villages, along the Western Ho Chi Minh Highway and Road 20) will be carried out in 2013 and again in 2017 for comparison.

³ Biodiversity and Protected Areas Management Project (BPAMP) (2006) Ranger-Based Data Collection, A Reference Guide and Training Manual for Protected Area Staff in Cambodia. Department of Nature Conservation and Protection, Ministry of Environment, Cambodia. A new more user-friendly version known as SMART is available.

⁴ Monitoring cave climate may be the single most important aspect of management for many caves for resource protection. Cave climate has profound impacts on many aspects of caves and their resources. Many cave processes are very sensitive to changes in cave climate parameters. People in a cave can significantly alter the microclimate of the cave.

.1

- Activities or actions were identified to address each of the threats identified in Chapter 3 above;
- Activities were defined through a participatory planning process to meet the objectives outlined in this management plan;
- Budget allocation is in line with legal documents issued by Government, Ministry of Agriculture and Rural Development, Interministerial documents and Quang Binh Provincial People Committee as well as in line with European Cost norms for consultant services.
- Budget allocation based on balance budget of Phong Nha region project that has been approved for each programme or activity relating to this operational management plan.

.2

The budget for this Operational Management Plan is allocated in two categories as per activity and defined as follows:

- Funding requirement for Phong Nha-Ke Bang National Park for period of 2013-2020 from state budget (Government and Quang Binh Province);
- Funding from ongoing the KfW and GIZ components/Project “*Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha Ke Bang National Park Region*”

		2013	2014	2015	201	201
		2013	2014	2015	201	201
VND (Unit: million VND) consist of	25 94	49 41	42 9 2	33 059	32 335	99 939
<i>Invest to activities</i>	87,066	28,281	21,612	11,699	10,975	14,499
<i>Regular expenditure for the Park *</i>	170,880	21,360	21,360	21,360	21,360	85,440
EUR (1/27.000VND)	9 553 545	1 838 540	1 591 55	1 224 409	1 19 08	3 01 428

Note: * Regular expenditure for the Park is temporary count for 356 staff assigned for year 2013.

:

1. Approved budget of the PNKB Region project in Table 8
2. Budget requiring approval from the PPC (mainly regular expenditures for PNKB NP in period of 2013-2020). See Table 9.

In additional budget to be invested for the Buffer zone based on the project: Conservation oriented buffer zone Socio-economic Development not yet approved in Table 10.

		2013	2014	2015	201	201
1.	995,867	471,557	153,822	119,722	119,722	131,044
2.	295,000	128,750	103,750	43,750	18,750	
3.	472,000	125,000	92,600	82,600	82,600	89,200
4.	626,233	94,185	148,048	64,000	64,000	256,000
5.	720,593	202,345	287,745	108,745	106,944	14,814
6	12,000	3,000	3,000	3,000	3,000	
	3 121 93	1 024 83	88 95	421 81	395 01	491 058
	84 28	2 1	21 302	11 389	10 5	13 259

Note: See details of each activity of each program in Appendix 1: Budget.

		2013	2014	2015	201	201 2020
1.						
Set up fire prevention management board and organize joint prevention teams.	2,080	260	260	260	260	1,040
3.						
Implementing the monitoring programme for key species: primates, ungulates and pheasant species.	13,824	1,728	1,728	1,728	1,728	6,912
3.						
Provide trainings on English language	400	50	50	50	50	200
4.						
Regular expenditure for the Park for 356 staff and officers in the period 2013-2020	170,880	21,360	21,360	21,360	21,360	85,440
Total (VND; 1 million)	18 184	23 398	23 398	23 398	23 398	93 592
Total (EUR, 27,000VND/1 EUR)	9 32 4 0	8 59 3	8 5 93	8 5 93	8 5 93	3 4 3 0

Note: * Number of staff and officers is based on the proposal "Organization and Management of PNKB are according to Decree No. 117/2010/NĐ-CP of the Government.

		2013	2014	2015	201	201 2020	
Need on investment capital for socio-economic development in the buffer zone in the period 2013-2020	3 519						X
Support plantation of "economic forest" (keo Acacia spp.) (2982 ha)	23,539.0	2,942	2,942	3,564	3,564	14,256	X
Plant native trees with high values (3612 ha)	32,508.0	4,064	4,064	4,064	4,064	16,256	X
Support planting bamboo for bamboo shoot (274 ha)	2,192.0	274	274	274	274	1,096	X
Forest protection contract with A Rem village	800	100	100	100	100	400	X
Support for buffer zone villages according to Decision 24 of the Government	50,240	6,280	6,280	6,280	6,280	25,120	X
Feasible study on Payment for Ecological Services to have move budget for the Park and buffer zone villages	300	300					
	109 59	13 9 0	13 0	14 282	14 282	5 128	

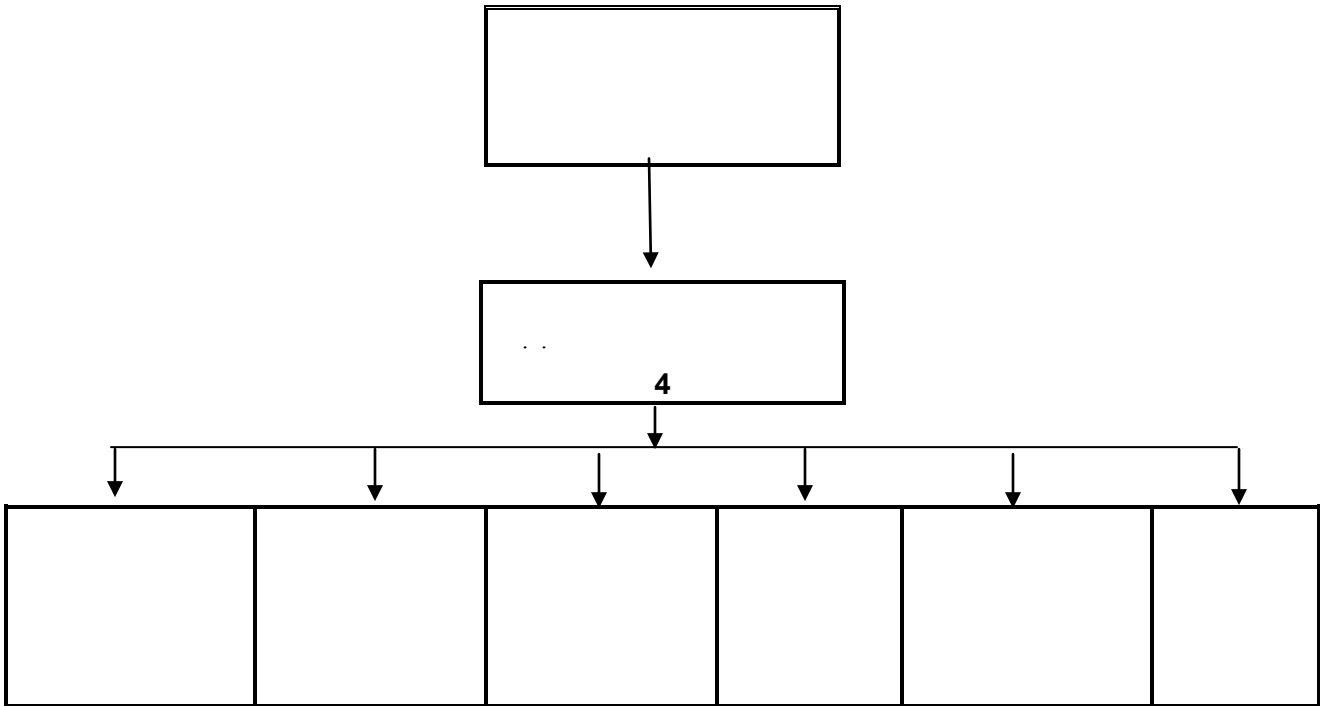
Note: See details of each activity of each program in Appendix 1: Budget

.1

3 2012

28

2012



.2

By the year 2013, total of 356 staff and officers was allocated for the Park in the functional units as follows:

- Directive board: 4 people, 1 Director and max. 3 Vice-directors, and three functional units management Board as follows:
 - Administration and Organisation Unit
 - Planning and Finance Unit
 - Scientific and International Cooperation UnitThree units under Management Board
 - Forest Protection Unit: It consist of Forest Protection, Mobile units and Administration unit,
 - Centre for Conservation, Rescue and development of living organism
- Phong Nha-Ke Bang Tourism Centre:

.3

.3.1

Quang Binh Provincial People's Committee is the agency which approve annual and five-year operational plan of the Park, budget allocation and provision for annual operation for the Park.

.3.2

Phong Nha - Ke Bang National Park Management Board is a professional unit under the Quang Binh PPC, responsible for the Park financial, asset and staffing management;

Phong Nha - Ke Bang National Park Management Board : is a professional unit which ensure its operational budget (ownership in accordance with Decree 43) and publicly benefit (the Management Board of Revolutionary Martyr Hero Memory Temple – Victorious 20 Road).

Phong Nha - Ke Bang National Park Management Board : is an administrative unit under direct management of the Director of Phong Nha -Ke Bang National Park cum FPD Director; Phong Nha - Ke Bang National Park Management Board is responsible for management of organization, staffing. Professional issues is managed by the Provincial Forest Protection Department.

Phong Nha - Ke Bang National Park Management Board : is a professional unit with its operation under the management by the Park Management Board. They operate within their mandates and functions under the direct instruction of leaders of the Park Management Board.

.3.3

The project has two components: the KfW and GIZ ones. GIZ's responsibility is mainly in technical cooperation, and leading buffer-zone and tourism planning. KfW's responsibility is largely investment, complementing and scaling-up GIZ's pilot projects, in addition to leading the development and implementation of a management plan for PNKBNP and complementary technical assistance to improve management, in particular law enforcement.

.3.4

Department of Planning and Investment
Department of Finance
Department of Agricultural and Rural Development
Department of Resources and Environment
Department of Culture, Sports and Tourism
Department of Science and Technology
Department of Construction
Department of Home Affairs

.3.5

Bo Trach district
Minh Hoa district
Quang Ninh district
13 buffer zone communes: Trong Hoa, Dan Hoa, Hoa Son, Trung Hoa and Thuong Hoa (Minh Hoa district), Hung Trach, Phuc Trach, Son Trach, Tan Trach, Thuong Trach, Xuan Trach and Phu Dinh (Bo Trach district) and Truong Son (Quang Ninh district).

1

2013 2020

(Unit: EUR)

		2013	2014	2015	201	201 2020				
1.										
Approve strategy and management plan	5,000	5,000						X		
Organize a boundary workshop on the Park's extension area	5,400	5,400						X		
Demarcate the Extension Area and upgrade demarcation where needed	10,000	7,000	3,000					X		
Carry out internal buffer zone planning for Tan Trach commune	7,407	7,407						X		
Strengthen law enforcement to reduce and stop illegal activities (including costs for field work)	162,600	40,650	40,650	40,650	40,650			X		
Develop coordination mechanism between the Park and local authorities, district forest protection department and arm-forces (police and military units) based in the region.	467,460	72,100	106,172	79,072	79,072	131,044		X		
Implementation of the coordination mechanism (part of above activity)								X		
Develop guidelines, regulations, and village agreements and commitment with local communities on forest protection. (part of above activity)								X		

		2013	2014	2015	201	201 2020				
Support the preparation and signing of agreements/Request local restaurants to commit not to use wildlife products (part of above activity)								X		
Build an informant network in villages to support law enforcement. (part of above activity)								X		
Put up sign posts/boards and Park information/regulation boards throughout the Park.	8,000	4,000	4,000					X		
Continue infrastructure construction: forest ranger stations, 2 nd Office of the Park	180,000	180,000						X		
Orchid rescue and multiplication Centre and laboratory	75,000	75,000						X		
Support for proposal on biodiversity criteria to be submitted to UNESCO (ix and x)	75,000	75,000						X		
	995 8	4 1 55	153 822	119 22	119 22	131 044				
2.										
Develop and implement Site Visitor Management Plan for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre	60,000	20,000	15,000	15,000	10,000			X		
Carry out visitor monitoring survey for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre	15,000	3,750	3,750	3,750	3,750			X		
Phong Nha Visitor Centre redevelopment and upgrade	25,000	15,000	10,000					X		

		2013	2014	2015	201	201 2020				
Site Visitor Management Plan for Eight Volunteers Cave .	5,000	5,000					X			
Water-based tourist product development in the PNKB NP/ Bufferzone	10,000	5,000	5,000				X			
Develop cave adventure	15,000	15,000						X		
Concept development for Botanical Garden	5,000		5,000				X			
Concept development for a tourism operation at the Bamboo Valley	15,000			15,000			X			
Concept development for Gao Forest	5,000			5,000			X			ADB
Concept development for U Bo Peak	5,000		5,000				X			
Analyze value of tourism chains in PNKBNP	40,000	20,000	20,000						GTZ	ADB
Support for farm tourism and marketing	10,000	5,000	5,000					X		ADB
Develop interpretation plan and action plan	40,000	20,000	20,000					X		ADB
Development of interpretation material for the Phong Nha Visitor Centre	20,000	5,000	5,000	5,000	5,000			X	GTZ	
Site specific conceptual interpretation plan and material for priority sites	25,000	15,000	10,000					X	GTZ	ADB
	295 000	128 50	103 50	43 50	18 50					
3.										
Develop communication and awareness raising strategy and plan	15,000	15,000						X		
Establish and operate village conservation groups (50 groups)	250,000	27,000	44,600	44,600	44,600	89,200		X		
Radio program in communal and provincial level (part of above activity)										

		2013	2014	2015	201	201 2020				
Organize and implement communication in schools in the buffer zone (part of above activity)										
Produce and design, publish and disseminate communication materials (e.g. posters, leaflets, booklets)	30,000	9,000	7,000	7,000	7,000			X		
Upgrade, maintain the Park's website	12,000	9,000	1,000	1,000	1,000			X		
Films (CD, VCD)	85,000	45,000	20,000	10,000	10,000			X		
Organize communication awareness events together with Tourism sector in the province	80,000	20,000	20,000	20,000	20,000			X		
	4 2 000	125 000	92 00	82 00	82 00	89 200				
4.										
Develop monitoring, training and testing program	7,407	7,407						X		
Implementing the monitoring programme for key species: primates, ungulates and pheasant species.	512,000	64,000	64,000	64,000	64,000	256,000	50%	50%		
Develop database for the Park, using the MIST software.	2,222	2,222						X		
Conduct a study on NTFPs, including medicinal herbs	5,556	5,556						X		
Conduct study on invasive and alien species in the Park and develop measures to control them;	5,556		5,556					X		
More surveys of cave biodiversity and fish community in the Park's cave system	78,492		78,492					X		
Develop species action plans for key species/group of species: big mammals, primates and restricted range bird species.	15,000	15,000						X		

		2013	2014	2015	201	201 2020				
	2 233	94 185	148 048	4 000	4 000	25 000				
5.										
Provide training on enforcement skills such as patrolling, dealing with violation cases, use of enforcement equipment and weapons, etc.	90,000	50,000	20,000	10,000	10,000			X		
Basic training on law enforcement for forest rangers	120,000	30,000	30,000	30,000	30,000			X		
Training on rescue, safety, laws, identification and CITES	90,000	22,500	22,500	22,500	22,500			X		
Training on education and communication skills	120,000	30,000	30,000	30,000	30,000			X		
Training on visitor management skills	28,000	28,000						X		
Training on cave management skills (Cave interpretation point /environmental Education facilities)	30,000		30,000					X		
Provide adequate patrol and enforcement equipment and facilities to rangers	150,000	27,400	110,800	11,800				X		
Organize in-country study tours and exchange visits for Park staff	20,000	10,000			10,000			X		
Organize overseas study tours and exchange visits for Park staff	40,000		40,000					X		
Training on management skills of the World Heritage site for key staff of the Park	29,630	3,704	3,704	3,704	3,704	14,814				UNESCO
Organize GIS, mapping	2,963	741	741	741	740			X		
	20 593	202 345	28 45	108 45	10 944	14 814				

		2013	2014	2015	201	201 2020				
.	12 000	3 000	3 000	3 000	3 000					
Inter-national workshop between: PNKB and Hinamno	12,000	3,000	3,000	3,000	3,000			X		
	81 185	212 90	338 190	119 190	11 388	29 28				
	22 0 4	5 45	9 131	3 218	3 1 9	800				

					2013	2014	2015	201	201 2020	
1.										X
Set up fire prevention management board and organize joint prevention teams.	team	104	20	2,080	260	260	260	260	1,040	X
Feasible study on Payment for Ecological Services to have move budget for the Park and buffer zone villages	option	1		300	300					X
4.										X
English language training	course	8	50	400	50	50	50	50	200	X
5.										X
Regular expenditure for the Park for 458 staff and officers in the period 2013-2020	staff	3664	60	219,840	27,480	27,480	27,480	27,480	109,920	X
Total (VND; 1 million VND)				222 20	28 090	2 90	2 90	2 90	111 1 0	
Total (EUR, 27,000VND/1 EUR)				8 245 185	1 040 3 0	1 029 259	1 029 259	1 029 259	4 11 03	

(Unit: EUR)

		2013	2014	2015	201	201 2020
1.	995,867	471,557	153,822	119,722	119,722	131,044
2.	295,000	128,750	103,750	43,750	18,750	
3.	472,000	125,000	92,600	82,600	82,600	89,200
4.	626,233	94,185	148,048	64,000	64,000	256,000
5.	720,593	202,345	287,745	108,745	106,944	14,814
.	12,000	3,000	3,000	3,000	3,000	
	3 121 93	1 024 83	88 9 5	421 81	395 01	491 058
	84 28	2 1	21 302	11 389	10 5	13 259

2020

(Unit: 1 million VND)

					2013	2014	2015	201	201 2020	
Need on investment capital for socio-economic development in the buffer zone in the period 2013-2020				3 519						X
5										
Support plantation of "economic forest" (keo Acacia spp.) (2982 ha)	ha	2982	7,893,685	23,539.0	2,942	2,942	3,564	3,564	14,256	X
Plant native trees with high values (3612 ha)	ha	3612	9,000,000	32,508.0	4,064	4,064	4,064	4,064	16,256	X
Support planting bamboo for bamboo shoot (274 ha)	ha	274	8,000,000	2,192.0	274	274	274	274	1,096	X
Forest protection contract with A Rem village	ha	8000	0.1	800	100	100	100	100	400	X
Support for buffer zone villages according to Decision 24 of the Government	village	1256	40	50,240	6,280	6,280	6,280	6,280	25,120	X
				109 2 9	13 0	13 0	14 282	14 282	5 128	

	2	5	
Current individual measures	Amount agreed with KfW	Total expenditures	Still to be disbursed (= 2 - 5)
Park Infrastructure	1,067,000.00	66,756.22	1,000,243.78
	193 000.00	-	193 000.00
Ranger stations (2 park/ 1 extension)	120,000.00	-	120,000.00
Extension office/ ranger station	60,000.00	-	60,000.00
Radio communication tower with repeater (w. maint. contract & solar power)	13,000.00	-	13,000.00
	5 000.00		5 000.00
Orchid rescue and propagation center w. laboratory	75,000.00	-	75,000.00
	0 000.00	5 .22	3 243. 8
Office (120 m2)	70,000.00	66,756.22	3,243.78
	330 000.00		330 000.00
Visitor center w. library (700 m2)	240,000.00	-	240,000.00

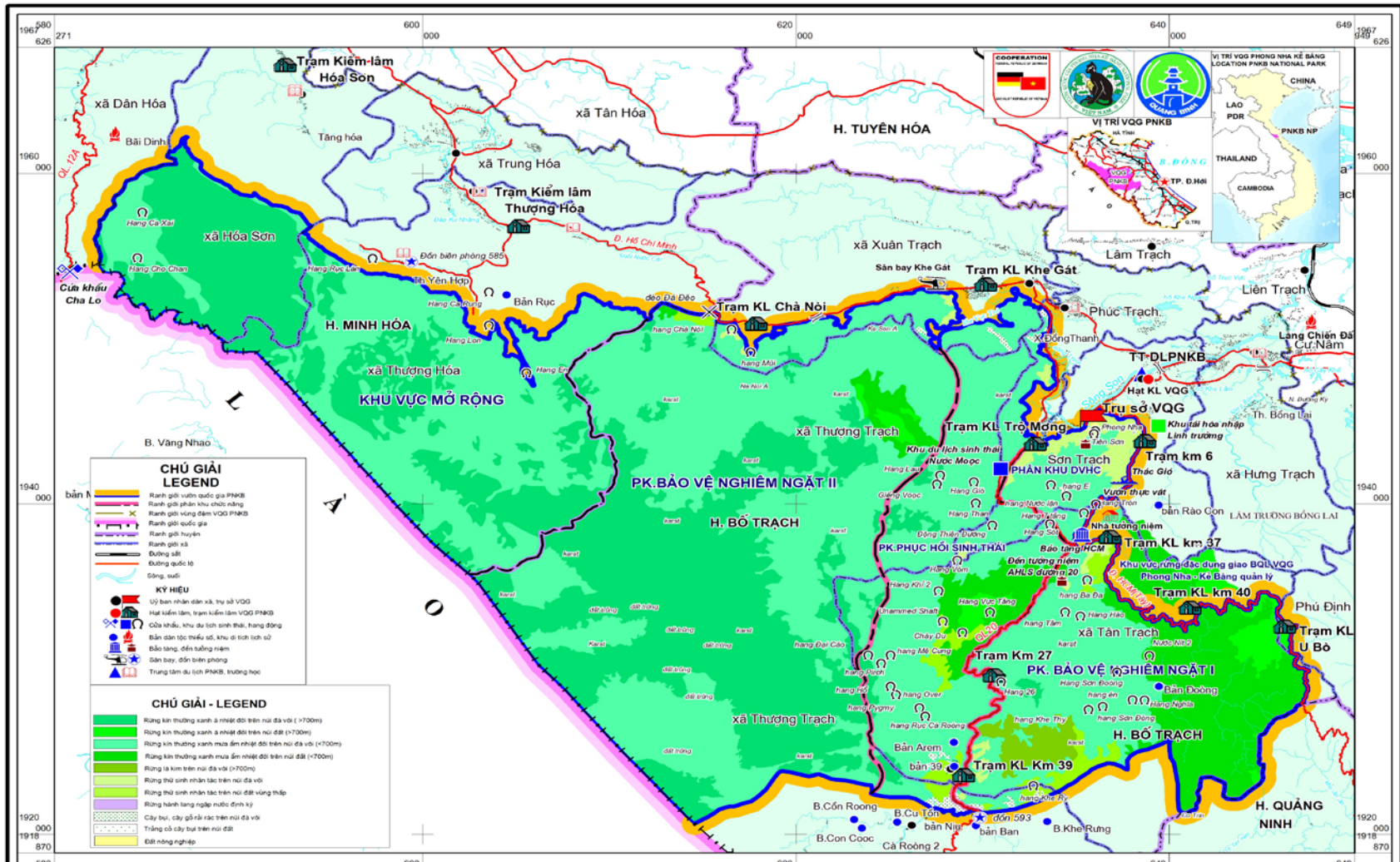
	2	5	
Current individual measures	Amount agreed with KfW	Total expenditures	Still to be disbursed (= 2 - 5)
	29 000.00	80 .21	28 193. 9
Park management plan	4,940.00	0.00	4,940.00
Stakeholder consultation (district level)	4,800.00	0.00	4,800.00
Stakeholder consultation (commune level)	140.00	0.00	140.00
Park extension	6,600.00	806.21	5,793.79
Stakeholder consultation (district)	1,600.00	0.00	1,600.00
Stakeholder consultation (commune/village)	5,000.00	806.21	4,193.79
Park protection fund PPF (to be 100% financed from VN contrib from yr 6 on)	717,460.00	0.00	717,460.00
Law enforcement & law monitoring	242,160.00	0.00	242,160.00
Maintenance of patrolling equipment	62,700.00	0.00	62,700.00
Field consumables	162,600.00	0.00	162,600.00
Establishment and operation of VCGs + Villagers financed by 661	250,000.00	0.00	250,000.00
	320 000.00		320 000.00

Visitor center exhibits/ interpretation panels/books	65,000.00	-	65,000.00
Sanitation & waste treatment system for visitor center	25,000.00	-	25,000.00
	399 000.00		399 000.00
Primate research habituation post	5,000.00	-	5,000.00
Nature interpretation trails (2) with sign boards	24,000.00	-	24,000.00
Trekking routes (4)	75,000.00	-	75,000.00
Adventure cave	15,000.00	-	15,000.00
Cave interpretation point	30,000.00	-	30,000.00
Cave planning and development	250,000.00	-	250,000.00
	33 0.00	182 232. 5	154 52 .25
Baseline and ecosystems survey	250,000.00	171,507.57	78,492.43
Threat baseline assessment	15,000.00	7,225.18	7,774.82
Awareness and attitude surveys	20,000.00	-	20,000.00
Key species action plan	15,000.00	-	15,000.00
Zonation/ park planning	5,400.00	-	5,400.00
Stakeholder consultation	6,360.00	-	6,360.00

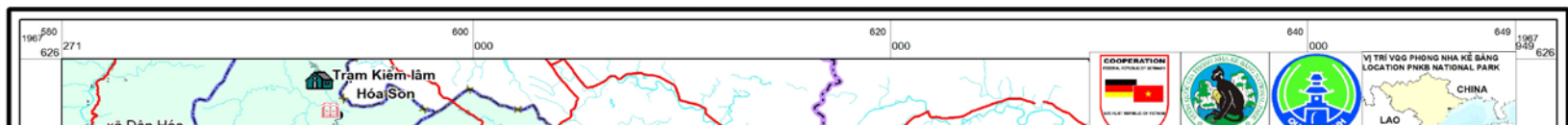
Tourism development	320,000.00		320,000.00
Community ecotourism facilities / Masterplan implementation Fund	320,000.00		320,000.00
	1 049 000. 00	80 .21	1 048 193. 9

(commune level)			
Mapping and documentation	20,000.00	3,500.00	16,500.00
Approval of Plan	5,000.00	-	5,000.00
	138 000.00	14 1 1.85	123 828.15
Investment plan (FIPI)	40,000.00	14,171.85	25,828.15
Support to IUCN/UNESCO WHS renomination for biodiv.	75,000.00	-	75,000.00
Approval of Extension	5,000.00	-	5,000.00
Boundary demarcation	10,000.00	-	10,000.00
Boundary signs	8,000.00	-	8,000.00
	1 541 0.00	2 3 1 0.82	1 2 8 599.18

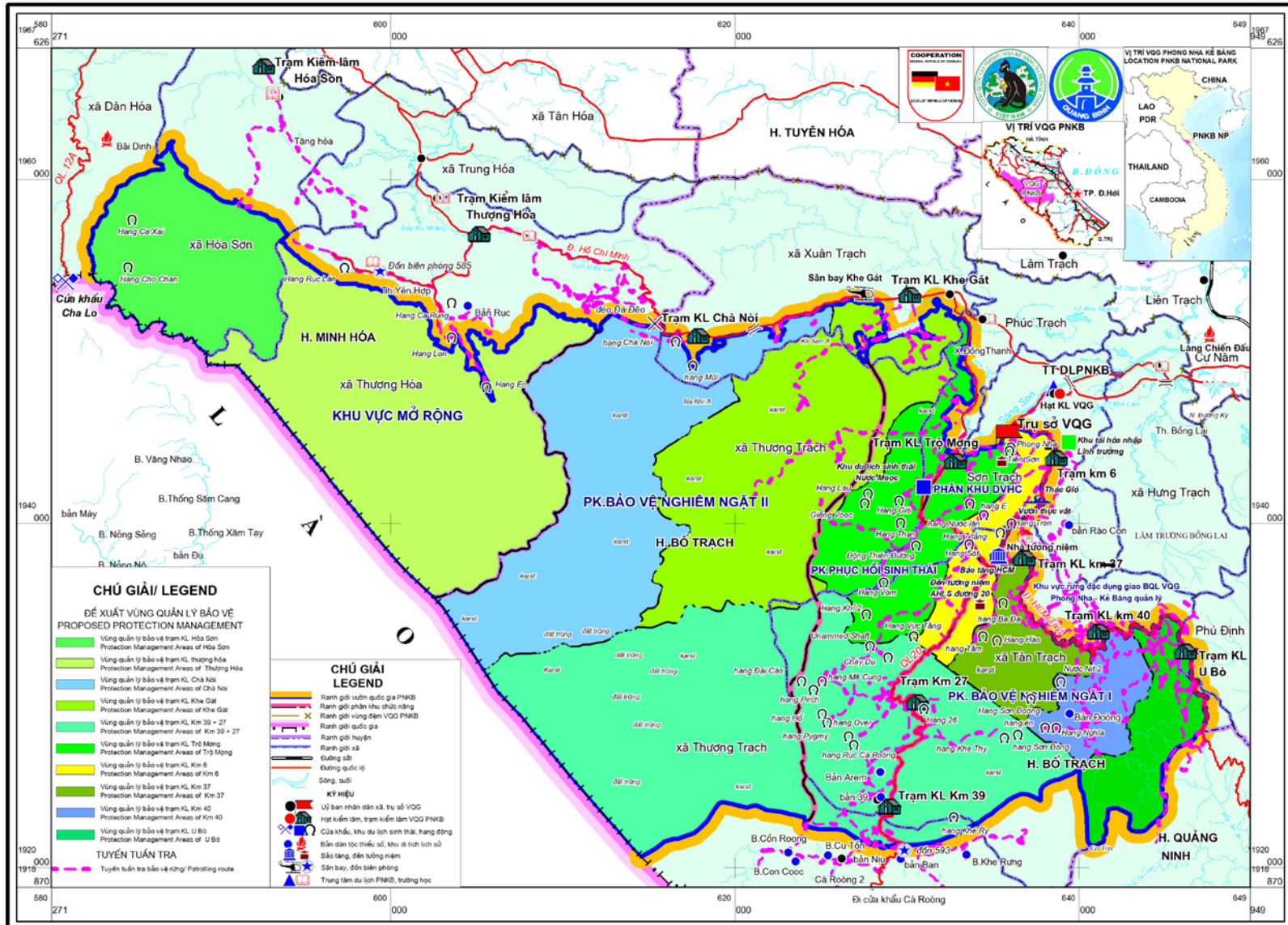
BẢN ĐỒ THẨM THỰC VƯỜN QUỐC GIA PHONG NHA KẾ BÀNG



BẢN ĐỒ QUY HOẠCH BẢO TỒN VƯỜN QUỐC GIA PHONG NHA - KẾ BÀNG CONSERVATION PLANNING IN PHONG NHA - KE BANG NATIONAL PARK



ĐỀ XUẤT PHÂN VÙNG QUẢN LÝ VÀ CÁC TUYẾN TUẦN TRA BẢO VỆ RỪNG VQG PHONG NHA - KẾ BÀNG PROPOSED FOR MANAGEMENT ZONES & PATROLLING ROUTES IN PHONG NHA - KE BANG NATIONAL PARK



NGUỒN TÀI LIỆU:
 - Bản đồ địa hình 1:50,000 hệ tọa độ quốc gia VN2000 của Bộ TN & MT.
 - Trung tâm Nghiên cứu Khoa học & Cứu hộ VQG Phong Nha - Kế Bàng.
 - Tọa độ GPS các tuyến tuần tra của các trạm kiểm lâm, VQG PNKB.

TỶ LỆ 1 : 220000

BQL DỰ ÁN KHU VỰC VQG PHONG NHA KẾ BÀNG
 Hệ tọa độ, độ cao quốc gia VN2000
 Mũi 48, Sơn vẽ: mặt, kinh tuyến trực: 105

3.1

			2012	200
1	<i>Asplenium cardiophyllum</i> (Hance) Baker	Tổ điều lá tim	NT	
2	<i>Dryopteris cyclopeltidiformis</i> C. Chr.	Ráng mọc xỉ mái tròn	NT	
3	<i>Selaginella tamariseina</i> (Beauv.) Spring	Quyển bá trường sinh		VU
4	<i>Cephalotaxus mannii</i> Hook.f.	Đỉnh tùng mann	VU	VU
5	<i>Calocedrus macrolepis</i> Kurz	Bách xanh	EN	EN
6	<i>Fokienia hodginsii</i> (Dunn) A. Henry et H. H. Thomas	Pơ mu	LR	EN
7	<i>Cycas pectinata</i> Buch. -Ham.	Thiên tuế lược	VU	VU
8	<i>Cycas siamensis</i> Miq.	Thiên tuế xiêm	VU	
9	<i>Cycas taiwaniana</i> Carruth.	Thiên tuế hàn quốc	EN	
10	<i>Chroestetes lanceolata</i> (T. Anders.) B. F. Hansen	Đài mác		CR
11	<i>Enicosanthellum plagioneurum</i> (Diels) Ban	Bân	LR	VU
12	<i>Mitrephora thorelii</i> Pierre	Mao đài lá nhỏ/Bân		VU
13	<i>Nageia fleuryi</i> (Hickel) de Laub.	Kim giao fleury	NT	
14	<i>Amentotaxus yunnanensis</i> H. L. Li	Đỉnh tùng vân nam	EN	
15	<i>Mangifera dongnaiensis</i> Pierre	Xoài đồng nai	EN	
16	<i>Mangifera indica</i> L.	Xoài ấn độ	DD	
17	<i>Pistacia cucphuongensis</i> Dai		VU	
18	<i>Alphonsea monogyna</i> Merr. et Chun		VU	
19	<i>Xylopiya pierrei</i> Hance	Dền trắng	VU	VU
20	<i>Rauvolfia micrantha</i> Hook.f.	Ba gác lá mỏng		VU
21	<i>Rauvolfia verticillata</i> (Lour.) Baill.	Ba gác vòng		VU
22	<i>Winchia calpophylla</i> A. DC.	Mớp lá đẹp, Sứa lá còng		VU
23	<i>Asarum balansae</i> Franch.	Sơn địch		EN
24	<i>Asarum caudigerum</i> Hance	Thổ tế tân		VU
25	<i>Balanophora laxiflora</i> Hemsl. in F. Forbes et Hemsl.	Dương đài hoa thưa		EN
26	<i>Markhamia stipulata</i> (Wall.) Seen. ex Schum.	Đinh		VU
27	<i>Aralia chinensis</i> L.	Công trung quốc	VU	
28	<i>Bursera tonkinensis</i> Guillaum.	Rấm	VU	VU

			2012	200
29	<i>Protium serratum</i> (Wall. ex Colebr.) Engl. in DC.	Cọ phèn		VU
30	<i>Codonopsis javanica</i> (Blume) Hook. f. et Thoms.	Đảng sâm		VU
31	<i>Euonymus chinensis</i> Lindl.	Chân danh trung quốc		EN
32	<i>Lophopetalum wightianum</i> Arn.	Ba khía		VU
33	<i>Gymnostemma pentaphyllum</i> (Thunb.) Makino	Thư trảng 5 lá (Thổ yếm)		EN
34	<i>Dacryodes breviracemosa</i> Kalkm.	Xuyên mộc dung	VU	
35	<i>Diplopanax stachyanthus</i> Hand.-Mazz.		VU	
36	<i>Dipterocarpus gracilis</i> Blume	Dầu thanh	CR	
37	<i>Dipterocarpus hasseltii</i> Blume	Dầu hasselt	CR	
38	<i>Dipterocarpus retusus</i> Blume	Chò đá	VU	
39	<i>Dipterocarpus turbinatus</i> Gaertn. f.	Dầu con rái đỏ, Chò chang	CR	
40	<i>Hopea chinensis</i> (Merr.) Hand.-Mazz.	Hongquang, Táu, May chi, Vu	CR	
41	<i>Hopea ferrea</i> Pierre	Săng đào, Sao tía	EN	EN
42	<i>Hopea hainanensis</i> Merr. et Chun	Sao hải nam	CR	EN
43	<i>Hopea mollissima</i> C. Y. Wu	Sao mặt quỷ	CR	VU
44	<i>Hopea pierreii</i> Hance	Kiên kiên phú quốc	EN	EN
45	<i>Hopea reticulata</i> Tardieu	Sao mạng	CR	
46	<i>Hopea siamensis</i> Heim	Kiên kiên	CR	
47	<i>Vatica cinerea</i> King	Táu mặt, Vu	EN	
48	<i>Vatica diospyroides</i> Symington	Làu táu thi, Táu muối	CR	
49	<i>Diospyros mun</i> A.Chev. ex H.Lec.	Mun	CR	EN
50	<i>Castanopsis ferox</i> (Roxb.) Spach	Kha thụ dữ, Cà ổi vọng phu		VU
51	<i>Castanopsis formosana</i> (Skan) Hayata	Kha thụ đài loan		EN
52	<i>Castanopsis hystrix</i> A. DC.	Cà ổi lá đỏ		VU
53	<i>Castanopsis lecomtei</i> Hickel et A. Camus	Kha thụ lecomte, Cà ổi Sa pa		VU
54	<i>Castanopsis namdinhensis</i> Hickel et A. Camus	Kha thụ nam định		VU A1c,d
55	<i>Fagus longi(e)petiolata</i> Seemen	Sồi cánh		EN
56	<i>Lithocarpus bacgiangensis</i> (Hickel et. A. Camus) A. Camus	Dẻ bắc giang		VU
57	<i>Lithocarpus fenestratus</i> (Roxb.) Rehd.	Dẻ lỗ, Dẻ cau		VU
58	<i>Quercus glauca</i> Thunb.	Sồi sim ?		VU

			2012	200
59	<i>Quercus langbianensis</i> Hickel et. A. Camus	Sòi langbiang, Sòi guòi		VU
60	<i>Bennettiodendron cordatum</i> Merr.		VU	
61	<i>Hydnocarpus annamensis</i> (Gagnep.) Lescot et Sleum.	Lọ nôi trung bộ	VU	
62	<i>Hydnocarpus hainanensis</i> (Merr.) Sleum.	Lọ nôi hải nam	VU	
63	<i>Hydnocarpus kurzii</i> (King) Warb.	Lọ nôi kurz	DD	
64	<i>Illicium ternstroemioides</i> A. C. Sm.	Đại hồi giang	VU	
65	<i>Annamocarya sinensis</i> (Dode) J. Leroy	Chò đăi	EN	EN
66	<i>Actinodaphne ellipticibacca</i> Kosterm.	Bộ trái bầu dục		VU
67	<i>Alseodaphne hainanensis</i> Merr.	Vạng trắng hải nam	VU	
68	<i>Cinnamomum mairei</i> Le'v.	Quế bạc	EN	
69	<i>Cinnamomum parthenoxylon</i> (Jack) Meisn.	Re cứu mộc	DD	CR
70	<i>Endiandra hainanensis</i> Merr. et Metc. ex Allen	Khuyết hùng hải nam, Vừ		EN
71	<i>Phoebe macrocarpa</i> C. Y. Wu	Re trắng quả to		VU
72	<i>Manglietia dandyi</i> Gagnep.	Vàng tâm		VU
73	<i>Michelia balansae</i> (DC.) Dandy	Giổi balansae		VU
74	<i>Paramichelia braianensis</i> (Gagnep.) Dandy in S. Nilsson	Giổi nhung		EN
75	<i>Dysoxylum loureirii</i> Pierre	Huỳnh đường		VU
76	<i>Ardisia silvestris</i> Pit.	Cơm nguội rừng, Khôi		VU
77	<i>Embelia parviflora</i> Wall. ex A.DC.	Thiên lý hương		VU
78	<i>Acmena acuminatissima</i> (Blume) Merr. et Perry	Thoa		VU
79	<i>Sindora tonkinensis</i> A.Chev. ex K. Larsen et S.S. Larsen	Gỗ dầu	DD	
80	<i>Dalbergia cochinchinensis</i> Pierre	Trắc	VU	
81	<i>Dalbergia oliveri</i> Gamble ex Prain	Cắm lai bông	EN	
82	<i>Dalbergia tonkinensis</i> Prain	Trắc bắc bộ	VU	
83	<i>Aglaia perviridis</i> Hiern.	Ngâu rất xanh	VU	
84	<i>Horsfieldia longiflora</i> de Wilde	Mè tương	VU	
85	<i>Knema mixta</i> de Wilde	Máu chó trộn	VU	
86	<i>Knema pierrei</i> Warb.	Máu chó pierrei	VU	
87	<i>Knema poilanei</i> de Wilde	Máu chó poilane	VU	
88	<i>Knema squamulosa</i> de Wilde	Máu chó vảy nhỏ	VU	
89	<i>Knema tonkinensis</i> (Warb.) de Wilde	Máu chó bắc bộ	VU	
90	<i>Myristica fragrans</i> Houtt.	Đậu khấu	DD	
91	<i>Linociera ramiflora</i> (Roxb.) Wall. ex G. Don	Hồ bì, Buôi	DD	

			2012	200
92	<i>Pittosporum pauciflorum</i> Wight & Arn.	Hắc châu ít hoa	VU	
93	<i>Platanus kerri</i> Gagnep.	Chò nước	VU	VU
94	<i>Fagerlindia depauperata</i> (Drake) Tirveng.	Găng nghèo, Chim chích		VU
95	<i>Leptomischus primuloides</i> Drake	Bạc cách		VU
96	<i>Rothmania vietnamensis</i> Tirveng.	Găng việt nam		VU
97	<i>Murraya glabra</i> (Guillaum.) Guillaum.	Nguyệt quới nhẵn		VU
98	<i>Helicia grandifolia</i> Lecomte	Quần hoa lá to	VU	
99	<i>Ixora umbellata</i> Vahl	Trang nhiều lá hoa	DD	
100	<i>Nephelium lappaceum</i> L.	Chôm chôm	VU	
101	<i>Sinoradlkofera minor</i> (Hemsl.) F.G. Mey.	Bông mộc	VU	EN
102	<i>Madhuca hainanensis</i> Chun et How	Sến hải nam	VU	
103	<i>Madhuca pasquieri</i> (Dub.) H. J. Lam	Sến mật	VU	EN
104	<i>Scaphium macropodum</i> (Miq.) Beume'e ex K. Heyne	Lười ươi		VU
105	<i>Styrax litseoides</i> J.E. Vidal	Bồ đề lá bời lờ	VU	
106	<i>Camellia fleuryi</i> (A. Chev.) Sealy	Trà hoa chevalier	VU	EN
107	<i>Aquilaria crassna</i> Pierre ex Lecomte	Trầm hương	CR	EN
108	<i>Excentrodendron tonkinense</i> (Gagnep.) H.T. Chang et R.H. Miao	Nghiến	EN	EN
109	<i>Livistona tonkinensis</i> Magalon	Kè bắc bộ	DD	
110	<i>Phoenix paludosa</i> Roxb.	Chà là biển	NT	
111	<i>Gastrochilus calceolaris</i>		CR	
112	<i>Schoutenia hypoleuca</i> Pierre	Sơn tần		VU
113	<i>Gmelina racemosa</i> (Lour.) Merr.	Tu hú chùm		VU
114	<i>Calamus platyacanthus</i> Warb. ex Becc.	Mây gai đẹp, Song mật		VU
115	<i>Calamus poilanei</i> Conrard	Mây Poilane, Song bột		EN
116	<i>Disporopsis longifolia</i> Craib.	Hoàng tinh cách		VU
117	<i>Peliosanthes teta</i> Andr.	Sâm cau		VU
118	<i>Anoectochilus calcareus</i>	Kim tuyến đá vôi		EN
119	<i>Bulbophyllum astelidum</i>	Cầu diệp sao		EN
120	<i>Bulbophyllum tixieri</i>	Cầu diệp tixier		EN
121	<i>Eria spirodela</i>	Nỉ lan bèo		EN
122	<i>Nervilia aragoana</i>	Trân châu xanh		VU
123	<i>Paphiopedilum dianthum</i>	Hài xoắn	EN	EN
124	<i>Paphiopedilum malipoense</i>	Hài xanh		EN
125	<i>Heterosmilax polyandra</i> Gagnep.	Kim cang nhiều tán		VU
126	<i>Paris polyphylla</i> Smith	Trọng lâu nhiều lá		EN

3.2

				2012	200
1.	Sunda Pangolin	<i>Manis javanica</i>	Tê tê java	EN	EN
2.	Chinese Pangolin	<i>Manis pentadactyla</i>	Tê tê	EN	EN
3.	Shield-nosed Leaf-nosed Bat	<i>Hipposideros scutinares</i>		VU	
4.	Greater Hairy-winged Bat	<i>Harpiocephalus mordax</i>		DD	
5.	Rickett's Big-footed Myotis	<i>Myotis ricketti</i>	Dơi muỗi chân lớn	NT	DD
6.	Bangal Slow Loris	<i>Nycticebus bengalensis</i>	Culi lớn	VU	VU
7.	Pygmy Slow Loris	<i>Nycticebus pygmaeus</i>	Culi nhỏ	VU	VU
8.	Southern Pig-tailed Macaque	<i>Macaca nemestrina</i>	Khỉ đuôi lợn	VU	VU
9.	Assamese Macaque	<i>Macaca assamensis</i>	Khỉ mốc	NT	VU
10.	Hatinh Langur	<i>Trachypithecus hatinhensis</i>	Voọc hà tĩnh	EN	EN
11.	Red-shanked Douc langur	<i>Pygathrix nemaeus</i>	Chà vá chân nâu	EN	EN
12.	Southern White-cheeked Gibbon	<i>Nomascus siki</i>	Vượn đen má trắng siki	EN	EN
13.	Dhole	<i>Cuon alpinus</i>	Chó sói	EN	EN
14.	Asiatic Black Bear	<i>Ursus thibetanus</i>	Gấu ngựa	VU	EN
15.	Sun Bear	<i>Helarctos malayanus</i>	Gấu chó	VU	EN
16.	Hog-badger	<i>Arctonyx collaris</i>	Lửng lợn	NT	
17.	European Otter	<i>Lutra lutra</i>	Rái cá thường	NT	VU
18.	Smooth-coated Otter	<i>Lutrogale perspicillata</i>	Rái cá lông mượt	VU	EN
19.	Oriental Small-clawed Otter	<i>Aonyx cinerea</i>	Rái cá vuốt bé	VU	VU
20.	Large Indian Civet	<i>Viverra zibetha</i>	Cầy giông thường	NT	
21.	Large-spotted Civet	<i>Viverra megaspila</i>	Cầy giông sọc	VU	VU
22.	Binturong	<i>Arctictis binturong</i>	Cầy mực	VU	EN
23.	Owston's Banded Civet	<i>Chrotogale owstoni</i>	Cầy vằn bắc	VU	VU
24.	Asiatic Golden Cat	<i>Catopuma temminckii</i>	Beo lửa	NT	EN
25.	Marbled Cat	<i>Pardofelis marmorata</i>	Mèo gấm	VU	VU
26.	Clouded Leopard	<i>Neofelis nebulosa</i>	Báo gấm	VU	EN
27.	Lesser Mouse-deer	<i>Tragulus kanchil</i>	Cheo cheo nam dương		VU
28.	Sambar	<i>Rusa unicolor</i>	Nai	VU	VU
29.	Large-antlered Muntjac	<i>Muntiacus vuquangensis</i>	Mang lớn	EN	VU
30.	Southwest China Serow	<i>Capricornis milneedwardsii</i>	Sơn dương	NT	EN
31.	Black Giant Squirrel	<i>Ratufa bicolor</i>	Sóc đen	NT	VU

32.	Laotian rock rat	<i>Laonastes aenigmamus</i>	Chuột đá trường sơn	EN	
33.	Annamite Striped Rabbit	<i>Nesolagus timminsi</i>	Thỏ vằn	DD	EN

3.3

No				2012	200
1	Chestnut-necklaced Partridge	<i>Arborophila charltonii</i>	Gà sò ngực gụ	NT	
2	Siamese Fireback	<i>Lophura diardi</i>	Gà lôi hông tía	NT	VU
3	Grey Peacock-pheasant	<i>Polyplectron bicalcaratum</i>	Gà tiền mặt vàng		VU
4	Crested Argus	<i>Rheinardia ocellata</i>	Trĩ sao	NT	VU
5	Blyth's Kingfisher	<i>Alcedo hercules</i>	Bồng chanh rừng	NT	
6	Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	Niệc nâu	NT	VU
7	Great Hornbill	<i>Buceros bicornis</i>	Hồng hoàng	NT	
8	Wreathed Hornbill	<i>Aceros undulatus</i>	Niệc mỏ vằn		VU
9	Red-collared Woodpecker	<i>Picus rabieri</i>	Gỗ kiến xanh cổ đỏ	NT	
10	Japanese Paradise-flycatcher	<i>Terpsiphone atrocaudata</i>	Thiên đường đuôi đen	NT	
11	Short-tailed Scimitar-babbler	<i>Jabouilleia danjoui</i>	Khướu mỏ dài	NT	
12	Sooty Babbler	<i>Stachyris herberti</i>	Khướu mỏ dài	NT	VU
13	Bare-faced Bulbul	<i>Pycnonotus hualon</i>	Chào mào trọc đầu	NA	new sp
14	Limestone Leaf-warbler	<i>Phylloscopus calciatilis</i>	Chích đá vôi	NA	new sp

3.4

				200	2012
			Ếch nhái		
1.	Cambodian Toad	<i>Ingerophrynus galeatus</i>	Cóc rừng	VU	
2.	Anderson's Frog	<i>Odorrana andersoni</i>	Chàng an-đéc-son	VU	
3.	Kio Whipping Frog	<i>Rhacophorus kio</i>	Ếch cây ki-ô	EN	VU
4.	Tonkin Bug-eyed Frog	<i>Theloderma corticale</i>	Ếch cây sần bắc bộ	EN	
			Thằn lằn		
5.	Indochinese Water Dragon	<i>Physignathus cocincinus</i>	Rồng đất	VU	
6.	Gecko	<i>Gekko gekko</i>	Tắc kè	VU	
7.	Water Monitor	<i>Varanus salvator</i>	Kỳ đà nước	EN	
			Rắn		
8.	Burmese Python	<i>Python molurus</i>	Trăn đất	CR	LR/nt
9.	Reticulated Python	<i>Python reticulatus</i>	Trăn gấm	CR	
10.	Radiated Rat Snake	<i>Coelognathus radiatus</i>	Rắn sọc dưa	VU	
11.	Green Tree Racer	<i>Gonyosoma prasinum</i>	Rắn sọc má	VU	
12.	Red Bamboo Snake	<i>Oreocryptophis porphyraceus</i>	Rắn sọc đốm đỏ	VU	
13.	Indochinese Rat Snake	<i>Ptyas korros</i>	Rắn ráo thường	EN	
14.	Common Rat Snake	<i>Ptyas mucosa</i>	Rắn ráo trâu	EN	
15.	Blue Krait	<i>Bungarus candidus</i>	Rắn cạp nia nam		
16.	Banded Krait	<i>Bungarus fasciatus</i>	Rắn cạp nong	EN	
17.	Chinese Cobra	<i>Naja atra</i>	Hổ mang trung quốc	EN	
18.	King Cobra	<i>Ophiophagus hannah</i>	Hổ chúa	CR	VU
19.	Big-headed Turtle	<i>Platysternon megacephalum</i>	Rùa đầu to	EN	EN
20.	Bourret's Box Turtle	<i>Cuora bourreti</i> (<i>C. galbinifrons</i>)	Rùa hộp bua-rê (Rùa hộp trán vàng)	EN	CR
21.	Cyclornated Box Turtle	<i>Cuora cyclornata</i> (<i>C. trifasciata</i>)	Rùa tròn đẹp (Rùa hộp ba vạch)	CR	CR
22.	Keeled Box Turtle	<i>Cuora mouhotii</i>	Rùa sa nhân		EN
23.	Giant Asian Pond Turtle	<i>Heosemys grandis</i>	Rùa đất lớn	VU	VU

				200	2012
24.	Asian Yellow Pond Turtle	<i>Mauremys mutica</i>	Rùa câm		EN
25.	Chinese Stripe-neck Turtle	<i>Mauremys sinensis</i>	Rùa cổ sọc		EN
26.	Four-eyed Turtle	<i>Sacalia quadriocellata</i>	Rùa bốn mắt		EN
27.	Elongated Tortoise	<i>Indotestudo elongata</i>	Rùa núi vàng	EN	EN
28.	Impressed Tortoise	<i>Manouria impressa</i>	Rùa núi viền	VU	VU
29.	Wattle-necked Softshell Turtle	<i>Palea steindachneri</i>	Ba ba gai	VU	EN
30.	Chinese Softshell Turtle	<i>Pelodiscus sinensis</i>	Ba ba trơn		VU
		Tổng số: 30 loài		24	15

3.5

			2012.1	200
1	<i>Squalidus argentatus</i>	Cá đực	DD	
2	<i>Spinibarbus hollandi (oshima)</i>	Cá chày đất	DD	
3	<i>Varicorhinus (Onychostoma) gerlachi</i>	Cá sinh	NT	
4	<i>Cirrhinus molitorella</i>	Cá trôi ta	NT	
5	<i>Carassioides phongnhaensis nsp.</i>	Cá Chanh	DD	
6	<i>Cyprinus melanes</i>	Cá dầy	DD	
7	<i>Cyprinus carpio</i>	Cá chép	VU	
8	<i>Cyprinus hieni nsp.</i>	Cá chép	DD	
9	<i>Schistura fasciolata</i>	Cá chạch đá sọc	DD	
10	<i>Vanmanenia sp2</i>	Cá vây bằng	DD	
11	<i>Hemibagrus centralus</i>	Cá lẳng Quảng Bình	DD	
12	<i>Hemibagrus vietnamicus</i>	Cá Nghét	DD	
13	<i>Sineleotris namxamensis</i>	Cá bóng	DD	
14	<i>Rhinogobius vermiculatus</i>	Cá bóng	DD	
15	<i>Anabas testudineus</i>	Cá rô đồng	DD	
16	<i>Anguilla marmorata</i>	Cá Chình hoa		VU
17	<i>Anguilla bicolor</i>	Cá Chình mun		VU
18	<i>Clupanodon thrissa</i>	Cá mò cờ hoa		EN

Note: nsp = New species to science

3.1

Illegal exploitation of wildlife is the greatest threat to the biological integrity of PNKBNP. The majority of threatened species in PNKBNP are primates and large mammals. In addition, other animal species are also hunted from the Park, including wild pig, civets, porcupines, turtles, and snakes. Hunting is widespread all over the region and all year round. Large and medium-sized animals, including primates, are mainly hunted in the core zone of the Park; while only small animals like rats and squirrels can still be found and trapped in the buffer zone. The peak hunting season is from August to March. Local hunters (coming from buffer zone communes) mainly comprise amateur opportunists who hunt during their spare time as a hobby; a tradition and a way for them to appreciate the forest and its natural specialties. Hunters coming from outside the buffer zone (e.g. from Bo Trach, Quang Trach, Tuyen Hoa and Minh Hoa districts of Quang Binh province) are mainly professionals, who are very skillful, know the forest very well, often hunt during the best hunting season and conduct long hunting trips in the forest. Information from consultation meetings and interviews in Thuong Hoa and Hoa Son communes revealed that those professional hunters also often collect other forest products during their hunting trips.

Hunting methods: in the past hunters and trappers used both guns and wire snare traps to catch mammals, but now mainly traps made of steel cable are used. Sometimes, “professional” hunting dogs are also used to search and chase certain kinds of hunted animals, such as mammals, pangolins, turtles and cobras. However, for small mammal species like rats, a kind of small bamboo trap (locally called “*bay sap*”) is used.

Hunting practice is related to a number of root causes, as follows:

- Bushmeat is of high market demand and high commercial value
- There still exist the need and the habit of using bushmeat for food in some areas.
- Hunting is a traditional custom/habit of local communities living near the forests.
- Local households lack jobs and alternative source of income.
- There is a low level of conservation awareness and limited knowledge of laws and regulations on the protection of this wildlife and the National Park.

Hunting activity is a principal threat to the survival of wildlife species in the region, especially for species that feed and move on the ground (e.g. civets and galliform birds). A bird biodiversity survey conducted by BirdLife International in 2011 in the Park’s extension area pointed out that a number of pheasant species, namely Green Peafowl *Pavo muticus*, Silver Pheasant *Lophora nycthemera*, Crested Argus *Rheinardia ocellata*, have been extirpated in the surveyed area. Turtle species also have become very rare.

3.2

Despite major efforts by the Park to curtail it, illegal logging does still happen in the Park, targeting a number of species of high commercial or utility values such as: *Dalbergia tonkinensis* (Hue/Trac) *Diospyros mun* (Mun), *Vatica* spp. (Tau), *Erythrophloeum fordii* (Lim), *Michelia* spp. (Gioi), Huynh *Tarrietia javanica*, Chua *Embelia ribes* etc. Timber species of high commercial value were extracted in the core zone of the Park, including the newly extended area, whilst timber for domestic use by local communities was mainly extracted in the buffer zone forests which are now under the management of forest companies. Hoa Son commune is an exception, where so far no timber extraction was observed in the core zone of the extension area of the Park. Logging happens all year round, but is most intensive during low agricultural season (i.e. after the harvest seasons of agricultural products).

Logging is conducted by both local people and people from other districts in Quang Binh Province, and for both domestic use and commercial purposes.

Illegal logging is driven by a number of causes as follows:

- The timber resources in the buffer zone forests are considerably depleted and therefore timber in the core zone of the Park is now targeted for logging.
- There are not enough jobs and alternative sources of income for local households.
- Many households in buffer zone communities do not have enough forest land for their household needs or to develop agro-forestry/plantations.
- Awareness raising among local communities on the conservation importance of the Park and laws and regulations regarding the protection and conservation of the World Heritage Site are still low.

As a result of illegal logging, many big timber species has become extremely rare or have even been locally extirpated due to prolonged overexploitation, such as *Dalbergia tonkinensis* (Hue) and *Aquilaria crassna* (Tram huong).

3.3

Non-timber forest products (NTFPs) have been extracted from the Park for many years. These consist of rattan (tribe Calameae), medicinal plants, orchids, *Ardisia silvestris* (La khoi/Com nguoi rung), *Anoectochilus setaseus* (Lan kim tuyen), palm leaves, bamboo shoots, bee honey, etc. This activity is carried out by communities inside and outside the buffer zone of the Park. NTFPs extraction activities are carried out all year round, except for bamboo shoots and bee honey that have to be collected in the right season. NTFP extraction is widespread and its intensity depends on the availability and richness of NTFPs in each region.

A number of root causes create incentives for this activity:

- High market demand
- Subsistence needs of local communities
- For the many local people who lack jobs and alternative income sources, NTFP collection provides a ready source of supplementary household income

Informants from series of consultation meeting indicated that non-sustainable harvesting practices have resulted in the rarity of some NTFPs such as *Anoectochilus setaseus* (Lan kim tuyen) and rattan within core and buffer zone.

The exception was honey collection by indigenous people in Phong Nha-Ke Bang region. This was considered to be a very sustainable collection practice, which could be encouraged so as to be widely shared and replicated.

3.4

PNKB NP has very high potential for cave and exploration tourism. The number of national visitors to the Park increased from 115,000 visitors in 2001 to 329,000 visitors in 2004, and the numbers continue to climb. The number of international visitors is also increased from 1,000 in 2001 to 11,800 visitors in 2007, and visitation by international travellers seems to be increasing even more quickly.

While tourism is one of the prime Objectives of the Park, and presentation of World Heritage values is one of the recognized missions of World Heritage sites, unrestricted tourism development impacts of infrastructure development on the Park conservation and the surrounding environment have to be seriously considered and assessed.

Mass tourism with low environmental awareness may cause disturbance to both local communities and wildlife. Some villagers in Phuc Trach commune (near Paradise Cave) observed that tourism activities caused noise disturbance to primates, air pollution and water pollution. There is already heavy pressure on certain popular touristic sites, resulting in noise and litter pollution.

Caves are particularly fragile environments, and tourism to these sites can leave permanent damage if not carefully planned and supervised. Tourism equipment installed inside the caves and the over-crowded tourist masses during summer months also cause negative impacts on the cave features and rare cave wildlife. Lighting systems can allow the growth of algae (*lampenflora*), which can discolour and permanently damage cave features.

To date, there has been no study on the impacts of tourism on the conservation of the Park or its World Heritage values. As cave tourism is developed and expanded, with plans to allow increase of these tourism levels and spread tourism to other parts of the park, there are bound to be further threats both to the tourist experience itself as well as to geomorphology and local biodiversity. Currently there very few sign posts, information boards with conservation guidance and messages and garbage bins in popular tourist locations in the Park, such as Phong Nha Cave, Paradise Cave, and popular streams.

3.5

The West branch of Ho Chi Minh Highway is a national project serving economic development and national defence purposes. The road lies along the boundary of much of the Park, and crosses through the Park's Ecological Restoration Sub-zone. The construction of the road caused some disturbance to the Park.

Road 20 crosses directly through the park from north to south. This road was constructed before 1965 and goes through PNKBNP. This is the only road for Thuong Hoa and Tan Trach communes to access Phong Nha. Currently, Road 20 is being upgraded. From an economic development perspective, upgrading the road will help Tan Trach and Thuong Trach communes access the outside world and market. It will also make the Park more accessible, therefore the Park's guard station at 39th Km and the check-point at 27th Km shall need to step up their enforcement and patrols. Attention should also be paid to raising the conservation awareness of local communities in Thuong Trach and Tan Trach communes.

3.

Invasive and alien species in the Park are mainly comprised of herbaceous and lianoid plants, such as *Chromolaena odorata*, *Mimosa diplotricha*, *Lantana camara*, *Mimosa diplotricha*, *Imperata cylindrica* etc. Invasive and alien species issues have not been considered in the management of the Park previous to this.

Some invasive and alien species have been introduced to the region in the infrastructure construction process (road and other infrastructure works). Some weeds and viney species were observed to be invasive, slowing down the natural rehabilitation/re-growth of forest adjacent to the buffer zone and along new roads.

3.

Extraction-Firewood collection in the Park is a common practice among local communities in the Buffer Zone.

Sometimes, firewood collected is also sold to "middle-men" for sale to further localities in the region. Firewood is an important source of fuel for households, due to their increasing fuel/firewood demand and the declining area of forest available to meet that demand. Currently, there is not yet any study on the firewood demand of local communities as well as the impacts of

firewood collection on biodiversity in the region. Some projects have piloted distributing fuel-saving stoves that use firewood replacement materials such as sawdust and rice husks, but those stoves are not popular, as the collection and use of firewood is much easier, faster and more convenient for local communities. In the longer term, without alternatives, this firewood collection practice will negatively impact the quality of natural forests.

3.8

Cattle grazing in the forest is a traditional practice of buffer zone communities. For example, 100 oxen belonging to households in Tan Trach commune graze in the core zone of the Park.

Main causes of the situation are:

- Letting cattle graze freely in the forests is a traditional practice in local communities.
- The need for pasture was not taken into account in land-use planning in the buffer zone communes.

Uncontrolled cattle grazing as it occurs today may negatively impact the enrichment planting of native species in the area targeted for this activity.

3.9

The Park's dominant topography is limestone karst, so there are very few above-ground streams and rivers in the core zone. Local people still do fishing in the buffer zone, normally using nets, but sometimes using electroshock devices and poison made from tree bark. Harvested fish are used for consumption in families and sold to market. Fishing happens also all year round, except for the two flooding months of September and October. Fishing using electric devices and poisons have widespread destructive impact on fish species and other aquatic life.

3.10

However, according to information obtained from the consultation meetings with villagers and local authority in A Ren village, Tan Trach commune, 70 households of Tan Trach commune are living inside the Core Zone, with about 150-200 ha of agricultural land. In addition, inside the Core Zone there is also 1 ha of agricultural land, used for growing maize and peanuts, which belongs to people from Chay Trai village, Phuc Trach commune.

Causes of encroachment are:

- Park planning did not adequately consider the land-use demand of Tan Trach commune;
- Subsistence needs of a growing population;
- Lack of agricultural land for buffer zone communities outside of the Core Zone;
- Low level of conservation awareness and awareness on forest protection laws and regulations.

3.11

Cinnamomum oil extraction is still being carried out in PNKB region, but has declined considerably. This activity is often observed in the core or buffer zone of the Park where forest quality is still good. This activity is carried out by local people from outside the buffer zone (e.g. Ron commune of Quang Trach District) with participation of local villagers.

Root causes of this activity are:

- High commercial value of *Cinnamomum* oil;
- Low level of conservation awareness and awareness on forest protection laws and regulations.

Cinnamomum oil extraction not only depletes *Cinnamomum* species, which are of conservation concern such as *Cinnamomum mairei* (globally Endangered) and *Cinnamomum parthenoxylon* (nationally Critical Endangered), but also damages the habitats around extraction camps (as trees around those camps were felled to be used as fire-wood) and pollutes nearby streams.

3.12

Forest fire seldom happens in Phong Nha – Ke Bang region. However, sometimes there are small fires in forest near agricultural land. There does exist the risk of forest fire due to slash and burn practice, infrastructure developments, wild bee honey collection and negligence by tourists and other visitors. Anthropogenic climate change, bringing with it erratic and unpredictable shifts in weather patterns, may increase the risk of severe drought and major fires in the future.

3.13

Every year, the PNKB region suffers from floods for 2-3 weeks during September and October. This natural seasonal flooding interrupts tourism activities each year. Occasional severe floods cause negative impacts on wildlife and habitats and have obvious destructive impacts on tourism infrastructure. Natural disasters may be intensified by change due to anthropogenic climate change (“global warming”).

Phụ lục 5:

18 200

Quang Binh provincial People's Committee
No. 18/2007/Decision -PPC

The Socialist Republic of Vietnam
Independence - Freedom - Happiness
Dong hoi, August 16th 2007

DECISION

on issuing regulations on management of
Phong Nha - Ke Bang National Park

QUANG BINH PROVINCIAL PEOPLE'S COMMITTEE

- ✧ Based on Law on organization of Provincial People's Council and Provincial People's Committee on 26th November 2003;
- ✧ Based on Law on Forest Protection and Development on 3rd December 2004;
- ✧ Based on Law on Environment Protection on 29th November 2005;
- ✧ Based on Convention for World Cultural and Natural Heritage Protection on 16th November 1972;
- ✧ Based on Law on Cultural Heritage on 29th June 2001;
- ✧ Based on Decree No. 23/2006/ND-CP of Government on 03rd April 2006 on issuing the guidance for implementing Law on Forest Protection and Development;
- ✧ Based on Decree No. 32/2006/ND-CP of Government on 30th April 2006 on managing rare, endangered fauna and flora;
- ✧ Based on Decision No. 186/2006/QD-TTg of Primer Minister on 14th August 2006 on issuing regulations for forest management;
- ✧ Based on Decision No. 189/2001/QD-TTg of Primer Minister on 12nd December 2006 on upgrading Phong Nha Natural Reserve to Phong Nha - Ke Bang National Park;
- ✧ Based on Decision No. 02/2003/QD-BTNMT of Ministry of Resources and Environment on 29th July 2003 on issuing regulations on environment protection;
- ✧ According to the suggestions of Director of Phong Nha - Ke Bang National Park's Management Board mentioned in the Proposal No.406/TTr-VQG on 25th July 2007;

DECISION

Article 1: This Decision was issued attachment with the regulations on management of Phong Nha - Ke Bang National Park.

Article 2: This Decision shall be validated after 10 days since official gazette already published.

Article 3: Chief of Provincial People's Office, Director the Management Board of Phong Nha - Ke Bang National Park, Directors of Department of Agriculture and Rural Development, Department

of Natural Resources and Environment, Department of Science and Technology, Department of Culture and Information, Department of Trade and Tourism, District People's Committees of Bo Trach, Minh Hoa, Quang Ninh, Commune People's Committees are located in the protected area of the National Park and involved in individuals, organizations have to be responsibly implemented this Decision./.

Recipients:

- Mentioned in Article 3;
- Government Office
- Ministry of Agriculture and Rural Development
- Ministry of Science and Technology
- Ministry of Culture, Sport and Tourism
- Ministry of Resources and Environment
- Division of Writing Check (Ministry of Judiciary)
- Provincial Standing Communist Board
- Provincial Standing People's Council
- Chair, Vice-Chairs of PPC
- Provincial Front Mother Land Committee
- Provincial National Assembly delegate
- Registration Department, Cultural and Social Division, Provincial People's Council
- Quang Binh newspapers and Radio-Television
- Judiciary Department
- Center for Provincial Official Gazette
- Saving at profiles

Provincial People's Committee

On behalf of Chairman

Vice-Chair madam

Pham Thi Bich Lua

REGULATIONS

on management of Phong Nha - Ke Bang National Park

(Issued attachment with Decision No. 18/2007/QĐ-UBND of Quang Binh Provincial People's Committee on 16th August 2007)

CHAPTER I

GENERAL REGULATIONS

Article 1. Modification scope

This Regulation provides for the management, protection, conservation, development and use Phong Nha - Ke Bang National Park.

Article 2: Application subjects

State agencies, domestic organizations, households and individuals as well as foreign organizations and individuals involved in Phong Nha - Ke Bang National Park have to be seriously applied this regulation and Laws of Vietnam such as international conventions involved in protection for the World Nature Heritages and biodiversity.

Article 3: Term interpretation

In this regulation the following terms are constructed as follows:

1. *Forest* means an ecological system consisting of the populations of forest fauna and flora, forest micro-organisms, forestland and other environment factors, of which timber trees and bamboo of all kinds or typical flora constitute the major components with the forest canopy cover of 0.1 or more. Forests include planted forests and natural forests on production, protective and special use forestland.
2. *Buffer zone* means the forest area, land area or water-surface land area bordering on a special-use forest that has effect of preventing or reducing the encroachment upon that special-use forest.
3. *Core zone* means the forest area, land area located in inside of the National Park.
4. *Strictly Protected Area* of special use forest is intact conservation areas which have been well protected and managed in order to observe natural changes of forests.
5. *Rehabilitation Area of special use forest* is area which has been well protected and managed in order to rehabilitate and re-grows.
6. *Administrations Service Area of special use forest* is area which has been being used to build headquarter of the Management Board of forest special use and facilities for doing the scientific researches, tourism services and entertainments.

7. *Forest products* mean products exploited from forests, covering forest plants and animals and other forest organisms. Forest products include timbers and non-timber forest products.

Article 4. Duties and responsibilities of Phong Nha - Ke Bang National Park

3 2012

28

2012

Article 5. Operations

The Management Board of Phong Nha - Ke Bang National Park is responsible for implementing the duties of managing Phong Nha - Ke Bang National Park. Beside, it also is responsible for supervising, monitor of implementing of this regulation and coordinating with authorities; relevant departments in order to conserve, renovate and use the outstanding values of the Park regarding cultural, socio-economic development strategy in long term.

CHAPTER II

PROTECTION SCOPE AND CONTENTS OF PHONG NHA - KE BANG NATIONAL PARK

Article 6. Protection scope

Protection scope mentioned in this regulation is recognized all of special use forests in according to the Decision No. 189/2001/QĐ-TTg on 12th December 2001 of Prime Minister on upgrading Phong Nha Natural Reserve to Phong Nha - Ke Bang National Park.

Article 7. Protection contents in core zone

Natural resources, historical and cultural relics, landscapes in the functional areas of Phong Nha - Ke Bang National Park have to be protected intact and sustainably developed.

1. In the Strictly Protected Area and Rehabilitation Area of the Park, the activities as follows are banned

Activities can change natural habitat of the forest except activities has been done according to the regulation on forest management, mentioned in Point 2b, Article 22, attachment with Decision No.186/2006/TTg of Primer Minister on 14th August 2006.

Activities can impact to environment, natural habitat of fauna and flora or species are being conserved.

Keeping and raising animals or growing animals/plants which are not native species located in Quang Binh province. In the special cases, they need to be decided / approved by Minister of Agriculture and Rural Development or Primer Minister.

Exploit biological, mineral resources and others; change natural habitat and forest accession; negative impact to wildlife/wilderness.

Domestic cattle and fowl husbandry

Make environment polluted such as solid garbage, daily garbage and other activities

Bringing poison chemical, explosive, inflammable into forests, fire on forests and edge of forests or use means of transport are threatened to natural environment.

Activities make damage, destroy, illegal occupy historical, cultural relics and landscapes; writing or painting on the caves, trees, historical sites and natural landscapes.

Building houses, stores, pagodas, temples, stations, mine exploitation or tourism facilities; except activities mentioned according to the regulation on forest management, Point 2b, Article 22, attachment with Decision No.186/2006/TTg of Primer Minister on 14th August 2006.

Superstition acts, putting up statues and altars on the caves, mountains, rivers and impolite behaviors at the tourism sites or on the vehicles.

Establish repair bases, shops/restaurants, photo shops or other services are not permitted by the authority.

Use land and forest have been planed that belong to Strictly Protected Area for rent or cooperation which can change natural evolution of the forests.

2. In the Administration Area, the activities mentioned below are banned

Activities that can change natural habitat of the forest, activities can impact to environment, natural habitat of fauna and flora.

Keeping and raising animals or growing flora which are not native species located in Quang Binh province. In the special cases, the need to be decided by Minister of Agriculture and Rural Development.

Exploiting endangered, rare floral species are banned (except dead or collapsed wood-trees and trees located in ground for construction sites according to the planning) based on Decree No. 32/2006/ND-CP of Government on endangered, rare forest fauna and flora management and category of both endangered, rare forest fauna and flora has been issued attachment.

Illegal hunting, trapping wildlife and other exploitation activities involved in biological resources that to be banned by law provisions

Natural resources exploitation such as stone, stalactites, war-weapons and other resources.

Making environment polluted

Bringing poison chemical, explosive, inflammable into forests, fire on forests and edge of forests or use means that threatened to damage natural environment.

Activities make damage, destroy, illegal occupy historical, cultural relics and landscapes; writing or painting on the caves, trees, historical sites and natural landscapes.

Building new facilities change or destroy the buildings that they have been negative impacted to forest ecology, growth and development of biological organism when not yet approved by authority.

Superstition acts

Article 8. Protection contents in buffer zone

1. Buffer zone is bordering with natural forest and slope in the side of Phong Nha - Ke Bang National Park. It needs protect in accordance with law on forest protection and development. In the bare land and hills, it needs plan for native species forestation and building sustainable forest garden.
2. The Management Board of Phong Nha - Ke Bang National Park organizes activities for local community in buffer zone can participate in protection, conservation, forest product

use and other natural resources, eco-tourism services in order to improve income and livelihood of community.

3. Master plan is needed for local residence. All organization and individual buildings have to be approved by functional authority such as architectures, designs, border marks and permit for construction. It is sure that not make polluted and negative impacts to natural landscapes of Phong Nha - Ke Bang National Park.
4. Services of hotels, guesthouses, shops, restaurants, ships, boats, and sport and entertainment complexes have to solutions for waste, garbage; prevent direct or indirect pollution to landscapes and natural environment.
5. If the proposals of building industrial, economic zones and construction sites can be risked affect to protected area of Phong Nha - Ke Bang National Park. It is necessary to carefully consider and find solutions to minimize negative impacts and handle.
6. The Management Board of Phong Nha - Ke Bang National Park is responsible for coordinating with local authority, relevant departments and agencies to implement measures of management and protection according to the government regulations on historical and cultural relics, landscapes protection.
7. Wildlife and wilderness as well as other resources of Phong Nha - Ke Bang National Park are banned trading.

CHAPTER III

RESPONSIBILITIES ON PROTECTION AND CONSERVATION IN PHONG NHA - KE BANG NATIONAL PARK

Article 9. Responsibilities of Phong Nha - Ke Bang National Park's Management Board

1. The Management Board of Phong Nha - Ke Bang National Park is responsible for assisting the Provincial People's Committee and responsibly coordinates with provincial and local authority to supervise, inspect, discover and handle the violations that directly or indirectly impacts to the values of Phong Nha - Ke Bang National Park.
2. In case of the fact that the values of Phong Nha - Ke Bang National Park is risked of damage caused for natural or human impacts such as changing structures, pollution, lacks of ecological balance; the Management Board of Phong Nha - Ke Bang National Park.
3. All resources of Phong Nha - Ke Bang National Park need to be surveyed and filed to monitor "succession" of resources and mentioned in the maps. All information mentions "succession" of resources and related to Phong Nha - Ke Bang National Park needs to be collected, observed, modified, saved and reported to the Provincial People's Committees in accordance with law provisions.
4. Coordinating with relevant departments in order to build planning, plans for conservation and renovation and evaluation, identification of Phong Nha - Ke Bang National Park's values.
5. Writing the proposals for protection, management and scientific researches, rescue, sustainable tourism and propose to higher authority for approval.

6. Together with authority, it participates in the project assessment of socio-economic development in buffer zone in order to propose to higher authority for approval. Beside, many measures and solutions to be presented to improve community livelihood; programmes are shown to attract participating in protection of Phong Nha - Ke Bang National Park.
7. Many programmes of propaganda, education on resources and environment protection have been done to community and visitors such as introduction of typical values of Phong Nha - Ke Bang National Park and regulations on management.
8. It is responsible for supervising and coordinating to handle the violations of individuals/organizations that violate law provisions and regulations on management of Phong Nha - Ke Bang National Park.
9. Strengthening the close cooperation-ship with Ministries and relevant state agencies, domestic and international organizations in order to attract more investment sources to conserve and use sustainable values of Phong Nha - Ke Bang National Park.

Article 10. Responsibilities of relevant departments and agencies

1. The District People's Committees, the Commune People's Committees that have implemented administrative management in buffer zone and core area of the National Park are responsible for cooperating with authority in order to aware local community on protecting Phong Nha - Ke Bang National Park in accordance with law provisions and this regulation.
2. Department of Culture and Information, Department of Traffic and Transportation, Department of Trade and Tourism, Department of Construction, Department of Science and Technology, Department of Resources and Environment, Department of Agriculture and Rural Development and relevant departments are responsible for coordinating to manage cultural, tourism, environment protection, security, social activities and other fields of socio-economics in the region.
3. Quang Binh Television - Radio, newspapers is responsible for building programmes for introduction, advertisement, propaganda on heritage protection to the provincial people and visitors.
4. Quang Binh Police and Border-Police is responsible for building plans to keep security and protect in the property.
5. Local community in the region is responsible for actively participating in protection of Phong Nha - Ke Bang National Park.

CHAPTER IV

CONSERVING, DEVELOPING AND USING THE VALUES OF PHONG NHA - KE BANG NATIONAL PARK

Article 11. Wildlife and wilderness rescue

1. The Management Board of Phong Nha - Ke Bang National Park is permitted to rescue wildlife and wilderness

2. After rescue, they are released into the forest of Phong Nha - Ke Bang National Park in accordance with law provisions.
3. Endangered, rare wildlife and wilderness located in Quang Binh province and bordering area discovered that they are illegal kept, transported, Quang Binh Forest Protection Department will collect and assist the Provincial People's Committee in transferring them to rescue in Phong Nha - Ke Bang National Park.
4. Domestic and international organizations want to implement activities of rescuing fauna and flora, it is necessary to coordinate with the Management Board of Phong Nha - Ke Bang National Park to submit the proposals to Ministry of Agriculture and Rural Development and the Provincial People's Committee for approval before projects can be started.

Article 12. Scientific researches, studies and trainings in Phong Nha - Ke Bang National Park

1. Carries out duties of scientific researches
 - a) The Management Board of Phong Nha - Ke Bang National Park plans to research and coordinate with domestic and international organization for building short term or long term programmes, proposals to submit for approval.
 - b) Report yearly to higher authority and Ministry of Agriculture and Rural Development, the scientific researches have to be reported and transferred for reality application
2. Domestic and international individuals/organizations have been being implementing scientific research theses, professional subjects, projects, trainings in Phong Nha - Ke Bang National Park have to obey strictly regulations as follows
 - a) Domestic individuals and organizations have demands of scientific research, and trainings in Phong Nha - Ke Bang National Park have to be permitted by writing documents of the Management Board of Phong Nha - Ke Bang National Park.
 - b) International organizations, non-government organizations (NGOs) and individuals implement or cooperate with domestic individuals and organizations on scientific research in Phong Nha - Ke Bang National Park have to be approved and agreed by authority according to the law provisions.
 - c) During implementation time, all activities are under guided and supervised by the Management Board of Phong Nha - Ke Bang National Park, it is not accepted that intact manner of ecosystem are impacted and specimens are illegal collected. The observation, writing, taking photos and filming can be accepted.
 - d) After any research, at least before 2 weeks, individuals and organizations who have completed the scientific research have to send reports involved in activities in the forest and impacts to the forest. After researches were declared, at least before 2 months, individuals and organizations have to report results of researches, surveys to issued agencies and the Management Board of Phong Nha - Ke Bang National Park.
 - e) Specimens collection and exchange with any purposes in Phong Nha - Ke Bang National Park need to be followed Decree No. 23/2006/ND-CP on 3rd March 2006 of Government

on implementing Law on forest protection and development; classify number of species, specimens, gene collection, time of collection and management, supervision are identified by the Management Board of Phong Nha - Ke Bang National Park, resources tax and other fee needed to be pay to the Management Board of Phong Nha - Ke Bang National Park in accordance with law provisions.

In case of the fact that specimens are brought to oversea, it is obligatory to be permitted by CITES Vietnam office.

- f) Individuals and organizations researches in Phong Nha - Ke Bang National Park have to be followed the guideline and regulations on forest protection of the Management Board of Phong Nha - Ke Bang National Park.
3. The Management Board of Phong Nha - Ke Bang National Park has to nominate staff to guide, supervise organizations, individuals who obligatorily implement the regulations.
4. If any individual and organization violates the violation, the Management Board of Phong Nha - Ke Bang National Park shall take minutes, suspend or stop activities and propose to higher authority for handling the violations.

Article 13. Coordination between tourism services and ecotourism-environment

1. The Management Board of Phong Nha - Ke Bang National Park is permitted to open business services in landscapes, entertainment, eco-tourism and environment in the National Park. The activities mentioned above have to be built investment project shall be approved by state authority and satisfied regulations as follows:
 - a) There are no impacts to conservation purposes and sustainable development, biodiversity, landscape environment, protective effects of Phong Nha - Ke Bang National Park. They have to be satisfied demands of security; do not take advantage of tourism activities to make political and security instability in the National Park's area and region.
 - b) The activities have to be safe and followed the guideline, supervision, monitoring of the Management Board of Phong Nha - Ke Bang National Park.
 - c) Take advantages for households, individuals located in core area and buffer zone of the National Park can participate in eco-tourism services to improve their livelihood.
2. The Management Board of Phong Nha - Ke Bang National Park has to build investment projects to coordinate with other activities on business regarding landscapes, entertainment, eco-tourism and environment in the National Park to submit to higher authority for approval and responsible for coordinating with relevant departments and agencies to take advantage conditions for individuals, organizations can participated in eco-tourism activities and services organized in

Phong Nha - Ke Bang National Park's area; examine implementation of the regulations, the violations can be handle and proposed to be disciplined or examined for penal liabilities according to the law provisions and open inform in the mass media the violations have been identified and handled.

3. Other individuals and organizations are enough capacity to exploit tourism services in Phong Nha - Ke Bang National Park have to be approved by the Provincial People's Committee and under managed by the Management Board of Phong Nha - Ke Bang National Park.
4. Organizing business in landscapes, entertainment, eco-tourism and environment are regulated as follows:
 - a) Have to follow regulations, disciplines on management of Phong Nha - Ke Bang National Park.
 - b) Individual and organization businesses are allowed participating in tourism services in Phong Nha - Ke Bang National Park's have to follow on regulations on management and protection of the World Heritage Site. Individual, households and organizations don's allow get fees at any site in Phong Nha - Ke Bang National Park if not yet approved by authority.
 - c) Individual and organization businesses are allow organize tours have to ensure safe for visitors and accident insurance, communication, information, polite serve behaviors, guide visitors following the regulations and rules of Phong Nha - Ke Bang National Park.
 - d) All vehicles such as boats, ships, cars, buses and others participating in transport in Phong Nha - Ke Bang National Park's area have to satisfied demands of technique standards such as traffic safety, insurance obligation, communications, life buoys, distinguishers, facilities or equipments are used to prevent pollution, ban on the parking in the wrong places.
5. Local authority in buffer zone of Phong Nha - Ke Bang National Park needs establish investment projects to develop production and rural infrastructure, improve community livelihood. Besides, regulations on locals and households are responsibilities for protecting and conservating of Phong Nha - Ke Bang National Park - the World Natural Heritage.

Article 14. Tourism activities management

The Management Board of Phong Nha - Ke Bang National Park is responsible for supervising all activities of individuals, organizations involved in tourism services in Phong Nha - Ke Bang National Park. The violations can be handled and proposed to be disciplined or examined for penal liabilities according to the law provisions and open inform in the mass media the violations have been identified and examined.

In case of the fact that relics, landscapes, tourism sites of Phong Nha - Ke Bang National Park has been downgraded and damaged, The Management Board of Phong Nha - Ke Bang National

Park can ask the Provincials People's Committee, Ministry of Agriculture and Rural Development, relevant departments and agencies to delay or stop tourism activities in order to protect, conserve not only all area but also landscapes and eco-system of National Park.

Article 15. Settlement for local community in the functional areas of National Park

1. Not allow to immigrate into Phong Nha - Ke Bang National Park
2. The Management Board of Phong Nha - Ke Bang National Park assists the Provincial People's Committee in building plans for resettlement to submit to state authority for approval. This programme is to remove people who located in the Strictly Protected Area of National Park from this area.
3. If people who live in the Strictly Protected Area but not yet removed, local individuals and households can be allocated forest in short term for protection by the Management Board of Phong Nha - Ke Bang National.
4. In the Rehabilitation Area, the Management Board of Phong Nha - Ke Bang National directly allocates forests to local individuals and households for protection and development.

Article 16. Regulations for ticket and excursion fees

1. Any domestic and international individual/organization comes to Phong Nha - Ke Bang National Park for implementing thesis, scientific research projects; using fields for studies, trainings, specimen collections, tourism service, and filming, taking photos have to pay fee in accordance of law provisions.
2. The Management Board of Phong Nha - Ke Bang National Park is responsibly for coordinating with Department of Finance, Provincial Bureau of Tariff to assist the Provincial People's Committee in planning tourism fees, ticket fees in accordance with law provisions on fee; in order to submit to state authority for approved.
3. Fee has to be paid for services during of scientific researches would be implemented by according to the negotiations between the Management Board of Phong Nha - Ke Bang National Park and individuals/organizations who want to study or visit in the National Park forests.
4. The Management Board of Phong Nha - Ke Bang National Park gets fee and ticket fee of these activities involved in the National Park in accordance of law provisions. This amount has to be contributed to state budget and then it is re-invested to protect and renovate Phong Nha Nha - Ke Bang National Park based on annual approved plans.

CHAPTER V

REWARD AND HANDLING THE VIOLATIONS

Article 17. Reward

Any organization, individual that has excellent achievements on management and protection of Phong Nha - Ke Bang National Park will be rewarded by law provisions.

Article 18. Handling the violations

State agencies, domestic organizations, households and individuals as well as foreign organizations and individuals involved in Phong Nha - Ke Bang National Park have to be seriously applied this regulation and Vietnamese Laws. If persons who commit of violating of this regulation, depending on the nature and seriousness of the violations, be disciplined or examined for penal liabilities according to the law provisions. If any causing damage be found, have to pay compensations for such damage in accordance with law provisions.

CHAPTER VI IMPLEMENTATION

Article 19. Implementation responsibilities

The Management Board of Phong Nha - Ke Bang National Park is responsible for coordinating with Department of Agriculture and Rural Development to assist the Provincial People's Committee in guiding and supervising this regulation implementation; actively coordinates with relevant departments and agencies to well manage Phong Nha - Ke Bang National Park, the World Natural Heritage.

During implementation time, if any difficulties can be found or needed amendment or modifications or some contents are not suitable, it is needed to inform to the Provincial People's Committee for considerations and amendments.

Provincial People's Committee
On behalf of Chairman
Vice-Chair madam
Pham Thi Bich Lua

Operational Management Plan 2013 to 2020 Phong Nha - Ke Bang National Park-World Heritage Site -----o0o-----

A Report of the Nature Conservation and Natural Resource Sustainable Management in Phong
Nha Ke Bang Region Project

Project director: Nguyen Trung Thuc

Project Chief Technical Advisor: Bas van Helvoort

Editor in Chief Luu Minh Thanh
Director of Phong Nha Ke Bang National Park

Compiled by: Le Trong Trai and William V. Bleisch
contributions from Bas van Helvort &
Nguyen Van Tri Tin – AHT CO

Maps: Mai Ky Vinh and Nguyen Quang Quyet

Translator: Dang Thi Hoa

Editing laguages in Vietnames/English Nguyen Van Tri Tin

.	Phong Nha - Ke Bang National Park	Director
.	Vice- director, PNKB National Park	Head of PNKB National Park Management Plan Working Team (MPWT)
.	Head of Administration and Organization Department, PNKB National Park	PNKB NP MPWT member
.	Head of Finance and Planning Department, PNKB NP	PNKB NP MPWT member
.	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MPWT member
.	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MPWT member
.	Eco-Tourist Centre, PNKB NP	PNKB NP MPWT member
.	National Park Forest Protection Division, PNKB NP	PNKB NP MPWT member
.	Phong Nha - Ke Bang National Park	Director of PNKB Forest Protection Department
.	China Exploration & Research Society	Technical advisor for Management Planning
.	Bird Life International	Technical advisor for Management Planning; Author of the Operational Management Plan for the PNKB National Park
.	IUCN World Commission on Protected Areas (WCPA)	Vice Chair Mountains Biome Theme, Technical advisor for World Heritage requirements
.	PNKB Region Project (KfW Component)	Chief Technical Advisor
.	PNKB Region Project (KfW Component)	Deputy Chief Technical Advisor
.	PNKB Region Project (KfW Component)	Former Chief Technical Advisor
.	PNKB Region Project (GIZ Component)	Advisor and project liaison
.	PNKB Region Project (GIZ Component)	Advisor
.	Vice Director, Phong Nha - Ke Bang National Park	Head of the STDP Task Force Group
.	National Park and Protected Areas Association of Vietnam	Co-author of the Sustainable Tourism Development Plan (STDP) for the PNKB NP Region

.	.	Project Manager, Primates Reintroduction Programme, Frankfurt Zoological Society	Advisor
.		Project Manager, Kolner Zoo	Advisor
.		Tourism Resource Consultants New Zealand – TRC	Co-author of the STDP for the PNKB NP Region
.		Tourism Resource Consultants New Zealand – TRC	Co-author of the STDP for the PNKB NP Region
		Vietnam FIPI	Compiler of the Buffer Zone Development Plan for the PNKB NP Region
		Compilers of the Greater Blue Mountains World Heritage Area Strategic Plan	Template and Background materials on World Heritage Sites

PROJECT SUPPORT

The Strategic Management Plan 2013 – 2025 for the Phong Nha - Ke Bang National Park Region was an output of the Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha - Ke Bang Region Project and was prepared as a consultancy assignment for the Project Management Unit with the support of the Kreditanstalt für Wiederaufbau (KfW). The project is funded by the Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (BMZ).

The project is a joint cooperation between the Provincial Peoples' Committee (PPC) of Quang Binh from the Vietnamese side and Kreditanstalt für Wiederaufbau (KfW), GTZ, and Deutscher Entwicklungsdienst (DED) from the German side. The PPC is the executing agency and the Department of Planning and Investment (DPI) of the PPC acts as project owner and implementing body. GTZ and KfW support the project by means of financial and technical cooperation. A cooperation agreement between the PPC and GTZ was signed on 19th October 2007 and on the 23rd of January 2008 the agreement between the PPC and KfW was signed.

The overall objective of the project is to contribute to the conservation of the Central Annamite Region and its biodiversity and ecological services in close relation with a sustainable socio-economic development in the Core Zone (including Administration and Service Area, Ecological Restoration Area, and Strictly Protected Area, including the extension area) and Buffer Zone of the National Park. The project seeks to reduce the pressure on the natural resources of the National Park in part by support for the reorganising of legal income and alternative livelihood activities of the local population. The Project duration is eight years, six years for the implementation phase and the last two years for the aftercare phase.

The project prepared a Sustainable Tourism Development Plan for the PNKB NP Region in 2010 and it also supports the on-going preparation of a Buffer Zone Development Plan for the Buffer Zone of the National Park, and an Operational Management Plan for the National Park itself. This Strategic Management Plan is a comprehensive planning document that guides the development of all aspects of the region, integrating the intervention strategies and implementation programme of these other plans to achieve the objectives of the World Heritage.

PEOPLE'S COMMITTEE OF QUANG BINH PROVINCE



Sustainable Tourism Development Plan 2010 to 2020 Phong Nha - Ke Bang National Park Region



September, 2010

Prepared by
Tourism Resource Consultants (TRC)

Prepared for
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

As part of the Nature Conservation and Sustainable Management of Natural Resources in
the Phong Nha Ke Bang National Park Region Project



ABBREVIATIONS

ADB	Asian Development Bank
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung
CBT	Community Based Tourism
CBfT	Community Benefit Tourism
CPC	Commune Peoples' Committee
CTMB	Community Tourism Management Board
DARD	Department of Agriculture and Rural Development
DED	Deutscher Entwicklungsdienst
DPC	District Peoples' Committee
DPI	Department of Planning and Investment
DCST	Department of Culture, Sports and Tourism
FFI	Flora and Fauna International
FIT	Free Independent Travellers
GDP	Gross Domestic Product
GMS	Greater Mekong Subregion
GTZ	Gesellschaft für Technische Zusammenarbeit
HCMC	Ho Chi Minh City
HRD	Human Resource Development
IUCN	International Union for Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau
LAC	Limits of Acceptable Change
Lao PDR	Lao Peoples' Democratic Republic
MARD	Ministry of Agriculture and Rural Development
MCST	Ministry of Culture, Sports and Tourism
MTCO	Meking Tourism Coordination Office
ODA	Overseas Development Assistance/Agency
PATA	Pacific Asia Travel Association
PNKB	Phong Nha Ke Bang
PNKB NP	Phong Nha Ke Bang National Park
PPC	Provincial Peoples' Committee
SEDP	Socio-Economic Development Plan
STDP	Sustainable Tourism Development Plan
TOR	Terms of Reference
TIPC	Tourism Information and Promotion Centre
TRC	Tourism Resource Consultants
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VFR	Visiting Friends and Relatives
VNAT	Vietnam National Administration of Tourism
WHS	World Heritage Site

TABLE OF CONTENTS

ABBREVIATIONS	II
TABLE OF CONTENTS	III
LIST OF FIGURES AND TABLES	VI
Figures	vi
Tables	vi
INTRODUCTION	7
1. PREAMBLE	7
1.1. Introduction	7
1.2. Mandate and orientation	8
1.3. Planning vision and timeframe	9
1.4. Geographical jurisdiction	10
1.5. Structure	12
2. PLANNING CONTEXT	13
2.1. Legal background	13
2.2. Current planning situation	15
2.3. Planning approach	17
2.4. Planning methodology	18
CHAPTER ONE - ANALYSIS AND ASSESSMENT OF TOURISM SITUATION AND POTENTIALS FOR THE PHONG NHA KE BANG NATIONAL PARK REGION, QUANG BINH AND VIETNAM	19
1. DESCRIPTION OF THE PNKB NATIONAL PARK REGION	19
1.1. The Phong Nha Ke Bang National Park Region	19
1.2. Phong Nha Ke Bang National Park	20
1.3. The Bufferzone	22
1.4. Institutional Framework of the Phong Nha Ke Bang Region	23
2. SITUATIONAL ANALYSIS	25
2.1. Current Tourism Situation in Vietnam	25
2.2. Tourism in Quang Binh and PNKB NP Region	31
2.3. Sustainable Tourism Development Analysis for PNKB NP Region	40
2.4. Strategic Directions for Sustainable Tourism Development for PNKB NP Region	44
CHAPTER TWO - SUSTAINABLE TOURISM DEVELOPMENT PLAN FOR THE PHONG NHA KE BANG NATIONAL PARK REGION 2010 – 2020	45
1. PLANNING VISION, OBJECTIVES AND PRINCIPLES	45
1.1. Planning vision	45
1.2. Sustainable tourism planning objectives	46
1.3. Sustainable tourism planning principles	46
2. FUTURE TOURISM GROWTH AND KEY SUSTAINABLE DEVELOPMENT ASSUMPTIONS FOR THE PNKB NP REGION	48

2.1.	Principles for sustainable tourism growth	48
2.2.	Forecast of visitors to the PNKB NP Region	48
2.3.	Strategies for sustainable tourism growth	50
2.4.	Key strategic tourism growth indicators and targets	50
3.	SPATIAL FUNCTIONAL AND TOURISM ZONING	53
3.1.	Introduction	53
3.2.	Description of Tourism Zones	53
3.3.	Guidelines for spatial functional zones	56
4.	TOURISM DEVELOPMENT AND INVESTMENT PROPOSAL PROCESS	65
4.1.	Tourism Development Investment: Calls for Proposals and Initial Screening	65
4.2.	Sustainable tourism development criteria for the proposal review, approval, implementation and operations process	65
5.	GUIDELINES AND ACTIVITIES FOR INVOLVING COMMUNITIES FOR POVERTY REDUCTION AND LIVELIHOOD IMPROVEMENT, AND ENVIRONMENTAL PROTECTION	67
5.1.	Introduction	67
5.2.	Community Based Tourism (CBT)	67
5.3.	Community Benefit Tourism (CBfT)	69
5.4.	Legislative imperatives and support	73
5.5.	Strategic Planning Framework	74
5.6.	Development activities	75
6.	TOURISM PRODUCT DEVELOPMENT	77
6.1.	Strategic approach and development guidelines	77
6.2.	Orientation of tourism products and tourism routes	78
6.3.	Strategic planning framework	83
6.4.	Development activities	86
7.	TOURISM MARKETING AND PROMOTION	92
7.1.	Strategic approach and guidelines	92
7.2.	Strategic planning framework	93
7.3.	Development activities	94
8.	TOURISM INFORMATION MANAGEMENT AND INTERPRETATION MANAGEMENT	96
8.1.	Introduction	96
8.2.	Strategic approach and development guidelines	96
8.3.	Strategic planning framework	97
8.4.	Development activities	98
9.	TOURISM HUMAN RESOURCE DEVELOPMENT	100
9.1.	Strategic approach and guidelines	100
9.2.	Strategic planning framework	101
9.3.	Development activities	103
10.	TOURISM INFRASTRUCTURE AND INVESTMENT	105
10.1.	Introduction	105

10.2. Strategic approach and guidelines	105
10.3. Current supporting infrastructure development considerations	106
10.4. Strategic planning framework	107
10.5. Development activities	108
CHAPTER THREE - IMPLEMENTATION REQUIREMENTS, SOLUTIONS, MONITORING AND IMPLEMENTATION PLAN	112
1. IMPLEMENTATION REQUIREMENTS	112
1.1. Management	112
1.2. Policies	114
2. IMPLEMENTATION SOLUTIONS	116
2.1. Raising awareness on Tourism	116
2.2. Solutions for tourism development management	117
2.3. Solutions for tourism development policies	118
2.4. Promotion and marketing solutions	120
2.5. Human Resource Development Solutions	120
2.6. Financial solutions	121
3. MONITORING GUIDELINES FOR THE IMPLEMENTATION	122
3.1. Introduction	122
3.2. Baselines, indicators and targets	123
3.3. Monitoring guidelines	125
3.4. STDP monitoring	126
4. IMPLEMENTATION PLAN	128
4.1. Introduction	128
4.2. Short term (up to 2012) priority implementation activities	129
4.3. Medium term (2013 to 2015) implementation objectives	142
4.4. Long term (up to 2020) implementation directives	144
APPENDIX	145
Appendix 1: Description of Visitor Markets and Segments	145
Appendix 2: Current Tourism Related Construction and Investment Projects for Quang Binh Province	150
Appendix 3: Yearly Visitor Market Segment Growth Estimates	152
Appendix 4: Yearly Visitor Number Forecast	153
Appendix 5: Global Sustainable Tourism Criteria	154
Appendix 6: PNKB National Park Region Tourism Site Assessments	157
Appendix 7: List of Tourism Activities by Tourism Site and Target Market	211
Appendix 8: Tourism business operations, Concession Policies and Regulations	216
Appendix 9: Operating Agreement for Community Based Tourism in the Bufferzone	224
Appendix 10: List of Potential Tourism Development Indicators	227
Appendix 11: List of key participants in the planning process	237

LIST OF FIGURES AND TABLES

Figures

Figure 1: Map of administrative borders of the PNKB NP and communes in the Buffer zone	19
Figure 2: Organisational structure of the PNKB NP	21
Figure 3: Institutional framework for the PNKB NP Region	24
Figure 3: International visitor arrivals to Vietnam	25
Figure 5: Tourism flows through Vietnam	29
Figure 6: Map of the GMS Region	30
Figure 7: Seasonality of visitors to PNKB NP region	34
Figure 8: Map of the tourism zones of the Phong Nha - Ke Bang National Park Region	63
Figure 9: Map of the tourism sites of the Phong Nha – Ke Bang National Park Region	64
Figure 10: Map of the detailed tourism routes and sites of the PNKB NP Region	81
Figure 11: Map of the detailed tourism routes and sites of the PNKB National Park Region	82
Figure 12: Tourism concession system	218

Tables

Table 1: Summary of jurisdictional zoning of PNKB NP Region	11
Table 3: Relevant national level laws	13
Table 4: Relevant National and Regional level decisions	13
Table 5: Relevant international level agreements	14
Table 6: Ethnic minorities per commune	22
Table 7: Visitor figures to Quang Binh Province and PNKB NP Region 2002 to 2009	31
Table 9: Key economic figures for tourism in Quang Binh and PNKB NP	33
Table 10: Tourism revenue summary of the PNKB NP Region, 2009	34
Table 11: Tourism employment in the PNKB NP Region	38
Table 12: Strengths and Opportunities for Sustainable Tourism Development in the PNKB NP Region ..	40
Table 13: Constraints and Threats for Sustainable Tourism Development in the PNKB NP Region	41
Table 14: Critical issues and solutions for sustainable tourism development	42
Table 15: Visitor forecast PNKB NP Region, 2009 to 2020	49
Table 16: Strategies for sustainable tourism growth	50
Table 17: Quantitative strategic tourism growth indicators and targets	51
Table 18: Qualitative strategic tourism growth indicators and targets	52
Table 19: Description and management objectives for High Volume Tourism Zone	53
Table 20: Description and management objectives of Nature and Heritage Tourism Zones	54
Table 21: Description and management objectives of Strict Ecotourism Zone	54
Table 23: Description and management objectives of Tourism Infrastructure Investment Zone	55
Table 24: Tourism management objectives and requirements for the Administrative & Service Area	56
Table 25: Tourism management objectives and requirements for the Ecological Restoration Area	57
Table 26: Tourism management objectives and requirements for the Strictly Protected Area	59
Table 27: Tourism management objectives and requirements for the Extension Area	60
Table 28: Tourism management objectives and requirements for the Bufferzone	61
Table 29: Initial Screening Criteria for Tourism Development Investment Proposals	65
Table 31: Strategic planning framework for CBT and CBfT	74
Table 32: Development activities for CBT and CBfT	75
Table 37: Strategic planning framework for tourism product development	83
Table 41: Strategic planning framework for tourism marketing and promotion	93
Table 42: Development activities for tourism marketing and promotion	94
Table 47: Strategic directives for tourism resource development	100
Table 49: Strategic planning framework for tourism human resource development	101
Table 50: Development activities for tourism human resource development	103
Table 51: Strategic directives for tourism infrastructure development	105
Table 52: Development guidelines for tourism infrastructure development	106
Table 60: Baseline items for monitoring activities	123
Table 62: Guidelines on timelines for monitoring	125
Table 72: Business sector/non-governmental investment projects	150
Table 73: Yearly visitor market segment growth estimates	152

INTRODUCTION

1. PREAMBLE

1.1. Introduction

1.1.1. Project Background

The Sustainable Tourism Development Plan (STDP) 2010 – 2020 for the Phong Nha Ke Bang National Park (PNKB NP) Region was prepared as a consultancy assignment for Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) as part of the Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha Ke Bang Region Project. The project is funded by the Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (BMZ).

The project is a joint cooperation between the Provincial Peoples' Committee (PPC) of Quang Binh from the Vietnamese side and GTZ, Kreditanstalt für Wiederaufbau (KfW) and Deutscher Entwicklungsdienst (DED) from the German side. The PPC is the executing agency and the Department of Planning and Investment (DPI) of the PPC acts as project owner and implementing body. GTZ and KfW support the project by means of financial and technical cooperation. A cooperation agreement between the PPC and GTZ was signed on 19th October 2007 and on the 23rd of January 2008 the agreement between the PPC and KfW was signed.

The overall objective of the project is to contribute to the conservation of the Northern Annamite Region¹ and its biodiversity and ecological services in close relation with a sustainable socio-economic development in the Corezone (including Administration and Service Area, Ecological Restoration Area, Strictly Protected Area and Extension Area) and Bufferzone of the National Park. The project seeks to reduce the pressure on the natural resources of the National Park as well as support the reorganising of legal income and alternative livelihood activities of the local population. The Project duration is eight years, six years for the implementation phase and the last two years for the aftercare phase.

The main interventions of the project that relate to tourism development are:

1. The management of the national park (KfW has the lead during planning and implementation)
2. The development of the Bufferzone (GTZ has the lead during the planning and KfW supports the implementation)
3. Tourism development in the PNKB Region (GTZ has the lead during the planning and KfW supports the implementation)

The project will also support to prepare a Master Plan for PNKB NP Region. This will be a comprehensive planning document that guides the development aspects of the region. The Master Plan will integrate the intervention strategies and implementation programme of the STDP.

¹ The Annamite Region is a mountain range of eastern Indochina, which extends approximately 1100 km (700 miles) through Laos, Vietnam, and a small area in northeast Cambodia. It is known in Vietnamese as Dãy Trường Sơn, in Lao as Phou Luang, and in French as the Chaîne Annamitique. The mountain range is also referred to variously as Annamese Range, Annamese Mountains, Annamese Cordillera, Annamite Mountains and Annamite Cordillera.

1.1.2. The need for tourism planning in the PNKB NP Region

The PNKB NP Region is a developing tourism destination in the central part of Vietnam. The Region is located in a unique natural environment, which is recognised on the UNESCO World Heritage List for its geological and scenic values. The PNKB NP received 311,630 visitors in 2009².

Tourism development in the PNKB NP Region, especially in the Bufferzone, is at an early stage. The region does not have a long history of tourism and consequently there are considerable opportunities for tourism development. Current tourism development within the PNKB NP Region is focused on the Phong Nha Township, the Phong Nha Cave (including Tien Son Cave) and the Eight Heroic Volunteers Cave. These sites receive a high volume of visitors, especially during the summer season. Visitors rarely or only occasionally visit other areas of the PNKB NP Region. Accommodation and tourism facilities are only available in the Phong Nha Township or in nearby Dong Hoi. The largest tourism operator in the PNKB NP Region is the PNKB NP which operates the Phong Nha Cave tours. However access to other areas of the National Park and the Bufferzone are limited due to capacity, lack of infrastructure and permit process.

Tourism has been growing fast in Vietnam since 1990 which, combined with the region's World Heritage Site (WHS) status, has led to the PNKB NP Region experiencing significant visitor growth over the past years. Increasingly, tourism developers are approaching the PPC of Quang Binh and the PNKB NP to develop tourism infrastructure in the region. At present there are only a few planning documents³ that refer to the PNKB NP Region. There is no planning document that specifically addresses the region and guides and advises the provincial or local authorities, the National Park or potential tourism development investors.

The PNKB NP Region is at a very crucial stage and any future tourism development in the region needs to be carefully planned so it does not compromise the region's sensitive and unique environment, cultural heritage and PNKB NP's WHS status. There is a need for tourism planning for the PNKB NP Region to ensure the conservation of the natural heritage and to encourage tourism development that benefits the region and its inhabitants. The STDP is very timely and seeks to provide a comprehensive tourism development planning framework that will help guide national, provincial and district government and potential tourism developers and investors in the future.

1.2. Mandate and orientation

The STDP has been prepared as a planning document to guide the management of sustainable tourism development for the PNKB NP region. The STDP intends to be a unifying, clearly laid out and readily implementable plan that will lead to the long-term sustainability of conservation and development in the PNKB NP Region.

The authority and ownership of the STDP is under the PPC of the Quang Binh Province, in particular the Department of Culture, Sports and Tourism. It is expected that the document will be accepted as a statutory document by the PPC and integrated to future tourism planning of the Quang Binh Province.

An additional intention of the STDP is to complement the PNKB NP Region Development Plan (PRDP), which will guide and manage all development aspects of the PNKB NP region. The Master Plan is set to include the management components of the PNKB NP and the Bufferzone. The Master Plan will be prepared in 2010.

² Data based on visitor statistics from the Tourism Administration, Department of Culture, Sport and Tourism of Quang Binh province

³ Master Plan for Tourism Development in Quang Binh Province for the Period 1996 to 2010 (Department of Trade and Tourism of Quang Binh, 1996); Master Tourism Plan for North Central Tourism Zone Up to 2010 and Forward to 2020 (VNAT, 2001); Comprehensive Study on Tourism Development in the Central Region of the Socialist Republic of Vietnam (JICA/VNAT, 2002).

Furthermore, the STDP is set to support the fulfilment of the UNESCO WHS requirements, to have instruments in place for the management of the WHS. The STDP will address the tourism management and planning of the PNKB NP WHS. A separate operational management plan for the PNKB NP which will include relevant parts of the STDP will be developed separately and finally integrated into the Master Plan.

The orientation of the STDP is set by a planning vision focusing on the overall desired development of the PNKB NP region and reflecting the interests of all involved and affected stakeholders. The planning objectives and principles provide specific approaches and guidelines for the management of sustainable tourism development and the implementation of the STDP.

The implementation plan of the STDP was developed through consultation, review and subsequent approval by relevant government departments, development agencies and partners and other relevant stakeholders. The principle execution of the STDP lies with the following agencies:

- PPC of Quang Binh as leading authority and lead agency for the implementation with assistance of the following departments:
 - Department of Culture, Sports and Tourism (DCST)
 - Department of Planning and Investment (DPI)
 - Department of Agriculture and Rural Development (DARD)
 - Department of Natural Resources and Environment (DoNRE)
- PNKB NP as an implementing agency and assistant to the PPC
- District Peoples' Committees (DPC) of Bo Trach, Minh Hoa and Quang Ninh as implementing agencies and assistants to the PPC
- GTZ, KfW, ADB and FFI, as a donor, implementing partner and technical assistant to the PPC

1.3. Planning vision and timeframe

1.3.1. Basis for the principles of sustainable tourism development

The Vietnam Law on Tourism defines sustainable tourism as:

“Sustainable tourism is development of tourism that meets the needs of the present without harming the ability of the future to meet its own tourism needs.”

The principles of sustainable tourism development include:

- Conservation and enhancement of resources. Tourism development must contribute to protection of the environment, conservation and enhancement of natural and cultural resources to ensure the long-term existence and health of these resources.
- Development of quality tourism products and services that reflect the special characteristics of the destination as well as the market demands and expectations of tourists and tourism businesses with interest in supporting sustainable development.
- Supports forms of local socio-economic development that contribute to an equitable distribution of benefits and livelihoods.

1.3.2. STDP planning vision

The planning vision guiding the STDP to 2025 is:

“The PNKB NP region is maintained in a manner that achieves the Conservation of Heritage Values with Improved and More Sustainable Livelihoods in Local Communities with the Support of Sustainable Tourism Development.”

1.3.3. Timeframe

The STDP has become effective with the approval of the PPC of Quang Binh at the end of 2009. It has a 10-year operational period from 2010 to 2020 that is guided in part by a planning vision to 2025. The operational implementation period of the planning document is structured in three planning approaches:



1.4. Geographical jurisdiction

The STDP will cover the complete PNKB NP Region. The PNKB NP Region is understood to comprise an area that includes the entire area of the PNKB NP (Corezone) and the 13 communes in four districts that border the National Park boundaries, generally referred to as the Bufferzone⁴.

Phong Nha Ke Bang National Park

The core zone of PNKB NP has an area of 85,754 hectares (ha) which is divided into three functional areas: a) Strictly Protected Area: 64,894 ha, b) Ecological Restoration Area: 17,449 ha and c) Administrative and Service Area: 3,411 ha⁵. The complete core zone of PNKB NP is recognised as a WHS by UNESCO.

In addition to the above, by issuing Decision No. 1678/QĐ-UBND dated 14 July 2008, the PPC of Quang Binh approved the extension of PNKB NP area. The Extension Area includes 31,070 ha of land in the Thuong Hoa and Hoa Son communes (Minh Hoa District) and is categorised as a special use forest. Table 1 provides a summary of the relevant jurisdictional zoning of the PNKB NP Region.

⁴ See details in Table 1 and 2

⁵ Decision No. 189/2001/QĐ-TTg dated on 12/12/2001

Table 1: Summary of jurisdictional zoning of PNKB NP Region⁶

Land area of Phong Nha – Ke Bang National Park Region		
	PNKB NP Core zone (ha)	Buffer zone (ha)
Strictly Protected Area	64,894	
Ecological Restoration Area	17,449	
Administrative and Service Area	3,411	
Extension Area	31,070	
Special Use Forest Area	8,364.5	
Land without Forest Area	173.6	
Other	367.5	
Total	125,729.6	217,908.44
Total land area of PNKB NP Region	343,638.04 ha	

Bufferzone

The Bufferzone has a total area of 217,908,44 ha and includes 13 adjacent communes with over 64,243 people. The people belong to different ethnic groups such as Kinh, Bru - Van Kieu (including Van Kieu, Khua, Macoong and Tri) and Chut (including Sach, May, Ruc, A Rem and Ma Lieng). Table 2 provides an overview of the relevant Bufferzone communities in 2009.

Table 2: Population of the Bufferzone in 2009⁷

District	Commune	Village	No. of households		Population	
			Core zone	Buffer zone	Core zone	Buffer zone
Bo Trach	Hung Trach	18	2.602		11.071	
	Phuc Trach	12	2.369		10.713	
	Son Trach	10	2.454		10.571	
	Tan Trach	2	0	78	0	444
	Thuong Trach	18	469		2.464	
	Phu Dinh	9	655		2.713	
	Xuan Trach	10	1.249		5.701	
Minh Hoa	Trung Hoa	10	1.037		5.122	
	Dan Hoa	12	669		3.342	
	Trong Hoa	16	641		3.463	
	Hoa Son	5	318		1.547	
	Thuong Hoa	10	654		3.065	
Quang Ninh	Truong Son	22	919		4.027	
			14.036	78	63.799	444
Total		147	14.114		64.243	

⁶ Decion No. 189/2001/QĐ-TTg dated on 12/12/2001, Decision No. 1678/QĐ-UBND dated on 14/7/2008, Decision No. 857/QĐ-UBND dated on 26/4/2007 and statistical data 2009 from District Statistical Department of Bo Trach, Minh Hoa and Quang Ninh

⁷ Source from statistical data 2009 from District Statistical Department of Bo Trach, Minh Hoa and Quang Ninh

1.5. Structure

The STDP is structured in an opening chapter and three main chapters.

- **The opening chapter** is an introduction and background to the planning document to understand the necessity of the planning and the context of how the plan was set up.
- **Chapter One – Analysis and Assessment of Tourism Situation and Potentials of the PNKB NP Region, Quang Binh and Vietnam** is a detailed current analysis of relevant areas for tourism development. This information forms the background of the STDP.
- **Chapter Two – Sustainable Tourism Development Plan for the Phong Nha Ke Bang National Park Region 2010 - 2020** is the main planning component of the document. It includes the planning vision, goals and objectives, the policy and regulatory framework of the STDP along with detailed strategies, guidelines and development activities for the following core areas: tourism development and investment proposal process, tourism business operations, concession policies and regulations, community based tourism, tourism product development, marketing and promotion, Information and interpretation, human resource development, and tourism infrastructure and investment.
- **Chapter Three – Implementation Requirements, Monitoring and Implementation Plan** outlines the requirements for implementing and monitoring the STDP and includes an implementation plan,

An Appendix provides relevant and associated documents that support the interpretation and implementation of the STDP.

2. PLANNING CONTEXT

2.1. Legal background

The STDP is prepared with guidance from relevant national and regional level laws and decisions. The following sections include a list of the relevant legal documents that were considered in the preparation of the STDP.

2.1.1. Relevant national level laws

Table 3: Relevant national level laws

Relevant National Level Laws
➤ Law on Organising People’s Council and People’s committee, dated November 26 th , 2003;
➤ Law on Forest Protection and Development, dated December 3 rd , 2004;
➤ Law on Environmental Protection, dated November 29 th , 2005;
➤ Law on Biodiversity, dated November 13 th , 2008;
➤ Law on Tourism, dated June 14 th , 2005;
➤ Law on Cultural Heritage, dated June 29 th , 2001;
➤ Law on Land, dated November 26 th , 2003;
➤ Law on Investment, dated November 29 th , 2005

2.1.2. Relevant national and regional level government decisions

Table 4: Relevant National and Regional level decisions

Relevant National and Regional Level Decisions
➤ Decree No. 23/2006/NĐ-CP on implementation of the Law on Forest Protection and Development dated on March 3 rd , 2006;
➤ Decree No. 80/2006/NĐ-CP on detailing and guiding the implementation of a number of Articles of the law on environmental protection dated on August 9 th , 2006;
➤ Decree No. 92/2007/NĐ-CP of Government dated on June 1 st , 2007; on detailing the implementation of some articles in the Law on Tourism;
➤ Decree No. 92/2002/NĐ-CP of Government dated on November 11 th , 2002 on detailing the implementation of some articles in the Law on Cultural heritage;
➤ Decree No. 59/2007/NĐ-CP on managing solid waste dated on April 4 th , 2007;
➤ Decree No 181/2004/ND-CP dated October 29 th , 2004 on implementation of the Land Law;
➤ Decree No. 108/2006/NĐ-CP of Government dated on September 22 nd , 2006 on detailing the implementation of some articles in the Law on Investment;

- Decision No. 186/2006/QĐ-TTg on promulgating the Regulations on Forest management dated on August 8th, 2006;
- Decision No. 189/2001/QĐ-TTg of the Prime Minister on upgrading Phuong Nha – Ke Bang Nature Reserve to National Park dated on December 12th, 2001;
- Decision No. 02/2003/QĐ-BTNMT of Ministry of natural resources and environment promulgation the regulation on Environmental protection on the field of tourism dated on July 29th, 2003;
- Decision No. 22/2006/QĐ-BTNMT dated on December 18th, 2006 of the Ministry of Natural resources and environment on applying Vietnamese standards on environment;
- Decision No. 104/2007/QĐ-BNN promulgating regulations on Management of Ecotourism activities in National Parks and Nature Reserves dated pm December 27th, 2007;
- Decision 18/2007/QĐ-UBND of QB PPC on issuing regulations on Management of PNKB NP dated on August 16th, 2007;
- Decree No 34/2000/ND-CP dated on August 8th, 2000 by the Government on Regulations for Border Areas of Socialist, Republic of Vietnam (SRV);
- Decree No. 21/2008/ND-CP dated August 9th, 2008 amending and supplementing a number of articles of the Government’s Decree No. 80/2006/ND-CP, detailing and guiding the implementation of a number of articles of the Law on environment protection
- Circular No. 179/2001/TT-BQP dated on January 1st, 2001 by the Ministry of National Defense on implementation guidelines of Decree No 34/2000/ND-CP dated on 18/8/2000 by the Government on Regulations for Border Areas of Socialist, Republic of Vietnam (SRV);
- Coordination Regulations on management of national territories and border lines in the province of Quang Binh (issued with attached Decision No 59/2006/QĐ-UBND dated on December 25th, 2006 by Quang Binh PPC)

2.1.3. Relevant international level agreements

Table 5: Relevant international level agreements

Relevant International Level Agreements
➤ Operational Guidelines for the Implementation of the World Heritage Convention, UNESCO World Heritage Centre, 2005;
➤ International Convention on Cultural and Natural Heritage Protection dated November 16th 1972

2.1.4. World Heritage Status requirements⁸

The Convention Concerning the Protection of the World Cultural and Natural Heritage, signed in Paris on November 16th, 1972, is an international agreement through which nations join together to conserve a collection of the world’s timeless treasures. The Convention protects hundreds of sites of “outstanding universal value” - including cultural, natural and mixed sites. To be included on the WHS list, a property must meet one or more of the specific cultural or natural criteria, and its value(s) must withstand the test of authenticity and/or integrity. The Convention sets four criteria for natural sites and six for cultural sites as a means of determining values by which a property may be designated a WHS.

⁸ Adapted from Pederson 2002, Managing Tourism at World Heritage Sites: A Practical Manual for World Heritage Site Managers, UNESCO World Heritage Centre.

The World Heritage Convention Article 5 notes that each State Party has to ensure the protection, conservation and presentation of the cultural and natural heritage situated on its territory by taking appropriate legal actions. The Convention urges governments to “adopt a general policy which aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programmes”. Recommendations include taking into account local and national plans, forecasts of population growth or decline, economic factors and traffic projections, as well as taking preventive measures against disasters.

Periodic reports need to be submitted by the State Parties every six years on the state of conservation of World Heritage sites. The World Heritage Centre can assist State Parties in preparing the reports. State Parties are also asked to submit reports and impact studies when large-scale work which may have an effect on the state of conservation is undertaken at the sites. Proactive strategies are being developed for each of the regions for monitoring heritage. The World Heritage Committee has opted for a regional approach to periodic reporting as a means of promoting regional collaboration and strategies. Each regional strategy is to result in a Regional State of the World Heritage Report.

The periodic report should consist of two sections. Section One should cover the State Party’s overall application of the World Heritage Convention, including its efforts to identify properties of cultural and/or natural value; the protection, conservation and presentation of the cultural and natural heritage; international cooperation and fund-raising; and education, information and awareness building. Section Two reports on the state of conservation of the sites. The main objective is to demonstrate whether the World Heritage values for which a property was inscribed on the World Heritage List have been maintained over time. All State Parties are requested to provide updated information on site management, factors affecting the property and monitoring arrangements.

World Heritage sites are placed on the List of World Heritage in Danger when the World Heritage Committee decides that a site is threatened by existing or potential threats, such as degradation from uncontrolled urbanisation or unsustainable exploitation of natural resources. The Committee can be alerted to possible dangers to a World Heritage site, and then decide in consultation with the State Party whether to place it on the List of World Heritage in Danger.

2.2. Current planning situation

2.2.1. Overview

Quang Binh Province’s emergence as a tourism destination is largely attributed to PNKB NP and the UNESCO WHS listing in July 2003. Since 2003, tourism activity has visibly increased and there is mounting pressure to develop more tourism infrastructure and facilities. The absence of a plan or strategy to support sustainable development of tourism is an ongoing concern of the PPC, PNKB NP and the international development agencies.

The relative lack of experience in tourism development and planning is evident in many areas with differing understandings and appreciation amongst tourism stakeholders, including a limited of understanding of the requirements and necessity of sustainable tourism development, and a lack of supporting policies, lack of experience and supporting structure for discussions with stakeholders and collaborative planning. There are also institutional challenges that include jurisdictional boundaries that are not clear and consistent with overlaps and gaps apparent. In the face of this, tourism development pressures continue to build and the sector is expanding without a strategic orientation and with mixed results. There is still time, and a wide stakeholder support’ for more sustainable forms of tourism development to be achieved in the province.

Planning for tourism development and national park management for the most part follows the conventional structure and systems of the government of Vietnam. While this structure

is effective to a point, the development and implementation of an effective STDP requires broader stakeholder collaboration and integrative management approaches and mechanisms.

At the provincial and regional level, tourism is considered primarily as an economic spearhead; a tool for generating investment, revenue, and employment. Industrial development in the traditional sense of factories and manufacturing has been at the heart of Quang Binh's development vision and activities and remains a provincial priority. As a result tourism is still frequently viewed as another industrial option for economic development. In fact the tourism industry is mostly made up of a service sector. While some segments of government also recognise tourism's potential contributions to resource conservation (natural, cultural, heritage) and broader socio-economic potentials such as targeting poverty reduction, these contributions are often missing in relevant policies and plans. A broader understanding and appreciation of the full range of development benefits potentially available through tourism would greatly enhance the development of more sustainable tourism development policies, plans and programmes that also capable of increasing the social economic contributions of this sector.

2.2.2. Relevant provincial level development planning

The Provincial Socio-Economic Development Plan (SEDP) is the main planning document for the province and provides both targets and directives that all sector development plans must support. The SEDP in turn needs to align with the National SEDP that sets out targets and directives for both economic sectors and geographic regions. SEDPs at both the national and provincial level are reviewed and revised every 4 years. The National SEDP was last revised in 2007 and the SEDP for Quang Binh was revised based on this and is in the final review stages.

2.2.3. Tourism development planning

As with all other sector development planning, tourism development planning must follow the directives of the SEDP as well as directives of the National Tourism Development Plan and Strategy. Sectoral planning at the provincial level takes place through line departments representing major sectors or areas requiring specific attention of the government with relevant ministries being charged to develop sectoral management plans and strategies.

At present, three tourism-planning documents refer to the Quang Binh Province and PNKB NP Region:

- Master Plan for Tourism Development in Quang Binh Province for Period 1996-2010 (Department of Trade and Tourism of Quang Binh, 1996)
- Master Tourism Plan for North Central Tourism Zone Up to 2010 and Forward to 2020 (VNAT, 2001)
- Comprehensive Study on Tourism Development in the Central Region of the Socialist Republic of Vietnam (JICA/VNAT, 2002)

Decision No. 38/2006/QD-UBND dated September 1st, 2006 of the PPC of Quang Binh Province describes the Tourism Development Programmes of the Quang Binh Province for the period 2006 to 2010. Decision No.1707/QD-UBND dated July 16th, 2008 of the PPC of Quang Binh approves the preparation of a Provincial Tourism Development Master Plan up to 2020 and vision up to 2025 and includes an outline of the document. Until now however, no Provincial Tourism Development Master Plan has been prepared.

2.2.4. Planning for the PNKB NP

The PNKB NP is under the authority of the PPC of Quang Binh and has a management board that reports directly to the PPC. The PNKB NP Management Board is responsible for the operational management of the National Park with management documents approved by the PPC.

At present there is no current management plan for the PNKB NP. The most recent park management plan is dated 2001, which was before the UNESCO WHS listing. This planning document refers to tourism, but not in much detail and is widely considered to be outdated and no longer relevant.

2.2.5. Tourism investment planning, assessment and approval process

Currently some tourism developments projects are briefly outlined and approved in the Tourism Master Plan. For other tourism development a call for investment is usually made and investors are invited to register and submit proposals. General tourism investment requests from interested investors are submitted to the PPC and screened before being passed on to the DCST and the DPI for review and comment. If found appropriate, investors are provided with feedback for developing a more detailed development proposal. Other relevant agencies are also asked to comment at this time. Once the detailed development plan is submitted by the investor an appraisal meeting is held with relevant departments for review. Once met with approval, the DCST and the DPI endorses the proposal and submits to the PPC for final review and approval.

2.3. Planning approach

Planning and developing the STDP involved a comprehensive, integrated, stakeholder-driven and adaptive planning approach that would meet the standards of international best practices. International bodies including UNESCO and the IUCN were consulted to ensure that the STDP would meet these standards.

The STDP development approach was led by a sustainable development orientation that sought the comprehensive integration of the park environment and the adjacent communities and their socio-economic-environmental dynamics as an integrated system wherein tourism is an active agent of change and integral component of this system. The STDP development process involved the active participation of stakeholders including local communities through workshops, surveys and consultations. This input was not only necessary for ensuring that the STDP will be a relevant and representative document, but also recognising that the implementation of the STDP will rely on strong stakeholder support and engagement. The STDP was designed to be adaptive in the sense that options were presented not as permanent but with the flexibility to be moulded to suit the expressed preferences and needs of the park and communities.

The participatory approach for the STDP was defined as follows:

Relevant stakeholders on all levels were heard and consulted via meetings and workshops as far as possible. The consultancy team endeavoured to invite not only members of the PPC, but also relevant stakeholders and community members to seminars, meetings and workshops. Visions, processes, activities and plans thus shaped and formed are put forward to the PPC for approval and ultimate decisions.

The participatory approach focused on strengthening and building local competence in the planning, development and management of sustainable tourism and associated elements. A Project Task Force was formed and consultants actively engaged with the members of the task force and other relevant local counterparts and provided informal mentoring and

capability building activities as far as possible. Task Force members were invited to join field trips and consultation meetings working alongside consultants. In addition, regular planning meetings were held with the task force.

Through this planning process the STDP was designed to provide tangible outputs that address priority issues and opportunities into a comprehensive implementation strategy that will utilise a collaborative approach to involve other development partners where strategically appropriate.

2.4. Planning methodology

The STDP was prepared between February 2009 and October 2009. The methodology to prepare the STDP included four core planning phases:

Phase 1 – Background Research and Consultation

- Review of existing tourism situation and relevant data and reports
- Formation of a Task Force for the plan preparation
- International Tourism Seminar
- Field visit and start of consultation process

Phase 2 - Analysis, Development and Consultation

- In-depth analysis of the issues and opportunities for tourism development
- Review and analysis in the context of the planning components:
 - Tourism policy, resource and visitor management
 - Tourism information and interpretation
 - Tourism training, capacity building and human resource development
 - Tourism product development
 - Tourism marketing and promotion
- Field visit and start of consultation process

Phase 3 - Preparation and Refining

- Review of analysis and consultations
- Preparation of the planning document
- Circulation of the planning document

Phase 4 - Finalising and Communication

- Review of the planning document
- Finalisation of the planning document
- Presentation of the planning document

CHAPTER ONE

ANALYSIS AND ASSESSMENT OF TOURISM SITUATION AND POTENTIALS FOR THE PHONG NHA KE BANG NATIONAL PARK REGION, QUANG BINH AND VIETNAM

1. DESCRIPTION OF THE PNKB NATIONAL PARK REGION

1.1. The Phong Nha Ke Bang National Park Region

The PNKB NP Region is located in the western part of the Quang Binh Province approximately 500km south of Hanoi in the narrowest portion of Vietnam between Laos and the Tonkin Gulf. It is made up of the PNKB NP area and a Bufferzone that includes 13 communes in the close vicinity of the National Park. The total size of the PNKB NP Region is 343,638 ha.

The main geological feature of the region is the karst landscape including spectacular limestone rock formations and blue rivers. Another very special part of the landscape formation is the extensive underground cave system found in the region including one of the world's largest cave systems and the world's largest cave.

The Annamite mountain range runs through the region, which is one of the world's 200 most important ecological regions, based on outstanding biodiversity and the richness of endemic species. The PNKB NP Region's karst landscape also forms a critical part of the Central Indochinese Limestone Ecoregion stretching from Quang Binh Province in Vietnam to Khammoune Province in Laos. The PNKB NP Region together with Hin Namno in Laos constitute the largest protected area of karst habitat in mainland Southeast Asia. Figure 1 depicts the administrative borders of the PNKB NP and communes in the Buffer zone.

Figure 1: Map of administrative borders of the PNKB NP and communes in the Buffer zone



1.2. Phong Nha Ke Bang National Park

Brief description

The area of today's PNKB NP has been a place of note since the 1920s when the Phong Nha cave was first discovered and visitors started to travel to the area. In 1937, the Bureau of Tourism of French Resident Superior in Hue issued a brochure to introduce tourists to Quang Binh Province and the Phong Nha Cave. During periods of war, the forests and caves around the PNKB NP area in general and the Phong Nha cave in particular were used as military quarters and weapon storages by the Vietnamese Army. PNKB NP and the area surrounding the National Park were also an important transport corridor for goods and for supporting military operations. The Ho Chi Minh Trail travels along the current National Park borders. National Road 20, which was an important access route to Lao PDR during the war, crosses the National Park property.

After the periods of war, local authorities organised and carried out surveys to protect the region around PNKB. In 1986, a strictly protected forest area in PNKB was established with an area of 5,000 ha. More people began visiting the area and in 1990 the first guesthouse was built at Xuan Son Ferry offering the first boat tours to Phong Nha Cave. In 1993, the PNKB Nature Reserve⁹ was established with an area of 41,132 ha and in 2001 the Vietnamese Government issued a Decision to upgrade the PNKB Nature Reserve to the PNKB NP. In 2003 the PNKB NP was officially listed as a UNESCO WHS. An extension¹⁰ to the National Park land was granted in 2008 which included 31,070 ha of land in the area of Thuong Hoa and Hoa Son communes (Minh Hoa District)

At present the PNKB NP comprises a total area of 125,729.6 ha referred to as the core zone area. The National Park land includes a strictly protected area (64,894 ha), ecological restoration zone (17,449 ha), administrative and service area (3,411 ha), an extension area (31,070 ha), special use forest area (8,364.5), land without forest (173.6 ha) and other land area (367.5 ha).¹¹

There are currently two ethnic minority groups with 78 households and 444¹² peoples living in the core zone of the PNKB NP. The Arem people have settled in village No. 39 of Tan Trach commune which is located along the National Road 20 near the Western border of the National Park. The Van Kieu people have settled in Doong village in Tan Trach commune located at the Southern border of the National Park. The Doong village is in the process of being resettled.

Organisation and management¹³

The PNKB NP has a management board with one director and two vice-directors and is organised in three units (Scientific Research and Rescue Centre, Cultural and Eco-tourism Centre, National Park Forest Protection Unit) and two functional office (Administration – Organization and Planning - Finance). Most relevant to tourism development in the PNKB NP is the Cultural and Eco-tourism Centre. Its tasks are regulated under Decision 313/QĐ-VQG dated 19/05/2004 issued by the PNKB NP Director on the regulations of functions and tasks of the Cultural and Eco-Tourism Centre. Figure 2 depicts the organisational structure of the PNKB NP.

The PNKB NP employs a total of 318 state officials and civil servants. The PNKB NP Office has 20 official staff, the National Park Forest Protection Unit has 124 permanent staff for protection and management of natural resources of the PNKB NP, the Cultural and

⁹ Decision 964 QĐ/UB by the People's Committee of Quang Binh Province dated 3 December 1993

¹⁰ Decision No. 1678/QĐ-UBND by the People's Committee of Quang Binh Province dated July 14th, 2008.

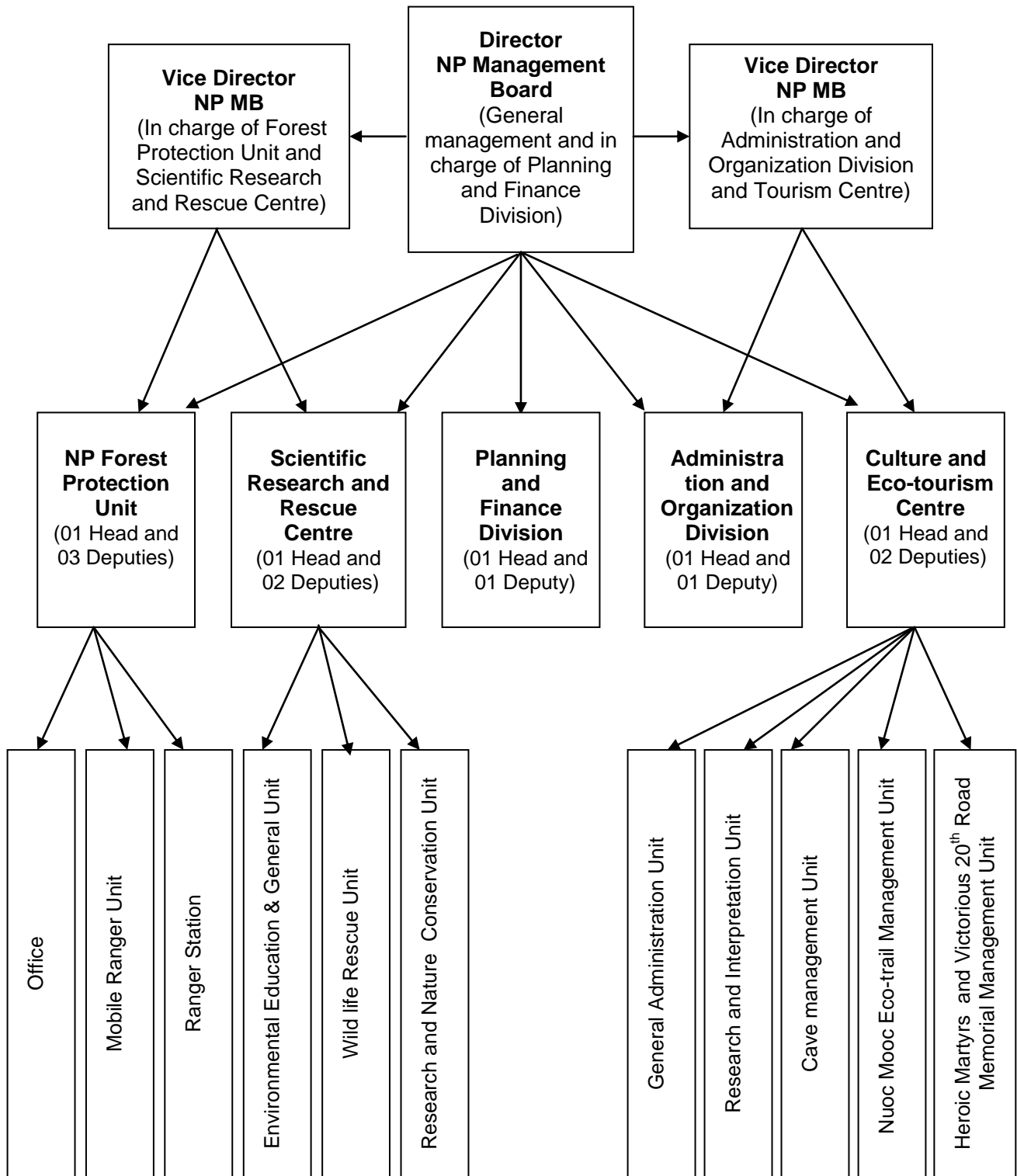
¹¹ Decion No. 189/2001/QĐ-TTg dated on 12/12/2001, Decision No. 1678/QĐ-UBND dated on 14/7/2008, Decision No. 857/QĐ-UBND dated on 26/4/2007 and statistical data 2009 from District Statistical Department of Bo Trach, Minh Hoa and Quang Ninh

¹² Source from statistical data 2009 from District Statistical Department of Bo Trach

¹³ Source from the Management Board of the PNKB National Park

Eco-tourism Centre has 147 permanent staff for sustainable management and development of cultural and ecological values and to promote the heritage values of PNKB NP and the Scientific Research and Rescue Centre has 27 permanent staff for research, conservation of scientific values and rescuing wildlife.

Figure 2: Organisational structure of the PNKB NP¹⁴



¹⁴ Source from the Management Board of the PNKB National Park

1.3. The Bufferzone¹⁵

Brief description

The Bufferzone is the area directly adjacent to the PNKB NP and, together with the National Park, forms the PNKB NP Region. The Bufferzone has a total area of 217,908.44 ha.

At present, the Bufferzone includes 155 villages and hamlets in 13 communes in three districts with 64,243 people or 14,114 households. The ethnic minority people living in the Bufferzone and core zone of the National Park belong mainly to the ethnicities of Bru - Van Kieu (Van Kieu, Khua, Ma Coong and Tri sub-groups) as well as Chut (Ma Lieng, May, Sach, Ruc, and Arem sub-groups). About 22.31 percent of the population of the Bufferzone belongs to ethnic minorities. Table 6 shows the number of ethnic minorities per commune in 2009.

Table 6: Ethnic minorities per commune

District	Commune	No of households	No of people	No of ethnic households	No of ethnic people	Percentage (%) ethnic people
Bo Trach	Hung Trach	2.602	11.071	0	0	0
	Phuc Trach	2.369	10.713	0	0	0
	Son Trach	2.454	10.571	32	146	1,38
	Tan Trach	78	444	74	437	98,42
	Thuong Trach	469	2.464	469	2.464	100,00
	Phu Dinh	655	2.713	0	0	0
	Xuan Trach	1.249	5.701	0	0	0
Minh Hoa	Trung Hoa	1.037	5.122	15	94	1,84
	Dan Hoa	669	3.342	651	3.323	99,43
	Trong Hoa	641	3.463	641	3.463	100,00
	Hoa Son	318	1.547	247	1.107	71,56
	Thuong Hoa	654	3.065	172	757	24,70
Quang Ninh	Truong Son	919	4.027	528	2.542	63,12
Total		14.114	64.243	2.829	14.333	22,31

Land use

The dominant resource and land use throughout the Bufferzone is forest land and forestry. Forest land covers about 95.54% (328,334 ha) of the total PNKB NP Region. Under Decision 857/QĐ - UBND of 20 April 2007 of the PPC of Quang Binh Province this forest land has been allocated to communes, state forest enterprises, management boards of protection forests and the PNKB NP.

¹⁵ Information adapted from the Vietnamese-German Cooperation PNKB Region Project Document, Decision No. 857/QĐ-UBND dated on 26/4/2007 and statistical data 2009 from District Statistical Department of Bo Trach, Minh Hoa and Quang Ninh and the Socio Economic Baseline Study commissioned by the Vietnamese-German Technical Cooperation Project "Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha Ke Bang National Park Region, Quang Binh Province, Vietnam" - November 2008

At present, 36.48% (125,362 ha) of this forest land belongs to the PNKB NP. The forest land in the Buffer zone makes up 59.06 % (202,972 ha) of the PNKB NP region area, in which 31.65 % (108,791 ha) are under the management of state forest enterprises and the Protection Forest Management Boards, and 27.40 % (94,181 ha) are managed by the communes of the Bufferzone.

The total area of agricultural land in the PNKB NP Region is about 7,074 ha, resulting in a significant disadvantage for the local livelihood systems in the Bufferzone. The average agricultural land per household is 0.50 ha, ranging from 0.24 ha in Tan Trach commune to 2.15 ha in Hoa Son commune. Only a fourth (1,255 ha) is irrigated land, explaining the generally low production. Unused land (barren forest land and fallow agricultural land) and other land amount to an estimated 8,230 ha. Except for a few small minority communities practicing shifting cultivation inside the PNKB NP as well as adjacent to its boundaries especially in Thuong Trach, Truong Son and Minh Hoa communes, agricultural land is allocated to households through landuse certificates. The main crops cultivated in the Bufferzone communes are paddy, maize, ground nut, pepper and cassava.

Local livelihood systems

Ethnic minorities in the region used to generate their income mainly from shifting cultivation and forest resources extraction in the hilly areas. However, due to sedentarisation programmes this livelihood strategy has become less important than previously and nowadays only involves about 2,000 households in the PNKB Region. These households typically rely on the forest resources as their primary year-round food source and economic earnings. Wild honey, rattan and *Corypha saribus* are the three most crucial activities that generate cash income. Ethnic minority groups often receive rice subsidies from annual forest protection contracts under Programme 661. In contrast, the Kinh settlers in the lowlands of the region have developed an agricultural base of intensive irrigated rice production combined with livestock, home garden and a small upland component in different variations depending on the availability of irrigable lowland, access to capital and know-how.

Both livelihood systems are under heavy pressure due to high population growth, medium to poor soil fertility as well as very limited availability of agricultural and forest land in general, aggravated through Park establishment and extension. As result there is a significantly high poverty rate in some communes of the Bufferzone, for example in Thuong Trach (96.88%), Dan Hoa (94.93%), Trong Hoa (94.25%), and Tan Trach (91.67%).

1.4. Institutional Framework of the Phong Nha Ke Bang Region

The PPC of Quang Binh has the highest level of authority and responsibility for managing and monitoring activities at the PNKB NP Region. PNKB NP management board is a unit directly under the PPC of Quang Binh. The most relevant Departments in the PPC include the Department of Culture, Sports and Tourism, the Department of Planning and Investment, and the Department of Agriculture and Rural Development.

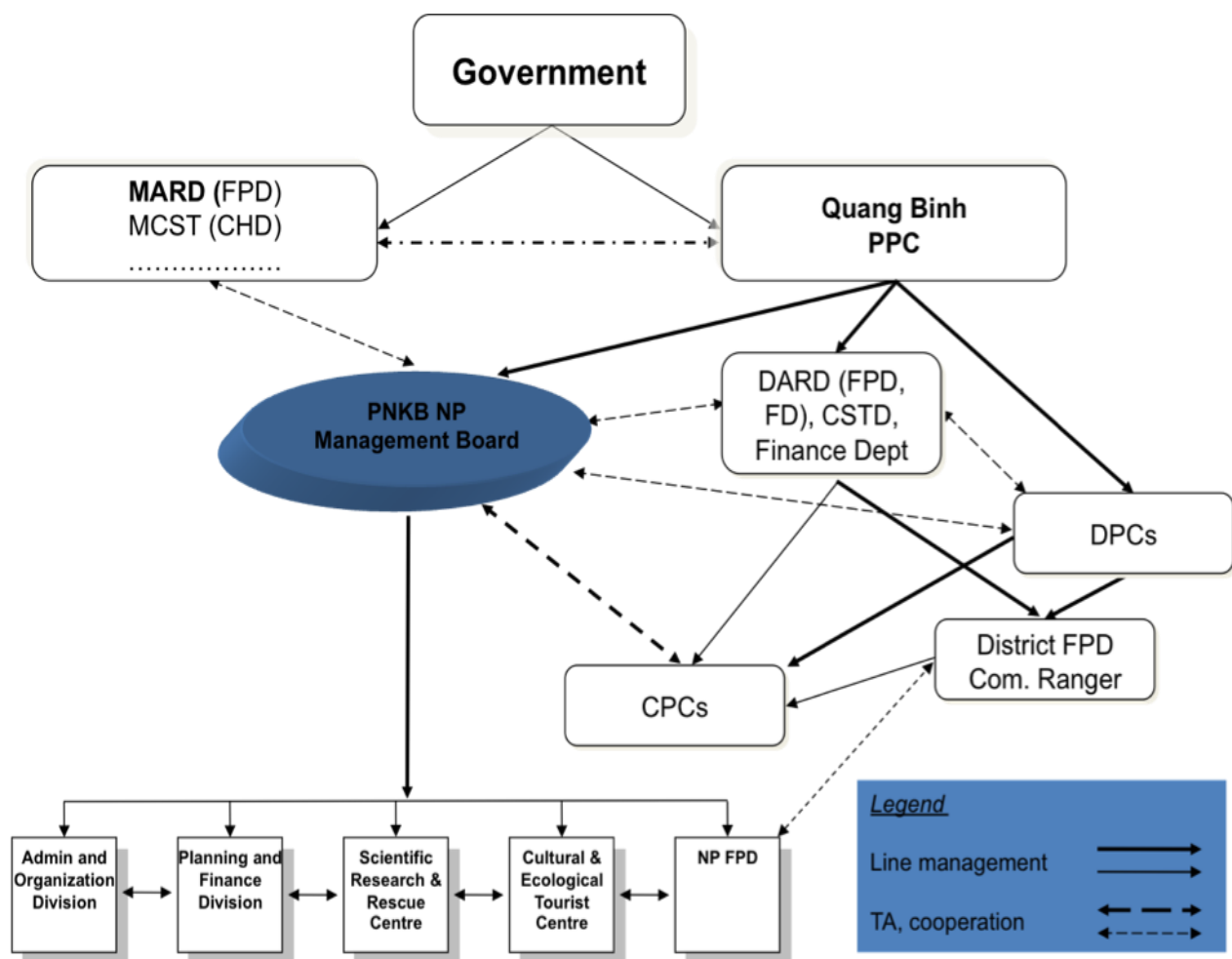
The institutional framework for management and monitoring of the PNKB NP Region is described as follows:

- The Department of Culture, Sports and Tourism has responsibilities for monitoring activities relevant to cultural conservation and development as well as tourism in both the Corezone and Bufferzone.
- The Department of Planning and Investment has the responsibility for directing the investment and implementation of infrastructure plans and activities delivered at the District and Commune levels.

- The Department of Agriculture and Rural Development and the Provincial Forest Protection Department have the responsibility for monitoring activities of forest resource management in both the Corezone and Bufferzone.
- The Department of Natural Resources and Environment has the responsibility for monitoring activities of land, rock, karst, mine and water resource management in the Park.
- The Department of Science and Technology has responsibility for monitoring activities relevant to science and technology in the Park.
- District Forest Protection Departments have responsibilities for monitoring activities of forest management in the Bufferzone.
- District Peoples' Committees (DPC) and Commune Peoples' Committees (CPC) have responsibilities for cooperating and mobilising the local people to participate in forest protection in both of the Corezone and Bufferzone.
- Communities in the Core Zone and Buffer Zone are able to participate in monitoring activities of natural resource management in their areas.

Figure 3 illustrates the institutional framework for the PNKB NP Region.

Figure 3: Institutional framework for the PNKB NP Region¹⁶



¹⁶ Adapted from KFW Project Institutional PNKB NP Review (2008)

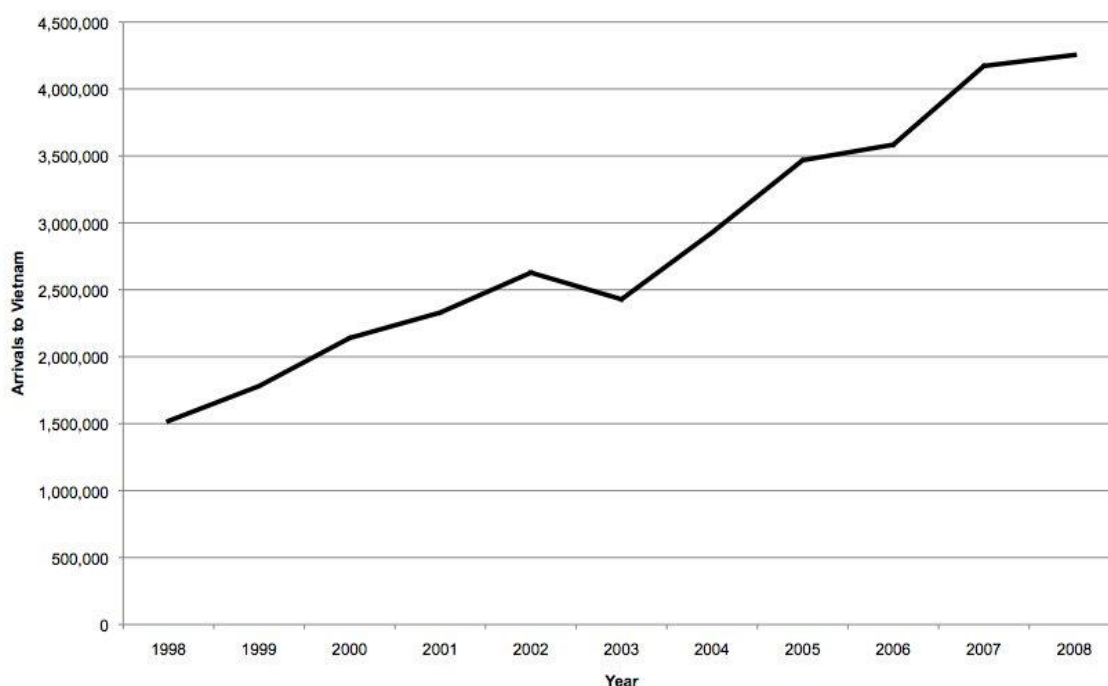
2. SITUATIONAL ANALYSIS

2.1. Current Tourism Situation in Vietnam

2.1.1. Visitor numbers¹⁷

Vietnam has experienced emerging prominence as a global tourism destination with a rapidly expanding and maturing tourism industry. In 1998, there were approximately 1.5 million international visitor arrivals to Vietnam. Since then, arrivals have nearly tripled to 4.2 million in 2008 (refer to Figure 3) and are estimated by VNAT to reach 4.6 million by 2010. Over the last ten years the average annual growth rate of visitor arrivals was approximately 18 percent. However there are indications that this level of growth has declined in recent years. The annual growth rate in the last year (2007 to 2008) was approximately two percent. The financial crisis has also significantly impacted Vietnam's latest international visitor arrivals. International visitor arrivals in 2009 reached approximately 3,772,359 million arrivals, which is almost 10.9 percent lower than those in 2008.

Figure 4: International visitor arrivals to Vietnam



2.1.2. International market analysis¹⁸

In 2009, 2,226,440 international visitors (or approximately 60% of all visitors) travelled to Vietnam for tourism purposes, mainly to explore the country's culture and landscape. Vietnam is becoming increasingly popular with business travellers (about 783,139 visitors – amounts to 99.8% of 2008). Approximately 517,703 international visitors (or 13.7% of all visitors) travel to Vietnam to visit friends and relatives. It can be assumed that a majority of those visitors are 'Viet Kieu' – Vietnamese who usually reside outside of Vietnam. 245,077 (or 6.49% of all visitors) travel to Vietnam for other purposes. Other international visitors increasingly include students who come to study the language, culture and history, via cultural-exchange programmes or inter-school programmes.

The Chinese market (excluding Taiwanese) accounts for the highest number of visitor arrivals to Vietnam, with 527,610 arrivals or approximately 14 percent of the total.

¹⁷ Sourced from VNAT Tourist Statistics 2009

¹⁸ Sourced from VNAT Tourist Statistics 2009

China has had strong economic growth in recent years, leading to an increase in shopping and tourism, with North Vietnam the most preferred destination. However, the Chinese market is often perceived as a low value, high volume market. America is the second largest source market with 403,930 arrivals. Other key source markets include the South Korean (362,115 arrivals), Japan (359,231 arrivals) and other Western countries such as Australia, France, Germany and Canada. More affluent and important source markets from Asia include Taiwan (271,643 arrivals), Malaysia (166,284 arrivals), Thailand (152,633 arrivals) and Singapore (114,404 arrivals).

The average length of stay for international visitors to Vietnam is approximately nine days. Most organised tours travel around the country for 4 to 7 days exploring Vietnam's main tourism sites. North American and European visitors tend to stay longer in the country than their Asian counterparts.

2.1.3. Domestic market analysis

Vietnam has a vibrant and fast growing domestic tourism market. Vietnamese officially have twelve days leave and an additional nine public holidays per year. Taking annual leave for holidays has become increasingly popular and it is estimated that the numbers of Vietnamese taking a holiday has grown from 11% of the population in 1999 to 24% in 2004. Key factors for the growth in domestic tourism are increasing disposable income, the development of a broad middle class and changing patterns of social behaviour.

The majority of domestic trips tend to be short, from one to three days, and the peak times are during the Lunar New Year, public holidays and summer holidays. Beach tourism and travelling to festivals are very popular with Vietnamese.

In 2006, domestic visitors accounted for approximately 18 million overnight visits and future projections indicate 25 million overnight visits by 2010. It is estimated that a domestic traveller spends between US\$30 and US\$80 per trip. The total domestic spend can be approximated at US\$1.4 billion per year. Land travel accounts for the highest proportion of all domestic tourism.

2.1.4. Economics and employment¹⁹

The tourism industry generates substantial economic returns for Vietnam. The tourism industry is expected to contribute directly approximately US\$4 billion or 3.8 percent to the Gross Domestic Product (GDP) in 2009. The contribution to the GDP is expected to grow to nearly US\$8 billion by 2019. Overall the tourism economy in Vietnam is expected to grow by 6.5 percent per year in real terms between 2010 and 2019.

Exports make up a very important share of the tourism industry in Vietnam. Of Vietnam's total exports, the tourism industry generates nearly 12 percent or US\$9 billion. This is expected to grow to over US\$22 billion by 2019.

Capital investment in tourism is estimated at nearly US\$ 3.5 billion or 8.3 percent of the total investments in 2009. This is expected to grow to approximately US\$ 6 billion by 2019. Government tourism operating expenditures are estimated at US\$89 million or 1.4% of the total government spend in 2009.

Indirect employment by the tourism industry is estimated at approximately 4.8 million jobs in 2009. This is about 10.4 percent of the total employment in Vietnam, or 1 in every 9.6 jobs. It is expected that by 2019 over 5.6 million people will be indirectly employed by the tourism industry. Direct tourism industry jobs account for over 1.3 million jobs or three percent of total employment. Forecasts indicate nearly 1.5 million direct jobs in the tourism industry by 2019.

¹⁹ World Travel and Tourism Council 2009, Travel and Tourism Economic Impact Vietnam.

2.1.5. Vietnam's tourism product and tourism zones

Vietnam's tourism product is strongly associated with its unique cultural and natural heritage. The natural landscape of Vietnam is spectacular and often unique and deserving of two Natural UNESCO WHS designations; Halong Bay and PNKB NP. Vietnam has a diversity of special customs represented by 54 different ethnic groups. The largest ethnic group are the Kinh people. The other ethnic groups are regarded as minorities. These special and unique cultural attributes are recognised with three Cultural WHS designations which include the Complex of Hue Monuments, Hoi An Ancient Town and the My Son Sanctuary. Additionally, two Cultural World Heritage designations have been awarded to the ancient Royal Court Music/Dance of the Hue Dynasties and the Gong Music/Dance of the ethnic minority groups of the Central Highlands. Vietnam's Tourism Development Strategy to 2010 divides the country into three Tourism Development Zones that are to feature relevant forms of tourism products:

Northern Tourism Zone

The Northern Tourism Zone encompasses 29 provinces from Ha Giang bordering China in the north, to Ha Tinh in the south, and from highland Lai Chau in the west to the coastal tourism hub of Halong in the east. Central to the zone is the national capital of Hanoi and the densely populated Red River Delta. The Northern Tourism Zone is divided into five micro-zones: Northeast, Northwest, North East Coast, South Northern and Central. Tourism in this zone focuses on urban and nature tourism, and associated ethnic cultural tourism and ecotourism, with some beach resorts. Beach tourism is comparatively constrained by a distinct winter season.

Within the Northern Zone are three key tourism development areas: (i) Hanoi and its surroundings, (ii) Halong Bay and the adjacent coastal region and (iii) the western mountain area of Sapa. Hanoi with a population of 5 million (after expansion in 2008), has ancient roots and is one of the most attractive cities in Asia. Close by are a number of protected areas like Cuc Phuong National Park, Cat Ba National Park, Bai Tu Long National Park that offer potential for developing mountain resorts and ecotourism potential. These upland areas are attractive to both international and domestic tourists, especially in the hot summer months. Centred on Halong Bay, a UNESCO World Heritage Site, is situated an important coastal and island development area. The natural and living ethnic cultural attractions of Sapa and its environs have recently experienced rapid growth in tourism. Yet, this area may still be considered to be at an initial stage of development.

North Central Zone

From Quang Binh in the north to Quang Ngai in the south, this comparatively narrow zone is comprised of six provinces, each stretching from mountain landscapes in the west to coastal seascapes to the east. There are two micro-zones: North and South. Tourism potential is high, but generally to date is underdeveloped and concentrated in the south sub-zone. Culture and nature tourism offer the greatest potential, with urban, ecotourism and beach/marine tourism potentially significant. The latter is somewhat constrained in the winter months, but less so than in the North Zone.

The key tourism development areas and centres in this zone are concentrated in or near the secondary cities of Hue and Da Nang. This mid-coast cluster has a rich combination of natural and cultural attributes, including the natural UNESCO WHS PNKB NP and three of the nation's five historical UNESCO WHS: Hue Imperial City complex, My Son Cham architectural complex, and the coastal trading town of Hoi An. Its upland and marine protected areas like Bach Ma National Park and Cu Lao Cham world biosphere reserve are promising for both nature and its most fragile component, ecotourism. Many beautiful beaches along the coast from Quang Binh to Quang Nam like Nhat Le (Quang Binh), Cua Viet (Quang Tri), Lang Co (TT-Hue), Non Nuoc (Da Nang), Cua Dai (Quang Nam), My Son (Quang Nam) offer high quality beach resorts.

South Central and Southern Zone

The South Central and Southern Zone comprise 26 provinces from Binh Dinh and Kon Tum in the north to Kien Giang and Ca Mau in the far south of the country, this large zone probably encompasses the widest variety of ecological systems among the three national tourism zones. The zone consists of two sub-zones (separated by the boundaries of Binh Phuoc/Dong Nai and Lam Dong/Binh Thuan provinces) further divided in four micro-zones: South Central/Coastal, Central Highland, East Southern and West Southern.

The South Central and Southern Zone with its superior infrastructure and other tourism support systems has recently experienced the most rapid and considerable growth of tourism among the three zones, so that tourism is becoming a key economic activity. The completion of the Trans-Asia Highway should be a further incentive to this sector. HCMC is the focal point in the southern sub-zone for tourism development. The seaside town of Nha Trang is the heart of the South-Central sub zone with its focus on beach/marine activities. The zone is rich in beach/marine attributes, as well as mountain environments and associated ethnic cultural diversity.

HCMC, in addition to offering its own comparatively well developed shopping, entertainment and cultural attractions, is the hub for tourism activities in the Mekong River Delta and on the river itself, which extends to the coast and up river into Cambodia. The other two key development areas centre on Da Lat and Nha Trang. The premier mountain resort and ecotourism potential development area of the zone is centred on the resort town of Da Lat and several nearby lakes. However, the significant protected areas of this upland region present additional potential. To the west the long coast has considerable potential for beach/marine tourism. To date, this is centred on three settlements: Nha Trang, Phan Thiet, and further south Vung Tau. There are also rural tourism and ecotourism potential to be carefully formulated, based on rich delta and coastal resources.

2.1.6. Tourism flows

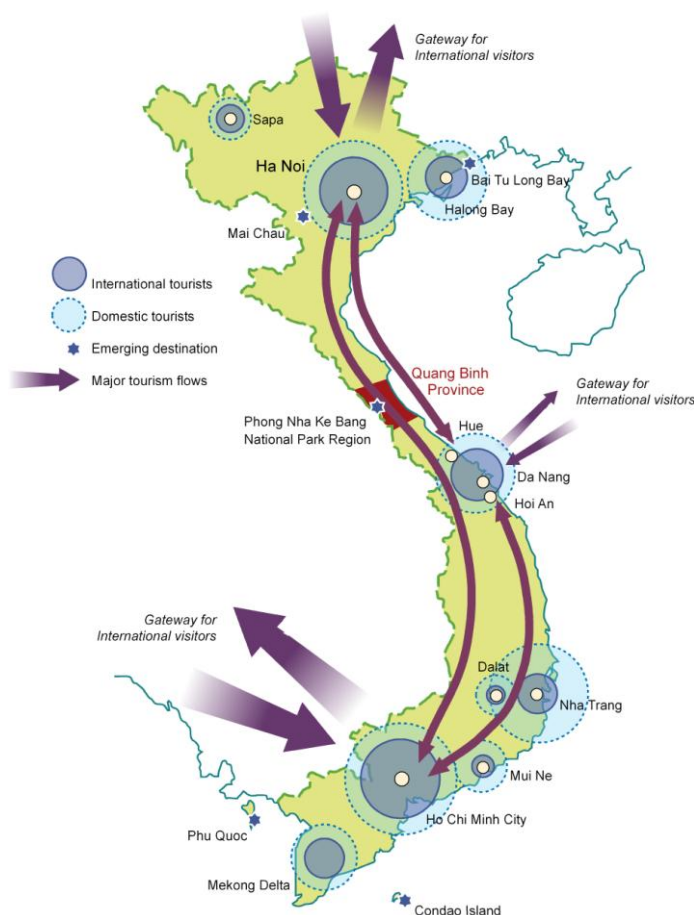
Vietnam's visitor flows are well established and somewhat predictable, particularly for international visitors. It is estimated that approximately 45 percent of international visitors arrive in the South with HCMC as the main gateway and about 40 percent are through the North with Hanoi as the gateway. Only about 15% of visitor arrivals are through the central part of Vietnam.

Figure 5 illustrates the major tourism flows²⁰ through Vietnam. The key international tourism flows within Vietnam are between the two major cities – Hanoi is the hub for access to destinations such as Sapa or Halong Bay, while HCMC is used as the hub in the south for destinations like Nha Trang and the Mekong Delta. There is no clearly defined directional tourism flow between HCMC and Hanoi.

Domestic tourism flows are mainly regional but often originate from the two major urban centres – Hanoi and HCMC. Along the major tourism flows there are a number of tourism and travel routes. Air connections between the major cities of Hanoi, Danang and HCMC are very good. Increasingly key provincial cities are connected to the air routes. For example, Dong Hoi has regular flights to Hanoi and HCMC. This makes provincial parts of Vietnam increasingly accessible and will likely change some of the tourism flows between the major centres.

²⁰ Tourism flows are indicative only and based on estimates.

Figure 5: Tourism flows through Vietnam



Nevertheless the majority of visitors travel through Vietnam by train or by road. Vietnam's railway system connects the major centres including the provincial areas on the direct route. The overall system of roads is still relatively poor, but the major highway systems also connect key provincial cities and the major centres. National Highway 1 connects the country from North to South along the coastal route. In addition, the HCM Highway runs through rural areas inland.

The Quang Binh Province and PNKB NP region are strategically well connected to the major tourism flows in Vietnam, especially for visitors travelling from Hue to Hanoi or vice versa. With better access and awareness, the Quang Binh Province and PNKB NP region should be increasingly integrated in the current major visitor flows.

2.1.7. Relevance of the Greater Mekong Subregion²¹

Vietnam is part of the Greater Mekong Subregion (GMS), which includes Thailand, Myanmar, Lao PDR, Cambodia and China. Further, Vietnam shares land borders with Lao PDR, Cambodia, and China that are the source of increasing economic development and tourism flows. Tourism in the GMS is significant. In 1998, the GMS region received approximately 12 million visitors including cross border visits. In 2008 visitor numbers have already grown to over 25 million visitors and cross border visits. By 2015, it is expected that between 46 and 52 million people will visit the GMS.

The tourism sector is included as one of the flagship programmes of the ADB's GMS Economic Cooperation Program. This is in recognition of the important contribution that the tourism sector makes towards the socioeconomic development and conservation of natural and cultural heritage resources. In 2005, the GMS Tourism Sector Strategy was prepared for guiding sustainable tourism development in the region from 2006 to 2015.

The GMS Tourism Sector Strategy is implemented through projects and programmes coordinated by the Mekong Tourism Coordination Office. The projects and programmes range from infrastructure projects to human resource development programmes.

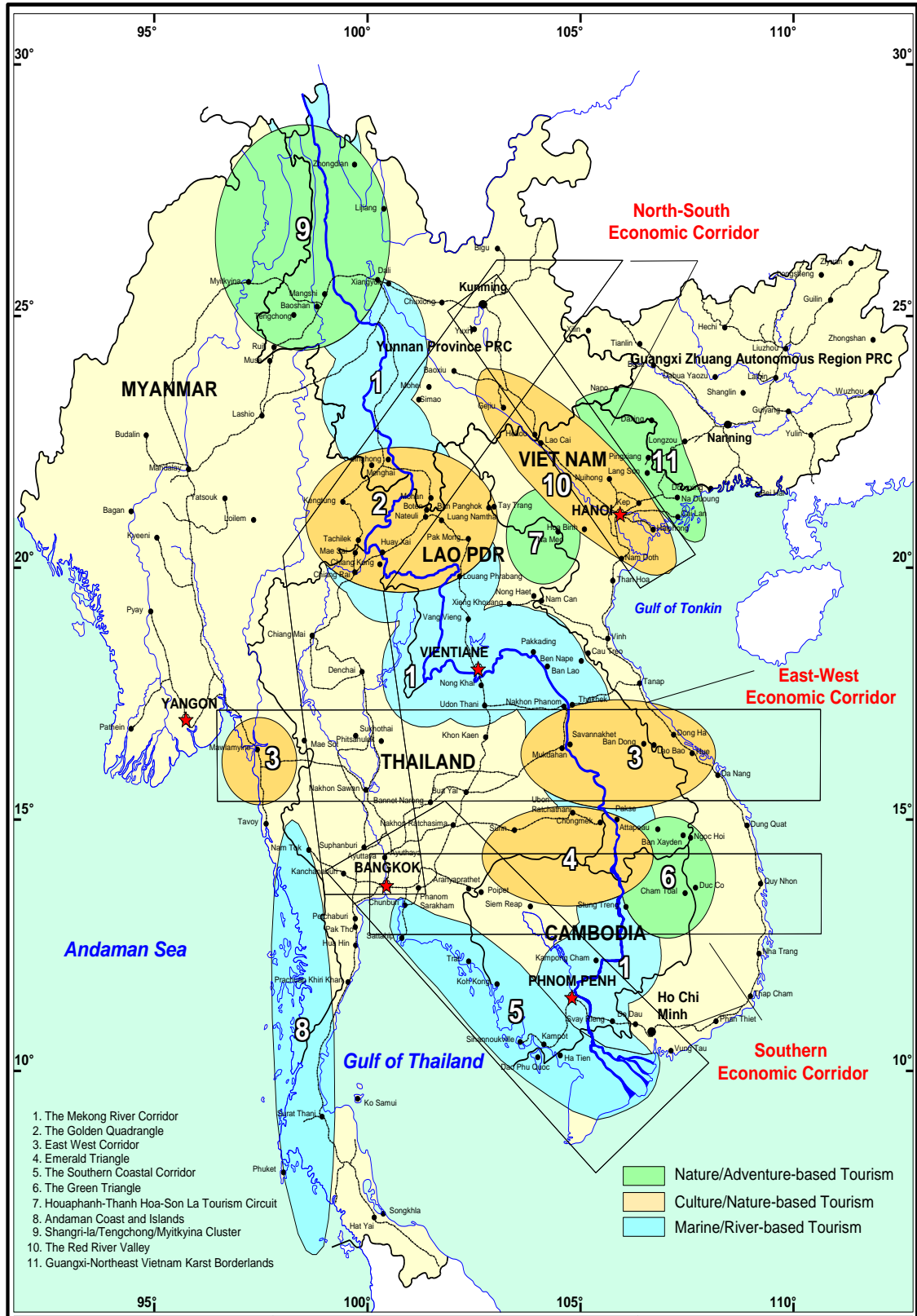
The GMS Tourism Sector Strategy tourism planning approach identifies 13 tourism priority areas. Figure 5 illustrates the tourism priority area (Heritage Necklace Circuit and Coastal and River Cruise Lines are not shown on the map).

²¹ Key data and map from the GMS Tourism Sector Strategy, PATA and MTCO.

Quang Binh Province and the PNKB NP Region are located in the East West Tourism Economic Corridor. This is a very significant economic development corridor of the GMS as it connects four countries – Myanmar Thailand, Lao PDR and Vietnam.

The PNKB NP region also includes a border gate (Cha Lo) therefore providing direct access to tourism flows from Lao PDR and the opportunity for cross border trade via the East West Tourism Economic Corridor.

Figure 6: Map of the GMS Region



2.2. Tourism in Quang Binh and PNKB NP Region

2.2.1. Visitor numbers for Quang Binh Province and PNKB NP region²²

Quang Binh Province

Over the past decade, visitor numbers to Quang Binh Province have grown significantly from approximately 135,000 in 1999 to nearly 740,000 in 2009. In recent years the growth in visitor numbers has been steady but there was about a 12% decline from the year 2007 to 2008. Domestic visitors make up the majority of visitors to Quang Binh Province and only approximately 2.37% are of international origin in 2009.

PNKB NP Region

The noticeable growth in visitors to the Quang Binh Province over recent years can be attributed largely to the UNESCO WHS listing of PNKB NP. Visitation to the PNKB NP Region has increased considerably in the past ten years from approximately 80,582 in 1999 to over 311,630 in 2009. Visitor numbers peaked in 2004, the year after the nomination as a WHS, with approximately 331,679 visitors,

It is estimated that about half of the visitors to the Quang Binh Province visit the PNKB NP Region. Again, the vast majority of visitors to the PNKB NP Region are of domestic origin. In 2009, there were approximately 300,015 domestic visitors and 11,615 international visitors. It should be noted that international visitors have grown nearly nine-fold from approximately 1,291 in 2003.

Table 7 includes a summary of the visitor figures for Quang Binh Province and the PNKB NP Region for 2002 to 2009.

Table 7: Visitor figures to Quang Binh Province and PNKB NP Region 2002 to 2009

Year	2002	2003	2004	2005	2006	2007	2008	2009
Total visitors to Quang Binh	319.437	399.799	615.215	510.194	551.894	593.062	527.959	737.341
International	5.377	4.941	6.573	12.228	16.448	23.574	20.144	17.461
Domestic	314.060	394.858	608.642	497.966	535.446	569.488	507.815	719.880
Visitors to PNKB NP Region	159.139	197.518	331.679	255.923	257.646	240.493	262.265	311.630
Proportion of Total visitors to Q. Binh	49,8%	49,4%	53,9%	50,2%	46,7%	40,6%	49,7%	42,3%
International	1.427	1.291	2.241	4.266	7.158	11.795	11.346	11.615
Proportion of international visitors to Q. Binh	26,5%	26,1%	34,1%	34,9%	43,5%	50%	56,3%	66,5%
Domestic	157.712	196.227	329.438	251.657	250.488	228.698	250.919	300.015
Proportion of domestic visitors to Quang Binh	50,2%	49,7%	54,1%	50,5%	46,8%	40,2%	49,4%	41,7%

²² Sourced from statistical data provided by the Tourism Administration of Quang Binh DCST and the Tourism Center of PNKB NP

2.2.2. Visitor Markets and Segments

At present there is no accurate information or research on market segments for the Quang Binh Province or for the PNKB NP Region. Visitor numbers for the key visitor markets (international and domestic) are based on the ticket sales of the PNKB NP for the boat tour to the Phong Nha Cave. It is assumed that a visitor to the region will most likely visit the Phong Nha Cave and that this therefore generally reflects visitor numbers to PNKB NP Region.

Based on available information, it is estimated that approximately 96 percent of the visitors to the PNKB NP Region are of domestic origin. Only approximately four percent are international visitors.

Indicative visitor profiles were established through observations during field visits, stakeholders interviews, a rapid market survey of tour operators and expert opinions. Appendix 1 provides detailed descriptions of the visitor segments for each of the visitor markets. Table 8 contains a summary breakdown of estimated visitor numbers and proportions for the visitor market segments based on the statistical data in 2009.

Table 8: Summary of Estimated Visitor Numbers and Proportions for Market Segments

Visitor Market	Visitor Segment	Estimated Number of Visitors	Estimated Proportions of Visitor Segments (%)	Estimated Proportions of Markets (%)
International	Free Independent Travellers	4,995	43.0%	
	Backpacker Travellers	1,858	16.0%	
	Group Tour Travellers (Western)	2,149	18.5%	
	Group Tour Travellers (Regional)	1,045	9.0%	
	Expatriate Travellers	406	3.5%	
	Regional Caravanning Travellers	348	3.0%	
	Other Travellers	814	7.0%	
Total International		11,615	100.0%	3.7%
Domestic	Group Tour Leisure/Holiday Travellers	223,512	74.5%	
	Independent Leisure/Holiday Travellers	69,003	23.0%	
	Education/Science Travellers	3,000	1.0%	
	Visiting Friends and Relatives	3,000	1.0%	
	Business/Government Travellers	1,500	0.5%	
	Total Domestic		300,015	100.0%	96.3%
Total Visitors		311,630		100%

For the international market, free independent travellers (FITs) are the primary visitor segment. Backpackers, Western group tour travellers and regional group tour travellers are regarded as secondary visitor segments. Growing niche market segments are expatriate travellers, regional caravanning travellers and other travellers.

For the domestic market, group tour leisure/holiday travellers are the primary market segment. Independent leisure/holiday travellers are a secondary visitor segment. Education/science travellers, visiting friends and relatives (VFRs) and business/government travellers are regarded as niche markets.

2.2.3. Tourism Economics²³

Tourism is a vital and growing economic industry in Quang Binh Province. Since 2003, total tourism income has more than doubled from nearly VND 120 billion (approximately US\$7.69 million) to VND 288 billion (approximately US\$ 21.79 million). It is estimated that every visitor spent about VND 517,000 per visit to Quang Binh.

Generally, there are no comprehensive or reliable figures for the tourism economy of the PNKB NP region. Figures from the PNKB NP note that the National Park had a total tourism income of nearly VND 12.24 billion (approximately US\$5 699,428), more than double the income of 2003. This indicates that the PNKB NP earned approximately VND 39,300 revenue per visitor to the National Park. There are no details on the direct economic impact of tourism on the local community. Rough estimates for the boat owners indicate a tourism revenue of approximately VND 6.23 billion (10 people per boatload, VND 200,000 per boat load).

Other tourism revenues are created by the hotel sector, restaurant sector and the selling of souvenirs. It is estimated that there are approximately 24,836 overnight visits or 16,557 room nights (based on 1.5 people per room night) in the region. At an average room rate of VND 150,000 per night, the hotel sector generates VND 2.48 billion. A rough estimate of about VND 30,000 per person for meals at restaurants and souvenirs equates to generating a revenue of VND 9.36 billion.

In total, it is estimated that the tourism generates at a minimum a revenue of 30.31 billion or just approximately US\$ 1,732,000 for the region. This corresponds to approximately VND 97,300 (US\$ 5.56) per person. It should be noted that this is a conservative estimate and that the actual tourism revenue for the region is likely higher. Table 9 describes the key economic figures for tourism in Quang Binh and PNKB NP. Table 10 provides a revenue summary for the PNKB NP Region for 2009.

Table 9: Key economic figures for tourism in Quang Binh and PNKB NP

Item	2003	2004	2005	2006	2007	2008	2009
Total Tourism Revenue Quang Binh (VND billion)	119.90	196.90	163.30	230.00	283.43	288.43	381.35
Total Tourism Revenue Quang Binh (US\$ million)	7.69	12.54	10.34	14.38	17.71	16.97	21.79
Revenue per visitor to Quang Binh (VND)	299,900	320,000	320,000	416,700	477,900	546,300	517,200
Total Tourism Revenue from PNKB NP entrance tickets (VND billion)	4.85	8.53	7.21	9.86	9.41	10.46	12.24
Total Tourism Revenue from PNKB NP entrance tickets (US\$)	310,897	543,312	456,329	616,240	588,750	615,294	699,428
Revenue per visitor to PNKB NP (VND)	24,600	25,700	28,200	38,300	39,200	39,900	39,300
<i>Note: Estimated exchange rate 1 USD</i>	15.600	15.700	15.800	16.000	16.000	17.000	17.500

²³ Key economic figures are estimates and should be seen as indicative only. At present there is no robust model to provide more accurate figures. Economic figures for the Quang Binh Province were provided by the DCST and tourism revenue figures for the PNKB NP were provided by the PNKB NP.

Table 10: Tourism revenue summary of the PNKB NP Region, 2009

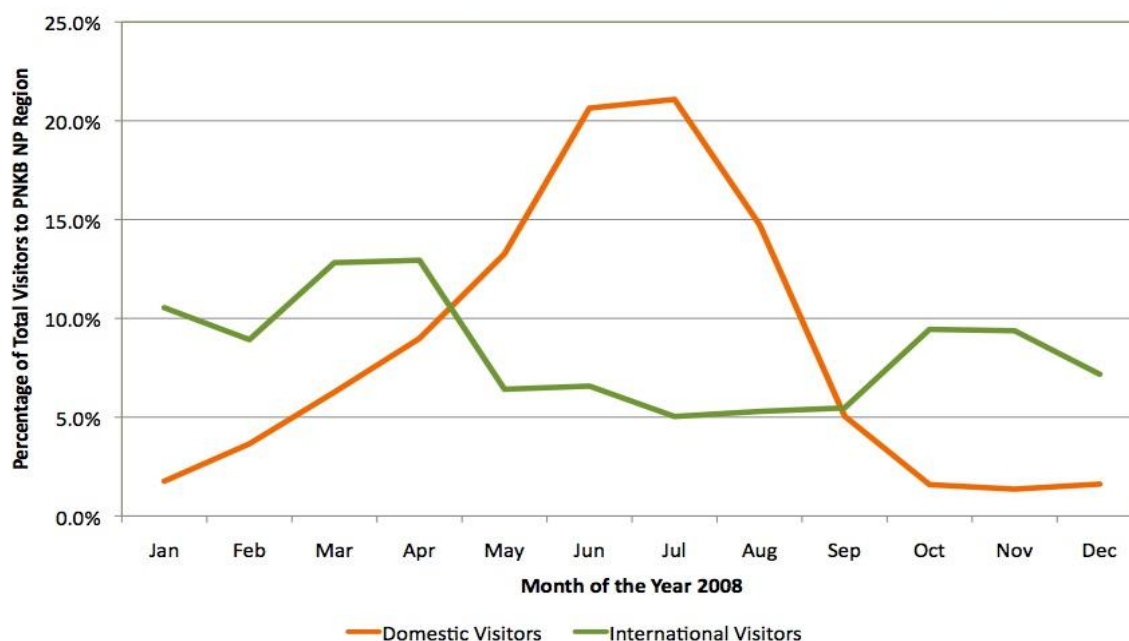
Revenue Sources	2009 (VND billion)	2009 (US\$)
Total Tourism Revenue from PNKB NP entrance tickets	12,24	699.428
Revenue through boat/rivercruising to Phong Nha Caves	6,23	356.000
Revenue from the hotel sector	2,48	141.714
Revenue from the restaurant sector and selling of souvenirs	9,36	534.857
Total estimated tourism revenue for the PNKB NP Region	30,31	1.732.000
Total per person estimated tourism revenue for the PNKB NP Region	97.300	5,56

2.2.4. Visitor seasonality of the PNKB NP region²⁴

Tourism to the PNKB NP region has a seasonal pattern. Approximately 75 percent of visitors travel to the PNKB NP region between April and August. The visitor volume of the domestic market dominates the tourism season. For Vietnamese, the main summer holiday time is between June and August. Other key holidays include TET (although not relevant for PNKB NP region in terms of visitation as Vietnamese generally visit family during TET), Liberation Day (30th April), Labour Day (1st May) and Independence Day (2nd September). Recently the Lunar New Year’s holiday has also become important. It should also be noted that the fall season (September to November) is very rainy and often impacted by Typhoons. Most domestic visitors avoid travelling to the central regions during this time of the year.

Interestingly, the main season of the international market is opposite to the domestic market. International visitors tend to travel to PNKB NP region from October to April. This corresponds with the general international visitor seasonality, especially to the Western group tour market. Overall however, the seasonality of international visitors to PNKB NP region is not considerably high and a low but steady volume of international visitors travel to the PNKB NP region year-round. Figure 7 illustrates the seasonality of visitors to the PNKB NP region.

Figure 7: Seasonality of visitors to PNKB NP region



²⁴ Seasonal patterns were based on PNKB NP tickets sales figures to the Phong Nha Cave.

2.2.5. Length of stay

Quang Binh Province is slowly achieving the status of a holiday destination where visitors spend their entire holiday. However, the majority of visitors to the Quang Binh province are touring travellers using the province as a stopping point as part of their travelling itinerary. Some travellers stop out of convenience (to break up the travel between Hanoi and Hue), others stop to specifically visit the PNKB NP. Only a few visitors come to Quang Binh for an extended beach holiday.

Statistics indicate an average stay of approximately 1.2 days for Quang Binh province. However, the reality might be somewhat lower. Many tourists through the province mainly use it as a travel through destination rather than a stopping destination.

The average length of stay in the PNKB NP region might be as low as less than 0.1 day – meaning that less than one in ten visitors stays for one night in the region. The vast majority of visitors travel to the PNKB NP region for a half-day visit or a full day visit, with most of them overnighing in Dong Hoi.

The main reasons for the relatively short length of stay are:

- ▶ Lack of accommodation with reasonable standards and capacity, and
- ▶ Lack of activities to engage visitors for a longer stay.

2.2.6. Tourism Flows in the Quang Binh Province and PNKB NP region

The majority of visitors come to the Quang Binh Province via the national highway system and via rail. National Highway 1 travels through Dong Hoi and the HCM Highway travels alongside the PNKB NP and through the PNKB NP region. The majority of people enter/exit the province on National Highway 1, only very few visitors use the HCM highway to enter or exit the province. Furthermore only approximately 1,600 international visitors crossed the border at the Cha Lo border gate in 2009. Dong Hoi is a regular stop on the Reunification Express Train Route operating between Hanoi and HCMC. There are at least ten trains each day on the route between North and South.

Based on interviews with tour operators in Vietnam, it is assumed that more visitors travel from South to North (Hanoi to Hue) through the province. International visitors seem to take both buses/coaches and the train equally, while more domestic travellers tend to travel through the Quang Binh Province by bus/coach. Most domestic package tours through or to Quang Binh use buses/coaches for their travels.

In the past few years Dong Hoi Airport has been significantly upgraded for larger capacity jet aircraft (up to A320/A321 or similar type). The airport is designed for a capacity of 300 passengers per hour or 500,000 per year. At present Vietnam Airlines operates either an ATR 72 (65 seat capacity) or a Fokker 70 (79 seat capacity) three times a week between Hanoi and Dong Hoi, and HCMC and Dong Hoi. In total, the six flights per week would have throughput capacity of 474 passengers (based on a Fokker 70) per week or 24,648 passengers per year in and out of Dong Hoi.

The tourism flows within Quang Binh are very predictable. While there are some other tourism attractions in the province, PNKB NP is by far the most popular. Hence tourism flows mainly travel from Dong Hoi to Phong Nha township and return. The Phong Nha Cave tends to be the first attraction that visitors visit in the PNKB NP region. In the PNKB NP region, the tourism flows tend to travel from the Phong Nha township to the Eight Volunteer Cave. There are no reliable statistics, but it is estimated that possibly a third of the tourism flows go around the administration area (with a possible stop at the Nuoc Mocc Eco-Trail) through the Chay Lap community towards National Highway 15, and then return to Dong Hoi.

2.2.7. Tourism management, marketing and promotions

Tourism management

The overall tourism management of the Quang Binh Province and the PNKB NP region is the responsibility of the PPC's Department of Culture, Sports and Tourism. The Cultural and EcoTourism Centre of the PNKB NP is responsible for overseeing the tourism management in the PNKB NP in coordination with the PPC. The management of tourism in the Bufferzone is coordinated through the Peoples' Committees in the relevant Districts and Communes in coordination with the PPC.

The relationships between the key tourism stakeholders, the PPC (Department of Culture, Sports and Tourism), PNKB NP, Bufferzone communes and business sector operators, are still rather weak, and at present there is no mechanism to support a structured or integrated planning for tourism and management. However, a tourism association for Quang Binh has been recently initiated and could strengthen the relationships between the stakeholders.

The Son Trach Commune, which is the main centre of the PNKB NP Region in terms of tourism, has a tourism management board. The management board was formed to strengthen the awareness and knowledge about tourism and to promote tourism in the commune. However the board's current involvement in tourism is rather weak and no recent activities have been recorded.

Tourism Marketing and Promotions

The tourism marketing and promotions for the Quang Binh Province is the responsibility of the PPC's Department of Culture, Sports and Tourism. However the current marketing and promotional outputs are very low, mainly due to funding and capacity constraints.

Recently the Tourism Information and Promotion Centre (TIPC) was established (Decesion No. 2316/ QD-UBND dated on August 31st 2009) which will be responsible for the tourism marketing and promotion of the Qunag Binh Province including the PNKB NP Region. However support for the TIPC has not been fully clarified yet.

The PNKB NP has some marketing collateral including site-specific brochures that were developed as part of the GTZ project. The larger hotels in Dong Hoi seem to be the most active in promoting the PNKB WHS as part of their resort packages. However there is no coherent and consistent marketing and promotion of the region.

As a result the current marketing and promotional profile of the PNKB NP Region is relatively low. Generally, tour operators and travel agencies sell and organise trips, accommodation, packages and tours to PNKB NP Region based on information collected without any official support from either the province or the national department of tourism.

Tour operators' and travel agents' knowledge about the PNKB NP Region and tourism activities is low and insufficient to actively promote and sell to their customers. Most tour operators and travel agencies do not have brochures or promotional material available about the PNKB NP Region. The general knowledge about PNKB NP Region seems to be that it is a UNESCO WHS and some awareness about the Phong Nha Cave.

2.2.8. Accommodation, tourism services and facilities, and tourism activities²⁵

Accommodation

Accommodation is likely to be the largest sector of the tourism industry in Quang Binh Province and the PNKB NP Region. In total there are 177 registered tourism

²⁵ Source from the Tourism Administration of Quang Binh DCST and the Tourism Center of PNKB NP

accommodation providers in the Quang Binh Province. This includes two four star hotels, 17 hotels between one and two stars and 156 unrated guesthouses. Combined there are approximately 2,698 rooms available in the province.

The majority of the accommodation providers are located in Dong Hoi. This includes the two international standard hotels. Accommodation in the PNKB NP Region is very limited and mainly available in the Phong Nha Township, which includes one two star hotel and approximately 20 guesthouses with a total of 188 rooms and 377 beds. The Cha Lo border village has a few guesthouses and some of the villages also have a guesthouse. However they are mainly used for occasional business and government people rather than for tourism purposes. There is currently one homestay in the Chay Lap village.

Comprehensive and reliable occupancy statistics are currently not available. Some official statistics refer to a 50 percent annual occupancy rate. However there may be times of the year, for example, during the summer holiday season and at public holidays, when accommodation is at capacity.

Tourism services and facilities

Tourism services and facilities such as travel agencies, shuttle services and tour information are largely only available in Dong Hoi and mainly limited to the two international standard hotels. There are plenty of restaurants and cafes around the Dong Hoi township, however western food is also only available in the two international standard hotels.

The PNKB NP region has a visitor centre located in the Phong Nha township and operated by the PNKB NP, however more can be done to enhance the quality and amount of tourism information and services. The visitor centre is part of the tourism boat harbour complex, which also includes ticket sales and a few souvenir stalls operated by local residents. It is estimated that there are approximately 28 souvenir shops and stalls and 21 restaurant and catering outlets mainly servicing visitors during the summer high season.

Tourism activities

There are relatively few tourism activities that engage visitors in Quang Binh Province and PNKB NP Region. While Quang Binh's coastline provides some opportunities for beach tourism, only limited efforts have been made. The PNKB NP is by far the biggest attraction in the province. However, tourism activities in the PNKB NP region are generally limited to a boat trip to the Phong Nha Cave and a few sightseeing opportunities around the National Park and Bufferzone.

At present Chay Lap village offers homestay services, and activities such as biking, kayaking and trekking to other villages in the Bufferzone are being developed. The Nuoc Mooc Ecotrail was opened in 2008 and provides visitors with the opportunity for an approximately one kilometre walk through some interesting forest with spots to rest and enjoy the river. There are currently no other organised tourism activities in the PNKB NP apart from sightseeing and short walks.

The PNKB NP's Cultural and Ecotourism Centre can be regarded as the largest local tour operator in the PNKB NP region. However, as noted above, tour activities are limited to the guiding of the boat trips to the Phong Nha Cave. Local residents independently operate the boats for the tours.

2.2.9. Tourism employment and human resource development²⁶

Tourism employment

The current direct employment in the tourism industry in the Quang Binh Province is estimated at approximately 2,252 jobs. Approximately 90 percent of the workforce is

²⁶ Source from the Tourism Administration of Quang Binh DCST and the Tourism Center of PNKB NP

employed in the accommodation and restaurant sector. Other sectors include travel services, government tourism management positions and tour guides. A majority of tourism employment is connected to the two international standard hotels in Dong Hoi.

In the PNKB NP region the PNKB NP is regarded as the largest employer of the tourism workforce. The Cultural and EcoTourism Centre of the PNKB NP employs 147 people of which 3 are part of the management team, 19 for administration, 50 tour guides for the Phong Nha Cave tour and 75 in the cave and technical management. Many of the tour guides have University degrees and are generally recruited from Dong Hoi as well as other parts of the country. All guides need to have a national certificate in tour guiding.

Tourism also employs a considerable number of people in or adjacent to the Phong Nha township and the Son Thuy village. The Son Trach Commune is the main centre of the PNKB NP Region. It is estimated that approximately 1,250 people in the commune have a job related to tourism. The majority of these people are operating the tour boats as transport operators for the Phong Nha Cave tour or photographers working in the vicinity of the Tourism Information Centre. Other local earning opportunities through tourism include operating souvenir shops, as well as providing cattle, fish and vegetables to the tourism food supply. The poverty level in the district has decreased dramatically, falling from 27% in 2001 to 8.5% in 2005. The average annual income per person is estimated to be VND 4.5 million per month. At present, it is estimated that there are about 310 boats operating on a rotating basis for the Phong Nha Cave tour. The boats are generally owned and operated by local families. Some families have up to three boats. Due to the number of boats, families are not able to operate the tour boats on a full-time basis. In the high visitor season there is demand for about one boat load per day, however in the low visitor season, it may take up to seven to ten days to operate a boat. It is estimated that up to approximately 650 people are involved in operating the tour boats on a part-time basis during the height of the season.

Additionally there is tourism employment in the hotels in Phong Nha township, the guesthouses in the region, selected restaurants that cater to visitors and food and souvenir stalls alongside the walking track between the Phong Nha Cave and the Dry Cave.

At this stage, no comprehensive surveys of tourism employment have been undertaken in the region. It is estimated that approximately 952 (full-time equivalent) are employed through tourism in the PNKB NP Region. Table 11 provides indicative estimates based on observation about tourism employment.

Table 11: Tourism employment in the PNKB NP Region

Employer	Estimated tourism employment
PNKB NP	147 full-time employed
Tour boat operators Phong Nha Cave	Up to 650 part-time employed or 310 full-time equivalent
Hotels and restaurants in the PNKB NP region	Up to 250 full-time employed or 120 full-time equivalent
Food, souvenir stalls and photographers	Up to 350 part-time employed or 175 full-time equivalent
Other sources of tourism income (supply chains)	Minimum of 350 part time or 200 full-time equivalent
Total estimated tourism employment	952 full-time equivalent

Human resource development

In recent years, the large hotel operators in Dong Hoi and the PPC's Department of Culture, Sports and Tourism have been actively organising tourism-training courses to

foster human resource development in tourism. Over 700 staff in the hospitality sector have received job specific training. However, this training was mainly focused on the hospitality sector in Dong Hoi, and PNKB NP region has received only very limited attention for tourism training.

Many of the provincial level officials and senior staff from the PNKB NP do not have formal tourism management training. Amongst officials there tends to be a lack of understanding of tourism policy and planning, tourism product development, tourism marketing, quality and standards for tourism development, human resource development for tourism and tourism research and statistics. There is an important need for tourism management training for officials.

The PNKB NP encourages human resource development and some interpretation training is provided to tour guiding staff. However technical knowledge about the landscape geology, caves and cultural heritage of the area is low. While many staff have University degrees, proficiency in English among PNKB NP staff is still very low and only very few tour guides speak English. With tourism developing rapidly in PNKB NP and visitors wanting to sightsee the park there is an urgent need for ongoing tourism training programmes for managing tours, visitors and wildlife.

Tour boat operators and other local residents employed in tourism services generally have very low levels of tourism training and experience with visitors, especially with international visitors. There is an apparent need for language training and tourism awareness courses so local residents have a better understanding of visitors and the effects of tourism development in the PNKB NP region.

2.2.10. Core infrastructure supporting tourism²⁷

In the period from 2001 - 2010, the Government of Vietnam is investing in the Quang Binh Province about VND1,500 billion for the development of transport, electricity and water systems. The investment projects are implemented through the government development programs 134 and 135, Government Bonds, Government Target Capital and Government Tourism Development Capital.

Transportation system

The road network of the PNKB NP Region includes the HCM Highway - East and West branches, National Highway 12A and parts of Provincial Road 10, 15, 20. The major roads are in good condition and maintained in good quality, which ensures good access within the communes and districts. District roads between communes and inter-village roads like in communes of Tan Trach, Thuong Trach, Dan Hoa, Trong Hoa, Thuong Trach, Tan Trach and Truong Son are unsealed and the majority of bridges, dams and spillways are still under-developed and/or in bad conditions. Current provincial and district development programs seek to improve the rural roading conditions by 2015.

Electricity

The national electricity network has been reaching the centre of all communes, except for Tan Trach and Thuong Trach which has the solar energy program supported by the national government. Within the PNKB NP, electricity including energy power exists only in the Administrative and Service Area and some ranger stations in the near border areas.

The province currently has guidelines to encourage domestic and foreign investors to build hydropower plants and to improve the transformer, low voltage stations and the grid system in all communes to ensure by the year 2015 all communes and villages have electricity for production and living.

²⁷ Source from the draft SEDP for the Quang Binh Province.

Water

In the past decade, many national and provincial government programs and projects have been implemented to partly meet the needs of water service for production and living of local people. Currently, there are self-flowing water points in over 50 percent of communes with a shortage of water resource. In the rest communes, main water sources are from wells, drilling pipes, streams and rivers.

According to the SEDP, the province has advocated to increase investment in building water supply systems in rural areas to ensure enough supply of clean water for 90% to 95% of the population in districts by year 2020.

2.2.11. Current tourism investment projects

The rather rapid tourism growth was accompanied by a series of tourism development projects. Over the past four years, it is estimated that more than 800 billion VND (approximately US\$45 million) were mobilised for tourism investments. This includes approximately VND80 billion (approximately US\$4.5 million) from the government's budget for developing infrastructure in the province. The government regards this as an 'ignition' budget to foster other financial sources from provincial budgets, international organisations and the business sector to further invest in tourism development in the province and PNKB NP region.

At present, there are 25 registered private sector/non-governmental tourism investment projects, of which two projects have been completed. Since 2003 there were 11 tourism related construction projects funded by the government. Most of those construction projects focused on the PNKB NP region. Appendix 2 provides a list of tourism related construction projects funded by the government and a list of private sector/non-governmental investment projects.

2.3. Sustainable Tourism Development Analysis for PNKB NP Region

2.3.1. Strengths and Opportunities

Table 12: Strengths and Opportunities for Sustainable Tourism Development in the PNKB NP Region

Strengths and Opportunities for Sustainable Tourism Development in the PNKB NP Region
➤ PNKB NP recognition as a UNESCO WHS.
➤ Relatively undisturbed and scenic environment.
➤ The region includes a range of tourism resources - natural, cultural, and historical.
➤ National and Provincial Government support for sustainable tourism development.
➤ Strong donor investment (GTZ, KfW and ADB) for the region. The majority of the donor investment focuses on the conservation of the region ranging from training initiatives to infrastructure development.
➤ Relatively easy access from within the Province and provincial capital, Dong Hoi. The road infrastructure to the region and within the region is sufficient for tourism development.
➤ Relatively central access to main tourism flows in Vietnam and to main tourism routes such as National Highway 1, HCM Highway, the East-West Economic Corridor, railway access and airport access.
➤ The region has mostly avoided large-scale infrastructure development that could have marginalised tourism development, especially the natural, cultural, and historical values of the

Strengths and Opportunities for Sustainable Tourism Development in the PNKB NP Region

region.

- High volume visitor attractions are concentrated in one area of the Park, and so far have not impacted on sensitive parts of the PNKB NP. There is an opportunity to effectively manage the high volume visitor flows.
- The region is a relatively compact area and tourism development can be contained to specific areas of the region.

2.3.2. Constraints and Threats

Table 13: Constraints and Threats for Sustainable Tourism Development in the PNKB NP Region

Constraints and Threats for Sustainable Tourism Development in the PNKB NP Region

- Insufficient or lack of integrated and coherent tourism planning and management. This includes planning at all levels - provincial, regional, district and specific tourism sites.
- Insufficient or lack of regulations, processes and policies for tourism development and investment.
- Insufficient or lack of tourism marketing activities.
- Relative low quality and lack of tourism attractions.
- Lack of quality tourism activities.
- Lack of tourism businesses, especially small to medium scale entrepreneurial activities and those based in Quang Binh. Most tourism business activities are spontaneous and lack longer-term planning and coordination.
- Insufficient or lack of quality standard accommodation.
- Low standard tourism support services such as an information centre, restaurants and entertainment facilities
- Relatively low short length of stay.
- High seasonality.
- Relatively low level of tourism spending – few options for tourist spending.
- Fairly narrow base of key source market segments (Domestic- Group Tour Leisure/Holiday Travellers = nearly 75%), should be more diversified.
- Overall low level of human resource development, especially in providing tourism services.
- Insufficient or lack of support for local communities to be involved in tourism. Community awareness of tourism development is limited and community based tourism is very underdeveloped.
- Communication issues between the PNKB NP and the local communes and communities.
- Sector coordination is still weak. Responsibilities and collaboration on tourism development amongst national and provincial government departments, communities and business sector is low and not adequate.
- Insufficient or lack of business sector investments – tourism activities and infrastructure.
- Relatively difficult procedures and permit processes to access the PNKB NP.
- Lack of quality handicrafts and other souvenir products.
- Lack of awareness or concern about sustainable tourism development.
- Risk from the approval of large-scale infrastructure development that may marginalise tourism development, especially the natural, cultural, and historical values of the region.

2.3.3. Critical issues and solutions for sustainable tourism development

Table 14: Critical issues and solutions for sustainable tourism development

Tourism relevant area	Critical Development issues	Solutions
Sustainable planning and management for tourism	<ul style="list-style-type: none"> ➤ Lack of comprehensive and integrated planning and management. ➤ Insufficient or lack of regulations, processes and policies for tourism development and investment. 	<ul style="list-style-type: none"> ➤ Preparation of the STDP that provides an integrated planning and management approach for tourism development for the Corezone and the Bufferzone of the PNKB NP Region. ➤ More collaborative and integrated planning required during the implementation of the Provincial SEDP. ➤ Develop policies which ensure a part of tourism revenue will go to conservation and community development
Sustainable visitor numbers and tourism economics	<ul style="list-style-type: none"> ➤ Insufficient information about visitor figures and tourism flows. ➤ Lack of information on visitor behaviour and visitor satisfaction. ➤ Insufficient data on tourism economics and lack of data on social and environmental impacts of tourism. ➤ Too ambitious tourism growth forecasts. ➤ Tourism too heavily focuses on only a few areas. 	<ul style="list-style-type: none"> ➤ Establish a visitor monitoring system and undertake regular behaviour and satisfaction surveys. ➤ Research, collect, share and analyse tourism data regularly. ➤ Develop a set of sustainable indicators that measure the economic, social and environmental impacts of tourism. ➤ Forecast tourism growth based on sustainability goals not on quantitative perceptions. ➤ More even and appropriate dispersion of tourism through the region.
Tourism marketing	<ul style="list-style-type: none"> ➤ Insufficient or lack of tourism marketing and promotional activities. ➤ Lack of collaborative promotion of the destination - PNKB NP Region. 	<ul style="list-style-type: none"> ➤ Prepare a destination marketing strategy and an action plan. ➤ Collaborate on marketing and promotional activities, especially public-private partnerships. ➤ Assign responsibilities for marketing and promotional activities. ➤ Implement marketing and promotional activities.
Tourism product development	<ul style="list-style-type: none"> ➤ Relative low quality and lack of tourism attractions. ➤ Lack of quality tourism activities. ➤ General lack of a diversity of tourism products. ➤ Not always based on strong market information. ➤ Insufficient or lack of community participation and involvement. ➤ Insufficient or lack of business sector investments. ➤ Current products still not distinctly 	<ul style="list-style-type: none"> ➤ Prepare tourism site assessments and assess feasibility of developing tourism activities and attractions. ➤ Prepare a tourism product development strategy. ➤ Focus tourism product development on quality objectives and not quantity objectives. ➤ Diversify the range of available tourism products according to visitor markets. ➤ Engage the communities in developing community based tourism activities.

Tourism relevant area	Critical Development issues	Solutions
	featuring the special and unique features of the region. ➤ Lack of comprehensive product development strategy.	➤ Engage the business sector to invest and develop activities and attractions. ➤ Strengthen the authorities' understanding of tourism product development and establish regulations and policies to monitor the tourism activities and attractions.
Tourism training and human resource development	➤ Insufficient competence in sector specific skills for all main stakeholder groups: – private and public sector, the Park and local communities.	➤ Assess the sector specific tourism training needs. ➤ Implement tourism training programmes.
Natural, historical and cultural heritage and significance	➤ Lack of a comprehensive management plan for PNKB NP including site-specific planning assessments. ➤ No periodic reporting in place to confirm UNESCO WHS.	➤ Implementation of the STDP. ➤ Initiation of reporting protocol (part of the monitoring plan).
Tourism information and interpretation	➤ Insufficient or lack of tourism information and interpretation of the natural, historical and cultural heritage on heritage and conservation values.	➤ Design and initiate a comprehensive information and interpretation strategy.
Environmental management	➤ Lack of standards for ensuring environmental management. ➤ Lack of awareness. ➤ Lack of an environmental management system. ➤ Lack of required protocols for monitoring and evaluation.	➤ Assess environmental management needs for tourism investments. ➤ Strengthen regulations and policies regarding environmental impact assessments for tourism investments. ➤ Any tourism development needs to contribute to the conservation objectives of the region. ➤ Regularly monitor and evaluate environmental management procedures. ➤ Organise “Environment Week” and Workshops/seminars on “sustainable tourism” for community and stakeholders
Sustainable tourism infrastructure development	➤ Lack of a comprehensive sustainable tourism infrastructure development plan and strategy. ➤ Insufficient or lack of a process for infrastructure development. ➤ Ad-hoc infrastructure development.	➤ Development and initiation of a sustainable tourism infrastructure plan and strategy. ➤ Clearly allocated zoning for tourism infrastructure projects. ➤ Strengthen regulations and policies regarding tourism infrastructure development. ➤ Provide a process for applications for infrastructure development.

Tourism relevant area	Critical Development issues	Solutions
Livelihoods and poverty reduction	<ul style="list-style-type: none"> ➤ Lack of awareness and appreciation of the potential and opportunities to support local poverty reduction through tourism development. ➤ Tourism activities are currently concentrated in only a few areas thus limiting the potential spread of tourism related benefits throughout the region. 	<ul style="list-style-type: none"> ➤ Integrate local communities in tourism planning. ➤ Engage the communities in developing community based tourism activities. ➤ Create awareness about tourism in relevant communities. ➤ Develop a support structure for communities to assist in developing tourism.

2.4. Strategic Directions for Sustainable Tourism Development for PNKB NP Region

Based on the current situational analysis, the critical tourism development issues and solutions as well as the overall context of the PNKB NP Region, the following strategic directions provides guidance for formulating the STDP:

- Conservation of heritage values is paramount. All tourism development in the region must contribute to the conservation of the Park and Region’s heritage values.
- Creating high quality tourism experiences that include quality attractions, products and services that emphasise awareness raising and interpretation of heritage conservation.
- Developing tourism to create a more balanced and equitable distribution of impacts and opportunities throughout the region that highlight the range of attractions and target poverty reduction and local livelihood improvement as priorities.
- Planning and managing tourism development in an efficient and effective manner that involves coordinated and integrating planning featuring broad stakeholder involvement and consideration of scientific and market information.
- Human resource development is an overall and crosscutting issue that underpins all aspects of successfully developing and managing tourism with conservation in the region.
- Effective marketing and promotion of the PNKB NP Region based on a strategic branding and positioning to attract specific market segments that will contribute to sustainable, high yielding tourism development in the region.

CHAPTER TWO

SUSTAINABLE TOURISM DEVELOPMENT PLAN FOR THE PHONG NHA KE BANG NATIONAL PARK REGION 2010 – 2020

1. PLANNING VISION, OBJECTIVES AND PRINCIPLES

1.1. Planning vision

Sustainable tourism development planning for the PNKB NP Region is based on the following planning vision:

“The PNKB NP region is maintained in a manner that achieves the **Conservation of Heritage Values** with **Improved and More Sustainable Livelihoods in Local Communities** with the **Support of Sustainable Tourism Development.**”

While it is important that the planning vision be a concise, comprehensive, and clear, more detailed descriptions of key components is useful:



The planning vision will be implemented in three planning phases:



1.2. Sustainable tourism planning objectives

The sustainable tourism planning goals address how tourism will be strategically managed in the STDP. The four sustainable tourism planning objectives are:



1.3. Sustainable tourism planning principles

Bases on these Sustainable Tourism Planning Goals more specific Planning Objectives will provide the basis for clear directions for the STDP.

i. Sustainable Tourism Development will ensure that:

- Natural processes for regeneration are not compromised.
- Overall quality and quantity of natural resources is maintained and enhanced.
- Overall quality and quantity of cultural and historical resources is maintained and enhanced.
- Tourism products are of a high quality that provide a high level of satisfaction for visitors.
- Tourism product and activities developed are assessed and approved based on sound market justification and financial operating capacity,
- Reasonable profits to service providers are achieved along with an equitable sharing of benefits and costs amongst relevant stakeholders and affected groups.

ii. Heritage Conservation will ensure that:

- All forms of tourism development must compliment, conserve and enhance the Park's cultural and natural heritage values and must not detract from or diminish these values.
- Conservation of cultural and natural heritage values are well supported by education, information and awareness raising efforts linked to, and support by, all tourism development and operations.

iii. Local Development will ensure that:

- Opportunities are provided for the development of tourism products in local communities, supported by through targeted trainings and community-based processes that provide opportunities for local people, and especially the poor, to partake in the tourism sector and economies.
- Opportunities are created for local people to benefit from engaging in the wider tourism sector, and not only in community-based activities. This will be supported by targeted trainings and other efforts to increase the delivery of local goods and services to the demands of the wider tourism including opportunities for direct employment.
- Commercial tourism business activities should directly address the employment and commercial engagement of local residents.

iv. Effective Planning and Management will ensure that:

- The cultural and natural features with tourism development potential are not exploited solely economic purposes in a way that damages or detracts from their value.
- Sustainable and efficient management of tourism in the PNKB Region will be effectively integration into tourism planning at the provincial, regional, national and appropriate global levels.
- Tourism plans and activities should be linked and integrated to other conservation and socio-economic development plans and activities in order to achieve maximum efficiencies, while avoiding needless duplication and preventable gaps in the implementation.
- Tourism planning in the PNKB Region must involve stakeholder consultation and support efforts for collaborative planning to ensure that the interests and ideas of all relevant and affected parties are heard from and incorporated as effectively as possible into tourism planning, development and management. Processes and procedures for consultative planning and cooperative management will be emphasised.

2. FUTURE TOURISM GROWTH AND KEY SUSTAINABLE DEVELOPMENT ASSUMPTIONS FOR THE PNKBNP REGION

2.1. Principles for sustainable tourism growth

Future tourism growth and key sustainable development assumptions of the STDP area geared towards sustainable and manageable visitor growth in the PNKB NP Region. The rationale for the future tourism growth model and visitor forecast was based on the following principles for sustainable tourism growth:

- Tourism growth that preserves the natural, historical and cultural heritage values of the PNKB NP Region and supports the UNESCO WHS of PNKB NP.
- Tourism growth that preserves the ecological integrity of the PNKB NP Region.
- Tourism growth that supports quality tourism experiences – this means providing a high standard of tourism products and activities and receiving higher yields in economic returns per volume of visitors.
- Tourism growth that contributes to an appropriate geographical spread of development where higher impact activities are concentrated in appropriate locations for effective management and lower impact activities that generate local benefits are suitably expanded throughout the region.
- Tourism growth that is tailored to target markets and aimed to maximise economic return (yield) rather than sheer volume.
- Tourism growth that is regulated and monitored site specific and on the principles of the limits of acceptable change.
- Tourism growth that uses management systems to control site visitor volumes to levels that are sustainable and do not compromise the biodiversity and the historical and cultural integrity of the PNKB NP Region.
- Tourism development that is manageable by the PPC, PNKB NP and relevant tourism stakeholders.
- Tourism development that institutionally separates tourism management and tourism operations in the PNKB NP to avoid conflicts of interest.
- Tourism development that uses concessions agreements between the PNKB NP and business sector operators for all activities in the PNKB NP.
- Tourism development that fosters community participation and provides benefits to the communities in the Bufferzone of the PNKB NP Region.
- Tourism development that minimises infrastructure needs and infrastructure development in the PNKB NP and consolidates the infrastructure in the Bufferzone of the PNKB NP Region.

2.2. Forecast of visitors to the PNKB NP Region

2.2.1. Estimating visitor demand

The visitor forecast is based on growth assumptions of visitor market segments for both the domestic and the international market. The estimates were developed on a review basis amongst the consultant team and should be seen as indicative and as a guideline for future

growth. The estimates are based on linear tourism growth. This means market fluctuations are not included, for example, a decrease of visitors due to the financial crisis or the rapid rise of visitor arrivals due to a marketing campaign.

Appendix 3 provides the estimated yearly growth figures for each of the market segments.

2.2.2. Visitor forecast for PNKB NP Region, 2008 to 2020²⁸

The forecast estimates that the total visitors to the PNKB NP Region will grow by nearly 19 percent from 2009 (311,630 visitors) to 2012 (370,193). By 2015, visitor numbers will increase to 455,076 (46% percent increase to 2009) and by 2020 visitor numbers will have more than doubled to 645,897 (107% increase to 2009).

Domestic visitors to the PNKB NP Region will grow by nearly 18 percent from 2009 (300,015 visitors) to 2012 (356,246). By 2015, visitor numbers will increase to 437,441 (46% percent increase to 2009) and by 2020 visitor numbers will have more than doubled to 621,365 (107% increase to 2009). The most considerable market segment in terms of growth are the Independent Leisure/Holiday Travellers. In the next decade this market segment will at times grow by up to 15 percent annually.

International visitors to the PNKB NP Region will grow by nearly 20 percent from 2009 (11,615 visitors) to 2012 (13,946). By 2015, visitor numbers will increase to approximately 17,635 (52% percent increase to 2009) and by 2020 visitor numbers will have more than doubled to nearly 24,532 (111% increase to 2009). FIT's, Western Group Tour Travellers and Regional Group Tour Travellers are the key growth segments of the international market.

Table 15 depicts an overview of the visitor forecast for the PNKB NP Region. Appendix 4 includes a yearly breakdown of the visitor number forecast upto 2020.

Table 15: Visitor forecast PNKB NP Region, 2009 to 2020

Visitor Market	Visitor Market Segment	"2009"	"2012"	"2015"	"2020"
International	Free Independent Travellers	4,995	6,055	7,626	10,300
	Backpacker Travellers	1,858	2,110	2,442	3,000
	Western Group Tour Travellers	2,149	2,605	3,595	5,478
	Regional Group Tour Travellers	1,045	1,353	1,834	2,975
	Expatriate Travellers	406	471	545	696
	Regional Caravanning Travellers	348	410	503	692
	Other Travellers	814	941	1,089	1,391
Total International		11,615	13,946	17,635	24,532
Domestic	Group Tour Leisure/Holiday Travellers	223,512	258,743	299,527	382,281
	Independent Leisure/Holiday Travellers	69,003	89,338	128,876	229,042
	Education/Science Travellers	3,000	3,152	3,345	3,694
	Visiting Friends and Relatives	3,000	3,309	3,758	4,149
	Business/Government Travellers	1,500	1,703	1,934	2,199
Total Domestic		300,015	356,246	437,441	621,365
Total Visitors		311,630	370,193	455,076	645,897

²⁸ See Appendix 3 for the Yearly Visitor Market Segment Growth Estimates and Appendix 4 for the yearly breakdown of the visitor number forecast upto 2020

2.3. Strategies for sustainable tourism growth

Based on the principles for sustainable tourism growth and the current visitor forecasts the following strategic directives will provide to orientation for guiding tourism growth in the short, medium, and long term.

Table 16: Strategies for sustainable tourism growth

Strategies for sustainable tourism growth
Short-term:
<ul style="list-style-type: none">➤ Improve existing sites to ensure sustainable impacts and enhance revenue/yield generating possibilities➤ Diversify facilities and attraction for dominant markets to induce longer stays and more opportunities for local spending➤ Market and promote to targeted market segments; regional and international➤ Develop more “pioneering” tourism products that emphasise conservation values and appeal to targeted market segments and certain segments of the currently dominant market.
Mid-Term:
<ul style="list-style-type: none">➤ Improve attractions, services and facilities for dominate market segments to improve and maintaining sustainable impacts while enhancing revenue generation and local earning potentials➤ Expand product based for targeted, higher-yielding market segments➤ Upscale Marketing and promotion to targeted market segments; regional and international➤ Utilise promotion and marketing activities to encourage more of the dominate market segments to experience newer products with a stronger conservation and local income earning possibilities
Long-Term:
<ul style="list-style-type: none">➤ Achieve a desirable balance of visitors by:<ul style="list-style-type: none">▪ Addressing the demands of dominant market segments with products that are conservation based, generating higher yields and support local earning generation, and▪ Attracting a greater percentage of higher yielding, more conservation orientated market segments through effective marketing and product development.

2.4. Key strategic tourism growth indicators and targets

The STDP is measure by a core set of sustainable tourism growth indicators. The indicators are divided in quantitative indicators such as such as the growth of visitor numbers, economic impact, length of stay and employment, and quantitative indicators that refer to the active implementation of the STDP including management and development activities.

The tracking of the indicators is structured in the three planning phases: Short Term Planning - up to 2012, Medium Term Planning - up to 2015, and Long Term Planning - up to 2020.

The indicators are strongly linked with to the monitoring and implementation of the STDP (Chapter Three). The indicators are organises in quantitative and qualitative indicators, and should be seen as a general tracking tool for the sustainable tourism development of the PNKB NP Region.

Table 17: Quantitative strategic tourism growth indicators and targets²⁹

Quantitative Indicators	Targets			
	Baseline 2009	Short Term Planning Up to 2012	Medium Term Planning Up to 2015	Long Term Planning Up to 2020
Total visitor numbers	311,360 (Based on visitors to the PNKB NP)	370,193 (Estimated visitor forecast)	455,076 (Estimated visitor forecast)	645,897 (Estimated visitor forecast)
Domestic visitor	300,015 (Based on visitors to the PNKB NP)	356,246 (Estimated visitor forecast)	437,441 (Estimated visitor forecast)	621,365 (Estimated visitor forecast)
International visitor	11,615 (Based on visitors to the PNKB NP)	13,946 (Estimated visitor forecast)	17,635 (Estimated visitor forecast)	24,532 (Estimated visitor forecast)
Length of stay	0.08 (Estimated)	0.10 (Target)	0.12 (Target)	0.14 (Target)
Total visitor nights	24,836 (Estimated based on length of stay and visitors to PNKB NP)	37,193 (Estimated based on length of stay and visitors to PNKB NP)	54,609 (Estimated based on length of stay and visitors to PNKB NP)	90,426 (Estimated based on length of stay and visitors to PNKB NP)
Total expenditure		Increase X%	Increase X% + 1	Increase X% + 2
Per person expenditure	VND 97,300 (Indicative baseline figure)	VND121,600 (Target: Increase by 25% from 2009)	VND152,000 (Target: Increase by 25% from 2012)	VND190,000 (Target: Increase by 25% from 2015)
Total tourism revenue	VND 30.31 billion Indicative baseline figure)	VND 45.02 billion (Based on total visitor numbers and per person expenditure)	VND 69.17 billion (Based on total visitor numbers and per person expenditure)	VND 122.72 billion (Based on total visitor numbers and per person expenditure)
Tourism direct employment	952 full-time equivalent (Estimated)	1,047 full-time equivalent (Target: Increase by 10% from 2009) Increase by 10% from initial baseline	1,151 full-time equivalent (Target: Increase by 10% from 2012) Increase by 20% from initial baseline	1,266 full-time equivalent (Target: Increase by 10% from 2015) Increase by 25% from initial baseline
Tourism indirect employment		Increase by 5% from initial baseline	Increase by 15% from initial baseline	Increase by 30% from initial baseline
Per person waste		Decrease by 10% from initial baseline	Decrease by 15% from initial baseline	Decrease by 20% from initial baseline

²⁹ See Appendix 4 for visitor number estimation in 2020.

Table 18: Qualitative strategic tourism growth indicators and targets

Qualitative indicators	Targets		
	Short Term Planning Up to 2012	Medium Term Planning Up to 2015	Long Term Planning Up to 2020
Quality of resources and conservation values	Negative impacts to resources and conservation values have been address at all sites achieving indicative improvements in overall quality.	Negative impacts to resources and conservation values are completely addressed and the quality of these resources/values are showing improvements.	Resources and conservation values are not experiencing unmanageable impacts and show overall improvement in quality.
Mainstream tourism product development	Existing tourism products have improved impact mitigation measures in place and are generating more revenues.	Mainstream tourism products have minimised negative impacts while maximising local benefits while conservation values are significantly enhanced.	Mainstream tourism products feature a strong conservation orientation contributing increased visitor awareness of conservation values.
Conservation-based tourism product development	More conservation-based tourism products are operational.	Appropriate expansion of conservation-based tourism products are attracting desirable levels of visitors and contributing to conservation and development objectives.	Conservation-based tourism products are well recognised as a key feature of PNKB, are contributing to contributing to conservation and development objectives, and achieving sustainable volumes of visitors.
Tourism marketing	Strong branding and position of PNKB as a high quality, conservation-based tourism destination is achieved.	Interest in conservation as a motivating factor for domestic visitors is increased. Increase in percentage of key target segments visiting.	PNKKB is recognised as a world-class destination for conservation-based tourism.
Tourism information and interpretation	Comprehensive information and interpretation strategy is in place. Site specific information and interpretation plans are in place.	Improved quality of information management system is evident in park planning and management. Improved quality of interpretation is reflected in visitor experiences and conservation objectives.	Improved planning and management and enhanced conservation awareness is reflected in achieving conservation, local livelihoods improvement, and tourism development objectives.
Tourism site management plans	Site management plans in pace for all actives tourism sites.	Site management plans are reviewed and refined while indicating improvements in conservation and local benefits achieved.	Site management plans are reviewed and refined while indicating improvements in conservation and local benefits achieved.
Visitor/Business satisfaction	Both visitors and tourism businesses are generally satisfied with the products and services and operational arrangements.	Both visitors and tourism businesses are well satisfied with the products and services and operational arrangements.	Both visitors and tourism businesses are highly satisfied with the products and services and operational arrangements.

3. SPATIAL FUNCTIONAL AND TOURISM ZONING

3.1. Introduction

Rationale and objectives

Zoning (definition: designation of geographical areas for specific planning and development purposes) is an important foundation of tourism planning. The principle purpose for tourism zoning is to ensure that the tourism development that takes place in a specific area is inline with supporting the overall development goals and objectives of the STDP and the management objectives of the PNKB NP.

Spatial functional zoning

Article 14 of Decision No. 186/2006/QĐ-TTg defines and describes spatial and functional zoning of national parks and protected areas in Vietnam and will provided the basis for the tourism zoning that ensures tourism visits, products and activities will occur in locations with appropriate management objectives and capacities. Tourism zones have been designed for the three management areas of the Corezone (Administrative and service area, ecological restoration area and strictly protected. The extension area is considered a special use forest at present) and for the Bufferzone area.

Tourism zoning

Tourism activities, infrastructure, and services can best be developed and managed under specific tourism zones to ensure that tourism activities take place at sustainable levels. This further ensures a high quality tourism experience that maximises conservation benefits and minimises negative impacts. Five specific tourism zones were designed to support the development of tourism in accordance to the management objectives of the PNKB NP, the spatial functional zoning objectives and regulations of Article 14 of Decision No. 186/2006/QĐ-TTg, and Decision 104/2007/QĐ-BNN promulgating regulations on Management of Ecotourism Activities in National Parks and Nature Reserves.

3.2. Description of Tourism Zones

Following are a description of the five specific tourism zones for PNKB NP.

3.2.1. High Volume Tourism Zone

Table 19: Description and management objectives for High Volume Tourism Zone

Description	Specific Management Objectives
<ul style="list-style-type: none">➤ This includes sites and areas that are capable of attracting large visitor numbers on a steady basis.➤ These sites typically require significant infrastructure investments such as access routes for transportation and pedestrians, resting, toilets and refreshment areas,	<ul style="list-style-type: none">➤ Manage and contain popular and highly visited tourism sites and activities that ensures impacts from high volume tourism activities in this area do not negatively influence other forms of tourism in the rest of the Park, and to contribute to the improvement of quality of livelihoods for people residing in or near the Park.➤ Provide an efficient management for high volume tourism flows in order maintain a high quality tourism experiences.➤ Ensure that impacts from high volume tourism activities in this area do not negatively influence other forms of tourism in the

Description	Specific Management Objectives
<p>ticketing and visitor control areas, shopping areas.</p> <ul style="list-style-type: none"> ➤ Visitors typically stay for a limited amount of time, require easy access, and easily understood information. 	<p>rest of the Park, and to contribute to the improvement of quality of livelihoods for people residing in or near the Park.</p> <ul style="list-style-type: none"> ➤ Ensure that the local communities are integrated in high volume tourism development and that economic benefits contribute to the improvement of quality of livelihoods. ➤ Promote appreciation of heritage and conservation values to a high volume of visitors.

3.2.2. Nature and Heritage Tourism Zones

Table 20: Description and management objectives of Nature and Heritage Tourism Zones

Description	Specific Management Objectives
<ul style="list-style-type: none"> ➤ This includes sites and areas that are capable of supporting moderate and steady numbers of tourism visits. ➤ The attractions of these sites and areas have natural and heritage values of a general interest. ➤ Visitors expect relatively easy access and more in-depth information. ➤ Infrastructure for these sites is typically modest and may include parking areas for transportation, simplified access routes for pedestrians, resting, toilets and refreshment areas, and ticketing and visitor control areas. 	<ul style="list-style-type: none"> ➤ Manage and support the development of tourism sites and activities for moderate visitation levels. ➤ Provide an efficient management of tourism impacts to maintain the natural and historical features of the site and area and to ensure a high quality visitor experience. ➤ Ensure site-specific regulations and restrictions are in place for visitors and commercial tourism operations. ➤ Ensure that the local community is not compromised but integrated in tourism activity development and that economic benefits contribute to the improvement of quality of livelihoods. ➤ Tourism products and services support learning and appreciation of heritage and natural values.

3.2.3. Strict Ecotourism Zone

Table 21: Description and management objectives of Strict Ecotourism Zone

Description	Specific Management Objectives
<ul style="list-style-type: none"> ➤ This includes sites and areas that are suitable for supporting low visitor numbers ➤ The natural features are the main attraction for visitors seeking an undisturbed wilderness experiences with a strong emphasis on understanding and appreciation of the local ecology. ➤ Infrastructure requirements are minimal and typical needed only for ensuring safe access and preventing damage to the local ecology. 	<ul style="list-style-type: none"> ➤ Manage and support the development of tourism sites and activities for low visitation levels – small groups. ➤ Tourism activities need to be based on the natural environment, and support the ecological conservation of the area and visited sites and ensure high quality visitor experience is maintained. ➤ Provide site-specific regulations and restrictions are in place for visitors and commercial tourism operations ➤ Ensure that the local community is not compromised but integrated in tourism activity development and that economic benefits contribute to the improvement of quality of livelihoods.

3.2.4. Community Benefit Tourism Zone

Table 22: Description and management objectives of Community Benefit Tourism Zone

Description	Specific Management Objectives
<ul style="list-style-type: none"> ➤ Community benefit tourism is tourism development that provides benefits to local communities. ➤ It takes place through two forms: <ol style="list-style-type: none"> 1. Community based tourism is tourism that takes place in and features aspects of the local community 2. Tourism benefits the community through economic activities in the village or that are linked to the tourism sector in the region – but may tourists may not necessarily visit the village. ➤ The latter example typically involves local communities providing products such as food and beverages, handicraft works, or other materials that are sold to the tourism sector - to either tourism businesses or to tourists. ➤ This includes sites and areas such as near local villages and current or potential tourism and activity sites where the community could get involved. ➤ The sites are capable of low to medium levels of tourism flows. However they may also be near high tourism volume sites. The Community Benefit Tourism Zone often overlaps with other tourism zones. ➤ The attractions of these sites and areas are linked to the community but may also feature have natural and heritage values Visitors expect relatively easy access and more in-depth information. ➤ Infrastructure for these sites is typically modest and may include parking areas for transportation, simplified access routes for pedestrians, resting, toilets and refreshment areas, and ticketing and visitor control areas. 	<ul style="list-style-type: none"> ➤ Manage and support the sustainable tourism development and tourism sites and activities that ensure sustainable livelihood benefits for local communities existing within this zone. ➤ Ensure that local communities have opportunities to actively engage and benefit from tourism development. ➤ Provide an efficient management for low to moderate levels of tourism flows to avoid adverse impacts on the communities and to maintain the natural and historical features of the site and area ,and to ensure a high quality visitor experience. ➤ Tourism site developments and activities are planned and managed in cooperation with relevant local communities. ➤ Ensure site-specific regulations and restrictions are in place for visitors and commercial tourism operations.

3.2.5. Tourism Infrastructure Investment Zone

Table 23: Description and management objectives of Tourism Infrastructure Investment Zone

Description	Specific Management Objectives
<ul style="list-style-type: none"> ➤ This includes sites and areas that can support moderate to high volumes of tourism flows. ➤ These sites and areas generally have no tourism attractions or activities, but are close to attractions and activities as well as to a considerable flow of visitors. ➤ This includes sites that are currently supporting tourism infrastructure or have the potential for tourism infrastructure development such as accommodations, restaurants, entertainment, vehicle access and parking, water, electricity, communications, and waste management facilities. 	<ul style="list-style-type: none"> ➤ Effectively locate and contain the significant tourism infrastructure required to better serve visitors to the PNKB NP Region. ➤ Provide an efficient management for tourism flows in order to maintain a high quality tourism experiences. ➤ Evaluate the most suitable sites for major tourism infrastructure developments such as accommodations, restaurants and entertainment facilities. ➤ Carefully review any tourism infrastructure developments based on management approaches and potential impacts. ➤ Ensure that the local community is not compromised but integrated in tourism infrastructure development and that economic benefits contribute to the improvement of quality of livelihoods.

3.3. Guidelines for spatial functional zones

3.3.1. Administrative and Service Area

Decision No. 186/2006/QĐ-TTg (Article 14) notes that the administrative and service area (sub-zone) are allocated for the construction and development of working offices and supporting facilities required for the routine activities of the National Park. This may include facilities for research and scientific purposes, and for the purposes of tourism, recreational and entertainment activities.

The administrative and service area of PNKB NP is approximately 3.411 ha. At present the area includes supporting infrastructure (management and scientific research) for the PNKB NP and tourism sites and facilities that attract a large number of visitors.

There are also a number of communities in this area that subsist on agricultural activities supplemented by engaging in tourism service activities and the extraction of natural resources from the National Park.

Tourism management objectives and requirements

Table 24: Tourism management objectives and requirements for the Administrative & Service Area

Tourism Management Objectives	Tourism Management Requirements
<ul style="list-style-type: none"> ➤ Contain and mitigate the negative impacts of high volume tourism activities. ➤ Provide easily accessible information and interpretation on environmental protection and historical appreciation. ➤ Achieve and maintain high quality tourism attractions, services that feature the natural and heritage values that are accessible for steady volumes of tourism activity. ➤ Support local community development where possible. 	<ul style="list-style-type: none"> ➤ No major infrastructure investments for the purposes of accommodation and entertainment. ➤ All visitors to this area must have paid entrance to the site. ➤ Visitors must stay on established paths, routes and itineraries. ➤ Each site will have in place procedures for regulating the appropriate volume of tourism visitors and appropriate visitor activities and behaviours, including safety. ➤ Both tourists and tourism service providers (guides) are themselves responsible for obeying these procedures and behaviour guidelines. ➤ Enforcement of these procedures and behaviours is the responsibility of the National Park. ➤ Visitation to sites in this area is provided for by tour companies registering with the Park or by transportation provided by the Park. Private access by vehicle is only permit by special permission by the Park.

Tourism zoning description

Given the operational functions of the area, and considering the current tourism situation as well as the tourism development potentials available, this area includes two tourism zones: High Volume Tourism Zone, Nature Tourism Zone.

Tourism activities in this area should be planned in close integration with the Community Benefit Tourism planning in the adjacent Bufferzone and relevant areas of the PNKB NP. The two tourism zones in this area have distinctive features and management requirements and should be linked in a complementary manner to develop a range of quality visitor experiences and to ensure operational efficiency.

➤ High Volume Tourism Zone

This zone roughly contains the area from the PNKB NP's main entrance, visitor information and reception area, along the road towards the National Park's

Headquarters and along the river towards the Phong Nha caves. The zone extends south along the HCM Highway West towards the intersection with National Highway 20, and includes the tourism sites (HCM Museum) near this intersection.

This area comprises primarily of disturbed forest, karst geology, rivers, areas of tourism facilities and administrative buildings, and residential areas. The zone includes sites that currently attract a large number of visitors (for example Phong Nha caves and the information centre), and sites with future tourism development potential.

➤ Nature and Heritage Tourism Zones

This zone encompasses the area that is in proximity the HCM Highway West from the junction with National Highway 20 towards the PNKB NP’s main entrance gate.

This area comprises mostly of disturbed forest, karst geology, river, and areas that offer tourism activities based on natural features. The natural environment in this zone is of relatively high quality, yet not too fragile to support moderate volumes of visitors. The zones area is easily accessible by existing roads and is well connected to other tourism sites and infrastructure facilities in the administrative and service area.

This zone has the potential for developing high quality, readily accessible, nature-based tourism activities that can sustain regular volumes of moderate tourism activity. For example. the Botanical Gardens can support medium to high levels of visitor flows with appropriate management and regulations. The Primate Rescue Centre needs to be managed with more controlled access to receive low to moderate volume of visitor flows. Other potential sites for tourism development in this area include Hang E (E Cave), Bamboo Valley, Hang Toi (Dark Cave), Nuoc Mooc Eco-Trail and the Song Chay River.

3.3.2. Ecological Restoration Area

Decision No. 186/2006/QĐ-TTg (Article 14) notes that the ecological restoration area (sub-zone) is the strictly managed and protected area for restoration of the forest ecosystems. In this area the opening of main roads and construct infrastructure is permitted only to protect and develop the forest as well as for serving tourism activities and services.

The ecological restoration area of PNKB NP is approximately 17.449 ha. Currently the area includes limited tourism activities and the majority of the area receives only few visitors. However, a number of potential tourism sites are located within this area.

There are also a number of ethnic minority communities in this area that subsist on agricultural activities and the extraction of natural resources from the National Park.

Tourism management objectives and requirements

Table 25: Tourism management objectives and requirements for the Ecological Restoration Area

Tourism Management Objectives	Tourism Management Requirements
<ul style="list-style-type: none"> ➤ To ensure that tourism development in this area is supportive, and not detrimental, to the functional objectives of this area for the restoration of forest ecosystems. ➤ Support the development of moderate levels of tourism activity with minimal infrastructure and managed in a manner that 	<ul style="list-style-type: none"> ➤ No major infrastructure investments for the purposes of accommodation and entertainment. ➤ Other tourism infrastructure development must support on modest levels of tourism activities and prevent easy levels of accessibility that supports high volumes of visitors. ➤ All visitors to this area must have paid entrance and hold a valid ticket. ➤ Visitation to sites in this area is provided for by tour companies registered with the Park or by transportation

Tourism Management Objectives	Tourism Management Requirements
<p>mitigates the negative impacts.</p> <ul style="list-style-type: none"> ➤ Provides high quality information and interpretation on environmental conservation. ➤ Support local community development where possible. ➤ The containment and minimisation of negative impacts from the one High Volume Site. 	<p>provided by the Park. Private access by vehicle is only permit by special permission by the Park.</p> <ul style="list-style-type: none"> ➤ Each site will have in place procedures for regulating the appropriate volume of tourism visitors and appropriate visitor activities and behaviours, including safety. ➤ Visitors must stay on established paths, routes and itineraries. ➤ Both tourists and tourism service providers (guides) are themselves responsible for obeying these procedures and behaviour guidelines. ➤ Enforcement of these procedures and behaviours is the responsibility of the National Park.

Tourism zoning descriptions

Based on the management regulations and objectives for sustainable tourism development, this area includes three tourism zones: High Volume Tourism Zone, Strict Ecotourism Zone and Community Benefit Tourism Zone.

➤ High Volume Tourism Zone

The Eight Volunteer Cave is an important historical and spiritual tourism site is currently attracting a high volume of visitors and will do so in the future. Although this site is within the Ecological Restoration Area where high volume tourism development is prohibited an exception is made for this site due to its importance and very close location to other important high volume tourism sites within the adjacent administrative and service area.

➤ Strict Ecotourism Zone

In this zone there is significant potential for careful ecotourism development with low volumes of visitors. Priority areas for ecotourism development will be the areas around and access to Hang Thien Duong (Paradise Cave), Me Bong Con, Hang Vom and the system of caves accessible from A-Rem village that includes Hang Ho and Hang Ca.

➤ Community Benefit Tourism Zone

The Community Benefit Tourism Zone is located where communities are residing in the PNKB NP and adjacent areas that can be access by these communities. The A-Rem village has the potential to benefit from tourism development. Tourism activities in the area such as trekking, animal viewing, water-based, and featuring traditional cultures will provide improved livelihoods, reduced pressures on natural resources, and offer quality tourism experiences.

3.3.3. Strictly Protected Area

Decision No. 186/2006/QD-TTg (Article 14) notes that the strictly protected area (sub-zone) is designated to be large enough to maintain intact natural ecosystems. Specific sub-zoning in the area shall be determined according to the conservation objectives, subjects and criteria and hydrological conditions. In this area it is prohibited construct infrastructure, apart from trails, stop stations, signboards addressing patrolling (forest protection) and selected eco-tourism activities. Trekking trails serving tourism must secure the safety of visitors and follow the guidance and supervision of the management board of the Park.

The strictly protected area of PNKB NP is approximately 64.894 ha. The vast majority of the area is inaccessible to visitors and present tourism activities in the area are very limited. There are potential tourism activities located in the area, such as the development of trekking routes. There are also a number of ethnic minority communities in this area that subsist on agricultural activities and the extraction of natural resources from the Park.

Tourism management objectives and requirements

Table 26: Tourism management objectives and requirements for the Strictly Protected Area

Tourism Management Objectives	Tourism Management Requirements
<ul style="list-style-type: none"> ➤ Ensure tourism development in this area only takes place when it contributes to the protection and support of natural developments of forests and ecosystems. ➤ Tourism in this area will be permitted at minimal levels of activity with special permission and objectives that support high quality interpretation and scientific research on environmental conservation and prevent any negative impacts. ➤ The construction of infrastructure is prohibited, apart from trails, stop stations, signboards addressing patrolling (forest protection). 	<ul style="list-style-type: none"> ➤ No permanent site development infrastructures. ➤ Visitation is only permitted by special permission by the Park. ➤ Visitation to sites in this area is only available through tour companies registered with the Park and in cooperation with Park staff and formal scientific missions authorised by the Park or other relevant agency. ➤ Each trip/mission will have in place procedures for regulating the appropriate volume of tourism visitors and appropriate visitor activities and behaviours, including safety. ➤ Both tourists and (guides) are themselves responsible for obeying these procedures and behaviour guidelines. ➤ Enforcement of these procedures and behaviours is the responsibility of the National Park. ➤ Private access is prohibited.

Tourism zoning description

Based on the management regulations and objectives for sustainable tourism development, this area includes a Strict Ecotourism Zone

- Strict Ecotourism Zone

In this zone there is significant potential for careful ecotourism development with low volumes of visitors. Priority areas for ecotourism development will be the areas U Bo Peak and Hang En.

3.3.4. Extension area

Decision No. 1678/QD-UBND approved the extension area of the PNKB NP. The extension area includes approximately 31,070 ha in the area of Thuong Hoa and Hoa Son communes (Minh Hoa District). At present no specific zone category has been approved for the extension area. It is likely that the extension area will be designated as either an ecological restoration area or strictly protected area.

Currently the vast majority of the area is inaccessible to visitors and there are no tourism activities in the area. Only few potential tourism sites are in the area and tourism development is limited. There are also a number of ethnic minority communities in this area that subsist on agricultural activities and the extraction of natural resources from the National Park.

Tourism management objectives and requirements

The suggested tourism management objectives and requirements are based on that of the ecological restoration area.

Table 27: Tourism management objectives and requirements for the Extension Area

Tourism Management Objectives	Tourism Management Requirements
<ul style="list-style-type: none"> ➤ To ensure that tourism development in this area is supportive, and not detrimental, to the functional objectives of this area for the restoration of forest ecosystems. ➤ Support the development of moderate levels of tourism activity with minimal infrastructure and managed in a manner that mitigates the negative impacts. ➤ Provides high quality information and interpretation on environmental conservation. ➤ Support local community development where possible. ➤ The containment and minimisation of negative impacts from the one High Volume Site. 	<ul style="list-style-type: none"> ➤ No major infrastructure investments for the purposes of accommodation and entertainment. ➤ Other tourism infrastructure development must support on modest levels of tourism activities and prevent easy levels of accessibility that supports high volumes of visitors. ➤ All visitors to this area must have paid entrance and hold a valid ticket. ➤ Visitation to sites in this area is provided for by tour companies registered with the Park or by transportation provided by the Park. Private access by vehicle is only permit by special permission by the Park. ➤ Each site will have in place procedures for regulating the appropriate volume of tourism visitors and appropriate visitor activities and behaviours, including safety. ➤ Visitors must stay on established paths, routes and itineraries. ➤ Both tourists and tourism service providers (guides) are themselves responsible for obeying these procedures and behaviour guidelines. ➤ Enforcement of these procedures and behaviours is the responsibility of the National Park.

Tourism zoning description

➤ Community Benefit Tourism Zone

There is a potential for tourism development if access is improved. There is currently one community, Ruc village, that would benefit from Community Benefit Tourism development and related activities such as trekking, animal viewing, water-based, and featuring traditional cultures. This could provide improved livelihoods, reduced pressures on natural resources, and quality tourism experiences.

3.3.5. Bufferzone

Decision No. 186/2006/QD-TTg (Article 24) notes that National Parks must have Bufferzones. The Bufferzones is area contiguous to the national park and includes all or a part of communes, wards and townships bordering on the Corezone of the National Park. Generally Bufferzones are established to prevent or reduce the human's encroachment upon national parks and that park management boards are urged to make arrangements for Bufferzone residents to participate in the protection, conservation and rational use of forest products and natural resources as well as for tourism related activities and services in and round the park to increase peoples' incomes and livelihoods.

The Bufferzone of the PNKB NP Region has a total land area of 226,544 ha and includes of 13 adjacent communes with approximately 60,000 people. Tourism in the Bufferzone is mainly limited to the Phong Nha township which forms the tourism hub for the PNKB NP

Region. At present community based tourism is developing near the Chay Lap village. There is a number of potential tourism sites located within this area.

Tourism management objectives and requirements

Table 28: Tourism management objectives and requirements for the Bufferzone

Tourism Management Objectives	Tourism Management Requirements
<ul style="list-style-type: none"> ➤ Support the development and management of tourism sites and activities that features the historical, cultural and natural environment that prioritises economic development and sustainable livelihoods for local communities and natural resource conservation both in the Bufferzone and the PNKB NP. ➤ Tourism development and management in the Bufferzone will be linked to the tourism development in the PNKB NP by providing complementary products and sites that serve to reduce tourism and resource extraction pressures in the Park and create a complete and comprehensive tourism destination for the region, linked to national and sub-regional tourism activity. ➤ All tourism development, especially infrastructure development in the Bufferzone should seek to engage local people and local economies as much as possible to maximise local economic development and sustainable livelihoods from tourism. 	<ul style="list-style-type: none"> ➤ Regulation and procedures for all major tourism sites in the Bufferzone including the appropriate volume of tourism visitors, description of visitor activities and behaviours and safety regulations. ➤ Both tourists and tourism service providers (guides) are themselves responsible for obeying these procedures and behaviour guidelines. ➤ Enforcement of these procedures and behaviours is the responsibility of the local (commune/District) authorities. ➤ Any commercial tourism operators will need to cooperate with relevant local (commune/District) authorities and consult the local community/residents on tourism developments. ➤ Visitation to tourism sites in the Bufferzone is provided for by tour companies and independent travel arrangements made by visitors.

Tourism zoning guidelines

Based on the relevant regulations, management objectives and tourism and community development potentials available this area has four tourism zones: Tourism Infrastructure Development Zone, Community Benefit Tourism Development, and Nature and Heritage Tourism Development, as well as routes for Historic Tourism Development.

➤ High Volume Tourism Zone and Tourism Infrastructure Investment Zone

The areas of Son Trach and Phuc Trach communes near to the main entrance of the National Park are designated as a High Volume Tourism Zone and Tourism Infrastructure Investment Zone. The significant part of these are largely disturbed, cultivated and inhabited by several communes. There is currently significant tourism infrastructure development (restaurants and guest houses) in the area, but there is still a strong need for better tourism planning and coordination. The areas are most suitable for major tourism infrastructure developments such as accommodations, restaurants and entertainment facilities.

➤ Community Benefit Tourism Zone

The designated areas in the Bufferzone often provide access to other tourism areas in the PNKB NP, and opportunities to develop both tourism activities focussed in the communities, and activities and service facilities to generally support the tourism development in the region. Other districts and communes located further from the main entrance to the PNKB NP have potentials for engaging in other tourism activities developed within the larger Bufferzone area.

➤ Nature and Heritage Tourism Zones

There is significant potential to develop nature and heritage tourism activities in the Bufferzone. Some sites are considered for priority tourism development include Than Dinh Mountain (not part of the Bufferzone but included due to its vicinity to the PNKB NP), Trooc River, and Phu Dinh Waterfall. Additionally, there is one site that is outside of the Bufferzone, Thac Mo (Dream) Waterfalls, and nature-based tourism activities and scenic spots along the Long Dai River. There are also numerous important and interesting historical sites in this region that deserve to be considered and planned and managed in a comprehensive and integrated manner in order to create uniform and high quality tourism products. Some sites with high potential for tourism development include Bai Dinh Historical Site, En Cave/Heavens Gate near Cha Lo and Hill 37, Cave 36 and Xuan Son Ferry, Cha Loi Cave, Hospital Cave, and Khe Gat Airfield.

The nature and heritage tourism sites and routes in the Bufferzone need to be developed and integrated into other provincial and national historical routes planned and developed in this area and should complement the high volume tourism sites within the Administrative and Service Area of the PNKB NP.

Figure 8 and 9 depict the tourism zones and sites of the Phong Nha - Ke Bang National Park Region

Figure 8: Map of the tourism zones of the Phong Nha - Ke Bang National Park Region.

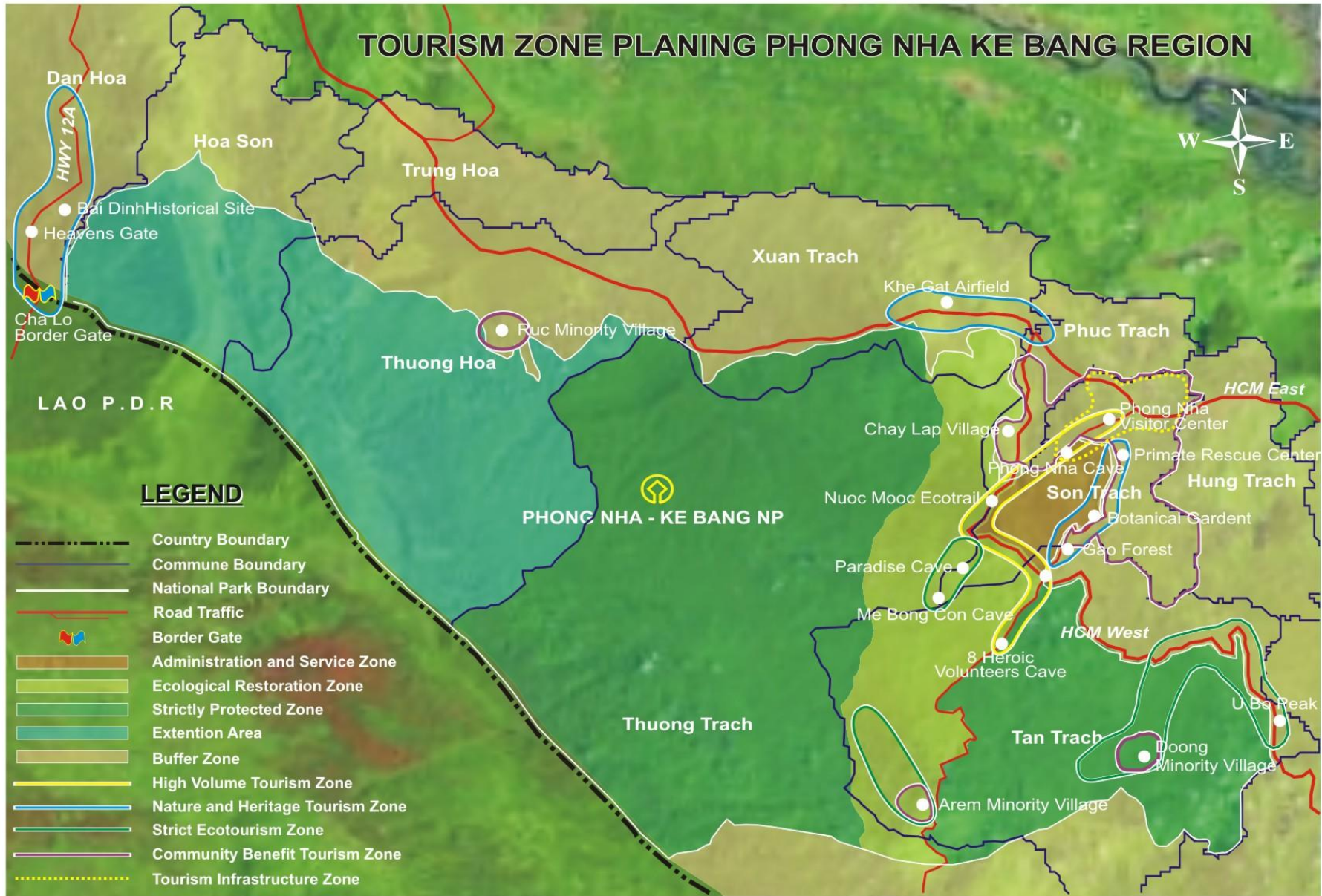


Figure 9: Map of the tourism sites of the Phong Nha – Ke Bang National Park Region



4. TOURISM DEVELOPMENT AND INVESTMENT PROPOSAL PROCESS

4.1. Tourism Development Investment: Calls for Proposals and Initial Screening

Calls for development proposals will be based on the tourism development investment detailed in the Implementation Plan of the STDP. Calls for investment will be conducted in an open and consistent manner to ensure a fair process that will attract the highest quality of proposals.

Table 29 provides a general set of standard conditions that prospective investors will have to demonstrate when submitting development proposals. The requirement for completing these conditions should be made clear to prospective investors before they prepare their proposals. The degree to which these conditions are met will provide a standard for initial investment proposal screening. Investment proposal that have successfully complied with these initial screening criteria will be eligible to advance to the process of review, approval and implementation.

Table 29: Initial Screening Criteria for Tourism Development Investment Proposals

Initial Screening Criteria for Tourism Development Investment Proposals
➤ Clear concept plan for the development
➤ Pre-feasibility of the concept plan
➤ Proof of long-term financial security
➤ Sound, market-based, business plan
➤ Provide the years of experiences and proven track record of quality performance in the tourism sector
➤ Statements on social benefit, and conservation enhancement
➤ A comprehensive environmental impact assessment

4.2. Sustainable tourism development criteria for the proposal review, approval, implementation and operations process

All processes for reviewing, approving, and implementation of tourism investment project must follow the procedures set out by the laws of Vietnam and the established governmental procedural standards of Quang Binh Province.

In addition to these standards and procedural norms, development and investment proposals should be evaluated against a set of sustainable tourism criteria as set out by the Global Sustainable Tourism Criteria listed in Appendix 5. The following provides a supplement of how these criteria can be incorporated into the tourism development proposal review, approval, implementation and operations process.

1. Review

Reviewing investment proposals against screening/selection criteria, with inputs from relevant government agencies and the NP. Feedback and recommendations are provided if necessary. The specific sustainable tourism criteria to apply to the investments under review to be determined upon a review by the most relevant government agencies and based on consideration of the location and sensitivity of the area to be developed, the form and scale of the proposed investment, and the impact mitigation strategy set out in the proposal. Once this set of criteria is established it will be applied to the development proposal under consideration in order to determine if and where the proposal requires modification to meet approval. Proposals that fully meet the criteria set out will progress on to the approval phase. Investors of proposals that fail to fully comply with the criteria set out will be informed where shortcomings exist and what is required for eventual approval, and invited to resubmit their proposals once adequate adjustments are complete.

2. Approval

Proposals that successfully pass the review phase will be awarded a development permit that will include a set of criteria to adhere to during the implementation and operational phases of their development. A more detailed set of impact indicators and standards for compliance will be designed that reflects the same criteria used during the review process but provides more details of what is to be expected throughout the implementation and operational phases.

3. Implementation

The PPC as represented by relevant departments and the NP will oversee the implementation and development of the investment project to ensure that compliance with criteria and conditions of the proposal approval are met.

Those found not to be in compliance with previously agreed implementation standards will receive a notification of violation clearly describing the infraction and the expected actions and timing to bring the infractions into compliance. If the infractions are not addressed a suspension of implementation can be imposed, and lifted only once the infractions have been adequately addressed. Serious and repeated failure to comply with the terms of the development approval can result in the annulment and revocation of development approvals.

4. Operations

The PPC as represented by relevant departments and the NP will monitor the operations of investment project to ensure that compliance with criteria and conditions of the proposal approval are maintained.

Those found not to be in compliance with previously agreed operational standards will receive a notification of violation clearly describing the infraction and the expected actions and timing to bring the infractions into compliance. If the infractions are not addressed a suspension of operation can be imposed, and lifted only once the infractions have been adequately addressed. Serious and repeated failure to comply with the terms of the development approval can result in the annulment and revocation of development approvals.

5. GUIDELINES AND ACTIVITIES FOR INVOLVING COMMUNITIES FOR POVERTY REDUCTION AND LIVELIHOOD IMPROVEMENT, AND ENVIRONMENTAL PROTECTION

5.1. Introduction

Tourism development can contribute to poverty reduction, livelihood improvement and environmental protection. It can be achieved through providing benefits to local communities, and takes place through two approaches:

1. **Community Based Tourism (CBT).** This is tourism that takes place in and features aspects of the local community, and the local community is directly involved in the development, operation, and management of tourism activities.
2. **Community Benefit Tourism (CBTf).** This is tourism that involves economic activities in the village that are linked to the tourism sector in the region – but tourists not necessarily through visit or engage with residents in their villages. This typically involves local communities providing products such as food, handicraft, or other materials that are sold to tourism businesses or visitors. This also includes employment in the tourism industry.

Through utilising both approaches local communities can receive the maximum benefits from tourism development in the area. It is anticipated that this approach will improve livelihoods, conserve natural and cultural resources both within and adjacent to the PNKB NP, and provide high quality, diversified tourism products to the PNKB NP Region.

5.2. Community Based Tourism (CBT)

5.2.1. Strategic approach

The CBT approach to tourism development seeks to utilise a community's tourism resources to achieve community development objectives. This approach relies on and supports broad community engagement in the planning, development and operation of tourism activities and services that feature local attractions and create an equitable distribution of benefits. While the CBT approach is community-led, it relies heavily on stakeholder engagement, especially support from local governments, tourism businesses and other development partners.

5.2.2. Development guidelines

Requirements

- Equitable benefit sharing within the community and tourism businesses operators using the CBT site. This is often achieved through:
 - Rotation system that provides equal opportunities for local service providers.
 - Producer groups for product providers that ensures a fair price and prevents unhealthy local competition
 - Community development fund that ensures that the wider community, especially the most disadvantaged, benefit from tourism activities in their village

- Contractual arrangements between the local community and tourism businesses operating at the site.
- Community-level organisation and management must provide equitable representation in a locally endorsed management structure. Often this can be achieved through the formation of a Local Community Tourism Committee or Association. Typically these bodies comprise a maximum of 10 community elected representatives with responsibilities to:
 - Manage the financial aspects in an open and transparent way.
 - Represent the community in tourism stakeholder meetings.
 - Monitor tourism development in the community.
- Market Viability. For any positive impact to result from a CBT initiative it must present a viable product that the market will buy. To ensure that CBT products are commercially viable it is necessary to:
 - Conduct proper market research that justifies starting a CBT initiative will be commercially viable.
 - Consult closely with tour operators throughout the project design, implementation, and promotion and delivery process.
 - Continue to improve products and services to meet the demands to key markets and changes in the market place.

Table 30 describes a typical CBT development process.

Table 30: Steps for developing CBT

Steps for Developing CBT
1. Site assessment reveals potential for CBT development: required resources, community interest, access and other considerations
2. Market validation of potential product feasibility assessment
3. Community awareness raising
4. Setting goals and preliminary activities to achieve these goals
5. Stakeholder engagement
6. Local organisation
7. Product development
8. Human resources development
9. Test product
10. Gradually start up operations: closely monitored and supported
11. Gradually handover local management responsibilities to the community as they become capable

Support network

The development of CBT typically requires a good support network. The following points describe a functional support network for CBT development:

- Support from local government agencies, development organisations and tourism businesses.
- Integrating support of other development partners/programmes in areas such as agricultural extension, rural infrastructure, skills development.
- Close coordination with other stakeholders, especially the business sector who can provide advice on product development, training assistance, and most importantly – market access.
- Supportive local development context created by local authority that permit and support tourism development in local communities.

Site selection

The site selection is crucial for CBT development. Ideally the CBT sites should be:

- Zoned for locations/sites where quality resources, access, attraction, interest, and ability (both internal and external conditions) exists.
- Ideally further away from main tourism sites, in order to:
- Balance the spread of tourism benefits more evenly throughout the region, and
- Provide more authentic CBT experiences for desired by the market sub-segments that best support this form of tourism.

5.3. Community Benefit Tourism (CBtT)

5.3.1. Introduction

Communities without the necessary requirements to host tourism can still achieve economic benefits through engagement in the tourism sector. Two main approaches:

- a. Income generation opportunities in the tourism economy, and
- b. Employment in the tourism sector

5.3.2. Income generation opportunities in the tourism sector economy Strategic approach

A market based approach that links local products to the demands of the tourism sector economy. This can involve:

- Selling local products to tourism businesses, such as agricultural products, typically through a value chain approach.
- Selling local products directly to tourists, such as handicrafts, locally produced speciality items or other souvenirs.

Development guidelines

Supporting this approach typically requires:

1. Market viability:

- Assessed through a comprehensive scan for potential products and review of the tourism sector market for the potentials and demands for the most high-impact products.
- Commercial viability with sufficient and equitable profit generating opportunities for those involved.
- Ongoing attention to markets demands, distribution channels, and product development.

2. Sufficiently broad network of skills and reliable market system:

- Steady and realistic pricing/costs/profits.
- Issues of consistency of quality and quantity are often main barriers.
- Reliable contracting and delivery of products/services.
- Local economies should avoid unhealthy competition to ensure a higher/fairer selling price.

3. Appropriate training on:

- Market demands and accessing new markets.
- Product refinement/development.
- Improved agricultural techniques.
- Entrepreneurial skills and micro-enterprise development and operations.

4. Sustainable Development Requirements:

- All income generating activities must strive to minimise and mitigate negative environmental impacts and seek to conform with local social norms and values.

Support network

- Forming producer groups also helps resolve certain issues like benefiting from economies of scale, more efficient training, organised benefit sharing.
- Support to product refinement or development.
- Business networking and contract/contracts.
- Development assistance partners can support by providing skills training for product development, and improved agricultural techniques.
- Local benefit distribution that ensures equal and fair access to opportunities amongst all community members.
- Favourable policies that support micro-enterprises and promotion of local products/services.

Site selection

The most suitable communities for initiatives to support income generation in the tourism economy must have either good access to tourism areas for direct selling to tourists, and/or

access to purchasers from the tourism sector for their local products. Close proximity to the main tourism sites and enterprises and tourism flows/routes would be advantageous. However, any communities in the region deserve consideration depending on the potential product-to-market opportunities identified.

5.3.3. Employment in the tourism sector

Strategic approach

Maximise opportunities for people from local communities to gain employment in tourism enterprises such as hotels, guesthouses and restaurants, as guides, or as site-level support (such as ticket sellers) and other tourism sector employment.

Development guidelines

Supporting this approach typically requires:

1. Make Tourism Training more Accessible to the Poor

Barriers to the poor participating more actively in tourism training programmes include the cost and time required to study, preclusive entrance requirements of formal training institutions, and lack of available of alternative and more accessible training facilities. To better engage the poor tourism training programs need to be developed that are affordable, fit local livelihood requirements, and are available in, or very near to where the poor live.

Two approaches are necessary to consider here, developing:

- Outreach programmes for community-based training support, and
- Intake programmes to provide more opportunities for the poor to participate in programmes provided by formal training institutions.

2. Make Tourism Training Relevant for the Poor

Vocational skills training should be based on both the current abilities of training participants and the tourism employment opportunities that they will likely engage in. Training techniques and materials might need to be developed for people with limited previous education. A quick return of benefits from training is especially relevant in the training of poor people who need more immediate results to keep them engaged in new income earning activities. On-the-job training is especially important to the poor who are in immediate need of incomes and should be made a priority focus of such programs.

3. Training for Entry-level Positions should also be followed by career advancement trainings.

While entry-level positions can provide the vital step up out of poverty, the full potential contributions available from people from disadvantage backgrounds should be further supported by opportunities to upgrading and career advancement training to support attainment of higher-level positions in the industry.

4. Greater Emphasis on Sustainable Development and Poverty Reduction Implications for Tourism Managers

Management capacity building and awareness raising on the importance of sustainable development and poverty reduction is required if the full contributions available from tourism in these areas are to be realised. Linking future tourism human resource development activities more closely with other national and regional poverty reduction strategies and programmes will leverage further impacts.

5. Seek to Partner with other Supporting Institutions, Organisations & Programmes

There are many institutions, organisations and programmes seeking to provide economic and livelihood enhancement opportunities for the poor that can provide excellent synergistic opportunities for integrating, up-scaling and enhancing training support to gain jobs in the tourism sector. Effective integration of more current vocational training techniques into the programmes and activities of established training institutions/programmes will also provide the further opportunities to effectively up-scale impacts. Enhanced links to the tourism industry can also lead to more industry-driven initiatives that are often highly effective and cost efficient, and sustainable.

Support Network

More specifically, roles for stakeholders to support greater employment of people from poor backgrounds include:

Government: Integrating policies and programmes, sector coordination:

- Need to coordinate their plans and policies with tourism wherever appropriate Other Ministries with strong influence over tourism development (such as Culture and Information, Agriculture and Rural Development, Planning and Investment, to name only a few).
- Overseeing and supporting better coordination within the overall sector – and joining as an active stakeholder.

Human Resource Development Institutions: Adaptive-innovative, out-reach and intake:

- Working closely with the business sector to ensure that their trainings are relevant and reflective of the sector's demand to ensure that their trainees are "industry ready" upon graduation.
- Develop appropriate approaches for reaching more poor students.

Tourism Businesses: Proactive partners – skills and opportunities:

- Proving on the job training and internship experience.
- Cooperation amongst industry members to collectively contribute to an overall enhancement of the industries human resources, and prevent unhealthy recruiting practices.
- Ensuring safe and fair working conditions for all employees.
- Reaching out to the community to be good corporate neighbours.

Development Sector: Coordination and integration of initiatives:

- Development organisations need to be engaged more fully in tourism development planning.
- Adapt and integrate their HRD, Tourism and Poverty Reduction initiatives and programmes.
- Provide targeted support to other stakeholders based on their areas of expertise.

Site Selection

The most suitable communities would be those in close proximity to the main tourism sites and enterprises, such as those close to the Tourism Infrastructure Zone. However, any communities in the region deserves consideration depending on the potential for access to training and employment opportunities.

5.4. Legislative imperatives and support

There is strong legislative support for providing local community benefits from tourism development in and near national parks and tourism destinations.

5.4.1. Law on Tourism

Articles 7 and 8 of the Law on Tourism provide further the legislative support for community participation in tourism.

➤ **Article 7. Participation of Local Community in Tourism Development**

1. The local community shall have rights to participate in and benefit from tourism activities; be liable to preserve tourism resources and nurture local cultural identity; maintain security, safety, social orders and environmental sanitation to create the attractiveness of tourism.
2. The local community shall be enabled to participate in the investment of tourism development, restoration and enrichment of various types of traditional cultures, folklore arts, crafts, goods production in service of tourists, contributing to uplift the material and spiritual life of the local people.

Communities can engage effectively in tourism activities through the formation of Tourism Associations that is covered by Article 8.

➤ **Article 8. Tourism Associations**

1. Tourism association shall be established on the basis of voluntary participation of tourism-related individuals and organisations; protect rights and legal interests and contribute to the development of its members.
2. Tourism association shall be entitled to take part in organising tourism propaganda, publicity and promotion activities; building and generalising legal regulations on tourism.
3. The organisation and operation of the tourism association shall be subject to the laws and regulations provided for association.

5.4.2. Decision No. 186/2006/QD-TTg

Article 24 of Decision No. 186/2006/QD-TTg pertains to the Bufferzones of national parks and states that Bufferzones shall be established to prevent or reduce the human's encroachment upon national parks and that park management boards shall make arrangement for Bufferzone residents to participate in the protection, conservation and rational use of forest products and natural resources as well as eco-tourist services so as to contribute to raising their incomes and associating their ways of earning living with activities in the parks.

5.5. Strategic Planning Framework

Table 31: Strategic planning framework for CBT and CBfT

Planning Timeframe	Functional Level	
	Community Based Tourism	Community Benefit Tourism
Short Term Planning – Immediate and High Priority Development Actions Year 1 - 3 (up to 2012)	<ul style="list-style-type: none"> ➤ Conduct awareness raising activities with local communities and authorities on the potentials of CBT development and the roles and responsibilities of stakeholders to support CBT development. ➤ Provide ongoing support to the Chay Lap CBT initiative as a pilot project to support the appropriate expansion of further CBT development in the region. ➤ Investigate the interest and opportunities for forming a CBT support network that could include tourism businesses, public authorities, development partners and local communities. 	<ul style="list-style-type: none"> ➤ Conduct a comprehensive scan to identify the full range of potential for matching local products with the demands of the tourism sector. This scan should be carried out in cooperation with the tourism businesses and development sector support to identify the most highest priority opportunities and developed into an coordinated action plan. ➤ Conduct a comprehensive assessment of tourism sector employment forecasts for the PNKB Region and together with cooperation from tourism businesses, vocational training institutions and the development sector to identify training needs and opportunities to support the design of an coordinated HRD action plan for local employment in the tourism sector.
Medium Term Planning – Intermediate Development Actions Year 3 - 5 (up to 2015)	<ul style="list-style-type: none"> ➤ Initiate support to CBT expansion in priority communities. ➤ Continued support to Chay Lap CBT initiative as a platform from which to support CBT profiling and expansion to other parts of the PNKB Region. ➤ Commence the establishment of a CBT support network if sufficient opportunities and interest exists. 	<ul style="list-style-type: none"> ➤ Implement initiatives set out in the action plan to enhance the income earning opportunities from the tourism sector for poor people living in the PNKB Bufferzone region. ➤ Implement the human resource development initiatives set out in the action plan to support increased employment of local people from the PNKB Region in the tourism sector.
Long Term Planning - Long-term Policies and Planning focus on Development Vision Year 5 - 10 (up to 2020)	<ul style="list-style-type: none"> ➤ Development of an integrated and well coordinated system of CBT developments in the region that strongly contributes to the overall quality and diversity of the tourism products of the PNKB Region while contributing to improved local livelihoods and the conservation of social and cultural values while protecting the environment. 	<ul style="list-style-type: none"> ➤ Establishment of a tourism sector that maximises the integration of local economies into the wider tourism economy to target poverty reduction, and provides opportunities and support for local people to gain employment tourism.

5.6. Development activities

Table 32: Development activities for CBT and CBfT

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1	<p>CBT Product Development in the PNKB NP</p> <ul style="list-style-type: none"> ➤ A Rem and Ruc villages: Conducted community development needs assessment, conduct socio-cultural sensitivity and conservation requirements, conduct environmental sensitivity analysis, support the community organisation, awareness raising and skills development for hosting tourism, establish and improve waste management, potable water and communications, conduct specific market analysis and product concept development, review policies permitting visitor stays, develop business agreements/concession system. 	<ul style="list-style-type: none"> ▶ 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Activity implementation
2	<p>Chay Lap CBT Product Development</p> <ul style="list-style-type: none"> ➤ Skills and language training for locals involved in tourism services to provide better (higher value) services, increase tourism awareness among local residents, develop and support the Chay Lap homestay as a replicable homestay model for the wider region, identify and support the operation of CBT activities such as biking, walking to other villages, kayaking and tubing, make the CBT activities available to day-visitors, identify additional opportunities to provide more households with tourism related earning, support the marketing and promotion of homestays and CBT activities in the region. 	<ul style="list-style-type: none"> ▶ Support business development and operations ▶ Capacity building 	<ul style="list-style-type: none"> ▶ Support business development and operations 	<ul style="list-style-type: none"> ▶ Core product consolidation ▶ Enhance positive impacts ▶ Operational support 	<ul style="list-style-type: none"> ▶ Monitoring and maintenance ▶ Broader networking links for CBT expansion
3	<p>CBT Product Development in the Bufferzone</p> <ul style="list-style-type: none"> ➤ Scanning and assessing further communities with CBT hosting potential and raise awareness about tourism in the communes and villages, assess the potential demand for CBT products in the Bufferzone, capacity needs assessments, survey and tour product assessments and feasibilities on financing mechanism. 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Activity implementation 	<ul style="list-style-type: none"> ▶ Activity implementation ▶ Support business development and operations
4	<p>CBfT in the Bufferzone</p>	<ul style="list-style-type: none"> ▶ Assessment, 	<ul style="list-style-type: none"> ▶ Assessment, 	<ul style="list-style-type: none"> ▶ Activity 	<ul style="list-style-type: none"> ▶ Activity

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
	<ul style="list-style-type: none"> ➤ Support the production of local products to be linked to the tourism supply chain, working in partnership with other relevant development initiatives (government and development organisation), consult further with tourism operators to clarify the actual demand for CBT products and work in cooperation to develop the most suitable products, support and integrate communes and villages in human resource development programmes. 	planning and consultation	planning and consultation <ul style="list-style-type: none"> ▸ Activity preparation 	preparation <ul style="list-style-type: none"> ▸ Activity implementation 	implementation <ul style="list-style-type: none"> ▸ Support business development and operations
5	Tourism Value Chain Analysis for the PNKB NP Region <ul style="list-style-type: none"> ➤ Conduct a study that provides tourism baseline indicators to support the expansion and development of tourism benefit opportunities including linking local products into the tourism economy and increasing local employment in the tourism sector. 	<ul style="list-style-type: none"> ▸ Conduct study identifying priority interventions 	<ul style="list-style-type: none"> ▸ Activity preparation ▸ Implement interventions 	<ul style="list-style-type: none"> ▸ Implement interventions ▸ Enhance market access 	<ul style="list-style-type: none"> ▸ Expansion of activities ▸ Up scaling and replication
6	CBT Human Resource Training <ul style="list-style-type: none"> ➤ Training needs assessment, skills and language training for locals involved in tourism services to provide better (higher value) services, increase tourism awareness among local residents. 	<ul style="list-style-type: none"> ▸ Needs assessment ▸ Design training interventions 	<ul style="list-style-type: none"> ▸ Implementation of training programs 	<ul style="list-style-type: none"> ▸ Enhancement and expansion of HRD programme 	<ul style="list-style-type: none"> ▸ Establish ongoing HRD support and implementation of training programs
7	Establishment of Community Enterprise Development Funds for Business Support & Construction <ul style="list-style-type: none"> ➤ Community enterprise development fund that supports: microenterprise tourism development loans such as homestays, community lodges and the community operation of CBT activities, business support for community agreements with commercial tour operators and funding for other HRD activities. 	<ul style="list-style-type: none"> ▸ Research optimal set up funding mechanisms 	<ul style="list-style-type: none"> ▸ Design specific intervention 	<ul style="list-style-type: none"> ▸ Implementation of funds ▸ Building support for funds 	<ul style="list-style-type: none"> ▸ Ongoing support to the funds as required

6. TOURISM PRODUCT DEVELOPMENT

6.1. Strategic approach and development guidelines

6.1.1. Strategic approach

The tourism product development in the PNKB NP Region will be based on high quality tourism products that feature the unique heritage, are properly sited, support and contribute to the overall tourism destination and consistent with the branding image, mitigate negative impacts and well matched to target markets.

Sustainable tourism product development is dependent on the following strategic directives:

Table 33: Strategic directives for tourism product development

Strategic Directives for Tourism Product Development	
➤	Capitalising on the unique aspects and features of PNKB region
➤	Directly support conservation and community development
➤	Compatible with the tourism development zones and site specific characteristics
➤	Support the sustainable use of resources
➤	Based on clear market information
➤	Support links with other tourism product and routes in these areas
➤	Integrate with current tourism programs of PNKB NP and other projects in the area
➤	Contribute to the comprehensive positioning of PNKBR tourism branding
➤	Products developed are appropriate scale and form with their sites

6.1.2. Development guidelines

The following guidelines provide more specific details on how the strategies describe above are put into action. For each product development activity a set of guidelines will be developed that describes. Priority guidelines for directing appropriate tourism product development in correspondence with the zoning areas:

Table 34: Development guidelines for tourism product development

General Product Development Guidelines	Tourism Zone Specific Priorities
➤ Preparation of a conservation, community development and sustainability statement.	i. <u>High Volume Tourism</u> : Impact mitigation
➤ Product feasibility statement that includes a product integration strategy, marketing strategy, environmental management and community development strategies.	ii. <u>Nature-Heritage Tourism</u> : Conservation and enhancement of heritage values
➤ Preparing and conducting stakeholder consultations.	iii. <u>Community Benefit Tourism</u> : Community engagement for community benefits
	iv. <u>Strict Ecotourism Tourism</u> : Impact mitigation and knowledge development
	v. <u>Tourism Infrastructure Investment</u> : Efficiencies and impact mitigation

6.2. Orientation of tourism products and tourism routes

6.2.1. Tourism activities and development potentials

All the relevant tourism sites in the PNKB NP Region have been assessed in terms of their potential for tourism activity development. Refer to Appendix 6 for a comprehensive site assessment. Table 35 provides an overview of the tourism activities and the general development potential. Appendix 7 further outlines the activities and matches them with specific key sites and target markets.

Table 35: Tourism activities and development potentials

Tourism Activity	Brief Description	General Development Potential
1. Sightseeing Caves	Sightseeing caving means visiting a caves that are easy accessible either by foot or by boat.	Very High
2. Scenic Sightseeing	Enjoying and experiencing the natural landscape.	Very High
3. War-time History	Sightseeing involving historical themes referring to the wartime history.	High
4. Walking	Walking activities range from short walks of five minutes to longer walks of two to three hours. Walking means that no special equipment is needed. Most walking routes should be walkable with normal footwear.	Very High
5. River cruising on a boat	River cruising using the current long boats.	High
6. Adventure Caving	Adventure caving activities refer to the exploring of remote and sensitive caves. These caves are not developed as high volume sightseeing caves. In order to experience the cave, the visitor may have to trek to the cave, climb in the cave or swim parts the cave.	High
7. Shopping and souvenirs	Buying locally made souvenirs.	Medium to High
8. Trekking	Trekking activities are longer walks ranging from half a day to multi day trips. Solid footwear is needed to walk on trekking trails and for multi day trips special equipment such as tents and cookery is needed.	Medium to High
9. Visiting villages and experience village activities	Visiting village experiences and engaging with village activities. This can range from walking through a village to engaging with villagers on daily activities such as ploughing rice paddy fields or cooking.	Medium to High
10. Homestay experience and activities	Overnight experience with a local family and engaging in daily life activities.	Medium to High
11. Scientific research	Visiting areas for scientific research and educational purposes.	Medium to High

Tourism Activity	Brief Description	General Development Potential
12. River kayaking or canoeing	Kayaking means travelling across water or a river while using a paddle. Kayaking is somewhat different from canoeing by the fact that a kayak has a closed paddling area and a canoe has an open paddling area. Kayakers sit in a seat on the bottom of the boat with their legs extended out in front of them. Canoeists will either sit on an elevated bench seat or kneel directly on the bottom of the boat.	Medium to High
13. Picnicking	Picnicking means eating a meal in the outdoors. Generally this refers to having lunch at a scenic location.	Medium to High
14. Swimming	Swimming refers to swimming activities in rivers and lakes.	Medium to High
15. Motorbike touring	This means touring with the motorbike on roads, both unpaved and paved.	Medium to High
16. River tubing	River tubing means floating in an inner tube down a river. People wear swimsuits or other gear that can be comfortably worn in the water. Life jackets are worn for additional safety.	Medium to High
17. Ethnic Minority Culture	Activities and experiences with Ethnic Minority cultures. This can range from interpretative stories to cooking classes.	Medium to High
18. Mountain biking/cycling	Mountain biking and cycling on the roads and paths around the region. Mountain biking involves also the cycling on unpaved roads.	Medium to High
19. Flying Fox/Zip Lines	A flying fox or zip line is a small cable car attached with a harness system that is propelled by gravity. A flying fox or zip line can span across valleys of tree.	Medium to High
20. Wildlife watching	Wildlife watching activities means watching the wildlife from a safe distance both for the visitor and the animals or birds.	Medium

6.2.2. Tourism routes for the PNKB NP Region

The major tourism flows to the PNKB NP Region travel from Dong Hoi to the Phong Nha township. The PNKB NP Administration and Service Area is the focal area for all the major tourism activity. Tourism routes were developed to support the visitor flow planning and to guide the product development. Table 43 shows the five tourism routes for the PNKB NP Region. Appendix 6 includes detailed assessments of the sites along the tourism routes.

Table 36: Tourism routes for the PNKB NP Region

Tourism Routes	Brief Description	Relevant Tourism Sites along the Route
Route 1: National Highway 12 Cha Lo - Khe Ve	Route 1 travels along National Highway 12 in the north of the PNKB NP Region. This route is between the Cha Lo Border Gate and the junction at Khe Ve.	Current tourism sites along the route include: En Cave/Heavens Gate and Bai Dinh Historical Site.

Tourism Routes	Brief Description	Relevant Tourism Sites along the Route
	The route provides some scenic viewpoints and has historical significant sites. This route travels through the Bufferzone.	
Route 2: National Highway 15 Khe Ve to the PNKB NP Administration and Service Area and HCM Trail	<p>Route 2 travels along National Highway 15 (HCM Highway) between the Khe Ve junction to the Bufferzone area of the Administration and Service Area (excluding the Son Trach commune).</p> <p>The route provides very scenic viewpoints of the PNKB NP. Generally the route is in the Bufferzone, although some tourism sites are in the PNKB NP.</p>	Current tourism sites along the route include: Thac Mo Waterfalls, Ruc Minority village, Cha Loi Cave, Khe Gat Airfield.
Route 3: Tourism route around the PNKB NP Administration and Service Area	<p>Route 3 travels around the PNKB NP Administration and Service Area. This route includes the major tourism sites of the PNKB NP Region. It is most likely used by the majority of visitors to the PNKB NP Region.</p> <p>The route is approximately equally shared between the Bufferzone and the PNKB NP. Most of the tourism sites are directly accessible from the tourism route.</p>	<p>Current tourism sites along the route include: Phong Nha township, Phong Nha Visitor Centre, Phong Nha Cave, Dong Tien Son Cave, Hang E, Bamboo Valley, Hang Toi, Primate Rescue Centre, Botanical Garden, Nuic Mooc Spring Ecotrail, Song Chai River, Gao Forest, Thac Gio Waterfalls, Hang Thien Duong, Me Bong Con and Hang Vom.</p> <p>Additionally the Eight Volunteers Cave is included in this route.</p>
Route 4: National Highway 20 (from the PNKB NP Administration and Service Area junction) to A Rem Village	<p>Route 4 travels between the junction of National Highway 20 in the PNKB NP and the border of the PNKB NP towards the Lao Border.</p> <p>The majority of the route is on an unsealed road which divides the Ecological Restoration Area and the Strictly Protected Area. The route provides at times very scenic viewpoints.</p>	Current tourism sites along the route include: Eight Volunteers Cave (shared with Route 3) and the A Rem Minority Village and surrounding caves
Route 5: HCM Trail (from the PNKB NP Administration and Service Area junction) via U Bo to Truong Son Village	<p>Route 4 travels between the junction of National Highway 20 in the PNKB NP along the HCM Trail to the exit/entrance of the PNKB NP towards the Truong Son Village.</p> <p>The route includes very scenic viewpoints of the PNKB NP and the Bufferzone.</p>	Current tourism sites along the route include: Access track via Doong village, Hang En and Son Doong Cave, U Bo Peak and Truong Son village/Song Long Dai River.

Figure 10 and 11 depict the detailed routes and sites of the Phong Nha – Ke Bang National Park Region

Figure 10: Map of the detailed tourism routes and sites of the PNKB NP Region

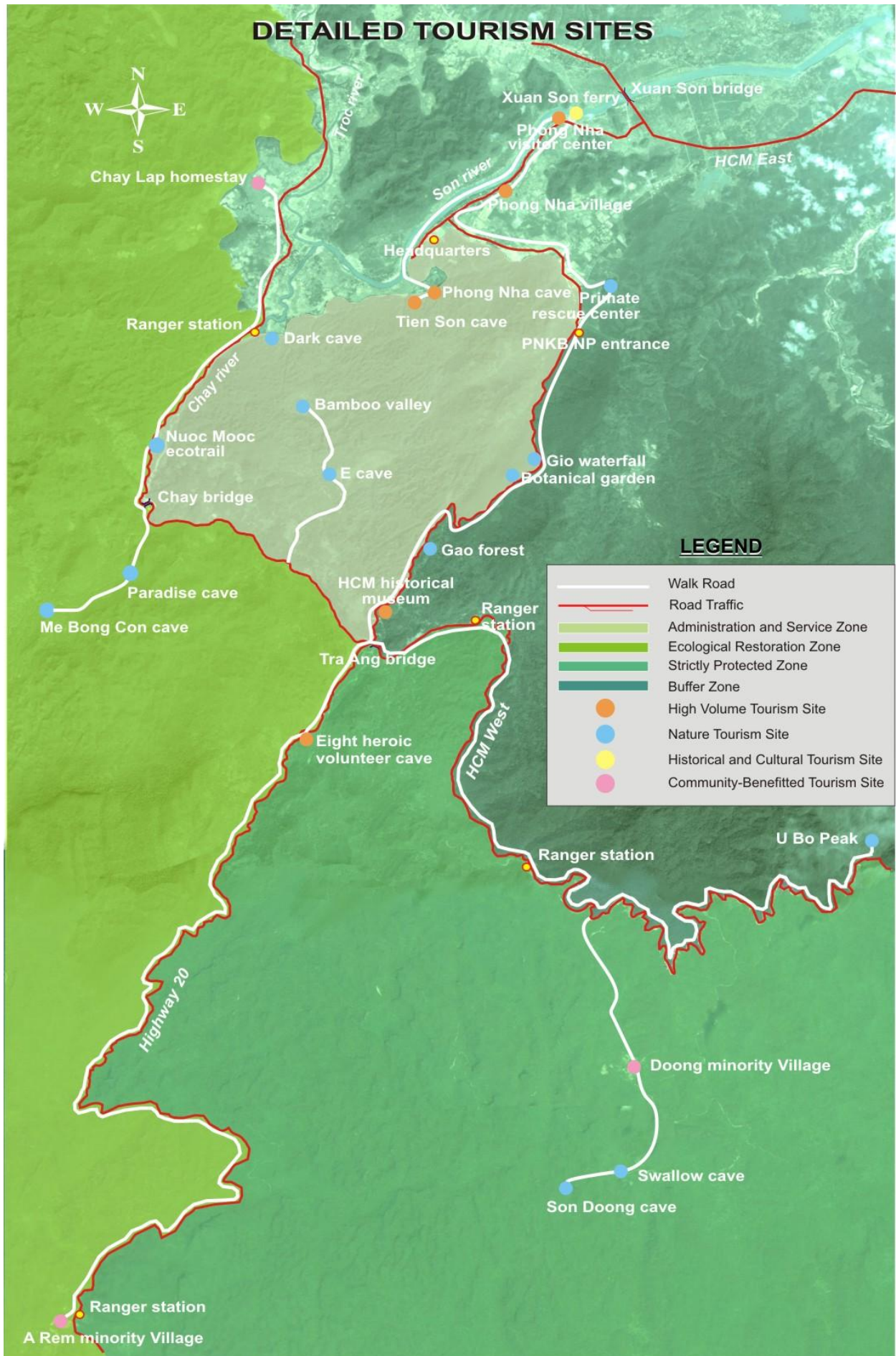


Figure 11: Map of the detailed tourism routes and sites of the Phong Nha – Ke Bang National Park Region



6.3. Strategic planning framework

Table 33: Strategic planning framework for tourism product development

Planning Timeframe	Spatial and Functional Area	
	Corezone of the PNKB NP (includes: Administrative and Service Area, Ecological Restoration Area, Strictly Protection Area, Extension Area)	Bufferzone
Short Term Planning – Immediate and High Priority Development Actions Year 1 - 3 (up to 2012)	<p>Administrative and Service Area:</p> <ul style="list-style-type: none"> ➤ Mitigate current negative impacts on tourism products and improve the quality of existing tourism products. Focus on the established key tourism sites and high visitor volume sites– Phong Nha Cave, Dry Cave and Eight Volunteers Cave. ➤ Investigate the feasibility for developing commercial tourism activities in the Bamboo Valley area for soft nature based activities as a medium-high visitor site that supports environmental/conservation awareness raising to larger numbers of visitors. Create sites level development plans. ➤ Develop and initiate site level development plans for tourism products for Botanical Garden and the Primate Rescue Centre that supports environmental/conservation awareness raising. ➤ Develop and initiate site level development plans for tourism products for Hang E (E Cave), Hang Toi (Dark Cave), Nuoc Mooc Spring Eco Trail and Song Chay River with a priority on linking these with soft adventure tourism activities such as walking, trekking, biking and kayaking. ➤ Align tourism products to potential tourism infrastructure developments supported by the ADB project such as the harbour development and bus route development. ➤ Enhance tourism product linkages with the Bufferzone. <p>Note: Before developing any other cave within the PNKB National park there has to be a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should include clear guidelines and criteria for such development taking particularly into account special criteria for WHS development.</p>	<p>Bufferzone:</p> <ul style="list-style-type: none"> ➤ Upgrade the quality of the Visitor Information Centre, especially interpretation materials. ➤ Support the establishment of existing community based tourism products – Chay Lap Village. ➤ Support the further development of soft adventure tourism activities (walking, trekking, biking and kayaking) in relevant areas of the Bufferzone. ➤ Develop and initiate site level development plans for tourism products for Cave 36 and Xuan Son Ferry, Cha Loi Cave, Khe Gat Airfield, and En Cave/Heavens Gate near Cha Lo and Hill 37 as a Historical Tourism product. ➤ Develop and initiate site level development plans for tourism products for U Bo Peak and Truong Son Village/Song Long Dai River. ➤ Conduct a study to support the expansion and development of future community based tourism products. ➤ Conduct a study to support the expansion and development of Community Benefit Tourism initiatives including providing products/services to tourists and the tourism economy, and strategies to increase local employment in the tourism sector. ➤ Enhance tourism product linkages with the Corezone.

Planning Timeframe	Spatial and Functional Area	
	Corezone of the PNKB NP (includes: Administrative and Service Area, Ecological Restoration Area, Strictly Protection Area, Extension Area)	Bufferzone
	<p>Ecological Restoration Area:</p> <ul style="list-style-type: none"> ➤ Mitigate current negative impacts on tourism products and improve the quality of existing tourism products at the Eight Heroic Volunteers Cave. ➤ Investigate the feasibility for developing tourism activities in the Me Bong Con and Hang Vom, Hang Thien Duong (Paradise Cave) areas. Create sites level development plans. ➤ Investigate the feasibility for developing tourism activities in the A Rem Minority Village and surrounding areas. Create sites level development plans. <p>Note: Before developing any other cave within the PNKB National park there has to be a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should include clear guidelines and criteria for such development taking particularly into account special criteria for WHS development.</p>	<p>Tourism Infrastructure Zone:</p> <ul style="list-style-type: none"> ➤ Conduct a comprehensive site planning and management strategy to support high volume tourism infrastructure. This study would identify and assess potential tourism infrastructure sites within the township, especially for larger scale accommodation development and incorporate infrastructure planning with an environmental management system, and based on accurate forecasts of visitor growth and market demands.
	<p>Strictly Protection Area:</p> <ul style="list-style-type: none"> ➤ Development of tourism products for the Hang En site and trekking route. ➤ Investigate the feasibility for developing tourism activities in the U Bo Peak. Create sites level development plans. <p>Note: Before developing any other cave within the PNKB National park there has to be a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should include clear guidelines and criteria for such development taking particularly into account special criteria for WHS development.</p>	
	<p>Extension Area:</p> <ul style="list-style-type: none"> ➤ Investigate the feasibility for developing tourism activities in the Ruc Minority Village surrounding caves. 	
Medium Term Planning – Intermediate Development Actions	<p>Administrative and Service Area:</p> <ul style="list-style-type: none"> ➤ Operate high quality tourism products for the high visitor volume tourism sites - Visitor Information Centre, Phong Nha Cave, Dong Tien Son Cave, and Ho Chi Minh Museum. 	<p>Bufferzone:</p> <ul style="list-style-type: none"> ➤ Operate successfully community based tourism products in selected areas of the Bufferzone. ➤ Establish and operate soft adventure tourism

Planning Timeframe	Spatial and Functional Area	
	Corezone of the PNKB NP (includes: Administrative and Service Area, Ecological Restoration Area, Strictly Protection Area, Extension Area)	Bufferzone
Year 3 - 5 (up to 2015)	<ul style="list-style-type: none"> ➤ Operate a range of soft adventure and nature tourism products based on medium visitor volume in the Bamboo Valley area. ➤ Operate a range of soft adventure and nature tourism products – based on medium visitor volume in the Hang E (E Cave), Hang Toi (Dark Cave), Nuoc Mooc Spring Eco Trail and Song Chay River areas. ➤ Strengthen and maintain tourism product linkages with the Bufferzone. ➤ Review and up-scale tourism product as appropriate. 	<p>activities (walking, trekking, biking and kayaking) in relevant areas of the Bufferzone.</p> <ul style="list-style-type: none"> ➤ Support the expansion and development of future community based tourism products. ➤ Support the expansion and development of community benefit tourism initiatives including providing products/services to tourists and the tourism economy, and strategies to increase local employment in the tourism sector. ➤ Strengthen and maintain tourism product linkages with the Corezone.
	<p>Ecological Restoration Area:</p> <ul style="list-style-type: none"> ➤ Development of tourism products for the Me Bong Con and Hang Vom, Hang Thien Duong (Paradise Cave) areas. ➤ Development of tourism products for the A Rem Minority Village and surrounding area. 	<p>Tourism Infrastructure Zone:</p> <ul style="list-style-type: none"> ➤ Support the investment and development for a high volume tourism in the Tourism Infrastructure Zone.
	<p>Strictly Protection Area:</p> <ul style="list-style-type: none"> ➤ Careful management of tourism products for the Hang En site and trekking route ➤ Development of tourism products for the U Bo Peak 	
	<p>Extension area:</p> <ul style="list-style-type: none"> ➤ If feasible, commence developing tourism activities in the Ruc Minority Village surrounding caves. 	
<p>Long Term Planning - Long-term Policies and Planning focus on Development Vision Year 5 – 10 (up to 2020)</p> <ul style="list-style-type: none"> ➤ High quality of tourism products that contribute to conservation and community development objectives ➤ Monitoring (ongoing review, maintenance, mitigation) ➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information 		

6.4. Development activities

Table 38: Development activities for tourism product development

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1	<p>Site Visitor Management Plan for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre</p> <ul style="list-style-type: none"> ➤ Develop a visitor management system for the Phong Nha Cave tour – including the Dong Tien Son Cave (Dry Cave) that regulates the visitor flows to the caves especially during the high season, establish a hourly carrying capacity for the cave, clearly define walking routes through the cave, and enhance and upgrade the lighting in the cave, strictly limit tour boats in the cave and at the cave entrance areas, develop clear guidelines and procedures for tour boat operators so visitor flows can be regulated, improve the quantity and quality of the information and interpretation materials about the Phong Nha Cave, investigate the potential to develop an interpretation centre at the entrance of the cave. 	<ul style="list-style-type: none"> ▶ Plan development and priority implementation activities 	<ul style="list-style-type: none"> ▶ Implementation activities and monitoring 	<ul style="list-style-type: none"> ▶ Implementation activities and monitoring 	<ul style="list-style-type: none"> ▶ Operation of high quality tourism product
2	<p>Visitor monitoring survey for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre</p> <ul style="list-style-type: none"> ➤ Set up and implement a regular visitor monitoring survey to assess the quality of the visitor experience 	<ul style="list-style-type: none"> ▶ Initial survey development 	<ul style="list-style-type: none"> ▶ Regular survey 	<ul style="list-style-type: none"> ▶ Regular survey 	<ul style="list-style-type: none"> ▶ Regular survey
3	<p>Conceptual redevelopment of the Visitor Information Centre</p> <ul style="list-style-type: none"> ➤ Planning: Integrate the Phong Nha Visitor Centre in the planning and management concept of the tourist port complex, improve the quantity and quality of the information and interpretation materials of the visitor centre, investigate a potential business model for the visitor centre, actively promote and integrate the visit centre as part of the Phong Nha Cave experience. ➤ Construction: Assess reconstruction requirements. 	<ul style="list-style-type: none"> ▶ Plan development and reconstruction assessment 	<ul style="list-style-type: none"> ▶ Reconstruction - Business development and operation 	<ul style="list-style-type: none"> ▶ Business development and operation 	<ul style="list-style-type: none"> ▶ Operation of high quality tourism product
4	<p>Site Visitor Management Plan for Eight Volunteers Cave</p> <ul style="list-style-type: none"> ➤ Develop a site management plan (including environmental management systems for waste collection and disposal) that includes visitor-monitoring system to assess site specific tourism flows, define walking routes at the sites, specifically between the Pagoda and the cave site, improved and expand tourism facilities and services, develop better interpretation materials about the 	<ul style="list-style-type: none"> ▶ Plan development and priority implementation activities 	<ul style="list-style-type: none"> ▶ Implementation activities and monitoring 	<ul style="list-style-type: none"> ▶ Implementation activities and monitoring 	<ul style="list-style-type: none"> ▶ Operation of high quality tourism product

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
	site and provide additional information about the region, investigate the potential of developing a walking opportunity to provide an additional experience on the site and to ease the visitor flows around the site.				
5	<p>Trekking product development in the PNKB NP</p> <ul style="list-style-type: none"> ➤ Assessment of the trekking route requirements, marking of the trekking routes, development guidelines and operating procedures for the trekking routes, management system for the trekking routes, environmental impact mitigations, carrying capacities, and interpretations materials. ➤ Suggested trekking routes – To Hang En, To Bamboo Valley, To Hang Tien Duong, To Me Bong Con and Hang Vom, To Hang Son Doong, A Rem community and surrounding caves. <p>Note: Before developing any other cave within the PNKB National park there has to be a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should include clear guidelines and criteria for such development taking particularly into account special criteria for WHS development.</p>		<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Implement activities ▶ Product development 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development and operations
6	<p>Walking, trekking and biking route development in the Bufferzone</p> <ul style="list-style-type: none"> ➤ Marking of the walking, trekking and biking route in the Bufferzone focused on the adjacent area of the administration and service area – Son Trach commune., development guidelines for the walking, trekking and biking route routes, management system for the walking, trekking and biking route that includes the community, environmental impact mitigations, carrying capacities, and interpretations materials. ➤ This should be linked to the CBT development in the Bufferzone ➤ Sites that should be included: Cave 36 and Xuan Son Ferry, selected villages and the riversystem. 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Implement activities ▶ Product development 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development and operations 	<ul style="list-style-type: none"> ▶ Business development and operations
7	<p>Water-based product development in the PNKB NP/ Bufferzone</p> <ul style="list-style-type: none"> ➤ Development of river activities such as kayaking, tubing, swimming, river cruising. ➤ Marking of the routes for water-based activities, development guidelines for water based activities, environmental impact mitigations, carrying capacities, consult with the PNKB NP and the community to cooperate on the river use, 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design ▶ Activity 	<ul style="list-style-type: none"> ▶ Implement activities ▶ Product development 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development 	<ul style="list-style-type: none"> ▶ Business development and operations

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
	<p>providing adequate training for interpretation services, visitor hosting, and potential safety rescue.</p> <ul style="list-style-type: none"> ➤ This should be linked to the CBT development in the Bufferzone ➤ Rivers that should be included: Song Chay River, Trooc River, Song Son and Song Long Dai. 	preparation		and operations	
8	<p>Adventure caving product development</p> <ul style="list-style-type: none"> ➤ Development of adventure caving activities. ➤ Assessment of caves on their adventure caving potentials, marking of the walking routes through the caves, development guidelines and operating procedures for adventure caving, environmental impact mitigations, carrying capacities, and interpretations materials. ➤ Caves that should be included: Hang E, Hang Toi, Hang Thien Duong, Me Bong and Hang Vom, Hang En <p>Note: Before developing any other cave within the PNKB National park there has to be a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should include clear guidelines and criteria for such development taking particularly into account special criteria for WHS development.</p>		<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Implement activities ▶ Product development 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development and operations
9	<p>Wildlife watching product development</p> <ul style="list-style-type: none"> ➤ Development of wildlife watching opportunities. ➤ Assessment of areas for wildlife watching, investigate infrastructure requirements such as viewing points or platforms, development of guidelines for wildlife watching. ➤ Focus on existing sites such as the Hatinh Langur viewing area just before the Nuoc Mooc Ecotrail, Primate Rescue Centre and Botanical Garden 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Implement activities 	<ul style="list-style-type: none"> ▶ Product development ▶ Product development support 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development and operations
10	<p>Concept development for a tourism operation at the Primate Rescue Centre</p> <ul style="list-style-type: none"> ➤ Develop a site-specific operational management plan to ensure safety, visitor guiding guidelines and prevention of impacts on the environment and animals, develop interpretation materials, interpreter training, scheduling, and impact assessment/monitoring program, design an appropriate visitation schedule with the project managers 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Implement activities 	<ul style="list-style-type: none"> ▶ Product development ▶ Product development support 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
					and operations
1 1	Concept development for Botanical Garden <ul style="list-style-type: none"> ➤ Prepare a concept plan for the Botanical Garden. This should include visitor management, trail development, information and interpretation, and potential infrastructure needs such as signage, parking, toilets and staff rooms, develop site-specific interpretation and information, investigate the opportunity to use PNKB NP staff or people from the community as interpretation guides. 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Implement activities 	<ul style="list-style-type: none"> ▶ Product development ▶ Product development support 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business development and operations
1 2	Concept development for a tourism operation at the Bamboo Valley <ul style="list-style-type: none"> ➤ Carefully review any investment proposals for the valley on their impact on the biodiversity of the area and the region in general, assess the biodiversity and clearly describe the existing wildlife of the valley, conduct a complete site assessment to determine an appropriate level of tourism product and infrastructure development that would meet the demands of the market while ensuring environmental protection and conservation values, investigate the potential for a canopy walk in the valley and prepare a feasibility study. 	<ul style="list-style-type: none"> ▶ Assessment of environmental sensitivity ▶ Market research 	<ul style="list-style-type: none"> ▶ Concept development ▶ Planning preparation 	<ul style="list-style-type: none"> ▶ Product design ▶ Assessment and planning ▶ Investment organisation 	<ul style="list-style-type: none"> ▶ Investment mobilisation ▶ Commerce development actives
1 3	Concept development for Gao Forest <ul style="list-style-type: none"> ➤ Prepare a concept plan for the Gao Forest. This should include visitor management, trail development, information and interpretation, and potential infrastructure needs such as signage, parking, toilets and staff rooms, develop site-specific interpretation and information, investigate the opportunity to use PNKB NP staff or people from the community as interpretation guides. 			<ul style="list-style-type: none"> ▶ Assessment and planning 	<ul style="list-style-type: none"> ▶ Product design ▶ Activity preparation
1 4	Concept development for U Bo Peak <ul style="list-style-type: none"> ➤ Investigate a trail route for U Bo Peak, investigate funding feasibilities for the trail route, consider how this site will be incorporated into other tourism routes/products. 		<ul style="list-style-type: none"> ▶ Assessment and planning 	<ul style="list-style-type: none"> ▶ Product design ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Implement activities
1 5	Site development for Thac Mo Waterfalls <ul style="list-style-type: none"> ➤ Site planning, develop the parking area as a designated rest stop of the National Highway 15. Key infrastructure needs at the rest area are: Signage to the parking area and waterfall, Toilets and rubbish facilities, Facilities for catering to tourist such as refreshments, relaxing, souvenirs selling. Develop 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Implement 	<ul style="list-style-type: none"> ▶ Product development ▶ Product development 	<ul style="list-style-type: none"> ▶ Product development support ▶ Business

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
	site-specific interpretation and information about the region. Develop the site as part of other tourism route development for National Highway 15.		activities	support	development and operations
1 6	Maintenance and extension of Nuoc Mooc Spring Eco Trail <ul style="list-style-type: none"> ➤ Review a potential expansion of the trail, review and check maintenance schedule of the trail, especially for the bridges, improve interpretation panels and information at the site, connect and integrate the trail with CBT activities at the Chay Lap village, seek more opportunities to contribute to local economic development –such as provision of goods and services (refreshments, souvenirs and local produce by nearby villagers, establish a visitor-monitoring plan and consider a site management plan for the future, support the marketing and promotion of the trail, and link and package the trail with other tourism activities. 	<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Implement activities for expansion 	<ul style="list-style-type: none"> ▶ Support business operations and product integration 	<ul style="list-style-type: none"> ▶ Ongoing support as needed
1 7	Monitor development of planned HCM Museum <ul style="list-style-type: none"> ➤ Monitor planning and construction of the museum, brief construction leaders about the STDP, integrate museum development in visitor management of the PNKB NP. Especially in the sightseeing touring route around the Administration and Service Area. Be aware that this will be a high volume tourism site. 	<ul style="list-style-type: none"> ▶ Cooperate 	<ul style="list-style-type: none"> ▶ Coordinate and integrate with other planning 	<ul style="list-style-type: none"> ▶ Integration with other planning 	<ul style="list-style-type: none"> ▶ Monitor
1 8	Development of minor tourism sites for driving route development <ul style="list-style-type: none"> ➤ The sites include: Cha Lo Cave (including viewing area from the Highway into the valley), Bai Dinh Historical Site, En Cave/Heavens Gate near Cha Lo and Hill 37, Than Dinh Mountain, Khe Gat Airfield. ➤ Site specific development that should include: Tidy up the site and potentially provide small-scale infrastructure such as toilets, develop site-specific interpretation and information about the region, develop the site as part of a tourism route development, raise awareness in the local community about tourism and supporting services such as refreshments, meals and souvenirs. 		<ul style="list-style-type: none"> ▶ Assessment and planning ▶ Product design 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Implement activities 	<ul style="list-style-type: none"> ▶ Product development ▶ Product development support
1 9	CBT product development in the PNKB NP <ul style="list-style-type: none"> ➤ A Rem and Ruc villages: Conducted community development needs assessment, conduct socio-cultural sensitivity and conservation requirements, conduct environmental sensitivity analysis, support the community organisation, awareness raising and skills development for hosting tourism, establish and 		<ul style="list-style-type: none"> ▶ Assessment, planning and consultation 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation ▶ Activity 	<ul style="list-style-type: none"> ▶ Activity implementation

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
	improve waste management, potable water and communications, conduct specific market analysis and product concept development, review policies permitting visitor stays, develop business agreements/concession system.			preparation	
20	Chay Lap CBT product development <ul style="list-style-type: none"> ➤ Skills and language training for locals involved in tourism services to provide better (higher value) services, increase tourism awareness among local residents, develop and support the Chay Lap homestay as a replicable homestay model for the wider region, identify and support the operation of CBT activities such as biking, walking to other villages, kayaking and tubing, make the CBT activities available to day-visitors, identify additional opportunities to provide more households with tourism related earning, support the marketing and promotion of homestays and CBT activities in the region. 	<ul style="list-style-type: none"> ▶ Support business development and operations ▶ Capacity building 	<ul style="list-style-type: none"> ▶ Support business development and operations 	<ul style="list-style-type: none"> ▶ Core product consolidation ▶ Enhance positive impacts ▶ Operational support 	<ul style="list-style-type: none"> ▶ Monitoring and maintenances ▶ Broader networking links for CBT expansion
21	CBT product development in the Bufferzone <ul style="list-style-type: none"> ➤ Scanning and assessing further communities with CBT hosting potential and raise awareness about tourism in the communes and villages, assess the potential demand for CBT products in the Bufferzone, capacity needs assessments, survey and tour product assessments and feasibilities on financing mechanism. 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Activity implementation 	<ul style="list-style-type: none"> ▶ Activity implementation ▶ Support business development and operations
22	CBfT in the Bufferzone <ul style="list-style-type: none"> ➤ Support the production of local products to be linked to the tourism supply chain, working in partnership with other relevant development initiatives (government and development organisation), consult further with tourism operators to clarify the actual demand for CBT products and work in cooperation to develop the most suitable products, support and integrate communes and villages in human resource development programmes. 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation 	<ul style="list-style-type: none"> ▶ Assessment, planning and consultation ▶ Activity preparation 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Activity implementation 	<ul style="list-style-type: none"> ▶ Activity implementation ▶ Support business development and operations
23	Tourism Value Chain Analysis for the PNKB NP Region <ul style="list-style-type: none"> ➤ Conduct a study that provides tourism baseline indicators to support the expansion and development of tourism benefit opportunities including linking local products into the tourism economy and increasing local employment in the tourism sector. 	<ul style="list-style-type: none"> ▶ Conduct study identifying priority interventions 	<ul style="list-style-type: none"> ▶ Activity preparation ▶ Implement interventions 	<ul style="list-style-type: none"> ▶ Implement interventions ▶ Enhance market access 	<ul style="list-style-type: none"> ▶ Expansion of activities ▶ Upscaling and replication

7. TOURISM MARKETING AND PROMOTION

7.1. Strategic approach and guidelines

7.1.1. Strategic approach

A comprehensive marketing and promotion approach is needed that presents a consistent and high quality image of the PNKB region to attract visitors from targeted market segments that supports sustainable tourism and conservation of heritage values.

Appropriate and effective marketing and promotion strategies and activities is dependent on the following strategic directives:

Table 39: Strategic directives for tourism marketing and promotion

Strategic Directives for Tourism Marketing and Promotion:
<ul style="list-style-type: none">➤ Capitalising on the unique aspects and features of PNKB region➤ Contribute to the comprehensive positioning of PNKBR tourism branding➤ Target prioritised market segments➤ Take full opportunity of effective cooperation and integration with relevant strategies, activities and partners➤ Maximise efficiencies and cost effectiveness➤ Coordination with other campaigns and strategies at the National and sub-regional levels.➤ Comprehensive and integrated strategy that incorporates other aspects of this plan in including the Information and Interpretation, HRD, Product development strategies and activities.

7.1.2. Development guidelines

Table 40: Development guidelines for tourism marketing and promotion

Development Guidelines
<ul style="list-style-type: none">➤ Guidelines for directing a comprehensive marketing and promotion strategy➤ Linked to Provincial, regional and National strategies and activities➤ Maintain a consistent image and message about PNKB Region as a destination➤ Emphasises the quality heritage values and efforts for conservation➤ Information: tracking, consumer satisfaction➤ With an emphasis on Learning and Conservation.➤ Key feature in Quang Binh and NC Vietnam, Vietnam's UNESCO Cluster, GMS East-West Tourism Corridor, Asia-Global World Heritage Sites

7.2. Strategic planning framework

Table 341: Strategic planning framework for tourism marketing and promotion

Planning Timeframe	Functional Level	
	PNKB Region	Quang Binh, National, and Sub-regional
Short Term Planning – Immediate and High Priority Development Actions Year 1 -3 (up to 2012)	<ul style="list-style-type: none"> ➤ Prepare comprehensive marketing strategy that includes: <ul style="list-style-type: none"> ▪ Comprehensive market analysis ▪ Positioning and branding strategy ▪ Marketing and distribution channels and strategies ▪ Promotional activities ➤ Establish a market information collection and analysis system that includes: <ul style="list-style-type: none"> ▪ Visitor and market tracking, ▪ Stakeholder satisfaction ➤ Develop quality marketing materials and promotional strategies that are consistent, targeted and accurately reflect the “branding” and “positing” of the PNKB NP Region tourism product. 	<ul style="list-style-type: none"> ➤ Incorporate PNKB NP Region into national and sub-regional strategies ➤ Participation of representatives from the DCST and businesses at national and sub-regional promotional events and trade fairs
Medium Term Planning – Intermediate Development Actions Year 3 - 5 (up to 2015)	<ul style="list-style-type: none"> ➤ Monitor market information, ➤ Improve and consolidate marketing material ➤ Exploit key distribution channels 	<ul style="list-style-type: none"> ➤ Expand on positioning of PNKB NP Region targeting key markets ➤ Incorporate PNKB NP Region further into national, regional and global markets/campaigns ➤ Exploit optimal marketing channels ➤ Upgrade and refine marketing materials ➤ On-going market analysis
Long Term Planning - Long-term Policies and Planning focus on Development Vision Year 5 – 10 (up to 2020)	<ul style="list-style-type: none"> ➤ Continued review and refinement of the product-market match in relation to achieving Park management objectives ➤ Maintaining and high quality of tourism marketing and promotional strategies, products and activities that contribute to conservation and community development objectives ➤ Monitoring (ongoing review and refinement) ➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information 	

7.3. Development activities

Table 352: Development activities for tourism marketing and promotion

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1	<p>Marketing and Promotion Strategy and Action Plan for the PNKB NP Region</p> <ul style="list-style-type: none"> ➤ This should include: comprehensive market analysis (based on visitor monitoring survey), positioning and branding strategy (working together with the Quang Binh Province and VNAT), development of marketing and distribution channels and a comprehensive action plan 	<ul style="list-style-type: none"> ▶ Plan development ▶ Priority implementation activities designed 	<ul style="list-style-type: none"> ▶ Priority implementation of strategy activities ▶ Further research as required ▶ Monitoring 	<ul style="list-style-type: none"> ▶ Comprehensive implementation of activities ▶ Monitoring and refinement 	<ul style="list-style-type: none"> ▶ Ongoing monitoring and refinement
2	<p>Visitor monitoring survey for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre</p> <ul style="list-style-type: none"> ➤ Set up and implement a regular visitor monitoring survey to assess the quality of the visitor experience. 	<ul style="list-style-type: none"> ▶ Initial survey development 	<ul style="list-style-type: none"> ▶ Regular survey 	<ul style="list-style-type: none"> ▶ Regular survey 	<ul style="list-style-type: none"> ▶ Regular survey
3	<p>Branding</p> <ul style="list-style-type: none"> ➤ Develop a consistent brand and logo for the region. This should be used for all the marketing collateral, media and interpretation signage. 	<ul style="list-style-type: none"> ▶ Branding strategy ▶ Logo design ▶ Priority implementation activity 	<ul style="list-style-type: none"> ▶ Continued branding activity 	<ul style="list-style-type: none"> ▶ Branding effectiveness assessment ▶ Revise as required 	<ul style="list-style-type: none"> ▶ Continued branding activities ▶ Branding expansion
4	<p>Development of marketing collateral for the PNKB NP Region</p> <ul style="list-style-type: none"> ➤ Develop consistent marketing collateral such as brochures, posters leaflets etc about the region. Include the development of a comprehensive tourism map and site-specific brochures. 	<ul style="list-style-type: none"> ▶ Initial improvement to materials for each sites 	<ul style="list-style-type: none"> ▶ Development of comprehensive, integrated marketing materials 	<ul style="list-style-type: none"> ▶ Review and update as required 	<ul style="list-style-type: none"> ▶ Review and update as required

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
5	Advertisement and promotion <ul style="list-style-type: none"> ➤ Implement advertisement and promotional activities as prepared in the Marketing and Promotion Strategy and Action Plan for the PNKB NP Region. 	<ul style="list-style-type: none"> ▶ Initial improvement to materials for each sites 	<ul style="list-style-type: none"> ▶ Development of comprehensive, integrated marketing materials 	<ul style="list-style-type: none"> ▶ Review and update as required 	<ul style="list-style-type: none"> ▶ Review and update as required
6	Website development and maintenance <ul style="list-style-type: none"> ➤ Develop a promotional website that represents the region and all of the tourism stakeholders. Potentially include a booking system platform for the main cave tours, activities around the regions and accommodation. 	<ul style="list-style-type: none"> ▶ Initial improvement to website based on marketing approach and clear information 	<ul style="list-style-type: none"> ▶ Extend content and establish booking system 	<ul style="list-style-type: none"> ▶ Refine content and operate booking system 	<ul style="list-style-type: none"> ▶ Ongoing refine content and operate booking system
7	Support for fam tours for tourism operators and media <ul style="list-style-type: none"> ➤ Provide ongoing in the region support to tourism operators and visiting media. Regularly invite key tourism operators (tour agents) and media representatives. 	<ul style="list-style-type: none"> ▶ Establish fam tour programme 	<ul style="list-style-type: none"> ▶ Regular fam tours 	<ul style="list-style-type: none"> ▶ Regular fam tours 	<ul style="list-style-type: none"> ▶ Regular fam tours
8	Participation at national and sub-regional promotional events and trade fairs <ul style="list-style-type: none"> ➤ Regularly participate at national and sub-regional promotional events and trade fairs. Based on Marketing and Promotion Strategy and Action Plan for the PNKB NP Region. 	<ul style="list-style-type: none"> ▶ Prepare comprehensive schedule of events ▶ Material preparation 	<ul style="list-style-type: none"> ▶ Participation in priority events 	<ul style="list-style-type: none"> ▶ Broader participation in priority events 	<ul style="list-style-type: none"> ▶ Ongoing participation in priority events

8. TOURISM INFORMATION MANAGEMENT AND INTERPRETATION MANAGEMENT

8.1. Introduction

This section includes important aspects of both effective information management (collection and utilisation of information) and the provision of high quality and effective interpretation (a form of information management), essential in providing high quality tourism experiences and supporting the PNKB NP management objectives.

8.1.1. Information management

The availability of quality information is of fundamental importance to the effective management of tourism in national parks and protected areas. Accurate and relevant information is needed to support effective monitoring and management of development impacts, development and maintenance of quality tourism products and tourism experiences, and marketing strategies. Information management is a comprehensive task that is best achieved through the development of an information management system comprised of interrelated components for information collection, organisation, production, analysis, and response.

8.1.2. Interpretation Strategy

The goal of all interpretive services is to increase each visitor's enjoyment and understanding of the PNKB NP, and to allow visitors to care about the park on their own terms. Effective interpretation is based on a comprehensive and integrated approach that strategically coordinates the visitor's access to specifically designed and located information sources within the destination area. The intention of this approach is to lead the visitor through an effective learning experience that is part of a rewarding tourism experience. In order to achieve the maximum effect it is important that all tourism information be designed and delivered through the development and implementation of a comprehensive interpretation strategy.

8.2. Strategic approach and development guidelines

8.2.1. Strategic approach

A comprehensive and coordinated Information Management and Interpretation strategy is of key importance for creating high quality tourism experiences that emphasise awareness raising and conservation of natural and heritage values, and support the accurate monitoring and effective management requirements by keeping track of overall and site specific tourism impacts, visitor satisfaction and market information.

Table 43: Strategic directives for tourism information management and interpretation management

Strategic Directives	
Tourism Information Management	Tourism Interpretation Management
<ul style="list-style-type: none"> ➤ Information on visitor characteristics, impacts and satisfaction needs to be collected at all tourism sites. ➤ Information needs to be effectively collected and presented to support well informed, strategic and timely management responses for impact management, product development and marketing. ➤ Information management needs to be carried out within a comprehensive and integrated information management system 	<ul style="list-style-type: none"> ➤ Quality visitor experiences and effective visitor awareness raising is dependant on a high quality and strategically coordinated interpretation. ➤ Interpretation will address all forms of tourism information including promotional materials, maps, brochures, passive and active information sources at visitor sites and inclusive of guides and information service providers. ➤ Interpretation covers the entire destination area in an integrated manner and will align with broader and affiliated tourism information strategies.

8.2.2. Development Guidelines

Table 44: Development guidelines for tourism information management and tourism interpretation management

Development Guidelines	
Tourism Information Management	Tourism Interpretation Management
<ul style="list-style-type: none"> ➤ Each tourism site will have specific procedures for information collection on visitor characteristics, impacts and satisfaction. ➤ Site-level information will be collected, organised and presented for management response at appropriate levels to support timely and effective management responses. 	<ul style="list-style-type: none"> ➤ Specific interpretation materials will be developed for each tourism site. ➤ Site-level interpretation materials will contribute to interpretation strategies for tourism awareness raising themes, thematic tourism areas, and the interest of key market segments. ➤ The interpretation strategy will be integrated into all forms of visitor information and designed to lead the visitor through an informative and rewarding awareness raising experiences as part of their visit to the PNKB region.

8.3. Strategic planning framework

Table 45: Strategic planning framework for tourism information management and interpretation management

Planning Timeframe	Functional Level	
	Information Management	Interpretation Management
Short Term Planning - Immediate and High Priority Development Actions Year 1 - 3 (up to 2012)	<ul style="list-style-type: none"> ➤ Design a Comprehensive Information Management system and Action Plan, inclusive of components to support the monitoring and management of tourism and the accurate recording of visitor activity for marketing purposes. ➤ Develop an information management training strategy. See HRD Section for more comprehensive details. 	<ul style="list-style-type: none"> ➤ Prepare a Comprehensive Interpretation Strategy and Action Plan. ➤ Develop general interpretation materials for Information Centre, including multi-media. ➤ Prepare site-specific interpretation materials for priority sites. ➤ Interpretation/Guide training for park staff, local communities, and tourism companies See HRD Section for more comprehensive details
Medium Term Planning - Intermediate Development Actions Year 3 - 5 (up to 2015)	<ul style="list-style-type: none"> ➤ Implement the Comprehensive Information Management system and Action Plan ➤ Implement the information management training strategy ➤ Operationalise the information management system 	<ul style="list-style-type: none"> ➤ Implement the Comprehensive Interpretation Strategy and Action Plan ➤ Implement the interpretation management training strategy ➤ Operationalise the interpretation management system
Long Term Planning - Long-term Policies and Planning focus on Development Vision Year 5 - 10 (up to 2020)	<ul style="list-style-type: none"> ➤ Maintaining a high quality of information management that contributes to effective management of sustainable tourism and heritage conservation ➤ Maintaining a high quality of interpretation as an essential component of the tourism experience and products that contribute to conservation objectives ➤ Monitoring (ongoing review and refinement) ➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information 	

8.4. Development activities

Table 46: Development activities for tourism information management and interpretation management

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1	<p>Development of a Information Management System</p> <ul style="list-style-type: none"> ➤ This is to collect information for the purposes of tourism impact management and planning, marketing and product development and for the interpretation. 	<ul style="list-style-type: none"> ▶ Plan development ▶ Priority implementation activities 	<ul style="list-style-type: none"> ▶ Implementation activities ▶ HRD for operation ▶ Monitoring 	<ul style="list-style-type: none"> ▶ Complete implementation activities ▶ Monitoring 	<ul style="list-style-type: none"> ▶ Ongoing monitoring and management
2	<p>Development of a Interpretation Plan and Action Plan Activities</p> <ul style="list-style-type: none"> ➤ Prepare an Interpretation Plan and Action Plan Activities. The Interpretation Plan should provide the management of PNKB NP a framework for interpreting the natural as well as cultural aspects of the park including recommending immediate actions to improve the current situation. 	<ul style="list-style-type: none"> ▶ Plan development ▶ Priority implementation activities 	<ul style="list-style-type: none"> ▶ Implementation activities ▶ HRD for operation ▶ Monitoring 	<ul style="list-style-type: none"> ▶ Complete implementation activities ▶ Monitoring 	<ul style="list-style-type: none"> ▶ Ongoing monitoring and management
3	<p>Development of a Tourism Monitoring and Management Programme</p> <ul style="list-style-type: none"> ➤ Prepare a Tourism Monitoring and Management Program. This should include key tourism indicators regular survey activities for the tourism sites. Provide annual reports. 	<ul style="list-style-type: none"> ▶ Design of Tourism impact monitoring and management program ▶ Commence initial, priority monitoring 	<ul style="list-style-type: none"> ▶ Implementation of monitoring and management programme at priority locations ▶ Expand monitoring implementation 	<ul style="list-style-type: none"> ▶ Comprehensive monitoring and management system established and operating 	<ul style="list-style-type: none"> ▶ Monitoring and management programme in full operation
4	<p>Development of interpretation material for the Phong Nha Visitor Centre</p> <ul style="list-style-type: none"> ➤ Interpretation content development for the Phong Nha Visitor Centre. This includes exhibition content for the visitor centre itself and descriptions of the regions and specific sites. 	<ul style="list-style-type: none"> ▶ Content development 	<ul style="list-style-type: none"> ▶ Exhibition development 	<ul style="list-style-type: none"> ▶ Exhibition development 	<ul style="list-style-type: none"> ▶ Continued refinement

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
5	Site specific conceptual interpretation plan and material for priority sites <ul style="list-style-type: none"> ➤ Prepare site-specific interpretation material for priority sites such Phong Nha Caves, Eight Volunteers Cave etc. The site-specific interpretation material should be consistent with the branding of the marketing collateral. 	<ul style="list-style-type: none"> ▸ Content development and preparation 	<ul style="list-style-type: none"> ▸ Preparation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Continued refinement
6	Site specific interpretation signage for priority sites <ul style="list-style-type: none"> ➤ Based on site-specific interpretation material, develop signage and markers at priority sites. All the signage in the PNKB NP should be consistent and standardised. 	<ul style="list-style-type: none"> ▸ Content development and signage preparation 	<ul style="list-style-type: none"> ▸ Signage preparation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Continued refinement
7	Regional promotional information signage <ul style="list-style-type: none"> ➤ Based on branding of the region, develop regional information signage along the tourism routes. 	<ul style="list-style-type: none"> ▸ Content development and signage preparation 	<ul style="list-style-type: none"> ▸ Signage preparation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Continued refinement
8	Information management training <ul style="list-style-type: none"> ➤ Training for tourism research aspects like, visitor monitoring surveys and tourism impact management. 	<ul style="list-style-type: none"> ▸ Content development and signage preparation 	<ul style="list-style-type: none"> ▸ Signage preparation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Continued refinement
9	Interpretation/guide training programme (refer also to HRD development activities) <ul style="list-style-type: none"> ➤ Training programme for cave guides for the PNKB NP. The focus should be on cave guides for the Phong Nha Caves. This training should include staff from the PNKB NP, local communities and potentially relevant tour companies. 	<ul style="list-style-type: none"> ▸ Establish training programme and manuals 	<ul style="list-style-type: none"> ▸ Implement training programme 	<ul style="list-style-type: none"> ▸ Expansion of training programme 	<ul style="list-style-type: none"> ▸ Continuation of training programme

9. TOURISM HUMAN RESOURCE DEVELOPMENT

9.1. Strategic approach and guidelines

9.1.1. Strategic approach

Enhancement and maintenance of quality human resources is of fundamental importance in achieving a high quality of results in all aspects of sustainable tourism development and heritage conservation of the PNKB region.

Each stakeholder group has specific human resource development requirements. Generally speaking these would include the following:

- **PNKB NP Management:**
Strengthen abilities for managing tourism development within the national park and the Bufferzone areas. Specific areas should include sustainable tourism management, tourism markets, tourism product development and enhancement, engagement in multi-stakeholder processes.
- **PNKB NP Staff:**
Strengthen abilities to support higher quality tourism experiences and ensure sustainable tourism practices in the parks, including appropriate visitor behaviour and providing effective awareness raising services.
- **Public Sector Officials:**
Strengthen abilities for supporting sustainable tourism development in the region. Specific areas should include principles of sustainable tourism development and planning, integrated tourism development, market-based tourism development, supporting multi-stakeholder development processes.
- **Local Tourism Industry:**
Strengthen abilities to support sustainable tourism development. Specifically the fundamentals and importance of sustainable tourism development and the roles and rewards for the business sector, market awareness and product development support in multi-stakeholder processes.

Table 47 depicts the strategic directives for tourism human resource development

Table 367: Strategic directives for tourism resource development

Strategic Directives for Tourism Human Resource Development	
➤	Seek partnership and support from development partners, public sector training programs and the business sector.
➤	Comprehensive HRD that includes strategies and recommendations for: <ul style="list-style-type: none">▪ Management, staff of National Park▪ Local communities (inside the Park and Bufferzone)▪ Other public sector (DPC, Border Security, Police, Customs)▪ Tourism business sector
➤	Human resource development needs to be developed as an ongoing program that will ensure the continued development of high quality personnel to manage, participate in, and represent the entire tourism sector.

9.1.2. Development Guidelines

Table 48: Development guidelines for tourism human resource development

Guidelines
<ul style="list-style-type: none"> ➤ Preparing and conducting stakeholder consultations to accurately identify training needs and mechanisms for delivery of training to the requirements of the stakeholder and targeted training groups. ➤ Wherever possible joint training activities that include multiple stakeholder groups should be pursued so as to contribute to shared and common understandings and strengthen cooperation. ➤ For training to be effective it must be based on practical knowledge building that is applicable to the expected functions of those being trained, whatever stakeholder group they are from.

9.2. Strategic planning framework

Table 37: Strategic planning framework for tourism human resource development

Planning Timeframe	Strategy and Targets	
Short Term Planning – Immediate and High Priority Development Actions Year 1 - 3 (up to 2012)	<u>Year 1 - 3</u> Providing strategic training issues and the to specific stakeholder groups through: <ul style="list-style-type: none"> ➤ Designing a comprehensive Human resource development and Maintenance Strategy for the Management and Enhancement of Tourism in the Region that will be established by the end of year 2 and implemented in year 3, and managed as an ongoing programme through the course of this plan. ➤ Target: 50% of overall representatives from each group have received training 	
	Training Focus	
	PNKB NP and Public Sector	Sector Stakeholder Groups
	<u>Management:</u> <ul style="list-style-type: none"> ➤ Tourism management, Caves management, Park management, Monitoring and Management, Consultative planning, Marketing Fundamentals <u>Staff:</u> <ul style="list-style-type: none"> ➤ Park Staff (tourism): Customer service, language for tourism ➤ Park Staff (other, FPD): Tourism issues in National Parks, working with other stakeholders (communities and business sector) <u>Public Sector:</u> <ul style="list-style-type: none"> ➤ Integrated and sustainable tourism planning and management 	<u>Communities:</u> <ul style="list-style-type: none"> ➤ Sustainable business practices, market awareness, product development, customer service, business operations <u>Tourism Sector:</u> <ul style="list-style-type: none"> ➤ Tourist guides and Interpreters (from the Park, Bufferzone and tour operators): Customer service, interpretation skills, safety and group management, language skills <u>Tourism Sector:</u> <ul style="list-style-type: none"> ➤ Sustainable business practices, market awareness, product development, customer service, business operations – provided through the Quang Binh Tourism Association with external support

Planning Timeframe	Strategy and Targets	
<p>Medium Term Planning - Intermediate Development Actions Year 1 - 5 (up to 2015)</p>	<p>Years 3-5</p> <ol style="list-style-type: none"> 1. Establishment of a permanent Human resource development Programme to provide training and skills upgrading system that will continue to provide quality human resources required for the ongoing, quality management and delivery of tourism in the region 2. Upgrading, expansion and replication of Activity 2 above 3. Target: 75% of overall representatives from each group have received training 4. Planning and preparations for Intermediate Actions 	
	Training Focus	
	<p style="text-align: center;">PNKB NP and Public Sector</p> <p><u>Management:</u></p> <ul style="list-style-type: none"> ➢ Advanced training in Tourism Management in National Parks, other as identified <p><u>Staff:</u></p> <ul style="list-style-type: none"> ➢ Park Staff (tourism): Ongoing training in customer service and language for tourism ➢ Park Staff (other): Ongoing training Tourism issues in National Parks, Working with other stakeholders <p><u>Public Sector:</u></p> <ul style="list-style-type: none"> ➢ Integrated and sustainable tourism planning and management 	<p style="text-align: center;">Sector Stakeholder Groups</p> <p><u>Communities:</u></p> <ul style="list-style-type: none"> ➢ Ongoing and expanded trainings to upgrade the skills and abilities in existing CBT sites and to facilitate the expansion of other CBT sites as required. <p><u>Tourism Sector:</u></p> <ul style="list-style-type: none"> ➢ Ongoing and expanded trainings in sustainable business practices, market awareness, and business management
<p>Long Term Planning - Long-term Policies and Planning focus on Development Vision Year 1 – 10 (up to 2020)</p>	<p>Strategy and Targets</p> <ol style="list-style-type: none"> 1. Maintaining a quality of human resource development that contributes to high quality tourism experiences and effective management of sustainable tourism and heritage conservation in the PNKB Region 2. Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information 3. Target: 90% of overall representatives from each group have received training 	
	Training Focus	
	<p style="text-align: center;">PNKB NP and Public Sector</p> <p><u>Management:</u></p> <ul style="list-style-type: none"> ➢ Advanced training in Tourism Management in National Parks, other as identified <p><u>Staff:</u></p> <ul style="list-style-type: none"> ➢ Park Staff (tourism): Ongoing training in customer service and language for tourism ➢ Park Staff (other): Ongoing training Tourism issues in National Parks, Working with other stakeholders <p><u>Public Sector:</u></p> <ul style="list-style-type: none"> ➢ Integrated and sustainable tourism planning and management 	<p style="text-align: center;">Sector Stakeholder Groups</p> <p><u>Communities:</u></p> <ul style="list-style-type: none"> ➢ Ongoing and expanded trainings to upgrade the skills and abilities in existing CBT sites and to facilitate the expansion of other CBT sites as required. <p><u>Tourism Sector:</u></p> <ul style="list-style-type: none"> ➢ Ongoing and expanded trainings in sustainable business practices, market awareness, and business management

9.3. Development activities

Table 38: Development activities for tourism human resource development

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1	<p>Establishment of a HRD Programme for the PNKB NP Region</p> <ul style="list-style-type: none"> ➤ Preparation of an extensive and comprehensive HRD tourism programme for the PNKB NP Region. The programme should include the below training initiatives. 	<ul style="list-style-type: none"> ▸ Needs assessment and programme development 	<ul style="list-style-type: none"> ▸ Programme implementation 	<ul style="list-style-type: none"> ▸ Programme implementation 	<ul style="list-style-type: none"> ▸ Sustained programme continuation
2	<p>CBT human resource training</p> <ul style="list-style-type: none"> ➤ Training needs assessment, skills and language training for locals involved in tourism services to provide better (higher value) services, increase tourism awareness among local residents. 	<ul style="list-style-type: none"> ▸ Needs assessment and design of training interventions 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Sustained programme continuation
3	<p>HRD tourism training for PNKB NP - management staff</p> <ul style="list-style-type: none"> ➤ Training needs assessment, tourism management in protected areas and bufferzone – this includes concession management, consultation with the community, understanding policies and regulations regarding tourism, monitoring and management of tourism. ➤ The training is aimed at park management staff ➤ Study tours for key management staff 	<ul style="list-style-type: none"> ▸ Needs assessment and design of training interventions 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Sustained programme continuation
4	<p>HRD tourism training for PNKB NP – general staff</p> <ul style="list-style-type: none"> ➤ Tourism awareness training and language skill training 	<ul style="list-style-type: none"> ▸ Needs assessment and design of training interventions 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Sustained programme continuation

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
5	HRD tourism training for PNKB NP – tourism department staff <ul style="list-style-type: none"> ➤ Customer service training and language skills training. 	<ul style="list-style-type: none"> ▸ Needs assessment and design of training interventions 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Sustained programme continuation
6	HRD tourism training for PNKB NP – cave guides <ul style="list-style-type: none"> ➤ Training programme for cave guides for the PNKB NP. The focus should be on cave guides for the Phong Nha Caves. This training should include staff from the PNKB NP, local communities and potentially relevant tour companies. 	<ul style="list-style-type: none"> ▸ Needs assessment and design of training interventions 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Sustained programme continuation
7	HRD tourism training for the wider industry sector <ul style="list-style-type: none"> ➤ Tourism training initiative for local and regional operators. 	<ul style="list-style-type: none"> ▸ Needs assessment and design of training interventions 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Ongoing HRD support and implementation of training programme 	<ul style="list-style-type: none"> ▸ Sustained programme continuation
8	Establishment of community enterprise development funds for business support and construction <ul style="list-style-type: none"> ➤ Community enterprise development fund that supports: microenterprise tourism development loans such as homestays, community lodges and the community operation of CBT activities, business support for community agreements with commercial tour operators and funding for other HRD activities 	<ul style="list-style-type: none"> ▸ Set up funding mechanism 	<ul style="list-style-type: none"> ▸ Funding for business support and construction 	<ul style="list-style-type: none"> ▸ Funding for business support and construction 	<ul style="list-style-type: none"> ▸ Sustained funding continuation

10. TOURISM INFRASTRUCTURE AND INVESTMENT

10.1. Introduction

Appropriate infrastructure development is of fundamental importance in achieving sustainable tourism development. Infrastructure provides the mechanical foundations necessary for the development and operation of tourism in an area. Careful and strategic design and delivery of infrastructure will go a long way in determining the overall quality and sustainability of tourism development. Infrastructure planning and investment for tourism development must follow and contribute to the same goals of the overall STDP; sustainability, heritage conservation, local livelihood improvements and quality tourism development.

Tourism development can often provide a good entry-point, or platform to support the wider utilisation of innovative infrastructure technologies such as recycling programmes, alternative energy systems and water/water treatment technologies based on natural processes. A tourism-led, environmentally responsible infrastructure development, can also be expanded and linked to provide benefits to local communities at or near tourism development sites.

Integrating the requirements of sustainable tourism development with the needs of local people and while minimising environmental impacts as well as inefficiencies of duplications and unnecessary delivery gaps. Specific initiatives relating to energy, water, waste management, transportation and communications are required to be delivered in a coordinated, integrated and efficient manner within a comprehensive and strategic infrastructure development plan.

10.2. Strategic approach and guidelines

10.2.1. Strategic approach

Table 39: Strategic directives for tourism infrastructure development

Strategic Directives for Tourism Infrastructure Development

- Any tourism infrastructure development in the PNKB NP Region must conform to existing regulations and park zoning requirements with appropriate environmental impact assessments (EIA) and impact mitigation measures.
- Any infrastructure developments in the PNKB NP Region must conform with the STDP.
- Standards of global best practices should be sought with all infrastructure developments.
- All efforts must be made to minimise the physical and aesthetic impacts and keep developments to an appropriate scale where in quality is emphasised over quantity.
- All infrastructure development must be undertaken through a coordinated and comprehensive strategic approach (integrating Government, development assistance and private investments) to ensure, quality, efficient sustainable development of tourism in the region.
- Efforts to extend tourism related infrastructure development to benefit local people in the vicinity should be considered as a strategic approach to improving local livelihood standards.

10.2.2. Development Guidelines

Table 402: Development guidelines for tourism infrastructure development

Development Guidelines
<ul style="list-style-type: none">➤ Any tourism infrastructure development in the PNKB NP must conform to the guidelines set out in Decision No 104/2007/QĐ/BNN and Decision No. 186/2006/QĐ-TTg.➤ Choosing appropriate site for construction and implementation➤ Using local and environmentally responsible materials➤ Following the local and traditional architectural styles➤ Building in harmony with the natural and cultural landscape➤ Using water and energy saving and renewable technologies➤ Ensuring local participation in infrastructure implementation activities

10.3. Current supporting infrastructure development considerations

The primary goal of ADB's GMS Sustainable Tourism Development Project is towards sustainable tourism development and contributes to the economic and social development, particularly focusing on poverty reduction poor, developing infrastructure for tourism, protection DSTG. The PNKB NP Region is selected as a primary destination for development support in this direction. ADB projects seek to improve environmental conditions and capacity building, awareness of the community in the project area about the need to protect natural resources and ecological environment. The interventions are planned to address existing environmental issues and manage increased visitation. The Project aims to demonstrate the use of low impact visitor infrastructure in sensitive karst environments in PNKB NP.

Following are supporting infrastructure development consideration from the ADB project:

- Reduction of solid waste pollution in the Song Chay River in PNKB NP and reduction of sanitation issues in local villages.
- Provision of waste collection bins and equipment, installation of gross pollutant traps in the existing drains, and improved management and hygiene practices at the solid waste site. The subprojects will involve small construction works (e.g. scenic lookouts, walking trails, parking areas, picnic facilities, interpretation).
- A baseline survey on vegetation surrounding the intervention sites will be conducted during the detail design to assess vegetation impacts and take into account the design and construction of the interventions. Monitoring of waste collection will be undertaken to measure the volume and types of waste so as to design and modify current waste collection and treatment practices and awareness programs.
- A baseline survey to assess the existing visitor impact within PNKB NP on (i) viewing of the Hatinh Langurs; and (ii) the condition and values of Phong Nha and Dong Tien caves. The study will enable the formulation of effective mitigation measures and adopt careful planning, design, construction and operation of the improved visitor facilities and tourism operations at these sites.

10.4. Strategic planning framework

Table 53: Strategic planning framework for tourism infrastructure development

Planning Timeframe	Spatial and Functional Area	
	Corezone of the PNKB NP (includes: Administrative and Service Area, Ecological Restoration Area, Strictly Protection Area, Extension Area)	Bufferzone
Short Term Planning – Immediate and High Priority Development Actions Year 1 -3 (up to 2012)	<ul style="list-style-type: none"> ➤ Formation of a Sustainable Infrastructure Development Taskforce ➤ Immediate coordination and cooperation with the ADB GMS Sustainable Tourism Development Project 	
	<p><u>Administrative and Service Area</u></p> <ul style="list-style-type: none"> ➤ Upgrading of the Phong Nha service infrastructure – from the visitor centre to the Phong Nha Caves. ➤ Infrastructure needs assessment for major tourism sites 	<p><u>Bufferzone</u></p> <ul style="list-style-type: none"> ➤ Development of walking and biking routes ➤ Infrastructure needs assessment for key tourism sites
	<p><u>Ecological Restoration Area and Strictly Protected Area</u></p> <ul style="list-style-type: none"> ➤ Assessment of most appropriate infrastructure requirements for current and future tourism development 	<p><u>Tourism Infrastructure Zone</u></p> <ul style="list-style-type: none"> ➤ Comprehensive Site Planning required first
Medium Term Planning – Intermediate Development Actions Year 3 - 5 (up to 2015)	<p><u>Administrative and Service Area</u></p> <ul style="list-style-type: none"> ➤ Review current infrastructure requirements. 	<p><u>Bufferzone</u></p> <ul style="list-style-type: none"> ➤ Review current infrastructure requirements.
	<p><u>Ecological Restoration Area and Strictly Protected Area</u></p> <ul style="list-style-type: none"> ➤ Review current infrastructure requirements. 	<p><u>Tourism Infrastructure Zone</u></p> <ul style="list-style-type: none"> ➤ Review current infrastructure requirements
Long Term Planning - Long-term Policies and Planning focus on Development Vision Year 5 – 10 (up to 2020)	<ul style="list-style-type: none"> ➤ Maintaining and high quality of infrastructure required to support sustainable tourism development ➤ Monitoring (ongoing review, maintenance, mitigation) ➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information 	

10.5. Development activities

Table 54: Development activities for tourism infrastructure development

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1	<p>Establishment of community enterprise development funds for business support and construction</p> <ul style="list-style-type: none"> Community enterprise development fund that supports: microenterprise tourism development loans such as homestays, community lodges and the community operation of CBT activities, business support for community agreements with commercial tour operators and funding for other HRD activities 	<ul style="list-style-type: none"> Set up funding mechanism 	<ul style="list-style-type: none"> Funding for business support and construction 	<ul style="list-style-type: none"> Funding for business support and construction 	<ul style="list-style-type: none"> Continued, self-sustaining operation of development funds
2	<p>Phong Nha and Tien Son Cave redevelopment and upgrade</p> <ul style="list-style-type: none"> Cave safety infrastructure, Cave trail safety infrastructure and Handrail. 	<ul style="list-style-type: none"> Assessment and planning – start of redevelopment and upgrade. 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Maintain 	<ul style="list-style-type: none"> Maintenance and enhancement as required
3	<p>Phong Nha Visitor Centre redevelopment and upgrade</p> <ul style="list-style-type: none"> Structural redevelopment of the visitor centre aligned to the redevelopment and upgrade of the Phong Nha boatlanding area. This includes the development of an interpretation centre in the area between the Phong Nha Cave and Tien Son Cave. 	<ul style="list-style-type: none"> Assessment and planning 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Maintenance and enhancement as required
4	<p>Phong Nha boatlanding redevelopment and upgrade</p> <ul style="list-style-type: none"> Structural redevelopment of the Phong Nha boatlanding. This should be aligned to the redevelopment of the visitor centre. 	<ul style="list-style-type: none"> Assessment and planning 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Maintenance and enhancement as required
5	<p>Cave protection support for other caves</p> <ul style="list-style-type: none"> Cave safety infrastructure, cave trail safety infrastructure and Handrail. This includes caves that are developed for adventure caving. 	<ul style="list-style-type: none"> Assessment and planning – start of protection support. 	<ul style="list-style-type: none"> Support and redevelopment 	<ul style="list-style-type: none"> Maintain 	<ul style="list-style-type: none"> Maintenance and enhancement as required

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
6	<p>Trekking trail upgrade and construction support</p> <ul style="list-style-type: none"> ➤ Development/upgrade of trekking trails in the PNKB NP. Key trails include: To Hang En, To Bamboo Valley, To Hang Tien Duong, To Me Bong Con and Hang Vom, To Hang Son Doong, A Rem community and surrounding caves. 	<ul style="list-style-type: none"> ▶ Assessment and planning of trekking trails 	<ul style="list-style-type: none"> ▶ Upgrade and redevelopment – maintenance 	<ul style="list-style-type: none"> ▶ Upgrade and redevelopment – maintenance 	<ul style="list-style-type: none"> ▶ Maintenance and enhancement as required
7	<p>Walking, trekking and biking route construction in the Bufferzone</p> <ul style="list-style-type: none"> ➤ Marking of the walking, trekking and biking route in the Bufferzone focused on the adjacent area of the administration and service area – Son Trach commune, development guidelines for the walking, trekking and biking route routes, management system for the walking, trekking and biking route that includes the community, environmental impact mitigations, carrying capacities, and interpretations materials. 	<ul style="list-style-type: none"> ▶ Assessment and planning of walking trekking and biking routes 	<ul style="list-style-type: none"> ▶ Marking construction and development 	<ul style="list-style-type: none"> ▶ Marking construction and development 	<ul style="list-style-type: none"> ▶ Maintenance and enhancement as required
8	<p>Maintenance and extension of Nuoc Mooc Spring Eco Trail</p> <ul style="list-style-type: none"> ➤ Review a potential expansion of the trail, review and check maintenance schedule of the trail, especially for the bridges, improve interpretation panels and information at the site, connect and integrate the trail with CBT activities at the Chay Lap village, seek more opportunities to contribute to local economic development –such as provision of goods and services (refreshments, souvenirs and local produce by nearby villagers, establish a visitor-monitoring plan and consider a site management plan for the future, support the marketing and promotion of the trail, and link and package the trail with other tourism activities. 	<ul style="list-style-type: none"> ▶ Construct extension and maintenance 	<ul style="list-style-type: none"> ▶ Maintenance 	<ul style="list-style-type: none"> ▶ Maintenance 	<ul style="list-style-type: none"> ▶ Maintenance and enhancement as required
9	<p>Construction support for the development of minor tourism sites for driving route development</p> <ul style="list-style-type: none"> ➤ The sites include: Cha Lo Cave (including viewing area from the Highway into the valley), Bai Dinh Historical Site, En Cave/Heavens Gate near Cha Lo and Hill 37, Than Dinh Mountain, Khe Gat Airfield. ➤ Site specific development that should include: Tidy up the site and potentially provide small-scale infrastructure such as toilets, develop site-specific interpretation and information about the region, develop the site as part of a tourism route development, raise awareness in the local community about tourism and supporting services such as refreshments, meals and souvenirs. 		<ul style="list-style-type: none"> ▶ Assessment and planning 	<ul style="list-style-type: none"> ▶ Initial phase of site development ▶ Enhance route development and integration 	<ul style="list-style-type: none"> ▶ Expansion of site development as suitable

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
10	Karst scenic viewpoint - improve tourist access and protective infrastructure <ul style="list-style-type: none"> Parking are 30m long, viewing platform 20m2, guardrail on outer edge. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Maintenance and enhancement as required
11	Rao Thung Trail and picnic area development <ul style="list-style-type: none"> Parking area 30m long, guardrail on outer edge, parking 10 cars, 2 minibuses, bus stop area 10 m long. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Maintenance and enhancement as required
12	Eight Volunteers Cave redevelopment and upgrade <ul style="list-style-type: none"> Picnic area, construction work, toilets, vendor stalls, landscaping and signage. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Redevelopment and upgrade 	<ul style="list-style-type: none"> Maintenance and enhancement as required
13	Tra Ang Bridge Upgrade HCM Trail Memorial <ul style="list-style-type: none"> Parking improvements, landscaping, develop and install interpretative panels. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Maintenance and enhancement as required
14	Resurgence viewpoint area development <ul style="list-style-type: none"> Covered waiting area, walking area, view point development, picnic area, interpretation and signage. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Maintenance and enhancement as required
15	Hatinh Langur Viewing Area development <ul style="list-style-type: none"> Parking area, interpretative viewing platforms, trail to the river, river pier and construction at the river. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Maintenance and enhancement as required
16	Chay Lap Boatlanding development <ul style="list-style-type: none"> Walking trail and boatlanding, supply of passenger boats, ticket booth and fiout, market and amenities block, toilets, bus stop, power and wastewater systems. 	<ul style="list-style-type: none"> Assess infrastructure development 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Planning and construction 	<ul style="list-style-type: none"> Maintenance and enhancement as required

#	Activity	Timeframe			
		2010	2011	2012	2013 to 2015
1 7	General Solid Waste Disposal Improvements <ul style="list-style-type: none"> ➤ Training for operation and maintenance, equipment, bins for waste collection, drainages and road repairs. 	<ul style="list-style-type: none"> ▸ Assessment and planning 	<ul style="list-style-type: none"> ▸ Improvements and construction 	<ul style="list-style-type: none"> ▸ Improvements and construction 	<ul style="list-style-type: none"> ▸ Maintenance and enhancement as required
1 8	Operational transportation support <ul style="list-style-type: none"> ➤ Shuttle buses for the Administration and Service Area. 	<ul style="list-style-type: none"> ▸ Assessment and planning 	<ul style="list-style-type: none"> ▸ Initiate Shuttle operation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Maintenance and enhancement as required
1 9	Site specific interpretation signage for priority sites <ul style="list-style-type: none"> ➤ Based on site-specific interpretation material, develop signage and markers at priority sites. All the signage in the PNKB NP should be consistent and standardised. 	<ul style="list-style-type: none"> ▸ Content development and signage preparation 	<ul style="list-style-type: none"> ▸ Signage preparation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Maintenance and enhancement as required
2 0	Regional promotional information signage <ul style="list-style-type: none"> ➤ Based on branding of the region, develop regional information signage along the tourism routes. 	<ul style="list-style-type: none"> ▸ Content development and signage preparation 	<ul style="list-style-type: none"> ▸ Signage preparation 	<ul style="list-style-type: none"> ▸ Maintain 	<ul style="list-style-type: none"> ▸ Maintenance and enhancement as required

CHAPTER THREE

IMPLEMENTATION REQUIREMENTS, SOLUTIONS, MONITORING AND IMPLEMENTATION PLAN

1. IMPLEMENTATION REQUIREMENTS

1.1. Management

1.1.1. Framework

STDP implementation will be directed through a management structure comprised of three levels: Directorship, Coordination, Implementation, and involves cyclical Monitoring, Reporting, Review and Management functions.

Table 55: Implementation requirements - management framework

Management Framework	
Unit and Position	Responsibilities
I. Directorship	
1. Director of NP 2. Chairman of district 3. Director of Tourism Department/or Vice-Director who in charge of tourism	1. Oversee the implementation of the STDP. 2. Ensure that all tourism activities including investments are in line of STDP and Forest Protected Law and other related laws. 3. Ensure that the STDP implementation is aligned and supported by Provincial and National-level plans, policies and programmes. <i>Reports to:</i> Coordination Steering Group annually
II. Implementation Coordination Steering Group	
1. Public Sector, Vice Chairpersons of Relevant Departments (6-8) 2. ODA, Program/Project Directors (4-5) 3. Businesses, Representatives from Quang Binh Tourism Association (2-3)	1. Achieve effective stakeholder coordination for implementing STDP. 2. Ensure that the implementation of the STDP is aligned and supported by provincial-level activities including the rolling out of the SEDP and other programmes. 3. Support coordination between NP and Bufferzone communities (DPC/CPC). <i>Reports to:</i> Provincial Chairperson, Provincial Tourism Steering Committee every quarter
III. Implementation Task Force	
1. Public Sector, Heads of Relevant Departments 2. ODA, Program/Project Advisor 3. Businesses with active interests in supporting STDP implementation - should be inclusive-not exclusive - number as deemed appropriate by Steering Groups and Task Force	1. Achieve the effective and coordinated implementation of the STDP. 2. Collaborate on implantation activities. 3. Share information and maintain active communications. 4. Establish and maintain coordination mechanisms between tourism businesses, the NP and Bufferzone communities (DPC/CPC). <i>Reports to:</i> Implementation Coordination Steering Group four times a year.

Table 56: Implementation requirements - monitoring, reporting review and management cycle

Monitoring, Reporting, Review and Management Cycle	
Management Unit	Reporting Responsibilities
<u>Implementation Task Force</u>	Collect and organise data and information to develop reports to submit to the Implementation Coordination Steering Group.
<u>Implementation Coordination Steering Group</u>	Reviews and elaborates on the report from Implementation Task Force. Add recommendations and submit to Directorship.
<u>Directorship</u>	Reviews report from Implementation Coordination Steering Group, circulate for responses at Provincial and Ministerial levels. Included recommendations and provide directives to the Coordinating Committee.
<u>Implementation Coordination Steering Group</u>	Based on directions from the Directorship develops coordination programmes and guidelines for implementation activities.
<u>Implementation Task Force</u>	Design implementation strategies and activities based on the directions provided by the Coordinating Committee.

1.1.2. Procedures

Implementation of STDP activities will be carried out through a standard set of procedures, one for government and development partner supported activities, and one for contracted activities.

I. Government and Development Partner supported activities:

The Implementation Coordination Steering Group will:

- Set the agenda and priorities for carrying out implementation activities.
- Collectively decide most effective process for activities implementation.
- Discuss and determine specific roles and responsibilities for activity implementation.
- Convey these procedures to the Implementation Task Force.

II. Contracted Activities

1. Design TOR based on the activities and objectives and site assessment durations.
2. Call for proposals and contract service providers in a transparent and fair manner.
3. Review and endorse outputs of TOR in including implementation action plan.
4. Call for proposal and contract service providers for implementing action plan.
5. Monitor and review implementation activities.

1.2. Policies

Effective implementation of the STDP will require the development and adaptation of policies. Policy requirements for implementing the STDP will include:

1. Development of provision for business contracting (based on a concession system) between NP and business sector operators for tourism services provision in the NP and the Bufferzone.
2. Facilitation the establishment of community development funds.
3. Development of a contracting mechanism for tourism services provision between community and local authorities for the delivery of tourism services in the Bufferzone areas.
4. Development Coordination – macro level pledge to harmonise development delivery in the province. This involves integration the STDP into SEDP implementation.
5. A mandate to sharing tourism revenue and benefits that are clearly visible to the Bufferzone communities for nature and local culture conservation
6. Development of favourable conditions for local participation in tourism services.
7. Support from government for infrastructure development and PNKB tourism marketing.

1.2.1. Promotion and marketing

The general public, especially involved and effected groups, will be made aware of the endorsement and intended implementation of the STDP. This will be achieved through an information dispersion campaign including print media, TV, Internet and radio.

Consultation and coordination activities/workshops will be carried out to mobilise an effective implementation of the STDP by appropriate stakeholder groups.

1.2.2. Human resources

The implementation requires a considerable effort in human resource development. Chapter Two Section Ten outlines the human resource development. The human resource requirement in terms of the implementation management is indicated below.

Table 57: Implementation requirements - human resources

Units and Position(s)	Indicative Time Required
I. Directorship	
1. PPC, Vice Chair	3 meetings with the Coordination Committee, 2 days each (1 for preparations and responses, 1 for attendance) = 6 days /year
2. DARD, Department Head 3. DCST, Department Head and TIPC	Review and advice on STDP implementation from Hanoi 3 days each = 6 days /year
Additional: Secretarial support requirements at PPC	1 day/month = 12 days /year
II. Implementation Coordination Steering Group	
1. Public Sector, Vice Chairpersons of Relevant Departments (6-8) 2. ODA, Program/Project Directors (4-5)	i. 3 planning meetings each year, 2 days each (1 for preparations and responses, 1 for attendance)

Units and Position(s)	Indicative Time Required
3. Businesses, Representatives from Quang Binh Tourism Association (2-3)	= 6 days /year ii. Ongoing responsibilities: ½ day/month = 6 days /year
Additional: Secretarial support requirements	2 days/month = 24 days /year
III. Implementation Task Force	
1. Public Sector, Heads of Relevant Departments 2. ODA, Program/Project Advisor 3. Businesses with active interests in supporting STDP implementation	i. Ongoing responsibilities: 2 day/month = 24 days /year ii. 3 planning meetings each year, 2 days each (1 for preparations and responses, 1 for attendance) = 6 days /year
Additional: Secretarial support requirements	4 days/month = 48 days per year

1.2.3. Financial

THIS SECTION WILL BE COMPLETED WITH/AFTER THE DONOR COORDINATION MEETING.

Areas	Period – Years			Totals	Required	Difference
	2010-2012	2013-2015	2016-2020			
<u>Infrastructure</u>						
Government	TBC	TBC	TBC	TBC	TBC	TBC
ODA	TBC	TBC	TBC	TBC	TBC	TBC
Business Sector	TBC	TBC	TBC	TBC	TBC	TBC
<u>Product Development</u>						
Government	TBC	TBC	TBC	TBC	TBC	TBC
ODA	TBC	TBC	TBC	TBC	TBC	TBC
Business Sector	TBC	TBC	TBC	TBC	TBC	TBC
<u>Planning</u>						
Government	TBC	TBC	TBC	TBC	TBC	TBC
ODA	TBC	TBC	TBC	TBC	TBC	TBC
Business Sector	TBC	TBC	TBC	TBC	TBC	TBC
<u>HRD</u>						
Government	TBC	TBC	TBC	TBC	TBC	TBC
ODA	TBC	TBC	TBC	TBC	TBC	TBC
Business Sector	TBC	TBC	TBC	TBC	TBC	TBC
<u>Sector Support</u>						
Government	TBC	TBC	TBC	TBC	TBC	TBC
ODA	TBC	TBC	TBC	TBC	TBC	TBC
Business Sector	TBC	TBC	TBC	TBC	TBC	TBC

2. IMPLEMENTATION SOLUTIONS

2.1. Raising awareness on Tourism

2.1.1. Raising awareness of managers

A substantial number of managers in tourism industry and related sectors appear not to understand satisfactorily the benefits of tourism to social and economic development, particularly in terms of accelerating the development of other economic sectors, creating more job opportunities, contributing to the conservation and sustainable development. To raise awareness of managers, the followings should be undertaken:

- Organising study tours to different tourist attractions, particularly those in National Parks, national and regional Nature Reserves where tourism activities attain notable development to figure out benefits from tourism activities and learn experiences on tourism development.
- Organising workshops/seminars on tourism, especially sustainable tourism with the participation of experts, tourism managers from localities where tourism is more developed.
- Providing updated information for tourism managers.

2.1.2. Improving awareness of investors, commercial tourism operators

The understanding of sustainable tourism among tourism investors and commercial tourism operators is sometimes limited. In some cases, investment projects or tourism businesses have significantly generated adverse impacts on natural resources, environment and sustainable tourism development. Those impacts will likely be noteworthy to sensitive sites in such special forests as Phong Nha - Ke Bang National Park. Therefore, it is necessary to raise their awareness, which include:

- Organising seminars, workshops on the relationship between sustainable development and interests of investors/tourism businesses. Beside invited scientists, speakers at these events should include successful tourism investors and businesses whose operations are in line with the principles of sustainable tourism development.
- Organising study tours to tourism sites succeeded in developing sustainable tourism, accountable tourism.
- Promote the publicity and interpretation of current regulations and policies relating to investment and impact management of tourism activities at WHS, National Parks and Nature Reserves.

2.1.3. Raising awareness of communities in the buffer zone on tourism development

In this regard, we should sufficiently provide information to communities about benefits that tourism brings, as well as alert on possible adverse impacts that tourism activities may cause. To raise the awareness and accountability of communities proves to be very important to enable a more open cooperation between communities and tourism managers and developers during their implementation of projects at community's area. To effectively realise this solution, it is required to:

- Develop several tourism promotion campaigns on local mass media to raise awareness of tourism in the community.

- Organise some forms of entertainment to enable people gain knowledge of tourism, drawing public attention, encouraging self-learning, raising awareness among community on tourism and livelihood improvement opportunities through the involvement of local community in tourism services and business.
- Notify publicly tourism development projects in the community and encourage the contribution of public opinion to the tourism development plan in all means.
- Promote the publicity and interpretation of current regulations and policies relating to protection of natural and cultural resources in the community. The fund for these activities should come from state budget or partly from revenues of tourism industry.

2.2. Solutions for tourism development management

- The task to improve the effectiveness of state management on tourism should be undertaken with the establishment of specialised agencies for tourism development in Phong Nha - Ke Bang National Park. For projects to develop tourism sites or important works, it is advisable to formulate the preparation task force (for investment appealing and promotion) and this will likely transform to be an effective project management board later on.
- The People's Committee of Quang Binh Province should coordinate the preparation of legal documents on tourism management and stipulate them at the soonest (regulations on managing tourist sites in the province, regulations on planning management, on construction of tourism works, etc. ..) to create a favourable legal corridor for the purpose of management and encouraging tourism development in the province in general and at Phong Nha - Ke Bang National Park in particular.
- Better coordination among related sectors and localities in the region should be enhanced (particularly among provinces in the North Central region with Hue and Danang as focal points; collaboration with Hanoi and Ho Chi Minh City – the two largest tourist hubs of the country). This is to realise STDP under the direction of Quang Binh People's Committee in addressing issues related to management of tourism development such as product development, tourism promotion, environmental protection against exploitation of natural resources, land use management, infrastructure, etc.
- Strengthen measures to protect heritage values, especially the values of landscape, biodiversity, indigenous culture and historical sites associated with Ho Chi Minh trail through Phong Nha - Ke Bang National Park.
- Regarding the protection of natural values it requires a comprehensive assessment on "loading capacity" of specific sites and possible tourism activities to be managed which are based on "loading capacity" regulations of Phong Nha - Ke Bang National Park rather than general provisions. Specific regulations should refer to experiences of other countries in the world and in the region on the criteria of "loading capacity". For instance, some recommendations by ecotourism experts indicate that the size of visitor groups to an eco-tourist destination, particularly high-value biodiversity and environmentally sensitive ones at a certain time should not be more than 20 people and three groups in one hour is at most and so on.
- The limitation and stipulation of regulations on "loading capacity" will assist a more effective management and contribute significantly to minimise the impact of tourist activities on heritage values of Phong Nha - Ke Bang National Park.
- Improve the effectiveness of state management on environment through:
 - Carrying out "Regulations on environmental protection in tourism" pursuant to the Decision No. 02/2003/QĐ-BTNMT issued on July 29th, 2003 by the Minister of Natural Resources and Environment under the authorisation of Prime Minister.

- Integrating environmental protection tasks with tourism investments in the National Park region, particularly in planning of tourist sites and services in association with Environmental Impact Assessment.

2.3. Solutions for tourism development policies

Experiences of tourism development at various heritage sites and National Parks prove very critical in designing policy mechanisms.

To ensure an effective implementation of STDP and positive contribution to tourism development for the locality and also for the country as a whole, Quang Binh People's Committee should direct the functional departments to focus on developing the following basic policies:

2.3.1. Tax policies

Based on the government's general tax policy, the People's Committee should direct functional departments in designing preferential mechanisms for tourism development of Quang Binh in general and Phong Nha - Ke Bang National Park in particular in terms of prioritising tax exemptions (especially land use tax in areas of difficult conditions, where infrastructure remains underdeveloped); applying tax reduction or tax holidays in the first operational years to some tourism businesses who pursue eco-friendly tourism in association with conservation, such as ecotourism and community-based tourism.

Besides, recommendations to the government should be made on the application of import duty reduction to certain types of tools and equipment in tourism – hospitality which can not be produced domestically (such as equipment in entertainment, food storage and processing, and specialised transport means, etc. ..) as these are essential tools in tourism to create quality tourism products for tourists.

2.3.2. Policies to mobilise investment capital

On the basis of national laws and local reality, Quang Binh might create favourable conditions and simplify administrative procedures to attract investors at home and abroad to do business in the province in general and Phong Nha - Ke Bang region in particular. It is advised to design some incentives for investors in priority areas (community-based tourism, cultural – craft village tourism, eco-tourism, etc.).

One of the crucial contents, which requires a thorough study during the design of 'Policies and mechanisms to mobilise investment capital', is the assurance of equitable and fair sharing of benefits in the course of business operation among stakeholders - Phong Nha Ke Bang National Park as property holder, PPC and DPC as local authority, operators in the National Park as investors and local communities.

2.3.3. Market policies and mechanisms

Based on tourist market studies at Quang Binh in general and Phong Nha - Ke Bang national park, in particular, both domestic and foreign markets, related departments should develop appropriate mechanisms and policies to make full use of these potential markets. This is combined with mechanisms and policies on insurance, banking services, health services, promotional price (discounts for big groups; long-stay visitors, education/science and student travellers; for visitors during low season, etc.) to encourage visitors to Quang Binh and Phong Nha - Ke Bang.

2.3.4. Community development policies

The policies to be applied should facilitate local communities in the buffer zone actively engaged in tourism development activities, to ensure their long-term benefits. In addition, it is required to have policies and regulations in place for tourism businesses to ensure a fair benefit sharing to local communities and in the conservation of nature and environment where their operations are.

Some recommended policies should be taken into consideration including:

- Specific policies on benefit sharing between tourism businesses in Phong Nha - Ke Bang region and local communities. The benefit sharing scheme should be worked out right from the planning process.
- Incentives to encourage training and employing local human resources for tourism development activities in Phong Nha - Ke Bang National Park.
- Tax reduction policy to encourage using local materials in construction of tourist facilities.
- Tax reduction policy and financial incentives for tourism development projects engaging local community, with a clear benefit sharing scheme to communities in buffer zone being in place.
- Preferential policies to encourage tourism development investments by local individuals and organisations. The National Park of Phong Nha - Ke Bang and local authority are entitled to make their physical contribution in joint-venture projects under the forms of land use or any tourism resources under their current management to enhance the status and benefits of local communities in the project.

Nevertheless, benefit sharing with local communities in Quang Binh and particularly in Phong Nha - Ke Bang does not simply mean to provide resources for community development. The important benefits of long-term significance to the community stay in the fact that through the development of tourism, communities will access to sustainable employment opportunity with higher income, which would in its turn reduce the pressure of local community to natural resources, tourist environment, and contribute actively to the development of sustainable tourism. With clear benefits brought about by tourism activities, the awareness of each member in the community to support local tourism will also be raised, thereby tourism activities will enjoy further favourable and sustainable development.

2.3.5. Policies of natural resources and environment protection

To protect tourism environment for sustainable development, beside appropriate monitoring and law enforcement solutions to minimise adverse impacts of socio-economic development to the environment, environmental protection activities in tourism should be paid more attention by accomplishing main mechanisms and policies as follows:

- Prioritised policies on tax exemptions or tax holiday in certain time with investment protecting tourism environment or adopting optimal technology in terms of environmental protection.
- Prioritised policies for tourism investment projects having feasible solutions in reducing pollution problems, directly benefiting the conservation of natural resources and environment.
- Preferential policies for Research and Development activities, applying innovative technologies in tourism, particularly in environmental protection, rational tapping of resources, ensuring sustainable tourism development, encouraging saving technologies of energy and clean water, and recycling solid waste in tourist facilities.

- Policies to encourage and support the development of eco-friendly tourism activities, especially ecotourism. This was made clear in the Strategy for Tourism Development of Vietnam during the period of 2001 – 2010, which was approved by the Prime Minister in Decision No. 97/2002/QĐ-TTg, on July 22th, 2002.
- Policies to encourage tourism development projects commit to protect, restore and develop natural resources, environment, ensure the sustainable development of Phong Nha - Ke Bang region.
- Developing mechanisms / policies suitable with local conditions to ensure part of revenues from tourism will go back to support the community, the conservation and development of environmental resources and tourism where tourism activities with the participation of the community are.

2.4. Promotion and marketing solutions

On the basis of the proposed strategy of tourism promotion for Phong Nha - Ke Bang, the following major solutions are needed:

- Conducting tourism promotion and marketing campaigns for the province and Phong Nha - Ke Bang in particular in a professional manner. This should be undertaken by an independent organisation (if possible) or an affiliated section of the Provincial Promotion Agency.
- Integrating the promotion plan for Phong Nha - Ke Bang into the general promotion program of the province and allocating corresponding budget for this important activity.
- Conducting investigations of key tourist markets for Phong Nha - Ke Bang to identify appropriate promotion approach (developing website, leaflets, brochures on Phong Nha - Ke Bang, producing promotion clips, participating trade fairs and events, etc.) for highest effectiveness.
- Making use of opportunities to approach support from Vietnam National Administration of Tourism to participate in events, tourism fairs, etc. so as to promote the image of Quang Binh Tourism with Phong Nha - Ke Bang National Park in country and abroad.
- Intensifying the application of advanced technologies and collaborating with different agencies in promoting the region on domestic mass media and external information channels, opening tourism promotion offices at key markets (in country and abroad), making full use of international assistance, particularly UNESCO to effectively promote Quang Binh Tourism in general and Phong Nha - Ke Bang in particular.
- Attention should be paid to tourist information posts with focus on Phong Nha - Ke Bang at high traffic points, major destinations like Hanoi, Hue, Danang and Ho Chi Minh City.

2.5. Human Resource Development Solutions

In order to develop qualified human resources for Quang Binh's Tourism in general, and Phong Nha - Ke Bang in particular, it is required to strengthen training activities for tourism employees with the following proposed actions:

- Conducting surveys to identify training needs for managerial staff of tourism industry and related sectors; employees directly engaged in different professional activities, especially tour guides; communities taking part in tourism services. This would provide the foundation to develop training or retraining plans of human resources for Quang Binh and Phong Nha - Ke Bang National Park.

- Taking the lead in organising training courses to improve management skills and expertise for existing tourism employees in the locality and Phong Nha - Ke Bang National Park. This activity should be funded by Quang Binh People's Committee to be allocated from state budget on annual basis.
- Collaboration with Hanoi, Hue, Danang in human resource training, particularly training on tour guides and hospitality as Hanoi, Hue and Danang are hospitality training centres of high quality and favourable places for internship.
- Making use of supports from Vietnam National Administration of Tourism and other international organisations, especially UNESCO in human resource training for tourism industry. Focus should be given to tour guides of Phong Nha - Ke Bang National Park.
- In the long run, there should be a master plan for human resource development in tourism industry which is associated with the General Development Strategy of Human Resource for Quang Binh.

2.6. Financial solutions

All financial resources will be mobilised for the investment needs and successful implementation of strategies defined in the STDP of Phong Nha - Ke Bang National Park. Major capital resources include:

- The fund from accumulated GDP of tourism businesses in Quang Binh province, bank loans; investments from businesses in the country, mobilised funds under Investment Law, funds from equitisation of tourism enterprises; fund from business concession; using land to create fund through prepaid land lease, exchanging termed land use right for infrastructure, etc.
- Creating favourable conditions (maybe with preferential policies and mechanisms on tax incentives, administrative procedures) to attract Foreign Direct Investment (FDI) or joint venture with foreign partners. This should be prioritised to competent investors in implementing key tourism projects being identified in the region of Phong Nha - Ke Bang.
- For State budget (both central and local resources) priority is given to development of internal infrastructure systems of key areas for tourism development in Phong Nha - Ke Bang region; the protection and enhancement of resources, tourism promotion for Phong Nha–Ke Bang National Park and training of human resources.
- Bank loans with preferential interest rates are used to encourage investment of tourism businesses in creating quality tourism products. Meanwhile, improvements should be made regarding loan procedures to enable faster construction, repairing and upgrading facilities.
- ODA loans: potential donors which can provide ODA loans including Japan, World Bank (WB), Asian Development Bank (ADB), and some international organisations such as UNDP and others. This would be a supplement resource to develop tourism facilities and technical infrastructure beside accumulated GDP from provincial tourism industry.

3. MONITORING GUIDELINES FOR THE IMPLEMENTATION

3.1. Introduction

3.1.1. Purpose

Monitoring is important for determining if tourism activities are achieving their objectives and if these objectives are contributing to the realisation of the overall development goals.

3.1.2. Levels and aspects for monitoring

To ensure accurate and timely collection and evaluation of impact information monitoring should take place at three levels.

Table 58: Levels for monitoring

Level	Description
1. Site Level	Most detailed level of assessment, required for effective management of particular sites. This information is necessary for making site-specific management responses in a timely manner to prevent serious site degradation and efficient tourism operations. The outputs of monitoring at this level also feed into assessment of the Zone-level.
2. Zone Level	Assessment of tourism activities in key areas of tourism activity (key points and zones) to ensure that tourism is operating effectively and sustainably within these larger areas that may contain several or more sites. Information from the site-level monitoring is consolidated into composite indicators suitable for making management decisions at this level. This information will feed into the Regional-level monitoring and assessment.
3. Regional Level	The focus of monitoring and assessment here is in determining and managing the STDP impact effectiveness, assessed in relation to achieving the STDP's goals and objectives. Information here is consolidated from the outputs of the zone-level assessments and incorporating factors from higher levels (provincial, regional, national, international) to develop management strategies for the region.

Two important aspects to consider in tourism monitoring in protected areas:

1. **Monitoring Visitor Impacts:** Provides the information pertaining to the impacts of tourism activities at a site or in an area.
2. **Monitoring Service Quality:** Provides information on how efficiently tourism services and activities are functioning. Maintaining adequate levels of service quality is of fundamental importance if tourism activities are to provide maximum positive, and minimal negative, impacts.

3.1.3. Monitoring and management process

At each of these levels and for both of these aspects monitoring and management processes will need to be designed and carried out through a comprehensive Monitoring and Management Plan. The typical process for designing and implementing a monitoring and management plan involves the following steps:

Table 59: Process for a comprehensive monitoring plan

Steps	Items
1. Planning for monitoring	<ul style="list-style-type: none"> ➤ Forming a steering committee. ➤ Holding a stakeholder meeting.
2. Developing a monitoring programme	<ul style="list-style-type: none"> ➤ Identifying impacts and indicators to be monitored. ➤ Selecting methods of measurement. ➤ Determining levels or limits of acceptable change. ➤ Developing an operational monitoring plan.
3. Conducting monitoring and applying the results	<ul style="list-style-type: none"> ➤ Training staff, managers, community representatives, tour guides/leaders. ➤ Carryout monitoring and assessment of data. ➤ Presenting monitoring results.
4. Evaluation and management decisions	<ul style="list-style-type: none"> ➤ Evaluating the out comes of the assessment and making management decision to improve results. ➤ Communication management response to stakeholders.

It is recommended that a comprehensive Monitoring and Management Plan be developed for the PNKB Region as a separate, and priority initiative. For the purposes of the STDP the information here is provide to assist the commencement and provide a strategic direction for this process.

3.2. Baselines, indicators and targets

3.2.1. Baselines

The collection of actuate baseline information is of fundamental importance as it provides that starting point from which conditions and impacts will be assessed in the future. Baseline information needs to be collected at each site and should cover the following aspects:

Table 410: Baseline items for monitoring activities

Baseline Item	Description
Visitor activity data	This includes the level of visitor activity for each site/zone. In additional to gross numbers that may be available any disaggregate information indicating: type of travel, source market, length of stay, spending, activities/sites visited, satisfaction levels of visitors, comments is also very useful.
Environment related data	This includes the condition of the environment and the most site appropriate indicators.
Social research data	This includes the current social condition at or near the tourism sites.

3.2.2. Indicators

For each site the most appropriate indicators will have to be determined, based on the following considerations:

- The particular characteristics of the site.
- The key management priorities and risks.
- Relevance of indicator to the impact being monitored.
- Ease of information collection.

The site-level indicators should be suitable in acquiring the information necessary to feed into these levels of impact monitoring and management. Broader level indicators need to be selected to match the management concerns at the Zone and Regional level as well.

See Annex 8 for a complete set of possible indicators.

3.2.3. Targets: limits of acceptable change and broad development objectives

Limits of acceptable change (LAC) is an approach to tourism impact management in National Parks and protected areas throughout the world. This approach recognises that each site will have a particular threshold for providing tourism activities at a level that does not damage the site adversely. This threshold, or limit of acceptable change, is usually a composite of several key factors, including:

- Tourist satisfaction
- Environmental condition
- Site aesthetics
- Income generation

Specific indicators will need to be selected for each of these factors based on the characteristics of the site of tourism zone and management priorities. Table X provides a process for the three monitoring levels mentioned previously.

Table 61: Process for monitoring levels

Level	Monitoring Process
1. Site Level	<ul style="list-style-type: none"> ➤ Obtaining clear evidence of the impact of tourism activities at a particular site. Monitoring and manage tourism activities at the site level in order to maintain tourism related impacts within the Levels of Acceptable Change (LAC). Each site will have specific criteria that describe the key aspects of acceptable change. The process for determining these key issues and how to measure them typically involves the following process: <ol style="list-style-type: none"> 1. Key issues identification 2. Goals to be achieved 3. Standards to be maintained in order to reach goals 4. Establish key indicators and make an inventory 5. Develop actions and strategies for impact mitigation 6. Monitor and review.

Level	Monitoring Process
2. Zone Level	<ul style="list-style-type: none"> ➤ Broad based assessment of acceptability of tourism impacts based on compiling, reviewing and assessing the site-level assessments to gain an overview of the impacts of tourism activities at a major site or specific zone. It is recommended that specific monitoring and management processes be designed for the following zones and areas: <ul style="list-style-type: none"> ▪ Corezone, including extension area <ul style="list-style-type: none"> - Administration and Service Area – Tourism Zones - Ecological Restoration Area – Tourism Zones - Strictly Protected Area – Tourism Zones - Extension Area – Tourism Zones ▪ Bufferzone – Tourism Zones ➤ For each of the areas and tourism zones LAC can also be designed. These will likely have the same categories/aspects of the site-level LACs but will be broader in order to integrate the specific information from the indicators and thresholds used at the various sites in each zone.
3. Regional Level	<ul style="list-style-type: none"> ➤ At this level it is recommended that specific monitoring and management processes be designed for: <ul style="list-style-type: none"> ▪ PNKB NP ▪ Bufferzone Region ➤ Each of these areas will have broad development targets that reflect the overall development goals and objectives. Compiling and reviewing the results from the zone-level assessment in terms of these broader, regional level development goals and objectives will provide an indication if the impacts of tourism development in the regional area making an effective contribution.

3.3. Monitoring guidelines

Different levels on monitoring and assessment require different frequency of attention. Table 62 indicated the monitoring levels and guidelines on timelines.

Table 422: Guidelines on timelines for monitoring

	Information gathering	Compilation of information	Evaluation of information	Management response
Sites	<i>Every 2 weeks</i>	<i>Every 2 months</i>	<i>Seasonal (Twice per year)</i>	<i>Seasonal (Twice per year)</i>
Zones	<i>Every 2 months</i>	<i>Seasonal (Twice per year)</i>	<i>Seasonal (Twice per year)</i>	<i>Annual</i>
Regional	<i>Seasonal (Twice per year)</i>	<i>Seasonal (Twice per year)</i>	<i>Seasonal (Twice per year)</i>	<i>Annual</i>

A coordinated effort is required to effectively collect, compile, and review information collected in the monitoring process to support the timely review and inform strategic management responses. Table 63 includes monitoring management responsibilities.

Table 63: Monitoring management responsibilities

	Site-level monitoring done by	Information compiled by	Information reviewed by	Management responded by
Administrative and Service Area	<ul style="list-style-type: none"> ▶ PNKB NP Staff ▶ Concessionaires, ▶ Tour leaders 	<ul style="list-style-type: none"> ▶ PNKB NP Tourism Centre 	<ul style="list-style-type: none"> ▶ PMB, ▶ Stakeholders 	<ul style="list-style-type: none"> ▶ PMB
Ecological Restoration Area	<ul style="list-style-type: none"> ▶ PNKB NP Staff, ▶ Concessionaires, ▶ Tour leaders 	<ul style="list-style-type: none"> ▶ PNKB NP Tourism Centre, ▶ PNKB NP FPD 	<ul style="list-style-type: none"> ▶ PMB, ▶ Stakeholders 	<ul style="list-style-type: none"> ▶ PMB
Strictly Protected Area	<ul style="list-style-type: none"> ▶ PNKB NP Staff, ▶ Concessionaires, ▶ Tour leaders 	<ul style="list-style-type: none"> ▶ PNKB NP Tourism Centre, ▶ PNKB NP FPD 	<ul style="list-style-type: none"> ▶ PMB, ▶ Stakeholders 	<ul style="list-style-type: none"> ▶ PMB
Bufferzone: i. General	<ul style="list-style-type: none"> ▶ C/VL, ▶ Tour leaders, ▶ CPC 	<ul style="list-style-type: none"> ▶ CPC/DPC 	<ul style="list-style-type: none"> ▶ DPC, ▶ PMB, ▶ Stakeholders 	<ul style="list-style-type: none"> ▶ PPC, ▶ DPC
Bufferzone: ii. Tourism Infrastructure Area	<ul style="list-style-type: none"> ▶ DPC, ▶ Businesses 	<ul style="list-style-type: none"> ▶ DPC 	<ul style="list-style-type: none"> ▶ DPC/PPC, ▶ PMB, ▶ Stakeholders 	<ul style="list-style-type: none"> ▶ PPC, ▶ DPC
STDP	<ul style="list-style-type: none"> ▶ Zone-level monitoring information compiled by PMB, DPC, DCST, MPI 		<ul style="list-style-type: none"> ▶ Stakeholders 	<ul style="list-style-type: none"> ▶ PPC, ▶ PMB, ▶ DPC

Note: PMB: Park Management Board, PTC: Park Tourism Centre/Division, FPD: Forest Protection Division, DPC: District People’s Committee, PPC: Provincial People’s Committee, CPC: Commune People’s Committee, DCST: Department of Culture, Sport and Tourism, C/VL: Commune/Village leaders – CBT management boards if established. Stakeholders: Representation from groups that have an interest in the area of assessment. Typically would include business and local community interest, conservation and livelihood improvement initiatives, and relevant government departments or agencies.

3.4. STDP monitoring

The SDTP as an instrument for achieving desired development outcomes also needs to be monitored and assessed periodically so that well informed adjustments can be made in a timely manner. Table 64 provides objectives and actions for monitoring of the STDP.

Table 64: STDP monitoring objectives and actions

Timeline	Objectives	Actions
Years 1-3	<ul style="list-style-type: none"> ➤ To ensure that tourism development activities are inline and contributing to mid-term development objective. 	<ul style="list-style-type: none"> ➤ Management plans and responses are reviewed in light of the emerging evidences form the monitoring process. ➤ Initial review of the STDP to determine if tourism impacts are contributing to the development objectives.
Years 3-5	<ul style="list-style-type: none"> ➤ To ensure that tourism 	<ul style="list-style-type: none"> ➤ Management plans and responses are

Timeline	Objectives	Actions
	<p>development mid-term objectives are contributing to desired development goals.</p>	<p>reviewed in light of the emerging evidences form the monitoring process.</p> <ul style="list-style-type: none"> ➤ Mid-term review of the STDP to determine if tourism impacts are achieving the development objectives and that these objectives are still in alignment with supporting the development goals. ➤ Appropriate revisions to the STDP are made if necessary.
<p>Years 5-10</p>	<ul style="list-style-type: none"> ➤ To ensure that the desired development goals are inline and contributing to long-term development vision for the region. 	<ul style="list-style-type: none"> ➤ Management plans and responses are reviewed in light of the emerging evidences form the monitoring process. ➤ Final evaluation of the STDP to determine if tourism development and management are achieving the development goals. ➤ Appropriate revisions to the STDP are made if necessary. ➤ Preparation for the development of the next STDP commence.

4. IMPLEMENTATION PLAN

4.1. Introduction

The implementation plan has become effective with the approval of the PPC of Quang Binh at the end of 2009. The implementation activities are structured in following three planning periods:



Short Term Planning: Year 1 - 3 (up to 2012)	Medium Term Planning: Year 3 - 5 (up to 2015)	Long Term Planning: Year 5 – 10 (up to 2020)
The STDP implementation will focus on:	The STDP implementation will focus on:	The STDP implementation will focus on:
<ul style="list-style-type: none">➤ High Priority Development Activities➤ Creating a Comprehensive Framework for STDP Implementation	<ul style="list-style-type: none">➤ Intermediate Development Actions➤ Realising Planning Objectives➤ Directing Development Towards Planning Goals	<ul style="list-style-type: none">➤ Achieving the Planning Goals➤ Policies and Planning Directions for Achieving Longer-termed Development Vision

4.2. Short term (up to 2012) priority implementation activities

4.2.1. Tourism development planning and management

Table 65: Short term implementation activities - tourism development planning and management

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen tation Timeframe
1	<p>Site Visitor Management Plan for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre</p> <ul style="list-style-type: none"> ➤ Develop a visitor management system for the Phong Nha Cave tour – including the Dong Tien Son Cave (Dry Cave) that regulates the visitor flows to the caves especially during the high season, establish a hourly carrying capacity for the cave, clearly define walking routes through the cave, and enhance and upgrade the lighting in the cave, strictly limit tour boats in the cave and at the cave entrance areas, develop clear guidelines and procedures for tour boat operators so visitor flows can be regulated, improve the quantity and quality of the information and interpretation materials about the Phong Nha Cave, investigate the potential to develop an interpretation centre at the entrance of the cave. 	✓✓✓	GTZ and KfW	<p>GTZ: Support for concept development and planning document.</p> <p>KfW: Assist with funding as part of the visitor centre construction – infrastructure development.</p> <p>Indicative Budget:\$60,000</p>	2010
2	<p>Visitor monitoring survey for Phong Nha Cave, Tien Son Caves and Phong Nha Visitor Centre</p> <ul style="list-style-type: none"> ➤ Set up and implement a regular visitor monitoring survey to assess the quality of the visitor experience. 	✓✓✓	GTZ	<p>This activity will be combined with Activity 1.</p> <p>Indicative Budget: \$15,000</p>	2010
3	<p>Conceptual redevelopment of the Visitor Information Centre</p> <ul style="list-style-type: none"> ➤ Planning: Integrate the Phong Nha Visitor Centre in the planning and management concept of the tourist port complex, improve the quantity and quality of the information and interpretation materials of the visitor centre, investigate a potential business model for the visitor centre, actively promote and integrate the visit centre as part of the Phong Nha Cave experience. ➤ Construction: Assess reconstruction requirements. 	✓✓	KfW	<p>Activity is supported by the GFA feasibility study. The activity will include the building of an information center (at the tourism harbour) and an interpretation center (at the entrance of the caves).</p> <p>Indicative Budget: \$20,000</p>	2010-2011

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
4	<p>Site Visitor Management Plan for Eight Volunteers Cave</p> <ul style="list-style-type: none"> ➤ Develop a site management plan (including environmental management systems for waste collection and disposal) that includes visitor-monitoring system to assess site specific tourism flows, define walking routes at the sites, specifically between the Pagoda and the cave site, improved and expand tourism facilities and services, develop better interpretation materials about the site and provide additional information about the region, investigate the potential of developing a walking opportunity to provide an additional experience on the site and to ease the visitor flows around the site. 	✓✓✓	PNKB NP	<p>The PPC authorised the PNKB NP to prepare a site management plan.</p> <p>Indicative Budget: \$5,000</p>	2010
5	<p>Trekking product development in the PNKB NP</p> <ul style="list-style-type: none"> ➤ Assessment of the trekking route requirements, marking of the trekking routes, development guidelines and operating procedures for the trekking routes, management system for the trekking routes, environmental impact mitigations, carrying capacities, and interpretations materials. ➤ Suggested trekking routes – To Hang En, To Bamboo Valley, To Hang Tien Duong, To Me Bong Con and Hang Vom, To Hang Son Doong, A Rem community and surrounding caves. 	✓	To Be Determined	<p>Before initiating the trekking product development in the PNKB NP there has to be a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should come up with clear guidelines and criteria for such development taking particularly into account special criteria for WHS development.</p> <p>Indicative Budget: \$10,000</p>	2011 - 2012
6	<p>Walking, trekking and biking route development in the Bufferzone</p> <ul style="list-style-type: none"> ➤ Marking of the walking, trekking and biking route in the Bufferzone focused on the adjacent area of the administration and service area – Son Trach commune., development guidelines for the walking, trekking and biking route routes, management system for the walking, trekking and biking route that includes the community, environmental impact mitigations, carrying capacities, and interpretations materials. ➤ This should be linked to the CBT development in the Bufferzone. ➤ Sites that should be included: Cave 36 and Xuan Son Ferry, selected villages and the riversystem. 	✓✓	ADB	<p>This activity needs to be aligned to ADB implementation activities.</p> <p>Indicative Budget: \$20,000</p>	2011 - 2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
7	<p>Water-based product development in the PNKB NP/ Bufferzone</p> <ul style="list-style-type: none"> ➤ Development of river activities such as kayaking, tubing, swimming, river cruising. ➤ Marking of the routes for water-based activities, development guidelines for water based activities, environmental impact mitigations, carrying capacities, consult with the PNKB NP and the community to cooperate on the river use, providing adequate training for interpretation services, visitor hosting, and potential safety rescue. ➤ This should be linked to the CBT development in the Bufferzone. ➤ Rivers that should be included: Song Chay River, Trooc River, Song Son and Song Long Dai. 	✓✓	ADB and PNKB NP	<p>This activity needs to be aligned to ADB implementation activities.</p> <p>The PNKB NP supports the product development.</p> <p>Indicative Budget: \$10,000</p>	2011 - 2012
8	<p>Adventure caving product development</p> <ul style="list-style-type: none"> ➤ Development of adventure caving activities. ➤ Assessment of caves on their adventure caving potentials, marking of the walking routes through the caves, development guidelines and operating procedures for adventure caving, environmental impact mitigations, carrying capacities, and interpretations materials. ➤ Caves that should be included: Hang E, Hang Toi, Hang Thien Duong, Me Bong and Hang Vom, Hang En 	✓	To Be Determined	<p>Before the adventure caving product development is initiated there needs to be a thorough scientific assessment of the caves and a decision of the PPC/Park Management Board about general policy of cave development. This policy decision should come up with clear guidelines and criteria for such development taking particularly into account special criteria for WHS development</p> <p>Indicative Budget: \$15,000</p>	2011 - 2012
9	<p>Wildlife watching product development</p> <ul style="list-style-type: none"> ➤ Development of wildlife watching opportunities. ➤ Assessment of areas for wildlife watching, investigate infrastructure requirements such as viewing points or platforms, development of guidelines for wildlife watching. ➤ Focus on existing sites such as the Hatinh Langur viewing area just before the Nuoc Mooc Ecotrail, Primate Rescue Centre and Botanical 	✓✓	ADB	<p>This activity needs to be aligned to ADB implementation activities.</p> <p>Indicative Budget: \$10,000</p>	2011 - 2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
	Garden.				
1 0	<p>Concept development for a tourism operation at the Primate Rescue Centre</p> <ul style="list-style-type: none"> ➤ Develop a site-specific operational management plan to ensure safety, visitor guiding guidelines and prevention of impacts on the environment and animals, develop interpretation materials, interpreter training, scheduling, and impact assessment/monitoring program, design an appropriate visitation schedule with the project managers. 	✓✓	Cologne Zoo	Indicative Budget: \$10,500	2011 - 2012
1 1	<p>Concept development for Botanical Garden</p> <ul style="list-style-type: none"> ➤ Prepare a concept plan for the Botanical Garden. This should include visitor management, trail development, information and interpretation, and potential infrastructure needs such as signage, parking, toilets and staff rooms, develop site-specific interpretation and information, investigate the opportunity to use PNKB NP staff or people from the community as interpretation guides. 	✓	PNKB NP	Indicative Budget: \$5,000	2012
1 2	<p>Concept development for a tourism operation at the Bamboo Valley</p> <ul style="list-style-type: none"> ➤ Carefully review any investment proposals for the valley on their impact on the biodiversity of the area and the region in general, assess the biodiversity and clearly describe the existing wildlife of the valley, conduct a complete site assessment to determine an appropriate level of tourism product and infrastructure development that would meet the demands of the market while ensuring environmental protection and conservation values, investigate the potential for a canopy walk in the valley and prepare a feasibility study. 	✓	To Be Determined	The Bamboo Valley will need a thorough scientific assessment and EIA before any development is considered. Indicative Budget \$15,000	2012
1 3	<p>Concept development for Gao Forest</p> <ul style="list-style-type: none"> ➤ Prepare a concept plan for the Gao Forest. This should include visitor management, trail development, information and interpretation, and potential infrastructure needs such as signage, parking, toilets and staff rooms, develop site-specific interpretation and information, investigate the opportunity to use PNKB NP staff or people from the 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$5,000	2011 - 2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
	community as interpretation guides.				
1 4	Concept development for U Bo Peak ➤ Investigate a trail route for U Bo Peak, investigate funding feasibilities for the trail route, consider how this site will be incorporated into other tourism routes/products.	✓	PNKB NP	Indicative Budget: \$5,000	2012
1 5	Monitor development of planned HCM Museum ➤ Monitor planning and construction of the museum, brief construction leaders about the STDP, integrate museum development in visitor management of the PNKB NP. Especially in the sightseeing touring route around the Administration and Service Area. Be aware that this will be a high volume tourism site.	✓	Ministry of National Defense	Indicative Budget: \$2,000	2010 - 2012
1 6	CBT product development in the PNKB NP ➤ A Rem and Ruc villages: Conducted community development needs assessment, conduct socio-cultural sensitivity and conservation requirements, conduct environmental sensitivity analysis, support the community organisation, awareness raising and skills development for hosting tourism, establish and improve waste management, potable water and communications, conduct specific market analysis and product concept development, review policies permitting visitor stays, develop business agreements/concession system.	✓	KfW	Indicative Budget: \$30,000	2012
1 7	Chay Lap CBT product development ➤ Skills and language training for locals involved in tourism services to provide better (higher value) services, increase tourism awareness among local residents, develop and support the Chay Lap homestay as a replicable homestay model for the wider region, identify and support the operation of CBT activities such as biking, walking to other villages, kayaking and tubing, make the CBT activities available to day-visitors, identify additional opportunities to provide more households with tourism related earning, support the marketing and promotion of homestays and CBT activities in the region.	✓✓✓	GTZ, KfW and ADB	GTZ will support this activity as a pilot project. KfW will consider investment based on GTZ supported action plan. ADB activities for CBT should be aligned to this activity. Activity 18 depends on this activity. Indicative Budget: \$30,000	2010

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
1 8	CBT product development in the Bufferzone <ul style="list-style-type: none"> ➤ Scanning and assessing further communities with CBT hosting potential and raise awareness about tourism in the communes and villages, assess the potential demand for CBT products in the Bufferzone, capacity needs assessments, survey and tour product assessments and feasibilities on financing mechanism. 	✓✓	GTZ and ADB	GTZ: Further activities will be based on Activity 17. ADB: This activity needs to be aligned to ADB implementation activities. Indicative Budget \$100,000	2011- 2012
1 9	CBfT in the Bufferzone <ul style="list-style-type: none"> ➤ Support the production of local products to be linked to the tourism supply chain, working in partnership with other relevant development initiatives (government and development organisations), consult further with tourism operators to clarify the actual demand for CBT products and work in cooperation to develop the most suitable products, support and integrate communes and villages in human resource development programmes. 	✓✓	GTZ, KfW and ADB	Actual production can be supported through Bufferzone Development Fund (BDF). This could become part of the Bufferzone Development Plan (BDP) facilitated through GTZ. This activity needs to be aligned to ADB implementation activities. Indicative Budget: To Be Determined	2011- 2012
2 0	Tourism Value Chain Analysis for the PNKB NP Region <ul style="list-style-type: none"> ➤ Conduct a study that provides tourism baseline indicators to support the expansion and development of tourism benefit opportunities including linking local products into the tourism economy and increasing local employment in the tourism sector. 	✓✓✓	GTZ and ADB	Indicative Budget: \$40,000	2010- 2011
2 1	Establishment of community enterprise development funds for business support and construction <ul style="list-style-type: none"> ➤ Community enterprise development fund that supports: microenterprise tourism development loans such as homestays, community lodges and the community operation of CBT activities, business support for community agreements with commercial tour operators and funding for other HRD activities. 	✓✓	KfW and ADB	This includes KfW's fund for Bufferzone development – microfinance programme. Refer also to Activitiy 19. Indicative Budget: To Be Determined	2011- 2012
2 2	Marketing and Promotion Strategy and Action Plan for the PNKB NP Region <ul style="list-style-type: none"> ➤ This should include: comprehensive market analysis (based on visitor 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities.	2011- 2012

#	Development Activity	Priority (✓ - Low to ✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
	monitoring survey), positioning and branding strategy (working together with the Quang Binh Province and VNAT), development of marketing and distribution channels and a comprehensive action plan.			Indicative Budget: \$50,000	
2 3	Branding ➤ Develop a consistent brand and logo for the region. This should be used for all the marketing collateral, media and interpretation signage.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$10,000	2011- 2012
2 4	Development of marketing collateral for the PNKB NP Region ➤ Develop consistent marketing collateral such as brochures, posters, leaflets etc about the region. Include the development of a comprehensive tourism map and site-specific brochures.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$40,000	2011- 2012
2 5	Advertisement and promotion ➤ Implement advertisement and promotional activities as prepared in the Marketing and Promotion Strategy and Action Plan for the PNKB NP Region.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$15,000	2011- 2012
2 6	Website development and maintenance ➤ Develop a promotional website that represents the region and all of the tourism stakeholders. Potentially include a booking system platform for the main cave tours, activities around the regions and accommodation.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$15,000	2011- 2012
2 7	Support for fam tours for tourism operators and media ➤ Provide ongoing in the region support to tourism operators and visiting media. Regularly invite key tourism operators (tour agents) and media representatives.	✓✓	ADB and KfW	This activity needs to be aligned to ADB implementation activities. KfW has a budget line for study tours and training. Indicative Budget: \$10,000	2011- 2012
2 8	Participation at national and sub-regional promotional events and trade fairs ➤ Regularly participate at national and sub-regional promotional events	✓✓	ADB and KfW	This activity needs to be aligned to ADB implementation activities.	2011- 2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
	and trade fairs. Based on Marketing and Promotion Strategy and Action Plan for the PNKB NP Region.			Indicative Budget: \$10,000	
2 9	Development of a Information Management System ➤ This is to collect information for the purposes of tourism impact management and planning, marketing and product development and for the interpretation.	✓✓	KfW	This activity needs to be aligned to KfW implementation activities – via baseline impact studies and then the formulation of monitoring and evaluation activities Indicative Budget: To Be Determined	2011- 2012
3 0	Development of a Interpretation Plan and Action Plan Activities ➤ Prepare an Interpretation Plan and Action Plan Activities. The Interpretation Plan should provide the management of PNKB NP a framework for interpreting the natural as well as cultural aspects of the park including recommending immediate actions to improve the current situation.	✓✓	ADB and KfW	This activity needs to be aligned to ADB and KfW implementation activities Indicative Budget: \$40,000	2011- 2012
3 1	Development of a Tourism Monitoring and Management Programme ➤ Prepare a Tourism Monitoring and Management Program. This should include key tourism indicators regular survey activities for the tourism sites. Provide annual reports.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$10,000	2011- 2012
3 2	Development of interpretation material for the Phong Nha Visitor Centre ➤ Interpretation content development for the Phong Nha Visitor Centre. This includes exhibition content for the visitor centre itself and descriptions of the regions and specific sites.	✓✓✓	GTZ and KfW	GTZ and KfW to allocate tasks. Combine with conservation awareness programme during management planning for PNKB NP. Indicative Budget: \$20,000	2010
3 3	Site specific conceptual interpretation plan and material for priority sites ➤ Prepare site-specific interpretation material for priority sites such Phong Nha Caves, Eight Volunteers Cave etc. The site-specific interpretation material should be consistent with the branding of the marketing collateral.	✓✓	ADB, KfW and GTZ	This activity needs to be aligned to ADB, KfW and GTZ implementation activities Indicative Budget: \$25,000	2011

4.2.2. Tourism Human Resource Development

Table 66: Short term implementation activities - tourism human resource development

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
1	Establishment of a HRD Programme for the PNKB NP Region <ul style="list-style-type: none"> ➤ Preparation of an extensive and comprehensive HRD tourism programme for the PNKB NP Region. The programme should include the below training initiatives. 	✓✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$40,000	2010-2012
2	CBT human resource training <ul style="list-style-type: none"> ➤ Training needs assessment, skills and language training for locals involved in tourism services to provide better (higher value) services, increase tourism awareness among local residents. 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$100,000	2010-2012
3	HRD tourism training for PNKB NP - management staff <ul style="list-style-type: none"> ➤ Training needs assessment, tourism management in protected areas and bufferzone – this includes concession management, consultation with the community, understanding policies and regulations regarding tourism, monitoring and management of tourism. ➤ The training is aimed at park management staff. ➤ Study tours for key management staff. 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$50,000	2010-2012
4	HRD tourism training for PNKB NP – general staff <ul style="list-style-type: none"> ➤ Tourism awareness training and language skill training. 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$50,000	2010-2012
5	HRD tourism training for PNKB NP – tourism department staff <ul style="list-style-type: none"> ➤ Customer service training and language skills training. 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$50,000	2010-2012
6	HRD tourism training for PNKB NP – cave guides	✓✓	ADB	This activity needs to be aligned to ADB	2010-

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
	➤ Training programme for cave guides for the PNKB NP. The focus should be on cave guides for the Phong Nha Caves. This training should include staff from the PNKB NP, local communities and potentially relevant tour companies.			implementation activities. Indicative Budget: \$100,000	2012
7	HRD tourism training for the wider industry sector ➤ Tourism training initiative for local and regional operators.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$30,000	2010- 2012

4.2.3. Direct tourism infrastructure development

Table 67: Short term implementation activities - direct tourism infrastructure development

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
1	Phong Nha and Tien Son Cave redevelopment and upgrade ➤ Cave safety infrastructure, Cave trail safety infrastructure and Handrail.	✓✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$453,000	2010- 2012
2	Phong Nha Visitor Centre redevelopment and upgrade ➤ Structural redevelopment of the visitor centre aligned to the redevelopment and upgrade of the Phong Nha boatlanding area. This includes the development of an interpretation centre in the area between the Phong Nha Cave and Tien Son Cave.	✓✓	KfW	This activity needs to be aligned to KfW implementation activities. Indicative Budget: \$250,000	2011- 2012
3	Phong Nha boatlanding redevelopment and upgrade ➤ Structural redevelopment of the Phong Nha boatlanding. This should be aligned to the redevelopment of the visitor centre.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$100,000	2011- 2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
4	Cave protection support for other caves <ul style="list-style-type: none"> ➤ Cave safety infrastructure, cave trail safety infrastructure and Handrail. This includes caves that are developed for adventure caving. 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$50,000	2012
5	Trekking trail upgrade and construction support <ul style="list-style-type: none"> ➤ Development/upgrade of trekking trails in the PNKB NP. Key trails include: To Hang En, To Bamboo Valley, To Hang Tien Duong, To Me Bong Con and Hang Vom, To Hang Son Doong, A Rem community and surrounding caves. 	✓	KfW	This activity needs to be aligned to KfW implementation activities. Indicative Budget: \$50,000	2012
6	Walking, trekking and biking routes construction in the Bufferzone <ul style="list-style-type: none"> ➤ Marking of the walking, trekking and biking routes in the Bufferzone focused on the adjacent area of the administration and service area – Son Trach commune, development guidelines for the walking, trekking and biking routes, management system for the walking, trekking and biking routes that includes the community, environmental impact mitigations, carrying capacities, and interpretations materials. 	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$100,000	2011- 2012
7	Maintenance and extension of Nuoc Mooc Spring Eco Trail <ul style="list-style-type: none"> ➤ Review a potential expansion of the trail, review and check maintenance schedule of the trail, especially for the bridges, improve interpretation panels and information at the site, connect and integrate the trail with CBT activities at the Chay Lap village, seek more opportunities to contribute to local economic development –such as provision of goods and services (refreshments, souvenirs and local produce by nearby villagers, establish a visitor-monitoring plan and consider a site management plan for the future, support the marketing and promotion of the trail, and link and package the trail with other tourism activities. 	✓✓	KfW	This activity needs to be aligned to KfW implementation activities. Indicative Budget: \$30,000	2011- 2012
8	Site development for Thac Mo Waterfalls <ul style="list-style-type: none"> ➤ Site planning, develop the parking area as a designated rest stop of the National Highway 15. Key infrastructure needs at the rest area are: Signage to the parking area and waterfall, Toilets and rubbish facilities, 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$15,000	2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen tation Timeframe
	Facilities for catering to tourist such as refreshments, relaxing, souvenirs selling. Develop site-specific interpretation and information about the region. Develop the site as part of other tourism route development for National Highway 15.				
9	<p>Construction support for the development of minor tourism sites for driving route development</p> <ul style="list-style-type: none"> ➤ The sites include: Cha Lo Cave (including viewing area from the Highway into the valley), Bai Dinh Historical Site, En Cave/Heavens Gate near Cha Lo and Hill 37, Than Dinh Mountain, Khe Gat Airfield. ➤ Site specific development that should include: Tidy up the site and potentially provide small-scale infrastructure such as toilets, develop site-specific interpretation and information about the region, develop the site as part of a tourism route development, raise awareness in the local community about tourism and supporting services such as refreshments, meals and souvenirs. 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$35,000	2012
10	<p>Karst scenic viewpoint - improve tourist access and protective infrastructure</p> <ul style="list-style-type: none"> ➤ Parking are 30m long, viewing platform 20m2, guardrail on outer edge. 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$15,000	2012
11	<p>Rao Thung Trail and picnic area development</p> <ul style="list-style-type: none"> ➤ Parking area 30m long, guardrail on outer edge, parking 10 cars, 2 minibuses, bus stop area 10 m long. 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$60,000	2012
12	<p>Eight Volunteers Cave redevelopment and upgrade</p> <ul style="list-style-type: none"> ➤ Picnic area, construction work, toilets, vendor stalls, landscaping and signage. 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$35,000	2011-2012
13	<p>Tra Ang Bridge Upgrade HCM Trail Memorial</p> <ul style="list-style-type: none"> ➤ Parking improvements, landscaping, develop and install interpretative panels. 	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$10,000	2012

#	Development Activity	Priority (✓ - Low to ✓✓✓ - High)	Responsible Agency/ Organisation	Comment and Indicative Budget Allocation	Implemen- tation Timeframe
1 4	Resurgence viewpoint area development ➤ Covered waiting area, walking area, view point development, picnic area, interpretation and signage.	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$80,000	2012
1 5	Hatinh Langur Viewing Area development ➤ Parking area, interpretative viewing platforms, trail to the river, river pier and construction at the river.	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$178,000	2012
1 6	Chay Lap Boatlanding development ➤ Walking trail and boatlanding, supply of passenger boats, ticket booth and fitout, market and amenities block, toilets, bus stop, power and wastewater systems.	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$362,000	2012
1 7	General Solid Waste Disposal Improvements ➤ Training for operation and maintenance, equipment, bins for waste collection, drainages and road repairs.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$195,000	2011- 2012
1 8	Operational transportation support ➤ Shuttle buses for the Administration and Service Area.	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$132,000	2012
1 9	Site specific interpretation signage for priority sites ➤ Based on site-specific interpretation material, develop signage and markers at priority sites. All the signage in the PNKB NP should be consistent and standardised.	✓✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$100,000	2011- 2012
2 0	Regional promotional information signage ➤ Based on branding of the region, develop regional information signage along the tourism routes.	✓	ADB	This activity needs to be aligned to ADB implementation activities. Indicative Budget: \$50,000	2012

4.3. Medium term (2013 to 2015) implementation objectives

Table 68: Medium term (2013 to 2015) implementation objectives

Medium term (2013 to 2015) implementation objectives
Tourism Product Development:
<u>Administrative and Service Area:</u>
<ul style="list-style-type: none">➤ Operate high quality tourism products for the high visitor volume tourism sites - Visitor Information Centre, Phong Nha Cave, Dong Tien Son Cave, and Ho Chi Minh Museum.➤ Operate a range of soft adventure and nature tourism products based on medium visitor volume in the Bamboo Valley area.➤ Operate a range of soft adventure and nature tourism products – based on medium visitor volume in the Hang E (E Cave), Hang Toi (Dark Cave), Nuoc Mooc Spring Eco Trail and Song Chay River areas.➤ Strengthen and maintain tourism product linkages with the Bufferzone.➤ Review and up-scale tourism product as appropriate.
<u>Ecological Restoration Area:</u>
<ul style="list-style-type: none">➤ Development of tourism products for the Me Bong Con and Hang Vom, Hang Thien Duong (Paradise Cave) areas.➤ Development of tourism products for the A Rem Minority Village and surrounding area.
<u>Strictly Protection Area:</u>
<ul style="list-style-type: none">➤ Careful management of tourism products for the Hang En site and trekking route.➤ Development of tourism products for the U Bo Peak..
<u>Extension area:</u>
<ul style="list-style-type: none">➤ If feasible, commence developing tourism activities in the Ruc Minority Village surrounding caves.
<u>Bufferzone:</u>
<ul style="list-style-type: none">➤ Operate successfully community based tourism products in selected areas of the Bufferzone.➤ Establish and operate soft adventure tourism activities (walking, trekking, biking and kayaking) in relevant areas of the Bufferzone.➤ Support the expansion and development of future community based tourism products.➤ Support the expansion and development of community benefit tourism initiatives including providing products/services to tourists and the tourism economy, and strategies to increase local employment in the tourism sector.➤ Strengthen and maintain tourism product linkages with the Corezone.
<u>Tourism Infrastructure Zone:</u>
<ul style="list-style-type: none">➤ Support the investment and development for a high volume tourism in the Tourism.
Marketing and Promotion:
Phong Nha Khe Bang National Park Region:
<ul style="list-style-type: none">➤ Monitor market information.➤ Improve and consolidate marketing material.

- Exploit key distribution channels.

Quang Binh, National, and Sub-regional:

- Expand on positioning of PNKB NP Region targeting key markets.
- Incorporate PNKB NP Region further into national, regional and global markets/campaigns.
- Exploit optimal marketing channels.
- Upgrade and refine marketing materials.
- On-going market analysis.

Information Management and Interpretation Management

Information Management:

- Implement the Comprehensive Information Management system and Action Plan.
- Implement the information management training strategy.
- Operationalise the information management system.

Interpretation Management:

- Implement the Comprehensive Interpretation Strategy and Action Plan.
- Implement the information management training strategy.
- Operationalise the interpretation system.

Human Resource Development

- Establishment of a permanent human resource development programme to provide training and skills upgrading system that will continue to provide quality human resources required for the ongoing, quality management and delivery of tourism in the region.
- Upgrading, expansion and replication of Activity 2 above.
- Planning and preparations for Intermediate Actions.

Tourism Infrastructure Development

Administrative and Service Area:

- Review current infrastructure requirements.

Ecological Restoration Area and Strictly Protected Area:

- Review current infrastructure requirements.

Bufferzone:

- Review current infrastructure requirements.

Tourism Infrastructure Zone:

- Review current infrastructure requirements.

4.4. Long term (up to 2020) implementation directives

Table 69: Long term (up to 2020) implementation directives

Long term (up to 2020) implementation directives
Tourism Product Development:
<ul style="list-style-type: none">➤ High quality of tourism products that contribute to conservation and community development objectives.➤ Monitoring (ongoing review, maintenance, mitigation).➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information.
Marketing and Promotion:
<ul style="list-style-type: none">➤ Continued review and refinement of the product-market match in relation to achieving Park management objectives.➤ Maintaining and high quality of tourism marketing and promotional strategies, products and activities that contribute to conservation and community development objectives.➤ Monitoring (ongoing review and refinement).➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information.
Information Management and Interpretation Management
<ul style="list-style-type: none">➤ Maintaining a high quality of information management that contributes to effective management of sustainable tourism and heritage conservation.➤ Maintaining a high quality of interpretation as an essential component of the tourism experience and products that contribute to conservation objectives.➤ Monitoring (ongoing review and refinement).➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information.
Human Resource Development
<ul style="list-style-type: none">➤ Maintaining a quality of human resource development that contributes to high quality tourism experiences and effective management of sustainable tourism and heritage conservation in the PNKB Region.➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information.
Tourism Infrastructure Development
<ul style="list-style-type: none">➤ Maintaining and high quality of infrastructure required to support sustainable tourism development.➤ Monitoring (ongoing review, maintenance, mitigation).➤ Enhancement as needed and selective expansion as deemed appropriate based on results to date, updated management objectives and market information.

APPENDIX

Appendix 1: Description of Visitor Markets and Segments

Visitor Markets and Segments for PNKB region	Key Interests for PNKB region
International Market	
<p><u>Primary Market Segment: Free Independent Travellers (FIT)</u></p> <ul style="list-style-type: none"> ➤ They travel to Vietnam without set arrangements, often have flexible itineraries and book their in-country travel such as to PNKB once they are in Vietnam – HCMC, Hanoi or Hue. They generally have some pre-arrangements by an in-country tour operator, but travel to PNKB individually or in a small group (often couples) or in a combined tour group. ➤ They are mainly from western markets but there is also a growing FIT markets from Japan, Singapore and Thailand. This market segment has the potential to stay in the PNKB NP region for more than one day. ➤ They include a range of age groups. ➤ They seek unique and meaningful experiences and they are high value in economic returns. However they seek low volumes in visitors at a destination. They would like to be engaged with activities and are interested and open to learn about the culture and environment of the region. They are active people and want to participate in activities rather than observing them. ➤ They stay in a broad range of accommodation – from homestay to luxury categories. However, they expect value for money from accommodation and tourism activities and assume high quality and international standards. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Ecotourism, adventure tourism and nature based tourism and culture and heritage of the region. ➤ Community-based tourism. ➤ Conservation and protected areas. ➤ Focus on packaged and individual low volume and low impact adventure activities, such as swimming, river kayaking, hiking and wildlife viewing. ➤ Focus on packaged and individual medium impact activities such as going on a boat ride along the river. ➤ Wildlife watching and experiencing cultural and heritage of the region.
<p><u>Secondary Market Segment: Backpacker Travellers</u></p> <ul style="list-style-type: none"> ➤ They travel to Vietnam without set arrangements, have flexible itineraries and book their in-country travel such as to PNKB once they are in Vietnam – HCMC, Hanoi or Hue. Some have pre-arrangements by a tour operator, but they generally travel to PNKB individually or in a small group (often couples). ➤ They often use local transportation or have their own motorbike while touring the country. They specifically look for destinations that are off the beaten track. ➤ They are mainly from western markets but there is also a growing backpacker market from Japan, Singapore and Thailand. This market segment has the potential to stay the longest in the PNKB NP region. ➤ They tend to be in the age groups of 20 to 35 years. However, there are also increasingly older age groups who travelling as backpackers. ➤ They seek unique and meaningful experiences. While they are strongly perceived as budget travellers, they can be high value (especially the older age groups) as their 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Ecotourism, adventure and nature based tourism and culture and heritage of the region. ➤ Community-based tourism. ➤ Conservation and protected areas. ➤ Focus on packaged and individual low volume and low impact adventure activities, such as swimming, river kayaking, hiking and wildlife viewing. ➤ Focus on packaged and individual medium impact activities such as going on a boat ride along the river. ➤ Wildlife watching and experiencing cultural and heritage of the region.

Visitor Markets and Segments for PNKB region	Key Interests for PNKB region
<p>spending often supports rural and local economies.</p> <ul style="list-style-type: none"> ➤ They would like to be engaged with activities and are interested and open to learn about the culture and environment of the region. They are active people and want to participate in activities rather than observing them. ➤ They prefer to stay in budget accommodation with quality standards. They expect value for money from accommodation and tourism activities. 	
<p><u>Secondary Market Segment: Western Group Tour Travellers</u></p> <ul style="list-style-type: none"> ➤ They generally travel to Vietnam and the PNKB NP region as part of small tour groups (up to 15 people) and all bookings are made prior through a tour operator or travel agent. They travel to Vietnam on set arrangements and have pre-planned itineraries. ➤ They are mainly from Europe, North America and Australasia. They only have limited time to spend in the PNKB region. ➤ They use transportation provided by the tour operators. ➤ They seek destinations that are interesting and relatively accessible. They value special destinations and will pay for unique experiences. ➤ They tend to be somewhat older and the majority is in the middle age groups. ➤ Their levels of spending and interests in purchasing souvenirs is typically higher than the above mentioned segments. ➤ They would mainly stay in up-market resorts such as ecolodges or medium category resorts. However, they expect value money from accommodation and tourism activities and assume high quality and international standards. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Brief and packaged community based tourism experiences. ➤ Value conservation and protected areas. ➤ Potential for short and packaged low impact tourism activities, such as swimming, river kayaking, hiking and wildlife viewing. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Have a particular interest in wildlife watching and experiencing cultural and heritage sites like caves used during the war time.
<p><u>Secondary Market Segment: Regional Group Tour Travellers</u></p> <ul style="list-style-type: none"> ➤ They generally travel to Vietnam and the PNKB NP region as part of a larger tour group (up to 40 people) and all bookings are made prior through a tour operator or travel agent. They travel to Vietnam on set arrangements and have pre-planned itineraries. ➤ They are mainly from North-Eastern Thailand and Lao PDR and use the land borders to enter Vietnam. They only have limited time to spend in the PNKB region. ➤ They use transportation provided by the tour operators. ➤ They seek destinations that are interesting and relatively easy accessible from the border areas. ➤ They include a variety of age groups. ➤ They stay in low to medium range resorts and hotels. They expect value money from accommodation. ➤ They seek entertainment facilities and passive tourism activities such as guided boat tours and short distances 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Occasionally easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Selected brief and packaged community based tourism experiences. ➤ Value landscape sightseeing experiences. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities.

Visitor Markets and Segments for PNKB region	Key Interests for PNKB region
<p>walking tours.</p> <ul style="list-style-type: none"> ➤ There spending patterns are led by value for money, unique and regional specialties and souvenirs. 	
<p><u>Niche Market Segment: Expatriates travelling in Vietnam</u></p> <ul style="list-style-type: none"> ➤ They live in Vietnam and choose destinations that can be accessed quickly for shorter breaks. They book their travels with an in-country tour operator or organise travels on their own. ➤ They often travel in smaller groups. They include a range of age groups. They are mainly from western markets. ➤ Many of them know Vietnam very well. They seek unique and meaningful experiences and they can be high value in economic returns. However they seek low volumes in visitors at a destination. ➤ They would like to be engaged with activities and are interested and open to learn about the culture and environment of the region. They are active people and want to participate in activities rather than observing them. ➤ They stay in a broad range of accommodation – from homestay to luxury categories. However, they expect value for money from accommodation and tourism activities and assume high quality and international standards. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Ecotourism, adventure tourism and nature based tourism and culture and heritage of the region. ➤ Community based tourism. ➤ Conservation and protected areas. ➤ Focus on packaged and individual low volume and low impact adventure activities, such as swimming, river kayaking, hiking and wildlife viewing. ➤ Focus on packaged and individual medium impact activities such as going on a boat ride along the river. ➤ Wildlife watching and experiencing cultural and heritage of the region.
<p><u>Niche Market Segment: Regional Caravanning Travellers</u></p> <ul style="list-style-type: none"> ➤ They live in Thailand or Lao PDR and choose destinations that are in driving distance to their own countries. ➤ Caravanning is a self drive tourism holiday and arrangements are generally not pre-organised, but an itinerary is developed. They often travel in groups of cars. Mostly friends and family travel together. ➤ They seek destinations that are interesting and relatively easy accessible from the border areas. ➤ They include a variety of age groups. ➤ They stay in low to medium range resorts and hotels. Occasionally in luxury categories. They expect value money from accommodation. ➤ They seek entertainment facilities and passive tourism activities such as guided boat tours and short distances walking tours. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Occasionally easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Selected brief and packaged community based tourism experiences. ➤ Value landscape sightseeing experiences. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities.
<p><u>Niche Market Segment: Other Travellers</u></p> <ul style="list-style-type: none"> ➤ Other travellers include all other potential market segment, for example other Asian group tour markets such as from China or Taiwan or visiting international scientists on expedition in PNKB NP. The visitor volume of these individual market segments is relatively small and not regarded as significant at this stage. They may however grow into a significant market in the future. 	<ul style="list-style-type: none"> ➤ Key interest on PNKB can not be generalised and are individual to the market segment.

Visitor Markets and Segments for PNKB region	Key Interests for PNKB region
Domestic Market	
<p><u>Primary Market Segment: Group Tour Leisure/Holiday Travellers</u></p> <ul style="list-style-type: none"> ➤ They visit PNKB as part of an organised tour group. They generally travel to the PNKB NP region on a tight itinerary and all bookings are made prior through a tour operator or travel agent. ➤ They are from different parts of Vietnam, however most tours are organised from the major centres such as HCMC, Hanoi or Hue. ➤ They use transportation provided by the tour operators. They generally stay only for a very limited time in the region. ➤ They seek destinations that are interesting and relatively accessible. Activities are generally all pre-arranged and included in the itinerary. ➤ They include a variety of age groups. ➤ They stay in low to medium range resorts and hotels. They expect value money from accommodation. ➤ They seek entertainment facilities and passive tourism activities such as guided boat tours and short distances walking tours. ➤ Their spending patterns are led by value for money, unique and regional specialties and souvenirs. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave and key historical and cultural significant sites. ➤ Occasionally easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Value landscape sightseeing experiences. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities.
<p><u>Secondary Market Segment: Independent Leisure/Holiday Travellers</u></p> <ul style="list-style-type: none"> ➤ They travel independently to PNKB. Often in small groups of family and friends. They hire a bus or a car. Some are also on self-drive holidays (caravanning). They come from around the country, but tend to start their journey in HCMC, Hanoi, Da Nang or Hue. ➤ Itineraries are generally developed, but not many pre-arrangements are made. They organise themselves with accommodation and activities at the destination. ➤ They seek destinations that are relatively easy accessible from the border areas. ➤ They include a variety of age groups. ➤ They stay in low to medium category resorts and hotels. Occasionally in luxury categories. They expect value money from accommodation. ➤ They seek entertainment facilities and passive tourism activities such as guided boat tours and short distances walking tours. ➤ Their spending patterns are led by value for money, unique and regional specialties and souvenirs. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave, and key historical and cultural significant sites. ➤ Occasionally easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Selected brief and packaged community based tourism experiences. ➤ Value landscape sightseeing experiences. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities.
<p><u>Niche Markets: Education/Science Travellers</u></p> <ul style="list-style-type: none"> ➤ They travel to PNKB for educational and research purposes. They include students and teachers. They are 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Potential for ecotourism, adventure

Visitor Markets and Segments for PNKB region	Key Interests for PNKB region
<p>particularly interested in the PNKB NP.</p> <ul style="list-style-type: none"> ➤ Itineraries and all other arrangements are pre-organised. ➤ They stay in low category hotels. 	<p>and nature based tourism and culture and heritage of the region.</p> <ul style="list-style-type: none"> ➤ Potential for community based tourism. ➤ Conservation and protected areas. ➤ Potential for packaged and low volume and low impact adventure activities, such as swimming, river kayaking, hiking and wildlife viewing. ➤ Potential for packaged medium impact activities such as going on a boat ride along the river. ➤ Wildlife watching and experiencing cultural and heritage of the region.
<p><u>Niche Markets: Visiting Friends and Relatives (VFR)</u></p> <ul style="list-style-type: none"> ➤ They often travel independently to PNKB to visit their family, relatives and friends. Often in small groups of family and friends. They hire a bus or a car. Some are also on self-drive holidays (caravanning). ➤ Itineraries are generally developed, but not many pre-arrangements are made. They organise themselves with accommodation and activities at the destination. ➤ They include a variety of age groups. ➤ They stay in low category hotels or with relatives. ➤ They seek entertainment facilities and passive tourism activities such as guided boat tours and short distances walking tours. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave. ➤ Occasionally easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Value landscape sightseeing experiences. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities . ➤ Potential for packaged medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities.
<p><u>Niche Markets: Business/Government Travellers</u></p> <ul style="list-style-type: none"> ➤ They travel to Quang Binh/Dong Hoi for business and government purposes. They include business travellers and government officers. They may also include a visit to PNKB as part of their trip. ➤ Itineraries and all other arrangements are pre-organised. ➤ They stay in low to medium category hotels. Their accommodation generally are arranged by local authorities or organisations. 	<ul style="list-style-type: none"> ➤ Major tourism sites – Phong Nha Cave and dry cave and key historical and cultural significant sites. ➤ Occasionally easy accessible ecotourism, nature based tourism and culture and heritage sites. ➤ Value landscape sightseeing experiences. ➤ Potential for organised and packaged and medium impact activities such as going on a boat ride along the river. ➤ Seek entertainment facilities and passive activities.

Appendix 2: Current Tourism Related Construction and Investment Projects for Quang Binh Province

Table 70: Tourism related construction project funded by the government

Items of construction		Timeframe	Total investment VND (billion)
1	Street to the resort of Vung Chua - Yen island	2005-2006	1.36
2	Road inside Phong Nha region	2006-2007	1,321
3	Street from Nhat Le Quang Phu to Ho Thieu Tri tourism site	2006	1.19
4	Repair the road to Yen Island tourism site	2007-2008	920
5	Lighting system from Ho Chi Minh highway to Phong Nha	2006-2008	4.41
6	The light lines	2007	1,050
7	Improvement of Nhat Le Quang Phu street	2003- 2009	24,885
8	Lighting system of Nhat le Quang Phu street	2004-2009	3,625
9	Pure water system for Phong Nha	2003-2009	6.26
10	Road inside Phong Nha tourism site	2007-2009	36.65
11	Road around Bo Ninh tourism site	2006	
Total			81,671

Table 43: Business sector/non-governmental investment projects

Project Name		Investor
A. Finished Projects		
1	Sun Spa Resort Bao Ninh	Truong Thinh construction company
2	Saigon Quang Binh hotel	Saigon Quangbinh Co. Ltd.
3	Nuoc Mooc ecotrail	Phong Nha Ke Bang NP
B. Implementing projects		
1	Vung Chua Dao yen ecotourism site	Dong Son Co. Ltd.
2	Gieng Da ecotourism site	Hoang Yen Co. Ltd.
3	Bao Ninh ecotourism site	Vinh Ha Co. Ltd.
4	Thieu Tri Lake resort	Ho Thieu Tri Co. Ltd. And partners

5	Phong Nha Ke Bang ecotourism site	Urban development company
6	Phong Nha resort ecotourism site	Minh Tan Co. Ltd.
7	Bang resort	Indochina Co. Ltd.
8	Bau Sen ecotourism site	
9	Guest house of public security	Public security
10	Non pagoda, Than Dinh mountain tourism site	Quang Ninh DPC
11	Phong Nha hotel	VINASHIN
12	Da Nhay tourism site	Hoan Cau 2 Co. Ltd.

C. Registered projects

1	Thung E ecotourism site	Indochina Co. Ltd.
2	Golf - Resort- Orchids garden – Casino	Indochina Co. Ltd.
3	Hai Ninh urban areas and park	Indochina Co. Ltd.
4	Bao Ninh ecotourism site	Duc Thang Co. Ltd.
5	Golfyard in the Northeast of D�ng Hoi	Indochina Co. Ltd.
6	Coastal Resort	Thailand group
7	Phong Nha Ke Bang ecotourism site	Linh Thanh group
8	Suspension system in Phong Nha Ke Bang NP	Soan Tien Tien Co. Ltd.
9	Binh Minh ecotourism site	Duc Thang Co. Ltd.
10	Tan Hai resort	Tan Hai Nam Co. Ltd.

Appendix 3: Yearly Visitor Market Segment Growth Estimates

Table 443: Yearly visitor market segment growth estimates

Visitor Market	Visitor Market Segment	Base to Year 1	Year 1 to 2	Year 2 to 3	Year 3 to 4	Year 4 to 5	Year 5 to 6	Year 6 to 7	Year 7 to 8	Year 8 to 9	Year 9 to 10	Year 10 to 11	Year 11 to 12
International	Free Independent Travellers	3%	3%	7%	10%	10%	7%	7%	7%	7%	7%	5%	5%
	Backpacker Travellers	3%	3%	5%	5%	5%	5%	5%	5%	5%	5%	3%	3%
	Western Group Tour Travellers	2%	3%	7%	10%	12%	12%	10%	10%	10%	10%	7%	7%
	Regional Group Tour Travellers	5%	7%	10%	10%	10%	10%	12%	12%	12%	12%	10%	5%
	Expatriate Travellers	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	Regional Caravanning Travellers	3%	3%	7%	7%	7%	7%	7%	7%	7%	7%	7%	5%
	Other Travellers	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	Total International	Average Growth	3%	4%	7%	9%	9%	8%	8%	8%	8%	8%	6%	5%
Domestic	Group Tour Leisure/Holiday Travellers	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
	Independent Leisure/Holiday Travellers	5%	7%	10%	10%	12%	12%	15%	15%	12%	12%	12%	10%
	Education/Science Travellers	1%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
	Visiting Friends and Relatives	2%	2%	3%	5%	5%	5%	3%	2%	2%	2%	2%	2%
	Business/Government Travellers	2%	3%	5%	5%	5%	5%	3%	3%	3%	3%	2%	2%
	Total Domestic	Average Growth	5%	5%	6%	6%	7%	7%	8%	8%	7%	7%	7%
Total Visitors	Average Growth	5%	5%	6%	6%	7%	7%	8%	8%	7%	7%	7%	7%

Appendix 4: Yearly Visitor Number Forecast

Table 74: Yearly visitor number forecast

Visitor Market	Visitor Market Segment	"2009"	"2010"	"2011"	"2012"	"2013"	"2014"	"2015"	"2016"	"2017"	"2018"	"2019"	"2020"
International	Free Independent Travellers	4.995	5.145	5.505	6.055	6.661	7.127	7.626	8.160	8.731	9.342	9.810	10.300
	Backpacker Travellers	1.858	1.914	2.009	2.110	2.215	2.326	2.442	2.565	2.693	2.827	2.912	3.000
	Western Group Tour Travellers	2.149	2.213	2.368	2.605	2.918	3.268	3.595	3.954	4.350	4.785	5.120	5.478
	Regional Group Tour Travellers	1.045	1.118	1.230	1.353	1.488	1.637	1.834	2.054	2.300	2.576	2.834	2.975
	Expatriate Travellers	407	427	449	471	495	519	545	573	601	631	663	696
	Regional Caravanning Travellers	348	358	384	410	439	470	503	538	576	616	659	692
	Other Travellers	813	854	896	941	988	1.038	1.089	1.144	1.201	1.261	1.324	1.391
Total International		11.615	12.030	12.841	13.946	15.205	16.385	17.635	18.987	20.452	22.039	23.321	24.532
Domestic	Group Tour Leisure/Holiday Travellers	223.512	234.688	246.422	258.743	271.680	285.264	299.527	314.504	330.229	346.740	364.077	382.281
	Independent Leisure/Holiday Travellers	69.003	73.833	81.217	89.338	100.059	112.066	128.876	148.207	165.992	185.911	208.220	229.042
	Education/Science Travellers	3.000	3.030	3.091	3.152	3.215	3.280	3.345	3.412	3.481	3.550	3.621	3.694
	Visiting Friends and Relatives	3.000	3.060	3.152	3.309	3.475	3.649	3.758	3.833	3.910	3.988	4.068	4.149
	Business/Government Travellers	1.500	1.545	1.622	1.703	1.789	1.878	1.934	1.992	2.052	2.114	2.156	2.199
Total Domestic		300.015	316.156	335.503	356.246	380.218	406.136	437.441	471.949	505.663	542.303	582.143	621.365
Total Visitors		311.630	328.185	348.345	370.193	395.422	422.522	455.076	490.936	526.115	564.342	605.464	645.897

Appendix 5: Global Sustainable Tourism Criteria

The Partnership for Global Sustainable Tourism Criteria

Sustainable tourism is on the rise: consumer demand is growing, travel industry suppliers are developing new green programs, and governments are creating new policies to encourage sustainable practices in tourism. But what does “sustainable tourism” really mean? How can it be measured and credibly demonstrated, in order to build consumer confidence, promote efficiency, and fight false claims?

The Global Sustainable Tourism Criteria are an effort to come to a common understanding of sustainable tourism, and will be the minimum that any tourism business should aspire to reach. They are organised around four main themes: effective sustainability planning; maximising social and economic benefits for the local community; enhancing cultural heritage; and reducing negative impacts to the environment. Although the criteria are initially intended for use by the accommodation and tour operation sectors, they have applicability to the entire tourism industry.

The criteria are part of the response of the tourism community to the global challenges of the United Nations’ Millennium Development Goals. Poverty alleviation and environmental sustainability – including climate change – are the main cross-cutting issues that are addressed through the criteria.

Beginning in 2007, a coalition of 27 organisations – the Partnership for Global Sustainable Tourism Criteria – came together to develop the criteria. Since then, they have reached out to close to 100,000 tourism stakeholders, analysed more than 4,500 criteria from more than 60 existing certification and other voluntary sets of criteria, and received comments from over 1500 individuals. The Sustainable Tourism Criteria have been developed in accordance with the ISEAL Code of Best Practice, and as such will undergo consultation and receive input every two years until feedback is no longer provided or unique.

Some of the expected uses of the criteria include the following:

- Serve as basic guidelines for businesses of all sizes to become more sustainable, and help businesses choose sustainable tourism programs that fulfil these global criteria;
- Serve as guidance for travel agencies in choosing suppliers and sustainable tourism programs;
- Help consumers identify sound sustainable tourism programs and businesses;
- Serve as a common denominator for information media to recognise sustainable tourism providers;
- Help certification and other voluntary programs ensure that their standards meet a broadly-accepted baseline;
- Offer governmental, non-governmental, and business sector programs a starting point for developing sustainable tourism requirements; and
- Serve as basic guidelines for education and training bodies, such as hotel schools and universities.

The criteria indicate what should be done, not how to do it or whether the goal has been achieved. This role is fulfilled by performance indicators, associated educational materials, and access to tools for implementation, all of which are an indispensable complement to the Global Sustainable Tourism Criteria.

The Partnership conceives the Global Sustainable Tourism Criteria as the beginning of a process to make sustainability the standard practice in all forms of tourism.

Global Sustainable Tourism Criteria

A. Demonstrate effective sustainable management.

- A.1. The company has implemented a long-term sustainability management system that is suitable to its reality and scale, and that considers environmental, sociocultural, quality, health, and safety issues.
- A.2. The company is in compliance with all relevant international or local legislation and regulations (including, among others, health, safety, labour, and environmental aspects).
- A.3. All personnel receive periodic training regarding their role in the management of environmental, sociocultural, health, and safety practices.
- A.4. Customer satisfaction is measured and corrective action taken where appropriate.
- A.5. Promotional materials are accurate and complete and do not promise more than can be delivered by the business.
- A.6. Design and construction of buildings and infrastructure:
 - A.6.1. comply with local zoning and protected or heritage area requirements;
 - A.6.2. respect the natural or cultural heritage surroundings in siting, design, impact assessment, and land rights and acquisition;
 - A.6.3 use locally appropriate principles of sustainable construction;
 - A.6.4 provide access for persons with special needs.
- A.7. Information about and interpretation of the natural surroundings, local culture, and cultural heritage is provided to customers, as well as explaining appropriate behaviour while visiting natural areas, living cultures, and cultural heritage sites.

B. Maximise social and economic benefits to the local community and minimise negative impacts.

- B.1. The company actively supports initiatives for social and infrastructure community development including, among others, education, health, and sanitation.
- B.2. Local residents are employed, including in management positions. Training is offered as necessary.
- B.3. Local and fair-trade services and goods are purchased by the business, where available.
- B.4. The company offers the means for local small entrepreneurs to develop and sell sustainable products that are based on the area's nature, history, and culture (including food and drink, crafts, performance arts, agricultural products, etc.).
- B.5. A code of conduct for activities in indigenous and local communities has been developed, with the consent of and in collaboration with the community.
- B.6. The company has implemented a policy against commercial exploitation, particularly of children and adolescents, including sexual exploitation.
- B.7. The company is equitable in hiring women and local minorities, including in management positions, while restraining child labour.
- B.8. The international or national legal protection of employees is respected, and employees are paid a living wage.
- B.9. The activities of the company do not jeopardise the provision of basic services, such as water, energy, or sanitation, to neighbouring communities.

C. Maximise benefits to cultural heritage and minimise negative impacts.

- C.1. The company follows established guidelines or a code of behaviour for visits to culturally or historically sensitive sites, in order to minimise visitor impact and maximise enjoyment.
- C.2. Historical and archaeological artefacts are not sold, traded, or displayed, except as permitted by law.
- C.3. The business contributes to the protection of local historical, archaeological, culturally, and spiritually important properties and sites, and does not impede access to them by local residents.
- C.4. The business uses elements of local art, architecture, or cultural heritage in its operations, design, decoration, food, or shops; while respecting the intellectual property rights of local communities.

D. Maximise benefits to the environment and minimise negative impacts.

D.1. Conserving resources

- D.1.1. Purchasing policy favours environmentally friendly products for building materials, capital goods, food, and consumables.
- D.1.2. The purchase of disposable and consumable goods is measured, and the business actively seeks ways to reduce their use.
- D.1.3. Energy consumption should be measured, sources indicated, and measures to decrease overall consumption should be adopted, while encouraging the use of renewable energy.
- D.1.4. Water consumption should be measured, sources indicated, and measures to decrease overall consumption should be adopted.

D.2. Reducing pollution

- D.2.1. Greenhouse gas emissions from all sources controlled by the business are measured, and procedures are implemented to reduce and offset them as a way to achieve climate neutrality.
- D.2.2. Wastewater, including gray water, is treated effectively and reused where possible.
- D.2.3. A solid waste management plan is implemented, with quantitative goals to minimise waste that is not reused or recycled.
- D.2.4. The use of harmful substances, including pesticides, paints, swimming pool disinfectants, and cleaning materials, is minimised; substituted, when available, by innocuous products; and all chemical use is properly managed.
- D.2.5. The business implements practices to reduce pollution from noise, light, runoff, erosion, ozone-depleting compounds, and air and soil contaminants.

D.3. Conserving biodiversity, ecosystems, and landscapes

- D.3.1. Wildlife species are only harvested from the wild, consumed, displayed, sold, or internationally traded, as part of a regulated activity that ensures that their utilisation is sustainable.
- D.3.2. No captive wildlife is held, except for properly regulated activities, and living specimens of protected wildlife species are only kept by those authorised and suitably equipped to house and care for them.
- D.3.3. The business uses native species for landscaping and restoration, and takes measures to avoid the introduction of invasive alien species.
- D.3.4. The business contributes to the support of biodiversity conservation, including supporting natural protected areas and areas of high biodiversity value.
- D.3.5. Interactions with wildlife must not produce adverse effects on the viability of populations in the wild; and any disturbance of natural ecosystems is minimised, rehabilitated, and there is a compensatory contribution to conservation management

Appendix 6: PNKB National Park Region Tourism Site Assessments

Administration and service zone of the PNKB NP

i. Phong Nha Cave – main part

Description, location and access

The Phong Nha Cave is a water cave and the feature attraction of the PNKB NP Region.

It is located in the administration and service area approximately 30 minutes by boat from the Phong Nha Township.

It can be accessed by boat and by foot.

Current tourism activity

The Phong Nha Cave is a high volume/mass tourism site.

The cave currently receives approximately 250,000 visitors per year. In the high season visitor numbers can easily exceed 2,000 in a day.

Tourism development opportunities

The Phong Nha Cave is the iconic site of the region and it can be generally assumed that the vast majority of the visitors will visit the cave during their visit.

There is significant scope for development to enhance the quality of the visitor experience at the Phong Nha Cave. This includes enhancing the lighting in the cave, information about the cave and interpretation in the cave.

At the cave entrance there is a suitable area to develop an interpretation centre about the Phong Nha Caves.

At present the tourism experience of the Phong Nha Cave is of sub-standard given the UNESCO WHS recognition of PNKB NP and there is significant scope for improvement.

Target Markets for tourism development

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Sightseeing caves (✓✓✓✓✓)

River cruising on a boat (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓)

Picnicking (✓✓✓✓)

Shopping and souvenirs (✓✓✓)

Scientific research/awareness raising (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

Being the main tourism attraction of the region, the Phong Nha Cave is the pillar of the tourism economy for the region. It generates direct employment such as tour boat operators or souvenir stalls, but also generates significant in-direct revenues such as local people providing local products or services to the hospitality sector.

Information and interpretation at the Phong Nha Cave and publicising the Phong Nha Cave can effectively raise awareness on conservation development issues. The Phong Nha Cave has the potential to educate the majority of visitors that travel to the PNKB NP Region.

Limiting factors

The caves size.

Further damage to the cave.

The impacts of high volume tourism –daily and hourly visitor are over capacity during the high season.

Mismanagement of the visitor flow to the cave.

Indicative carrying capacity and key management priorities

The carrying capacity of the Phong Nha Cave needs to be carefully evaluated based on daily and hourly visitor flows. The carrying capacity needs to be aligned to a management system and a trail system in the cave. It needs a series of visitor impact management procedures.

The present visitor management system is weak and poor in its implementation. Especially during the high season the hourly and potentially daily visitor flow easily exceeds the sustainable capacity of the cave. The visitor impacts are clearly visible and the cave is already considerably damaged.

With an appropriate management system in place this site could still maintain visitor number in the 2,000-2,500/day

Immediate action guidelines for management and development

Develop a visitor management system for the Phong Nha Cave tour – including the Dong Tien Son Cave (Dry Cave) that regulates the visitor flows to the caves especially during the high season.

Establish a hourly carrying capacity for the cave.

Clearly define walking routes through the cave, and enhance and upgrade the lighting in the cave.

Strictly limit tour boats in the cave and at the cave entrance areas.

Develop clear guidelines and procedures for tour boat operators so visitor flows can be regulated.

Improve the quantity and quality of the information and interpretation materials about the Phong Nha Cave.

Investigate the potential to develop an interpretation centre at the entrance of the cave.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

ii. Phong Nha Cave – deeper cave area

Description, location and access

The deeper cave area of Phong Nha Cave is an extension of the main water cave beyond the point where most visitors alight to walk through the cave.

The deeper cave area offers an extended boat ride of approximately 1.6 kilometres.

Current tourism activity

There is no regular tourism activity at this stage. Visits are only possible through special arrangements with the Park.

Tourism development potential

Additional tourism product to the normal Phong Nha Cave experience.

It could be used as a special higher priced tour product.

Target Markets for tourism development

All market segments with a sense for adventure

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓)

Adventure Caving (✓✓✓✓✓)

River kayaking/canoeing (✓✓✓✓✓)

Scenic sightseeing (✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

Being the main tourism attraction of the region, the Phong Nha Cave is the pillar of the tourism economy for the region. It generates direct employment such as tour boat operators or souvenir stalls, but also generates significant in-direct revenues such as local people providing local produce or services to the hospitality sector.

Information and interpretation at the Phong Nha Cave and publicising the Phong Nha Cave can effectively raise awareness on conservation development issues. The Phong Nha Cave has the potential to educate the majority of visitors that travel to the PNKB NP Region

Limiting factors

The size and especially the width of the extension area. The extension area is at stages very narrow and may only be suitable for one or two boats at one time.

Damage to the cave.

The impacts of high volume tourism – daily and hourly visitor flows at the main cave site are over capacity during the high season

Mismanagement of the visitor flow to the cave

Specialised equipment and training required to run safe visits to this area.

Indicative carrying capacity and key management priorities

The carrying capacity of the Phong Nha Cave extension area should be in line with the daily and hourly visitor flows of the main area. The extension area may only be accessible on a seasonal basis, for example only during the low season.

Based on observation the Phong Nha Cave extension area may be suitable for up to two boats at any time in the extension area. An indicative carrying capacity of between 100-150 visitor/day would be reasonable.

Immediate action guidelines for management and development

A biodiversity survey is required along with an environmental sensitivity analysis to determine if, and how much, tourism activity this site can support without incurring damages.

If tourism visits are to be permitted, then appropriate safety equipment and training will be required to make such visits safe.

Align all visitor management system to the main Phong Nha Cave part.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)

- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

iii. Dong Tien Son Cave (Dry Cave)

Description, location and access

The Dong Tien Son Cave is an elevated dry cave above the Phong Nha Cave, and another feature attraction of the PNKB NP Region.

It is located in the administration and service area approximately 30 minutes by boat from the Phong Nha Township.

It can be accessed by foot only. The walking distance from the Phong Nha Cave to the Dong Tien Son Cave is approximately 30 minutes.

Current tourism activity

The Dong Tien Son Cave is a high volume/mass tourism site

The cave currently receives approximately 250,000 visitors per year. In the high season visitor numbers can easily exceed 2,000 in a day. It assumed that the majority of people who visit the Phong Nha Cave will also visit the Dong Tien Son Cave

Tourism development potential

The tourism development potential for the Dong Tien Son Cave is high.

The view from the trail to the cave is beautiful, and the cave itself provides an interesting experience.

There is considerable potential to improve the quality of the visitor experience. This includes enhancing the lighting in the cave, information about the cave and interpretation in the cave.

At the bottom of the walkway to the Dong Tien Son Cave is a suitable area to develop an interpretation centre about the Phong Nha Caves.

At present the tourism experience of the Dong Tien Son Cave is of sub-standard given the UNESCO WHS recognition of PNKB NP and there is significant scope for improvement.

Target Markets for tourism development

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Sightseeing caves (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research/awareness raising (✓✓✓)

Shopping and souvenirs (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

The Dong Tien Son Cave is next to the Phong Nha Cave the most visited attraction in the PNKB NP Region. It generates direct employment such as tour boat operators or souvenir stalls, but also generates significant in-direct revenues such as local people providing local produce or services to the hospitality sector.

Information and interpretation at the Dong Tien Son Cave and publicising the Dong Tien Son Cave can effectively raise awareness on conservation development issues. The Dong Tien Son Cave has the potential to educate the majority of visitors that travel to the PNKB NP Region.

Limiting factors

The caves size.

Relatively steep access to the cave.

Further damage to the cave.

The impacts of high volume tourism –daily and hourly visitor are over capacity during the high season.

Mismanagement of the visitor flow to the cave.

Indicative carrying capacity and key management priorities

The carrying capacity of the Dong Tien Son Cave needs to be carefully evaluated based on daily and hourly visitor flows. The carrying capacity needs to be aligned to a management system and a trail system in the cave. It needs a series of visitor impact management procedures.

The present visitor management system is weak and poor in its implementation. Especially during the high season the hourly and potentially daily visitor flow easily exceeds the sustainable capacity of the cave. The visitor impacts are clearly visible and the cave is already considerably damaged.

With an appropriate management system in place this site could still maintain visitor number in the 2,000-2,500/day.

Immediate action guidelines for management and development

Develop a visitor management system for the Phong Nha Cave tour – including the Dong Tien Son Cave (Dry Cave) that regulates the visitor flows to the caves especially during the high season.

Establish a hourly carrying capacity for the cave.

Clearly define walking routes through the cave, and enhance and upgrade the lighting in the cave.

Strictly limit tour boats in the cave and at the cave entrance areas.

Develop clear guidelines and procedures for tour boat operators so visitor flows can be regulated.

Improve the quantity and quality of the information and interpretation materials about the Dong Tien Son Cave.

Investigate the potential to develop an interpretation centre at the entrance of the cave.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

iv. Hang E (E Cave)

Description, location and access

Hang E is situated and accessed from the eastern part of the Administration and Service Area of the PNKB NP. Access to the cave is via trail from the Ho Chi Minh Highway. It takes approximately two hours to walk from the road to the cave entrance. The trail entrance can be reached in approximately 60 minutes by car from the Phong Nha township or within 40 minutes from Chay Lap village.

The cave itself is a water cave with river flowing out of the cave. Interestingly the river system of Hang E

is connected to Hang Toi and the Song Chay. The Bamboo valley lies in the area just in front of the cave. The direct access to the inside of the cave is only possible by swimming.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The cave offers the opportunity for adventure caving. Guided trekking trips could be offered to the cave. The cave itself could be explored by swimming or floating into the caves with tubes.

The trail to the cave is established and only needs little clearance. The trek to the cave is a nice jungle trail with some vistas of the forest canopy

The trekking to the cave and the adventure caving together could be a stand alone tourism product and developed as a full day activity.

Target Markets for tourism development

Visitors that are interested in adventure caving.

Domestic market – Expatriates travelling in Vietnam.

International market – FITs, backpackers and selected western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Adventure Caving (✓✓✓✓✓)

Trekking (✓✓✓✓✓)

Swimming (✓✓✓✓✓)

Tubing (✓✓✓✓✓)

Sightseeing caves (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Scientific research (✓✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

The site has significant potential as an adventure caving site. Local people could be trained as cave guides or support crew. There is are also opportunities to link tourism activities at Bamboo Valley, Hang Toi and CBT activities in the Chay Lap community for tourism support services.

Appropriate interpretation materials would support natural history and heritage conservation appreciation.

Limiting factors for tourism

The cave can only be accessed by swimming or tubing into the cave.

In order to establish adventure caving, there is a need of competent and trained guides including equipment.

Seasonal flooding of the cave.

Only for specific target markets and low visitor volumes.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop an adventure caving company.

Mismanagement of the cave procedures and regulations.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Develop a site specific operational management plan to ensure safe access and prevention of environmental impacts, and appropriate interpretation materials.

Develop operational guidelines for adventure caving in Hang E.

Investigate the business potential for an adventure caving company among the communities. Potentially aligned to CBT activities.

Develop relevant interpretation and information about the cave.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

v. Bamboo Valley

Description, location and access

The Bamboo Valley is situated and accessed from the eastern part of the Administration and Service Area of the PNKB NP. Access to the valley is via trail from the Ho Chi Minh Highway. It takes approximately two hours to walk from the road to the valley entrance. The trail entrance can be reached in approximately 60 minutes by car from the Phong Nha township or within 40 minutes from Chay Lap village.

The Bamboo Valley is just next to Hang E.

The Bamboo Valley features a range of natural forest and includes some wildlife.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The location, access, and resource available in this area present significant opportunities to develop tourism activities and service to help alleviate the current high pressure on the area's high volume sites.

These same attributes also provide strong potential for tourism development to support awareness raising on conservation and environmental appreciation if developed appropriately.

The valley offers scenic views and potential opportunities for wildlife watching.

There is a potential to combine activities with the adventure caving at Hang E.

There is a potential to develop a canopy walk or other soft nature based walking activities.

The trail to valley is established and only needs little clearance. The trek to valley is a nice jungle trail with some vistas of the forest canopy.

Target Markets for tourism development

This depends on the activities on offer and access to the valley. Activities should be focused on soft-nature based tourism.

This could potentially include all market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Trekking (✓✓✓✓✓)

Walking (✓✓✓✓✓)

Swimming (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research (✓✓✓✓)

Wildlife watching (?)

Flying Fox (?)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

If developed appropriately as a medium-high visitor site the opportunities to provide environmental/conservation awareness raising to larger numbers of visitors is significant.

The site has potential for soft nature based walking activities. Local people could be trained as guides or support crew. There is are also opportunities to link tourism activities at Hang E, Hang Toi and CBT activities in the Chay Lap community for tourism support services.

Appropriate interpretation materials would support natural history and heritage conservation appreciation.

Limiting factors for tourism

The current access trail is limited to trekking rather than walking activities.

Any larger infrastructure development in the valley could compromise the access area to the valley. At present the walk to the valley takes approximately two hours, in order to attract a larger market potential, it is likely that the trail would need to be realigned and widened. Some significant trail work would be needed as there are some rocky and steep sections along the current trail.

Seasonal flooding of the river.

Potentially only limited wildlife.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop a canopy operation.

Indicative carrying capacity and key management priorities

The indicative carrying capacity will depend on the activities developed and on the access route to the valley.

Given the size and development potential of this area, if appropriate impact mitigation measures are put in place with appropriate tourism products and services this site could support medium volumes of visitors.

Any permanent infrastructure development should be carefully reviewed on the wider impacts of the PNKB NP and the WHS.

Any tourism development in the area should be based on best practices only.

Immediate action guidelines for tourism management and sustainable development

Carefully review any investment proposals for the valley on their impact on the biodiversity of the area and the region in general.

Assess the biodiversity and clearly describe the existing wildlife of the valley.

Conduct a complete site assessment to determine an appropriate level of tourism product and infrastructure development that would meet the demands of the market while ensuring environmental protection and conservation values.

Investigate the potential for a canopy walk in the valley and prepare a feasibility study.

vi. Hang Toi (Dark Cave)

Description, location and access

The Hang Toi is located directly at the Song Chay near the northern entrance of the PNKB NP in the administration and service area.

The cave can only be accessed by boat, but can only be walked into by foot.

The cave is a mix of a wet and dry cave. The entrance to the cave is somewhat difficult to access but manageable.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The cave offers the opportunity for adventure caving.

Relatively easily accessible once an entrance path has been established.

The cave has been fully measured and assessed.

Target Markets for tourism development

Visitors that are interested in adventure caving.

International market – FITs, backpackers and selected western tour group travellers.

Domestic market – Expatriates travelling in Vietnam.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓/✓)

Adventure Caving (✓✓✓✓✓)

Sightseeing caves (✓✓✓✓✓)

Learning about the area (✓✓✓✓)

River kayaking/canoeing (✓✓✓✓)

Scientific research (✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

The site has significant potential as an adventure caving site. Local people could be trained as cave guides or support crew. There are also opportunities to link tourism activities at Hang Toi to CBT activities in the Chay Lap community including boat travel and other tourism support services.

Appropriate interpretation materials would support natural history and heritage conservation appreciation.

Limiting factors for tourism

The main entrance area of the cave is entirely comprised of very sharp and jagged rocks and is quite dangerous to walk on in its current state. A walkway would need to be formed.

Seasonal flooding of the cave.

Only for specific target markets and low visitor volumes.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop an adventure caving company.

Mismanagement of the cave procedures and regulations.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Develop a site specific operational management plan to ensure safe access and prevention of environmental impacts, and appropriate interpretation materials.

Develop operational guidelines for adventure caving in Hang Toi.

Clearly define walking routes through the cave.

Investigate the business potential for an adventure caving company among the communities. Potentially aligned to CBT activities.

Develop relevant interpretation and information about the cave.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

vii. Primate Rescue Centre

Description, location and access

The Primate Rescue Centre is a semi-enclosed area that is used for the reintroduction of primates into the wild.

It is located approximately 2 km from the main tourism centre and off the road to the Botanical gardens and Eight Volunteers Cave.

There is a well maintained walking trail around the Primate Rescue Centre. It takes about 45 minutes to walk around the semi-enclosed area.

Current tourism activity

There are currently no tourism activities. Occasionally educational groups visit the site.

Tourism development potential

The tourism development potential for the Primate Rescue Centre is medium high.

The site offers a good opportunity to offer wildlife watching and to enjoy the natural surroundings. The wildlife watching at the Primate Rescue Centre is compared to whale watching as it is not assured to see animals at every visit. Primates can be located by radio equipment.

Easily accessible from the Phong Nha township.

There is a well-established walkway around the semi-enclosure.

Well set up to receive visitors.

Target Markets for tourism development

All market segments with an interest wildlife watching.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓)

Walking (✓✓✓✓✓)

Wildlife Watching (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research (✓✓✓✓)

Picnicking (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

PNKB NP staff and Local people could be trained as wildlife guides.

Site interpretation would provide an excellent opportunity to raise awareness of biodiversity conservation of the PNKB NP Region. The visitor wildlife watching could be integrated in the wildlife monitoring plan.

Limiting factors for tourism

More interpretation materials and guide/interpreter training would be required.

The best time for viewing primates is in the early morning and later afternoon and visitor would likely be organized at these time (off peak visitor time for the other main sites in this area).

A suitable parking area and some visitor facilities would need to be developed.

Indicative carrying capacity and key management priorities

Wildlife watching groups should be limited to maximum of 20 people per group excluding guides.

Groups would need to be separated by 30 minute or one hour intervals to avoid crowding at viewing sites and to ensure the interpretation and the visitor experience is not diminished.

Immediate action guidelines for tourism management and sustainable development

Develop a site-specific operational management plan to ensure safety, visitor guiding guidelines and prevention of impacts on the environment and animals.

Develop interpretation materials, interpreter training, scheduling, and impact assessment/monitoring program

Design an appropriate visitation schedule with the project managers

viii. Botanical Garden

Description, location and access

The Botanical Garden is approximately 25 minutes from the Phong Nha township.

It is located just after the main entrance of the PNKB NP on the way to the Eight Heroic Volunteers Cave.

Current tourism activity

There are currently no tourism activities and only few visitors seem to stop at the site.

Tourism development potential

The site provides the opportunity to develop an interpretive walk through a botanical garden.

The buildings could be used for information and interpretation.

It could receive steady visitor flows as a stopping point from the Phong Nha township to the Eight Heroic Volunteers Cave.

Target Markets for tourism development

Visitors travelling to the Eight Volunteers Cave and Ho Chi Minh Museum.

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓)

Walking (✓✓✓✓✓)

Wildlife Watching (✓✓✓✓)

Scenic sightseeing (✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research (✓✓✓✓)

Picnicking (✓✓✓)

Potential contribution to conservation objectives and community development

General conservation and local development potential (✓✓✓✓)

Information and interpretation panels could describe the biodiversity of the PNKB NP and provide information about the PNKB NP Region.

It could provide small-scale employment for PNKB NP staff and potentially for people in the community adjacent to the Park.

Limiting factors for tourism

Relatively poor facilities at this stage.

Relatively unspectacular site at present. Needs a tidy up.

Lack of interpretation, information and signage.

Very limited walking trail development at present.

Indicative carrying capacity and key management priorities

At present there is only limited space for visitors and parking. A carrying capacity would need to be determined when a parking area as well as a trail is fully developed.

At this stage there should be no more than 40 visitors at any one time at this site.

Immediate action guidelines for tourism management and sustainable development

Prepare a concept plan for the Botanical Garden. This should include visitor management, trail development, information and interpretation, and potential infrastructure needs such as signage, parking, toilets and staff rooms.

Develop site-specific interpretation and information.

Investigate the opportunity to use PNKB NP staff or people from the community as interpretation guides.

ix. Ho Chi Minh Museum (planned)

Description, location and access

The Ho Chi Minh Museum building is planned at the junction of the Ho Chi Minh Highway and Provincial Highway 20 in the PNKB NP.

It would be located approximately 45 minutes from the Phong Nha township.

Current tourism activity

There are currently no tourism activities. The museum is still in planning and construction work has not started.

Tourism development potential

The Museum will be of regional and national historical importance.

The Museum location provides access to considerable and steady tourism flow. This would certainly be a high volume tourism site once it is operational.

It would be likely part of the mainstream sightseeing package for the PNKB NP Region. It could be integrated in a touring package as a stopping point from the Phong Nha township to the Eight Heroic Volunteers Cave.

Target Markets for tourism development

Visitors interested in the history of the area and Ho Chi Minh.

All market segments – however the primary market would be the domestic market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

War-time history (✓✓✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research (✓✓✓✓)

Picnicking (✓✓✓)

Shopping and souvenirs (✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

The high volume of visitor to this site will provide an opportunity to deliver heritage conservation

awareness raising to a significant number of people – appropriate interpretation will be necessary.

The potential to employ members of the local community to service the museum.

Limiting factors for tourism

No detailed construction planning available yet.

Building delays.

The main access road from the PNKB's main entrance and reception area is still narrow - two tour busses travelling in opposite directions could not pass in most sections.

Indicative carrying capacity and key management priorities

No detailed construction plans were available at this stage.

It is expected that this will be a high volume tourism site and therefore should have sufficient parking space and a visitor management system.

It is likely that this site will be built to support 2,000-2,500 visitors per day during the peak of the season.

Immediate action guidelines for tourism management and sustainable development

Monitor planning and construction of the museum. Brief construction leaders about the STDP.

Integrate museum development in visitor management of the PNKB NP. Especially in the sightseeing touring route around the Administration and Service Area. Be aware that this will be a high volume tourism site.

x. Nuoc Mooc Spring Eco Trail

Description, location and access

The Nuoc Mooc Spring Eco Trail was developed in 2007/08 and opened in 2008. It is located entirely in the PNKB NP.

Its entrance is easily accessible from the Ho Chi Minh Highway. It is approximately 10 minutes drive from the Northern entrance of the PNKB NP's Administration and Service Area. The Chay Lap village is approximately 20 minutes drive from the trail.

The trail is approximately three kilometres and takes 45 minutes to complete. The trail travels at parts along the Song Chay River.

Current tourism activity

The current tourism activity is relatively low.

Exact visitor numbers could not be obtained from the PNKB NP.

The PNKB NP currently charges an entrance fee of VND50,000 to the site.

Tourism development potential

Potential to introduce visitors to a nature tourism and ecotourism experience.

The site has the potential to develop in a medium volume visitor activity.

The walking experience could be seen as a soft tourism adventure for people who previously did not had a lot of nature based tourism experiences. The trail is well suited for domestic and regional markets and could be included in some international package and FIT visitors looking for a soft-nature experience – but not an adventure tourism product.

The last sections of the trail provide a swimming opportunity and potentially a start for other water-based tourism activities such as kayaking, canoeing or tubing.

There is an opportunity to extend the trail and therefore extend the time of stay and experience at the trail.

A CBT tour guiding business could potentially be developed.

Target Markets for tourism development

Visitors with interest on soft-nature based tourism.

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Walking (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓)

Picnicking (✓✓✓✓)

Swimming (✓✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

It could be integrated and aligned to CBT activities at Chay Lap village and provide additional income to the community.

Information and interpretation panels could describe the biodiversity of the PNKB NP and provide information about the PNKB NP Region.

Limiting factors for tourism

Insufficient or lack of suitable interpretation panels.

Lack of integration with other tourism activities – such as CBT activities and packages of tour operators.

Entrance fee – higher than to the Phong Nha Caves.

Lack of maintenance of the trail.

Indicative carrying capacity and key management priorities

Up to 20 visitors per group. More visitors at any one time in a group along the trail could diminish the visitor experience.

At present there are no carrying capacity concerns. Considering the length of the trail and its one way system, an indicative capacity no more than five groups or 100 people on the trail at any one time is suitable. The visit would take around 45 minutes; this would result in a carrying capacity of approximately 1,000 visitors per day. Otherwise crowding at specific viewing points might occur.

A visitor management system will need to be developed if the site develops into a medium volume visitor site and above capacity are reached.

Immediate action guidelines for tourism management and sustainable development

Review a potential expansion of the trail.

Review and check maintenance schedule of the trail, especially for the bridges.

Improve interpretation panels and information at the site.

Connect and integrate the trail with CBT activities at the Chay Lap village.

Seek more opportunities to contribute to local economic development –such as provision of goods and services (refreshments, souvenirs and local produce by nearby villagers).

Establish a visitor-monitoring plan and consider a site management plan for the future.

Support the marketing and promotion of the trail, and link and package the trail with other tourism activities.

xi. Song Chay River

Description, location and access

This river is flowing through the PNKB NP towards the Bufferzone where it connects with Song Trooc and Song Son rivers.

The river is relatively easy accessible, especially around the area of the Nuoc Mooc Spring Eco Trail and the Ranger Station which marks the Northern entrance of the PNKB NP's Administration and Service Area.

Current tourism activity

At present there is only limited tourism activity on the Song Chay River.

In the area of the PNKB NP, the Nuoc Mooc Eco-Trail goes at times along the river. There are opportunities to swim in the river.

In the Bufferzone there are kayaks for rent through the Chay Lap Village CBT initiative. This initiative has just commenced.

Tourism development potential

There are opportunities for water-based activities such as kayaking, tubing and swimming along parts of the river - should be integrated into activities along the Song Trooc and Song Son rivers.

There are opportunities for animal viewing and nature appreciation along this stretch of water - should be integrated into activities along the Song Trooc and Song Son rivers.

The activities should be integrated and coordinated with other activities along the Song Trooc and Song Son rivers.

Access to the Dark Cave, Nuoc Mooc Spring Eco trail and an other scenic sites along this section of river are available.

Target Markets for tourism development

Domestic market – Expatriates travelling in Vietnam, domestic sub-segments interested in soft adventure or water-based recreation.

International market – FITs, backpackers and small western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Swimming (✓✓✓✓✓)

Kayaking (✓✓✓✓✓)

Canoeing (✓✓✓✓✓)

Tubing (✓✓✓✓✓)

River cruising on a boat (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓)

Picnicking (✓✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

The development of kayaking, tubing and swimming as part of the CBT could provide significant income to the local people from Chay Lap.

The development of CBT businesses for local people could provide an alternative income generation fro

some community members and potentially reduce poaching and logging activities in the PNKB NP for some members in the community.

The nature setting and features of this stretch of river would support good conservation awareness with appropriate interpretation materials/services.

Limiting factors for tourism

Some parts of the river section in the PNKB NP have not the highest value in terms of tourism potential but provide a convenient access point for river-based tourism activities.

Difficult relationship between the PNKB NP and the community. To maximise the tourism potential of the river access to the river in the PNKB NP may be needed.

Current lack of supporting services for example, refreshments, meals or inner tube rentals.

Lack of tourism business skills in the community, including language skills and operational skills considering health and safety.

Limited amount of kayaks for rent at present.

Indicative carrying capacity and key management priorities

Up to 30 visitors along the river at any one time in order to avoid crowding which would diminish the visitor experience.

Up to 100 visitors along the river systems of Song Chay and Song Son. The Trooc River could be the entry point for those visitors.

Immediate action guidelines for tourism management and sustainable development

Develop appropriate interpretation materials.

Consult with the PNKB NP and the community to cooperate on the river use.

Develop clear guidelines for river activities.

Expand and enhance tourism services (refreshments and meals) and CBT activities (kayaking, tubing and swimming) in the area.

Providing adequate training for interpretation services, visitor hosting, and potential safety rescue.

xii. Gao Forest

Description, location and access

The Gao forest is approximately 25 minutes driving distance from the Phong Nha township. It is located off the Provincial Road 20 and along the Rao Thuong spring, spreading from Km 11 to Km 13.

This is a primeval forest of pure Gao trees, with the area of 15ha of high straight trees with large shade, surrounded by the Rao Thuong spring.

Current tourism activity

There are currently no tourism activities and only few visitors seem to stop at the site.

Tourism development potential

The site provides the opportunity to develop an interpretive walk through a primeval Gao forest.

It could receive steady visitor flows as a stopping point from the Phong Nha township to the Eight Heroic Volunteers Cave.

There are also opportunities for swimming and wildlife watching.

Target Markets for tourism development

Visitors travelling to the Eight Volunteers Cave and Ho Chi Minh Museum

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Walking (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Scenic sightseeing (✓✓✓)

Learning about the area (✓✓✓✓✓)

Scientific research (✓✓✓✓✓)

Picnicking (✓✓✓)

Swimming (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

Information and interpretation panels could describe the biodiversity of the PNKB NP and provide information about the PNKB NP Region.

It could provide small-scale employment for PNKB NP staff and potentially for people in the community adjacent to the Park.

Limiting factors for tourism

Relatively unspectacular site at present. Needs a tidy up.

Relatively difficult access from Provincial Road 20.

Lack of interpretation, information and signage.

Very limited walking trail development at present.

Indicative carrying capacity

At present there is only limited space for visitors and parking. A carrying capacity would need to be determined when a parking area as well as a trail is fully developed.

At this stage there should be no more than 40 visitors at any one time at this site.

Immediate action guidelines for tourism management and sustainable development

Prepare a concept plan for the Gao Forest. This should include visitor management, trail development, information and interpretation, and potential infrastructure needs such as signage, parking, toilets and staff rooms.

Develop site-specific interpretation and information.

Investigate the opportunity to use PNKB NP staff or people from the community as interpretation guides.

xiii. Thac Gio (Wind) Waterfalls

Description, location and access

The Thac Gio waterfalls are approximately 15 minutes driving distance from the Phong Nha township. The waterfalls are located at km 8 on the Provincial Road 20, just nearby Dong Tien slope.

In the surrounding area, there are some big trees down at the lower section of the waterfall, particularly the Gua tree (Fiars Callora), a member of mulberry family (*Mora ceac*), with the diameter of more than 10 persons' hands. This is a light-driven tree live with the age of nearly 1000 years old, whose body was a proof of wartime. In addition, we can find at this place also some rare animals like monkey, snake, porcupine, squirrel, etc.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The Thac Gio Waterfalls cannot be considered a destination on its own but be seen as an attraction along the historic and scenic touring of Provincial Road 20.

Key tourism development activities would be enjoying the natural surroundings.

Target Markets for tourism development

Visitors travelling to the Eight Volunteers Cave and Ho Chi Minh Museum.

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Walking (✓✓✓✓)

Wildlife Watching (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Scientific research (✓✓✓✓✓)

Picnicking (✓✓✓✓)

Swimming (✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

Information and interpretation panels could describe the biodiversity of the PNKB NP and provide information about the PNKB NP Region.

It could provide small-scale employment for PNKB NP staff and potentially for people in the community adjacent to the Park.

Limiting factors for tourism

Lack of interpretation and signage.

No parking area, visitors just park aside Road 20.

The site is a stopping site as part of a tourism route but not a destination itself.

Indicative carrying capacity

Up to 30 visitors at any one time at the waterfall site in order to avoid crowding which would diminish the visitor experience. With more tourism facilities developed at/near the parking would increase the site's carrying capacity.

Parking at the rest stop area should be sufficient for two medium sized buses and up to ten cars.

Immediate action guidelines for tourism management and sustainable development

Site planning, develop the parking area as a designated rest stop of the Road.

Key infrastructure needs at the rest area are:

Signage to the parking area and waterfall.

Facilities for catering to tourist such as refreshments, relaxing, souvenirs selling.

Develop site-specific interpretation and information about the region.

Develop the site as part of other tourism route development for Road 20.

Ecological Restoration Area of the PNKB NP

xiv. Eight Heroic Volunteers Cave

Description, location and access

The Eight Heroic Volunteers Cave is located on Provincial Highway 20. It is approximately 40 minutes driving distance from the Phong Nha township.

The Eight Heroic Volunteers Cave is an important spiritual and historical site. It is easily accessible through the roading network inside the PNKB NP.

Restroom facilities, a waiting and a parking are provided close to the site.

Current tourism activity

The Eight Heroic Volunteers Cave is a high volume tourism site.

No confirmed visitor numbers are available, but it is estimated that 150,000 visitors, or potentially more travel to this site.

Tourism development potential

The site is very popular with domestic visitor and is an important spiritual and historical site.

There is scope for development to enhance the quality of the visitor experience at the Eight Heroic Volunteers Cave. This includes enhancing the interpretation and information about the cave and the surrounding area.

Potentially a small walk could be developed to the river area. This could also ease the visitor flows at the site.

There are very good tourism product synergies with the Ho Chi Minh Museum and this will certainly attract additional visitors.

There is potential to develop and upgrade tourism service facilities, including resting areas, refreshments, souvenirs, and materials required for spiritual worshipping.

Target Markets for tourism development

Visitors interested in spiritual worshipping and the history of the region and Vietnam.

All market segments – however the primary market would be the domestic market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

War-time history (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Sightseeing caves (✓✓✓)

Learning about the area (✓✓✓✓)

Picnicking (✓✓✓✓)

Shopping and souvenirs (✓✓✓✓)

Potential contribution to conservation objectives and community development

General conservation and local development potential (✓✓✓)

Information and interpretation at the Eight Heroic Volunteers Cave could raise awareness on conservation development issues.

Being a key tourism attractions in the PNKB NP Region there is scope for generating revenues by local people through operating supporting tourism service facilities such as refreshments, souvenirs, and materials required for spiritual worshipping.

Limiting factors for tourism

Insufficient or lack of supporting facilities and services.

Insufficient or lack of information and interpretation materials.

The cave entrance to the Eight Heroic Volunteers Cave is very small.

Limited size car parking area.

No tourism activities in the immediate vicinity.

Indicative carrying capacity and key management priorities

There are currently carrying capacity issues during the high season. The crowding has been mitigated to some extent by blocking the road so visitors have to walk from the parking area to the cave site.

The cave site and the pagoda area are relatively small. Crowding will be unavoidable due to the popularity of the site. A one-way walking path should be clearly defined from the Pagoda to the cave site in order to manage the crowding.

Additional facilities such as resting areas, better information and interpretation, and potentially a small walking track could further mitigate the crowding at this site.

Impact mitigation efforts this site could support a high volume of short staying visitors. 50 visitors at a time, for 15 minutes (200/hour) over the day (10 hours) = 2,000/day. An effective visitor management system is needed for this site.

Immediate action guidelines for tourism management and sustainable development

Develop a site management plan (including environmental management systems for waste collection and disposal) that includes visitor-monitoring system to assess site-specific tourism flows.

Define walking routes at the sites, specifically between the Pagoda and the cave site.

Improved and expand tourism facilities and services.

Develop better interpretation materials about the site and provide additional information about the region.

Investigate the potential of developing a walking opportunity to provide an additional experience on the site and to ease the visitor flows around the site.

xv. Hang Thien Duong (Paradise Cave)

Description, location and access

Paradise Cave lies at an altitude of 360 meters above the sea level. The gate to the cave is only about 4.2 square meters wide, above the steep cliffs. The cave locates in the ecological restoration zone of Phong Nha-Ke Bang National Park, about 70 km northwest of Dong Hoi and 4.7 km west of the West Branch Ho Chi Minh Trail.

The visitor center is more than 2km away from Ho Chi Minh Trail and is currently approached by several means of transport like car, motorbike and mountain-bike.

It takes about 10 minutes to get to the visitor center by car. From ticket counters to the foot of the mountain starts a trail of about 1 km long. To ensure the ecological environment and a stable life for the primates, visitors are only allowed to use facilities such as environment-friendly cars electric (golf carts) for about 7 minutes, or walking for 20 minutes. And it takes visitors approximately another 25 minute walk over more than 500 steps up to the mountain and cave gate.

The infrastructure is new and in good conditions and consistent with the landscape and surroundings. A guided cave tour takes about 1.5 hours to get through a wooden walkway of 700m.

Current tourism activity

Truong Thinh Corporation is the first private enterprise permitted by Quang Binh PPC to invest in ecological tourism development in the Park. Truong Thinh has started its investment and develop Thien Duong ecotourism business in two phases. Currently, Phase I, including the development of pathway to the cave and installation of wooden board walks and white light systems in the cave has been completed and put into operation.

Tourism development potential

The cave is still very well preserved and in an original state.

The cave is of high potential as a stand-alone eco-tourism product and should be developed as a very exclusive tourism product – high pricing

The access to the cave on the trail is good and a scenic walk. The cave would provide a very high quality visitor experience if delivered professionally.

Target Markets for tourism development

Visitors interested in and well aware of eco-tourism and .

Domestic market – Expatriates travelling in Vietnam, Caravan and group travellers

International market – FITs, backpackers and small groups of western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

Visitors interested in and well aware of eco-tourism and .

Domestic market – Expatriates travelling in Vietnam, Caravan and group travellers

International market – FITs, backpackers and small groups of western tour group travellers.

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓)

Tour guiding through the cave could inform about the cave, its biodiversity and raise awareness about the landscape of the region. It would also effectively raise awareness about the conservation development issues.

A cave guiding business could be established that employs local people with considerable cave guiding experience. This could provide a business opportunity for local operators out of the community. Potentially also aligned to the CBT activities.

Limiting factors for tourism

High sensitivity of the cave environment and irreversible damage to the cave.

Potentially only seasonal activity.

Access trail – would need some careful work especially in the last section.

Only for specific target markets and low visitor volumes.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop an adventure caving company.

Mismanagement of the cave procedures and regulations.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Assess the cave on its biodiversity value.

Develop a site operational management plan for Hang Thien Duong. This should include a clearly defined trail through the cave, an identified area for rest at the entrance of the cave and maintenance and management of the trail. It should also include clear procedures for potential activity operators and regulation and requirement for health and safety in the cave and on the trail.

Investigate the business potential for an adventure caving company among the communities. Potentially aligned to CBT activities.

Develop relevant interpretation and information about the cave.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

xvi. Me Bong Con and Hang Vom

Description, location and access

The Me Bong Con and Hang Vom caves are located along the Song Chay river system.

Me Bong Con is approximately 2-3 hours walk one way from the access trail at the Ho Chi Minh Highway and Hang Vom is approximately 4-5 hours walk one way from the access trail at the Ho Chi Minh Highway.

Apparently Hang Vom can also be reached by traversing Hang Thien Duong.

Current tourism activity

There are currently no tourism activities in the caves.

Tourism development potential

The caves have only been explored by scientific explorations. Detailed background information is limited and based on conversations with the cave exploration team.

The caves would have considerable adventure caving potential once adventure caving has been sophisticated in the region with a professional adventure caving company.

The trekking and exploration of the caves could be a stand alone eco-tourism product for an adventure caving company.

Potential for wildlife watching.

The cave trekking tour package would provide a very high quality visitor experience if delivered professionally.

This would potentially be a multi day cave trekking activity product.

This would be an exclusive trekking/caving tourism product and focused on high pricing and low visitor numbers.

Potential to do a roundtrip caving product with Hang Thien Duong.

Target Markets for tourism development

Visitors interested in eco-tourism and adventure caving.

Domestic market – Expatriates travelling in Vietnam.

International market – FITs, backpackers and small groups of western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓)

Trekking (✓✓✓✓✓)

Sightseeing caves (✓✓✓✓✓)

Adventure caving (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓✓)

Scientific research (✓✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓)

Tour guiding through the caves and the jungle trails could inform about the cave, its biodiversity and raise awareness about the landscape of the region. It would also effectively raise awareness about the conservation development issues.

A cave guiding business could be established that employs local people with considerable cave guiding experience. This could provide a business opportunity for a local operators out of the community. Potentially also aligned to the CBT activities.

Opportunities to enhance conservation and environmental awareness raising are very good if an appropriate interpretation programme is developed.

Limiting factors for tourism

High sensitivity of the cave environment and damage to the cave.

Trail inside the caves would need to be clearly defined.

Potentially only seasonal activity.

Maintenance of access trails.

Only for specific target markets and low visitor volumes.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop an adventure caving company.

Mismanagement of the cave procedures and regulations.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Assess the caves and the area on their biodiversity value.

Develop standard operational procedures for trekking and caving tour to both caves. This should include a clearly defined trail through the caves, an identified area for rest at the entrance of the cave including tent sites and maintenance and management of the trail. It should also include clear procedures for potential activity operators and regulation and requirement for health and safety in the caves and on the trail.

Investigate the business potential for an adventure caving company among the communities. Potentially aligned to CBT activities.

Develop relevant interpretation and information about the cave.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

xvii. A Rem Minority Village and surrounding caves

Description, location and access

The A Rem Minority Village including some surrounding caves are located off Provincial Highway 20 in the PNKB NP.

The road to the A Rem village is relatively rough (only accessible by four wheel drive) and it takes approximately 2 hours drive (dry conditions) from the Eight Heroic Volunteers Cave to the village.

The village is a resettled community of the Rem ethnic minority group. The village is reasonably accessible and is situated near some very nice natural features such as caves and ancient forests. The cultural traditions of the Rem people are still apparent, but are at risk of being lost.

Current tourism activity

There are currently no tourism activities. The village receives very few visits and is only accessible by special permission for community development or research purposes.

Tourism development potential

The tourism development potential for the A Rem Minority Village is low to medium.

There is potential to develop a CBT site (homestay and activities) and a base for trekking, sightseeing and other nature-based activities in the vicinity including visiting Hang Ho – Hang Ca cave network.

The area is very scenic and there are established walking trails to the cave sites.

Developing some historic interpretation of the Ho Chi Minh Trail history along the access road would add an interesting dimension to this product.

Target Markets for tourism development

Visitors interested in CBT, trekking and adventure caving.

Domestic market – Expatriates travelling in Vietnam.

International market – FIT's and backpackers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓)

Ethnic minority culture (✓✓✓✓✓)

Homestay experience and activities (✓✓✓✓✓)

Trekking/Walking (✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓✓)

Sightseeing caves (✓✓✓)

Adventure caving (✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

This is a very poor community surviving in difficult conditions through low yielding and environmental harmful agricultural practices and dependence on forest resource. Tourism development through CBT has the potential to provide an important alternative or additional source of incomes and it would improve the local infrastructure and services such as waste management, potable water and communications.

Interpretation could support conservation awareness raising amongst the local community and visitors

Limiting factors for tourism

Relatively poor access route, especially during rainy conditions

Some basic and important conditions in this very poor village will have to improve before hosting tourism is viable. Most notably waste management, potable water and communications. Other support required will be for community organisation, awareness raising and skills development for hosting tourism and supporting cultural revitalisation and strengthening.

Potential difficult relationship between the PNKB NP and the A Rem village community.

Potential border security and access issues along Provincial Highway 20.

Indicative carrying capacity and key management priorities

A gradual process of introducing tourism at this village will be required. The carrying capacity will depend on the overnight accommodation available and the socio-cultural allowance of the villagers. At present there is no official overnight accommodation apart from possibilities to overnight at the ranger station outside of the village or in the local school house.

With appropriate planning, preparation, and environmental and social awareness raising and impact measures in place this site could foreseeable support up 20 visitors per night.

Immediate action guidelines for tourism management and sustainable development

Prepare a social development needs assessment.

Establish and improve waste management, potable water and communications.

Support the community organisation, awareness raising and skills development for hosting tourism.

Establish activities for supporting cultural revitalisation and strengthening of the community.

Consult with the community on CBT options – homestays and activities.

Strictly protected zone of the PNKB NP

xviii. U Bo Peak

Description, location and access

The U Bo Peak is located at the southern end of the PNKB NP.

It can be accessed off the Ho Chi Minh Highway. It is approximately 90 minutes drive from the Phong Nha township.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The tourism development potential for the U Bo Peak is medium.

There is the potential to develop a walking trail to the U Bo Peak. Access to the walking trail would be near the ranger station at the southern end of the PNKB NP.

The walking trail could be added on tourism activity for visitors travelling out of the PNKB NP via the Ho Chi Minh Highway. A walking trail at the U Bo Peak could not be considered a stand alone tourism activity and would need to be linked with other tourism activities through an route and or integrated product.

Potential product packages could be developed with the Truong Son Village/Son Long Dai River.

Target Markets for tourism development

Visitors with interest on soft-nature based tourism.

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓)

Walking (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓)

Picnicking (✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

There is a possibility to link the walking trail to activities at the Truong Son Village/Son Long Dai River. The trail could potentially support people from the adjacent villages by providing services such as refreshments, meals and local produce.

Interpretation and information along the walking trail could raise awareness on conservation issues and inform visitors about the biodiversity of the region.

Limiting factors for tourism

The walking trail does not exist at the moment and no details trail plans have been developed.

U Bo Peak is relatively peripheral to other tourism activities in Administration and Service Area.

Funding to establish the trail.

Need for additional tourism infrastructure development such as a parking area and restrooms.

Indicative carrying capacity and key management priorities

This needs to be evaluated with the developed of trail route with stopping and interpretation points and materials. Preferably the trail route is a one-way round trip route to avoid crowding along the trail.

If adequate facilities and trail development is completed it can be foreseeable that a trail system could be developed that would support up to 45 visitors (3 groups of 15) at a time on a 45 minute walk. This would result in a carrying capacity of approximately 400-500 visitors/day.

Immediate action guidelines for tourism management and sustainable development

Investigate a trail route for U Bo Peak.

Investigate funding feasibilities for the trail route.

Consider how this site will be incorporated into other tourism routes/products.

xix. Hang En

Description, location and access

Hang En is located almost in the centre of the Strictly Protected Area in the south of the PNKB NP.

It can only be accessed by a walking trail which originates from the Ho Chi Minh trail about 2 kilometres before the ranger station at the southern end of the PNKB NP.

It takes between six to eight hours to walk from the Ho Chi Minh Highway to Hang En. The walking track is well maintained and the route follows along a river and includes river crossings.

The cave can be traversed in approximately one hour.

The cave is relatively large by its size and has 3 main entrances/exits. All three entrances are large and spectacular. A river runs through the cave making it inaccessible during the rainy season.

Current tourism activity

There are currently no tourism activities. The cave is currently only visited by local people and cave expedition teams who use it as a base to stay overnight in the area.

Tourism development potential

The trekking trail to Hang En travels through a very scenic valley and is well-maintained and ready for guided trekking tours.

The cave can be used for overnighing by trekking groups.

The trekking to Hang En could be an excellent stand alone trekking tourism product. This would be a multi-day trekking activity with one or two nights camping along the trekking route.

Potential for wildlife watching.

Target Markets for tourism development

Visitors interested in eco-tourism and multi-day trekking.

Domestic market – Expatriates travelling in Vietnam.

International market – FITs, backpackers and small groups of western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Trekking (✓✓✓✓✓)

Cave sightseeing (✓✓✓✓✓)

Adventure caving (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Wildlife Watching (✓✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Swimming (✓✓✓✓)

Tubing (✓✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

Guided trekking to Hang En could inform about the biodiversity of the PNKB NP and raise awareness about the landscape of the region. It would also effectively raise awareness about the conservation development issues.

A guided trekking business could be established that employs local people with considerable trekking and cave guiding experience. This could provide a business opportunity for a local operators out of the community. Potentially also aligned to the CBT activities.

Limiting factors for tourism

High sensitivity of the cave environment and damage to the cave.

Maintaining of the trekking trail for tourism.

Only seasonal activity, during the rainy season the cave is not accessible.

Only for specific target markets and low visitor volumes.

No system in place for managing trekking operations.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop a trekking company.

Mismanagement of the trekking and cave procedures and regulations.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Assess the cave on its biodiversity value and prepare a site management plan. This is especially important if trekking groups regularly overnight at the cave. Temporary facilities for waste management are likely to be needed and should be managed appropriately to avoid any impacts on the PNKB NP.

Investigate the business potential for a trekking company among the communities. Potentially aligned to CBT activities.

Develop relevant interpretation and information about the cave and the trekking route.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)

- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

xx. Hang Son Doong

Description, location and access

The Hang Son Doong is located in the vicinity of Hang En. It is approximately a 90-minute walk along and through the river to access the entrance to Hang Son Doong.

The cave was only recently fully discovered and was confirmed as the world's largest cave.

The entrance of the cave is spectacular, but largely inaccessible due to its steep and very rocky environment. The cave has a fast flowing river which can be heard at the cave entrance.

The trail from Hang En to Hang Son Doong is seasonal and only accessible during the dry season.

Current tourism activity

There are currently no tourism activities in the cave. Only selected expedition groups have visited the cave.

Tourism development potential

The cave itself is inaccessible for tourism development. Even adventure caving is too dangerous in this cave. Access should only be provided to expeditions with professional mountaineering and diving equipment.

The cave entrance is spectacular through its rocky nature, the constant wind blow, sound of the cave river and the fact that it is the largest cave in the world.

The visiting of the entrance of the cave could be part of a trekking tour to Hang En.

Target Markets for tourism development

Visitors interested in eco-tourism and multi-day trekking.

Domestic market – Expatriates travelling in Vietnam.

International market – FITs, backpackers and small groups of western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓)

Trekking (✓✓✓✓✓)

Cave sightseeing (✓✓✓✓✓)

Adventure caving (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓)

Scientific research (✓✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

Guided trekking to Hang Son Doong as part of the trekking tour to Hang En could inform about the biodiversity of the PNKB NP and raise awareness about the landscape of the region. It would also

effectively raise awareness about the conservation development issues.

A guided trekking business could be established that employs local people with considerable trekking and cave guiding experience. This could provide a business opportunity for local operators out of the community. Potentially also aligned to the CBT activities.

Limiting factors for tourism

High sensitivity of the cave environment and damage to the cave.

Maintaining of the trekking trail. Much of the trail runs along or through the river. After every rainy season the trail would need to be cleared and established.

Only seasonal activity, during the rainy season the cave is not accessible.

Only the cave entrance is accessible for tourism.

Only for specific target markets and low visitor volumes.

No system in place for managing trekking operations.

Insufficient or lack of guiding skills – competent guides including equipment.

Insufficient or lack of tourism business skills to develop a trekking company.

Mismanagement of the trekking and cave procedures and regulations.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Assess the cave on its biodiversity value and prepare a site management plan.

Investigate the business potential for a trekking company among the communities. Potentially aligned to CBT activities.

Develop relevant interpretation and information about the cave and the trekking route.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

PNKB NP extension area

xxi. Ruc Minority Village

Description, location and access

The Ruc Minority village is situated approximately 30 minutes from the National Highway 15 in the extension area of the PNKB NP.

The village is easy accessible by road and situated in a long stretching valley with nice scenic features.

The cultural traditions of the Ruc people are at risk of being lost. The Ruc are one of the most endangered minorities in Vietnam. The Ruc are former cave dwellers who have been resettled over the past 40 years to the current village location. Villagers grow their own agriculture and receive government subsidies.

Current tourism activity

There are currently no tourism activities. Visit to the village is only by special permit at present.

Tourism development potential

The village site could be developed as a CBT project. The Ruc Minority are a unique and fascinating culture which could be the foundation for the tourism development.

The caves where the Ruc formerly lived are still accessible and at times used by the Ruc people as overnight accommodation on seasonal hunting activities. Walking to the main cave sites take approximately eight hours. There is an opportunity to develop trekking trips with an overnight stay at these caves sites.

CBT activities could be a stand alone tourism product for the region. However they would need to be carefully developed and managed in partnership with the community.

Target Markets for tourism development

Visitors interested in CBT, trekking and adventure caving.

Domestic market – Expatriates travelling in Vietnam.

International market – FIT's and backpackers and a special product for small group travel.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓)

Ethnic minority culture (✓✓✓✓✓)

Homestay experience and activities (✓✓✓✓✓)

Trekking/Walking (✓✓✓✓)

Scenic sightseeing (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓)

Sightseeing caves (✓✓✓)

Adventure caving (✓✓✓)

Scientific research (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

This is a very poor community surviving in difficult conditions through low yielding and environmental harmful agricultural practices and dependence on forest resource. CBT would have the potential to provide an important alternative source for incomes and improvements to local infrastructure and services such as waste management, potable water and communications.

Interpretation could support conservation awareness raising amongst the local community.

Limiting factors for tourism

Some basic and important conditions in this very poor village will have to improve before hosting tourism is viable. Most notably waste management, potable water and communications. Other support required will be for community organisation, awareness raising and skills development for hosting tourism and supporting cultural revitalisation and strengthening.

Potential difficult relationship between the PNKB NP and the A Rem village community.

Potential border security issues along National Highway 15. At present this is a high sensitive and restricted area.

Indicative carrying capacity and key management priorities

A gradual process of introducing tourism at this village will be required. The carrying capacity will depend on the overnight accommodation available. At present there is no official overnight accommodation in the village.

Immediate action guidelines for tourism management and sustainable development

Consult with the community, the PNKB NP and other government departments about tourism development in the village.

Arrangements for an easement on access for visitors to this site.

Prepare a social development needs assessment.

Establish and improve waste management, potable water and communications.

Support the community organisation, awareness raising and skills development for hosting tourism.

Establish activities for supporting cultural revitalisation and strengthening of the community.

Consult with the community on CBT options – homestays and activities.

Establishment of fundamental tourism hosting facilities (accommodations, meals provisions,) and services (guides, interpretation, chances to purchase local products)

Bufferzone

xxii. Phong Nha Township

Description, location and access

The Phong Nha township is located in the Son Trach commune and is main hub for tourism activities in the PNKB NP Region.

The township is easily accessible by road and is about one hour drive from Dong Hoi.

Current tourism activity

At present, the township receives between 260,000 and 300,000 visitors annually. This is a high volume tourism site.

The township includes an assortment of tourism facilities and services including accommodation (one hotel and a range of guest houses – Nha Nghi), restaurants and entertainment facilities. Most of tourism facilities are situated along the main access road and near the port for the tourist boats.

Tourism development potential

The Phong Nha township is the most suitable location in the PNKB NP Region for expanding tourism infrastructure, facilities and services including accommodation, restaurants and entertainment in order to meet the future demand for visitors to the region.

Target Markets for tourism development

Domestic market - independent leisure holiday travellers

International market – selected FITs and backpackers

The target markets and segments could easily be expanded, If higher standard accommodation facilities

(2-3 star accommodation) with sufficient capacity (to accommodate tour groups) is available.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓)

Mountain biking/cycling (✓✓✓)

Shopping/Souvenirs (✓✓✓✓✓)

Potential contribution to conservation objectives and community development – Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

The development and concentration of tourism infrastructure, facilities and services in the Phong Nha township will help relieve the PNKB NP from potential negative impacts from tourism, support the efficient and effective containment management visitors to the region and

Maximise opportunities for supporting local economic development.

Limiting factors for tourism

The Phong Nha township requires comprehensive site planning and management.

Lack of private sector investment.

Lack of skilled local people.

Limited supporting services and other tourism activities.

Indicative carrying capacity and key management priorities

At present there are no carrying capacity concerns for the Phong Nha township. However management of traffic flows on the main road and visitor flows at the tourist port area should be closely monitored.

The township has sufficient land space for tourism infrastructure development. However strict environmental impact assessments should be enforced and visitor management systems should be introduced.

Strategic and comprehensive site planning will support maximising visitor levels while maintaining impacts at an appropriate level.

Immediate action guidelines for tourism management and sustainable development

Comprehensive site planning and management especially around the tourist port area is required before any further tourism development takes place. The planning and management needs to incorporate infrastructure planning with an environmental management system, and based on accurate forecasts of visitor growth and market demands.

Identify and assess potential tourism infrastructure sites within the township, especially for larger scale accommodation development.

xxiii. Phong Nha Visitor Centre

Description, location and access

The Phong Nha Visitor Centre is part of tourist port complex in the Phong Nha township which includes the main boat launch, ticketing office, souvenir stands, parking lot and a few restaurants.

It is the main tourism focal point for visitors taking a boat tour to the Phong Nha caves.

The main visitor centre features a display area of approximately 100 square meters.

The Phong Nha Visitor Centre is operated by the PNKB NP.

Current tourism activity

Only few information displays and panels exist. The information and interpretation in the visitor centre leaves much room for improvement. It is of sub-standard given the UNESCO WHS recognition of PNKB NP.

Currently most visitors tend to spend little time in this building.

Tourism development potential

There is significant potential to vastly improve the tourism potential of this site. Especially in terms of providing quality information and interactive experiences that engage visitors.

This Phong Nha Visitor Centre can be regarded as the first site that visitors will be experiencing when they come to the PNKB NP Region. It has the potential to be visited by all visitors who take a boat tour to the Phong Nha Cave.

The visitor centre has the potential to be operated as a tourism business, potentially including a bookshop and quality souvenirs.

Target Markets for tourism development

All market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Scientific research (✓✓)

Shopping/Souvenirs (✓✓✓✓)

Potential contribution to conservation objectives and community development – Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

The Phong Nha Visitor Centre could be better used to effectively raise awareness on conservation development issues. It has the potential to educate the majority of visitors that travel to the PNKB NP Region.

Limiting factors for tourism

At present there is a lack of quality information and interpretation to capture the attention of visitors.

Lack of integrated planning and management of the tourism port complex.

Limitations of the current building – size and make up.

Funding by the PNKB NP.

Indicative carrying capacity and key management priorities

At present there is no carrying capacity concerns. The building could easily handle up to 50 people at any time staying on average 15 minutes = 200 people/hour.

The future development of building including information and interpretation displays will determine the carrying capacity.

Immediate action guidelines for tourism management and sustainable development

Integrate the Phong Nha Visitor Centre in the planning and management concept of the tourist port complex.

Improve the quantity and quality of the information and interpretation materials of the visitor centre.

Investigate a potential business model for the visitor centre.

Actively promote and integrate the visit centre as part of the Phong Nha Cave experience.

xxiv. Chay Lap Village

Description, location and access

Chay Lap Village is located in Phuong Lap Commune, in Bo Trach District along the HCM Highway. The village is easily accessible via National Highway 15 approximately 30 minutes from the Phong Nha township. It is also close to the PNKB NP entrance on the northern side of the Administration and Service Area.

Current tourism activity

Tourism activity in the Chay Lap Village commenced in late 2008. Visitor numbers are still relatively low and estimated at lower than 1,000 per year. However the village has received steady and increasing visitor numbers.

There is currently one homestay available. The following activities are being currently developed: walking, kayaking, bicycling, other homestay activities, and volunteering possibilities.

Tourism development potential

The homestay development in the Chay Lap village is regarded as the first true CBT development in the region.

The homestay has strong support and interest from a variety of tour operators in Vietnam.

The homestay could potentially be an important model for CBT replication in the PNKB NP Region.

Other tourism activities in the area can be supported from this location.

Target Markets for tourism development

Domestic market – Expatriates travelling in Vietnam, more adventurous sub-segments of the domestic market.

International market – FITs, backpackers and small western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Visiting villages and experience village activities (✓✓✓✓✓)

Homestay experience and activities (✓✓✓✓✓)

Mountain biking/cycling (✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓)

Kayaking (✓✓✓✓)

Canoeing (✓✓✓✓)

Swimming (✓✓✓✓)

Potential contribution to conservation objectives and community development – Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

Contributes to the community development by providing additional means of income and diversifies the local industry.

Provides local residents alternative income earnings and potentially protect the PNKB NP from illegal poaching logging activities.

Providing opportunities for visitors to learn about local cultures/customs and how these relate to environmental and cultural sustainability.

Limiting factors for tourism

The homestay currently has a maximum capacity of 8 – 10 people/night.

Support by the PNKB NP for CBT activities adjacent and in the National Park.

Current marketing and promotion of the region to receive sufficient clients from the target markets.

Distribution channels with the tour operators need to be established.

Current activities need to be enhanced and diversified.

More attention to local human resource development, including training and awareness raising, so that more residents can engage in tourism activities.

Indicative carrying capacity and key management priorities

The homestay currently has a maximum capacity of 8 – 10 people/night.

The hosting family is also not yet capable of providing other services to more than up to ten people.

It is important to maintain the “village atmosphere” of this site/product. Expansion of the home stay facilities should be carefully considered including additional sites and families.

At maximum it should be expected that no more than 50 people per overnight stay in Phoung Lap commune and only 30 people per overnight stay in Chay Lap village itself.

For day visitors a target of a maximum of 100 people per day would be initially suitable.

Visitor numbers should be regularly monitored, especially with regard to their impacts on the community.

Immediate action guidelines for tourism management and sustainable development

Skills and language training for locals involved in tourism services to provide better (higher value) services.

Increase tourism awareness among local residents.

Develop and support the Chay Lap homestay as a replicable homestay model for the wider region.

Identify and support the operation of CBT activities.

Make the CBT activities available to day-visitors.

Identify additional opportunities to provide more households with tourism related earning.

Support the marketing and promotion of homestays and CBT activities in the region.

xxv. Trooc River

Description, location and access

The Trooc River starts at the junction with Song Chay and Song Son, and flows out from PNKB NP near the entrance toward the Chay Lap village.

The majority of the river that can be considered for tourism use is in the Bufferzone.

Current tourism activity

At present there is only limited tourism activity on the river.

There are kayaks for rent through the CBT development at the Chay Lap village that are used to access this part of the river.

Only very few tour boats from the Phong Nha caves travel up the Trooc River.

Tourism development potential

There are opportunities for water-based activities such as kayaking, tubing and swimming along parts of the river.

The activities should be integrated and coordinated with other activities along the Song Chay and Song Son rivers.

There are also opportunities to develop an alternative port for the tour boats to the Phong Nha caves in order to manage the high volume visitor flows to the caves and within the Administration and Service

Area.

Target Markets for tourism development

Domestic market – Expatriates travelling in Vietnam, more adventurous sub-segments of the domestic market.

International market – FITs, backpackers and small western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Swimming (✓✓✓✓✓)

Kayaking (✓✓✓✓✓)

Canoeing (✓✓✓✓✓)

Tubing (✓✓✓✓✓)

River cruising on a boat (✓✓✓✓✓)

Wildlife Watching (✓✓✓)

Learning about the area (✓✓✓✓)

Picnicking (✓✓✓✓)

Potential contribution to conservation objectives and community development – Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

The development of kayaking, tubing and swimming as part of the CBT could provide significant income to the local people from Chay Lap.

The development of CBT businesses for local people could provide an alternative income generation for some community members and potentially reduce poaching and logging activities in the PNKB NP for some members in the community.

Developing suitable information materials in this location would support awareness raising for environmental conservation.

Limiting factors for tourism

Some parts of the river section may not have the highest value in terms of tourism potential but provide a convenient access point for river-based tourism activities.

Difficult relationship between the PNKB NP and the community. To maximise the tourism potential of the river access to Song Chay river in the PNKB NP may be needed.

Current lack of supporting services for example, refreshments, meals or inner tube rentals.

Lack of tourism business skills in the community, including language skills and operational skills considering health and safety.

Limited amount of kayaks for rent at present.

Indicative carrying capacity and key management priorities

Up to 30 visitors along the river at any one time in order to avoid crowding which would diminish the visitor experience.

Up to 100 visitors along the river systems of Song Son.

The Trooc River could be the entry point for visitors to the Song Son.

The Trooc River could be the exit point for visitors from the Song Chay.

Immediate action guidelines for tourism management and sustainable development

Consult with the PNKB NP and the community to cooperate on the river use, especially in combination

with the Trooc river.

Develop clear guidelines for river activities.

Expand and enhance tourism services (refreshments and meals) and CBT activities (kayaking, tubing and swimming) in the area.

Providing adequate training for interpretation services, visitor hosting, and safety rescue for boat service operators.

xxvi. Cave 36 and Xuan Son Ferry

Description, location and access

Cave 36 and Xuan Son Ferry are located in Son Trach and relatively easy accessible from the HCM Highway.

The cave was formally used by the military for storing munitions and weapons. There is an access trail from the cave to the Xuan Son Ferry site. Cave 36 was part of a larger network of caves in the area that were used for similar military purposes.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The medium to high tourism development potential is based on the unique and well preserved aspects of this "special function" cave.

The cave and Xuan Son Ferry could be part of a walking/biking tourism heritage route through villages, scenic karst landscape and other historic sites in the area. It could be linked easily to CBT activities in and around the Chay Lap village.

Target Markets for tourism development

Domestic market – FIT and group visitors interested in the military history of the area. Expatriates travelling in Vietnam, independent leisure/holiday travellers (that are interested in military heritage sites) and education/science travellers (that are interested in military heritage sites).

International market – FITs, backpackers, small western tour group travellers and regional caravanning travellers (that are interested in military heritage sites).

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

War-time history (✓✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Visiting villages and experience village activities (✓✓✓)

Scientific research (✓✓)

Picnicking (✓✓✓✓)

Potential contribution to conservation objectives and community development – Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

Being part of a walking/biking tourism heritage route, there would be in-direct and direct income earning possibilities for people from nearby villages/communes.

Good interpretation and sensitive site-level development will contribute to conserving the historical heritage of Cave 36 and Xuan Son Ferry.

Limiting factors for tourism

Both the Cave 36 and Xuan Son Ferry need to be integrated into other tourism activities and promotions

in the area – potentially developing a walking/biking tourism heritage route.

Funding to develop and maintain the route. The current access paths need considerable improvement and need to be aligned and mapped.

Current lack of interpretative materials and general information about the area.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Prepare an operational management plan for the cave site.

Improve current access trails and then further develop a walking/biking tourism heritage route.

Increase tourism awareness among local residents.

Investigate the opportunity to train local people as guides and identify and support the operation of other CBT in the area.

Support additional services such as refreshments, meals and souvenirs at appropriate and controlled points.

Make sure key infrastructure is in place:

- Signage to the parking or rest areas.
- Toilets and rubbish facilities.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

xxvii. Cha Noi Cave

Description, location and access

The Cha Loi Cave is situated near National Highway 15. It is relative easy accessible via trail from the Highway. It takes about 45 minutes walking one-way to reach the cave entrance.

The cave is approximately 45 minutes driving from the Phong Nha township and the Chay Lap village.

The valley surrounding the cave is scenic and spectacular from the highway.

The cave was formerly used by the military for storing weapons and ammunition.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The tourism development potential for Cha Loi Cave is low to medium.

The cave could be developed as a showcave for its special use during the war.

There is a potential to develop the cave as a stopping sites on National Highway 15 as part of a historical and scenic tourism route.

Target Markets for tourism development

Visitors travelling along National Highway 15.

Domestic market – FIT and group visitors interested in the military history of the area. Expatriates travelling in Vietnam, independent leisure/holiday travellers (that are interested in military heritage sites) and education/science travellers (that are interested in military heritage sites).

International market – FITs, backpackers, small western tour group travellers and regional caravanning travellers (that are interested in military heritage sites).

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓)

War-time history (✓✓✓✓✓)

Learning about the area (✓✓✓✓)

Visiting villages and experience village activities (✓✓✓)

Scientific research (✓✓)

Potential contribution to conservation objectives and community development – Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

The adjacent village could benefit from visitors stopping at the site and potentially buying refreshments and local produce.

Good interpretation and sensitive site-level development will contribute to conserving the historical heritage of the cave.

Limiting factors for tourism

Lack of interpretation and signage.

The site is a stopping site as part of a tourism route but not a destination itself.

There are apparently poisonous snakes in the entrance area.

The trail to entrance of the cave would need to be properly developed.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying

capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Prepare an operational management plan for the cave site.

Clarify the situation of the poisonous snakes in the entrance area.

Improve current access trails the cave.

Increase tourism awareness among local residents.

Investigate the opportunity to train local people as guides and Identify and support the operation of other CBT in the area.

Support additional services such as refreshments, meals and souvenirs at highway parking area.

Develop interpretation materials and approach.

Make sure key infrastructure is in place:

- Signage to the parking or rest areas.
- Toilets and rubbish facilities.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

xxviii. Phu Dinh Waterfall

Description, location and access

The trail to the Phu Dinh Waterfall is accessible at the end of a dirt road off the National Highway 15 southeast of the PNKB NP. The trail follows the river to a series of waterfalls and ends at the Phu Dinh Waterfall.

Current road access to the trailhead is in poor condition.

There is prominent deforestation at the trail start and first section. The upper reaches of the river are more scenic and offer swimming opportunities.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The tourism development potential for Phu Dinh Waterfall is low.

The access is relatively good but adventurous. Only accessible by four wheel drive most of the year.

The Phu Dinh Waterfall product is not unique or of very high quality, there are better opportunities for similar activities elsewhere in the region.

The location between Dong Hoi and the PNKB NP main entrance is an advantage and the trail is

relatively developed.

Target Markets for tourism development

Selected visitors from the flowing market segments that have an interest in nature based recreation – walking and swimming.

Domestic market – FITs or small groups looking for a resting or recreational place. Expatriates travelling in Vietnam, independent leisure/holiday travellers and education/science travellers.

International market – FITs, backpackers, small western tour group travellers and regional caravanning travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓)

Learning about the area (✓✓)

Picnicking/Outdoor Leisure (✓✓✓)

Swimming (✓✓)

Scientific research (✓)

Shopping/Souvenirs (✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓)

There are some poor communities in the vicinity that could offer some limited tourism services such as refreshments, meals and souvenirs.

Potential ticketing for this site could generate further revenues for the community. However a steady stream of visitors would be needs and of course visitors need to be willing to pay.

Interpretation could support conservation awareness raising amongst the local community.

Limiting factors for tourism

Relatively poor access route.

Limited use for tourism activities, apart from walking and swimming at the waterfall.

Not a unique site and no other attractions nearby.

Indicative carrying capacity and key management priorities

Up to 30 visitors along the walking route at any one time in order to avoid crowding which would diminish the visitor experience. The site could only support about 4 groups or 120 visitors/day, but only if appropriate toilets were provided.

Immediate action guidelines for tourism management and sustainable development

Consult and investigate the feasibility to develop the site for visitors. However, the development of this site is not a high priority and the site deserves only secondary consideration for tourism development.

xxix. Bai Dinh Historical Site

Description, location and access

The Bai Dinh Historical Site is located on National Highway 12.

This is an historical significant site and marks an important battle during the American War.

Current tourism activity

There are currently no tourism activities.

Tourism development potential

The tourism development potential for the Bai Dinh Historical Site is low.

There is a potential to develop the Bai Dinh Historical Site as a stopping site on National Highway 12 as part of a historical tourism route.

The site is easy accessible and visible from the road.

There are increasingly more visitors crossing the Cha Lo Border and travel on National Highway 12.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

War-time History (✓✓✓✓✓)

Learning about the area (✓✓)

Scientific research (✓✓)

Shopping/Souvenirs (✓✓✓✓)

Target Markets for tourism development

Visitors travelling along National Highway 12.

Domestic market - FIT and group visitors interested in the military history of the area. Independent leisure/holiday travellers passing through.

International market – FITs, backpackers and regional caravanning travellers.

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

The adjacent village could benefit from visitors stopping at the site and potentially buying refreshments, meals, local produce and souvenirs.

Information and interpretation panels could describe the historical importance about the site and provide information about the PNKB NP Region.

Limiting factors for tourism

Relatively unspectacular site at present. Needs a tidy up.

Lack of interpretation and signage.

Lack of tourism awareness amongst local residents.

The site is a stopping site as part of a tourism route but not a destination itself.

Indicative carrying capacity and key management priorities

Up to 40 visitors (one large tour bus load) at any one time in order to avoid crowding which would diminish the visitor experience.

Immediate action guidelines for tourism management and sustainable development

Tidy up the site and potentially provide small-scale infrastructure such as toilets.

Develop site-specific interpretation and information about the region.

Develop the site as part of a historical tourism route development for National Highway 12.

Raise awareness in the local community about tourism and supporting services such as refreshments, meals and souvenirs.

xxx. En Cave/Heavens Gate near Cha Lo and Hill 37

Description, location and access

The En Cave/Heavens Gate near Cha Lo and Hill 37 are located off National Highway 12, near Cho Lo Boarder crossing to Laos.

The En Cave is an elevated dry cave which was used as a weapons storage during the American War. There is also a wet cave at the bottom of the trail to the En Cave. The trail to En Cave takes approximately 45 minutes and is at times steep.

Heavens Gate and Hill 37 mark historically important battles during the American War.

Current tourism activity

There are currently no tourism activities.

Only few special arranged tours.

Tourism development potential

The tourism development potential for the En Cave/Heavens Gate and Hill 37 is low.

There is a potential to develop the Heavens Gate marker as a stopping site on National Highway 12 as part of a historical tourism route. The area already has a parking area and offers a scenic view towards En Cave.

The site is easy accessible and visible from the road.

There are increasingly more visitors crossing the Cha Lo Border and travel on National Highway 12.

The trail to En Cave offers a nice walking opportunity and the cave provides a good view of the area.

Target Markets for tourism development

Visitors travelling along National Highway 12. Interest in nature based activities such as walking and historical heritage.

Domestic market - FIT and group visitors interested in the military history of the area and independent leisure/holiday travellers travelling through.

International market – FITs, backpackers and regional caravanning travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

War-time History (✓✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Scientific research (✓✓)

Picnicking/Outdoor Leisure (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

Communities in the vicinity could benefit from visitors stopping at the site and potentially buying refreshments, meals, local produce and souvenirs.

Information and interpretation panels could describe the historical importance about the site and provide information about the PNKB NP Region.

Limiting factors for tourism

This is a sensitive area for border security and safety. Visitor access to the En Cave maybe significantly regulated and restricted.

The access trail to the En Cave is not suitable for regular tourism visits at present.

Lack of interpretation and signage.

Lack of tourism awareness amongst local residents.

Indicative carrying capacity and key management priorities

The caves are a very sensitive environment and any damages are irreversible and should therefore be strictly avoided in order to conserve the cave for future generations. Identifying indicative carrying capacity and setting up key management priorities is to ensure a high quality visitor experience and safety regulations and cave maintenance is ensured at any time.

A professional assessment study of the carrying capacity in terms of average and peak numbers of daily visitors, group size and frequency, permissible activities, etc., of the cave by reputable cave experts is required before opening to visitors. The number of daily visits and visitors to the cave depends on infrastructure conditions and visitor control capacity of the investor/ cave business runner as well as monitoring capability of the Phong Nha - Ke Bang NP Administration Unit. Limitation of the cave carrying capacity does not mean a possibility of maximization of received visitors but cave protection and preservation. All visitors and visitor groups must be supervised by competent cave guides, preferably with some form of certification or competence check. In turn, cave guides must be supervised by NP staff for strict compliance to regulations and behaviour codes.

Another key management priority is an environmental and social impact assessment and mitigation plan. Such an assessment and plan should also cover the environment of the cave, the access road, and other tourist facilities.

Immediate action guidelines for tourism management and sustainable development

Review and consult on regulations and procedures to access the En Cave.

Improve the quality and safety of the access trail to En Cave. Investigate potential access to the lower wet cave.

Develop site-specific interpretation and information about the region.

Develop the site as part of a historical tourism route development for National Highway 12.

Raise awareness in the local community about tourism and supporting services such as refreshments, meals and souvenirs.

Make sure key infrastructure is in place:

- Signage to the parking or rest areas.
- Toilets and rubbish facilities.

Management Steps taken/ considered must comply with relevant IUCN and UNESCO international regulations. Reference documents include:

- Management Manual of Tourist Sites in WHS (Arthur Pedersen, 2002)
- IUCN Guidelines for Cave and Karst Protection (Adiran Phillips, WCPA, 1997)
- Guidelines for Cave Access Classification System (Graeme Worboys, Adrian Davey and Clyde Stiff, 1979)
- International Show Caves Association's Management Guidelines for Show Caves (Stein-Erik Lauritzen, Julia James and Paul Willimas, ISCA, 2009)
- International Union of Speleology Code of Ethics (UIS, 2009)

xxxi. Cha Lo Border/Economical Area

Description, location and access

This is the immediate border township and area crossing to Laos on National Highway 12.

The border crossing is approximately two hours from the Phong Nha township.

Current tourism activity

There current tourism activity is low. It is estimated that up to 1,000 visitors cross the border at present. Only very few tour groups from or to Lao use the crossing.

Overnight accommodation, meals and entertainment are available. However mostly to supporting the transportation industry. Only few travellers tend to overnight here.

Tourism development potential

The tourism development potential for the Cha Lo Border/Economical Area is low.

There are increasingly more visitors crossing the Cha Lo Border and travel on National Highway 12. This could be the start of end point of a historical tourism route as part of National Highway 12.

Some accommodation providers and restaurants are established, although of mediocre quality.

The township could service travellers crossing border, if visitor flows at the border crossing increase.

Target Markets for tourism development

Visitors travelling along National Highway 12.

Domestic market - independent leisure/holiday travellers.

International market – FITs, backpackers and regional caravanning travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓)

Shopping/Souvenirs (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓)

People in the township could benefit from visitors stopping and potentially buying refreshments, meals, local products and souvenirs.

Information and interpretation panels at a suitable place could provide information to visitors entering Vietnam and guide them to visit places in the PNKB NP Region.

Limiting factors for tourism

Relatively poor facilities at present. Mainly serving the transportation sector, but not necessarily suitable for visitors.

Relatively peripheral from the rest of the region and it is not a destination itself.

No tourism attractions or activities in the immediate vicinity.

Indicative carrying capacity and key management priorities

At present there are no carrying capacity concerns for the Cha Lo Border/Economical Area.

Immediate action guidelines for tourism management and sustainable development

Integrate in historical tourism route development for National Highway 12.

Develop and provide tourism information about the PNKB NP Region visitors entering Vietnam.

xxxii. Truong Son Village/Song Long Dai River

Description, location and access

The Truong Son Village/Song Long Dai River are in the south of the PNKB NP Region accessible via the HCM Highway West. To access the site from the north, visitors would need to travel on the HCM Highway West which is part of the PNKB NP.

The Truong Son village provides an entry point to the Song Long Dai river that flows towards the coast to Dong Hoi.

The Truong Son village is approximately 90 minutes distance from the Phong Nha township.

Current tourism activity

There are currently no tourism activities. The river can be used by special arrangement.

Tourism development potential

The tourism development potential for Truong Son Village/Song Long Dai River is medium.

Easy accessible via scenic route through the PNKB NP.

The Truong Son Village forms the entry point to the Song Long Dai River.

The Song Long Dai River has very nice natural features such as small rapids and scenic points including places to stop along the river for activities such as swimming, walking and refreshment, possibly camping as well. There is a suitable exit point where the river flows under National Highway 15, which offers a dockside, parking, and road access.

The Song Long Dai River is suitable for canoeing (as a day activity), kayaking (as a day activity) and scenic tours on long boat (half day activity).

Target Markets for tourism development

This depends on river activities – canoeing and kayaking are more adventurous activities while the long boats could also attract some of the more mainstream visitors.

Domestic market – Those interested in moderate level nature-based adventure tourism. Expatriates travelling in Vietnam.

International market – FITs, backpackers and selected western tour group travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Learning about the area (✓✓✓)

River kayaking/canoeing (✓✓✓✓✓)

River cruising on a boat (✓✓✓✓✓)

Wildlife watching (✓✓✓)

Swimming (✓✓✓✓)

Visiting villages and experience village activities (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

There is an opportunity to develop CBT activities based on canoeing, kayaking and scenic tours on long boats with people from the Truong Son village. Other additional potentials include providing tourism services such as refreshments, meals and local produce.

Interpretation and information material could raise awareness on conservation, especially as visitors would move downstream from more natural areas towards areas with human intervention.

Limiting factors for tourism

No present tourism activities. Current lack of organisational and supporting facilities for tourism activities.

Unsure relationship between the PNKB NP and the community. The main access route would need cooperation with the PNKB NP.

Funding and training to establish and maintain a tourism operation along the river.

Lack of tourism business skills in the community, including language skills and operational skills considering health and safety.

The current long boats will need to be modified for tourism purposes.

Indicative carrying capacity and key management priorities

At present there is no carrying capacity concerns.

Generally groups for tourism activities on the river should be kept small. Up to ten people per group excluding guides. It also depends on the tourism activity.

Immediate action guidelines for tourism management and sustainable development

Consult with the PNKB NP and the community to cooperate on the river use and activities.

Investigate the feasibility of a tourism business operation for the river.

Potentially initiate a CBT operation with tourism activities - canoeing, kayaking and scenic tours on long boats.

Improve long boats and equipment necessary to support quality and safe travel along the river.

Develop clear safety and management guidelines and trainings for river activities.

Skills and language training for locals involved in tourism services to provide better (higher value) services Integration with tourism packages/routes.

Monitoring system.

xxxiii. Other communes and villages

Description, location and access

There are 13 communes with approximately 60,000 people in the Bufferzone area.

Most communes and villages are accessible within two hours from the Phong Nha township.

Current tourism activity

The current tourism activity is focused on the Son Trach commune. At present the vast majority of the communes and villages do not benefit from tourism development in the PNKB NP Region.

Tourism development potential

CBT - hosting communities that feature local culture, natural sites or other attractions.

CBfT:

Being part of a tourism route and receiving in-direct tourism benefits such as linking local products and services to the main tourism economy in the region.

Direct employment in the tourism industry, such as in the hospitality sector.

Target Markets for tourism development

All markets and the wider sector through supply chain linkages for local products and services.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓)

Potential activities include:

Learning about the area (✓✓✓✓)

Visiting villages and experience village activities (✓✓✓✓)

Shopping/Souvenirs (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓)

Communities in the Bufferzone can derive benefits from hosting tourism activities in their communities or by providing goods and services to the tourism industry in the area.

Sustainable tourism activities can also support cultural and environmental conservation.

Limiting factors for tourism

Lack of awareness of possible economic linkages with the tourism sector.

Possible lack of actual number of communities capable of hosting CBT.

Lack of awareness of tourism development potential in or near some of these communities.

Lack of tourism business skills in the community, including language skills and operational skills considering health and safety.

Lack of market awareness of tourism demands and the demands of the tourism industry. How to market local products to these markets.

Indicative carrying capacity and key management priorities

Depends on the community and form of tourism to be developed.

Depends on market demand to CBT product.

Immediate action guidelines for tourism management and sustainable development

Support the production of local products to be linked to the tourism supply chain, working in partnership with other relevant development initiatives (government and development organisation).

Assess further communities with CBT hosting potential and raise awareness about tourism in the communes and villages.

Consult further with tourism operators to clarify the actual demand for CBT products and work in cooperation to develop the most suitable products.

Support and integrate communes and villages in human resource development programmes.

xxxiv. Than Dinh Mountain

Description, location and access

The Chua Non Pagoda, Than Dinh Mountain and Rao Da Lake are located at Truong Xuan Commune, Quang Ninh District. It is approximately 25 minutes driving distance from Dong Hoi City to the South-West.

The Chua Non pagoda – Than Dinh mountain is an important spiritual and historical site. It is easily accessible through the roading network and steps up to the peak of the mountain.

Current tourism activity

The Chua Non Pagoda is a high volume but seasonal tourism site.

Visitors are mainly from the locality and surrounding districts during summer, festivals and full moon days.

Tourism development potential

The site is very popular with domestic visitor and is an important spiritual and historical site.

There is scope for development to enhance the quality of the visitor experience at the Chua Non Pagoda. This includes enhancing the interpretation and information about the pagoda and the surrounding area.

There are very good tourism product synergies with the Rao Da lake, Historic Long Dai Ferry and Heroic Monument. This will certainly attract additional visitors whom come for refreshment or worshipping.

There is potential to develop and upgrade tourism service facilities, including resting areas, refreshments, souvenirs, and materials required for spiritual worshipping.

Target Markets for tourism development

Visitors interested in spiritual worshipping and the history of the region and Vietnam.

All market segments – however the primary market would be the domestic and local market segments.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

War-time history (✓✓✓✓✓)

Scenic sightseeing (✓✓✓✓)

Learning about the area (✓✓✓✓✓)

Picnicking (✓✓✓✓✓)

Shopping and souvenirs (✓✓✓✓)

Swimming (✓✓✓✓)

Worshipping (✓✓✓✓✓)

Potential contribution to conservation objectives and community development

General conservation and local development potential (✓✓✓✓)

Information and interpretation at the Chua Non pagoda could raise awareness on conservation development issues.

Scope for generating revenues by local people through operating supporting tourism service facilities such as refreshments, souvenirs, and materials required for spiritual worshipping.

Limiting factors for tourism

Insufficient or lack of supporting facilities and services.

Insufficient or lack of information and interpretation materials.

No tourism activities in the immediate vicinity.

Low awareness of tourism activities of local authorities and communities.

Indicative carrying capacity

The pagoda area is relatively small. Crowding will be unavoidable due to the popularity of the site. The one-way walking path should be developed big enough in order to manage the crowding.

Additional facilities such as resting areas, better information and interpretation, and potentially a small walking track in the surrounding area could further mitigate the crowding at this site.

Impact mitigation efforts this site could support a high volume of short staying visitors. 50 visitors at a time, for 15 minutes (200/hour) over the day (10 hours) = 2,000/day. An effective visitor management system is needed for this site.

Immediate action guidelines for tourism management and sustainable development

Restore the pagoda and develop a management mechanism of the pagoda.

Develop a site management plan (including environmental management systems for waste collection and disposal) that includes visitor-monitoring system to assess site-specific tourism flows.

Define walking routes at the surrounding area of the pagoda, specifically on top of the mountain.

Improved and expand tourism facilities and services.

Develop better interpretation materials about the site and provide additional information about the region.

Investigate the potential of developing a walking opportunity to provide an additional experience on the site and to ease the visitor flows around the site.

xxxv. Khe Gat Airfield

Description, location and access

The Khe Gat Airfield is located along National Highway 15, it actually forms part of the road.

The site was an existing airstrip during the American War. The site is approximately 30 minutes for the Phong Nha township.

Current tourism activity

There current tourism activity is low. Occasionally visitors may stop alongside the road.

Tourism development potential

The tourism development potential for Khe Gat Airfield is low.

There is a potential to develop the Khe Gat Airfield as a stopping site on National Highway 15 as part of a historical and scenic tourism route.

The site has the potential to be developed into a stopping area or possibly a picnic area alongside National Highway 15.

Target Markets for tourism development

Visitors travelling along National Highway 15.

Domestic market - independent leisure/holiday travellers.

International market – FITs, backpackers and regional caravanning travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Learning about the area (✓✓✓✓✓)

War-time History (✓✓✓✓✓)

Shopping/Souvenirs (✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓)

The adjacent village could benefit from visitors stopping at the site and potentially buying refreshments, meals, local produce and souvenirs.

Information and interpretation panels could describe the historical importance about the site and provide information about the PNKB NP Region.

Limiting factors for tourism

Lack of interpretation and signage.

Lack of tourism awareness amongst local residents.

The site is a stopping site as part of a tourism route but not a destination itself.

A potentially sensitive military area where a future airport might be built.

Indicative carrying capacity and key management priorities

Up to 100 visitors at any one time in order to avoid crowding which would diminish the visitor experience.

Site planning for the area is needed, as there are currently no stopping bays along the road to guarantee safety to visitors.

Immediate action guidelines for tourism management and sustainable development

Site planning, there are currently no stopping bays along the road to guarantee safety to visitors.

Key infrastructure needs at the rest area are:

Signage to the parking area.

Toilets and rubbish facilities.

Develop site-specific interpretation and information about the region.

Develop the site as part of a historical tourism route development for National Highway 15.

Raise awareness in the local community about tourism and supporting services such as refreshments, meals and souvenirs.

Adjacent to Bufferzone

xxxvi. Thac Mo (Dream) Waterfalls

Description, location and access

The Thac Mo Waterfalls are on the driving route of National Highway 15 from Khe Ve to the Phong Nha Area – HCM Highway. A parking area for the walking trail to the waterfalls is located just off the HCM Highway. The Thac Mo Waterfalls are approximately 45 minutes driving distance from the Phong Nha township.

The waterfalls are approximately 10 minutes walking distance from the parking area.

Current tourism activity

There are currently no tourism activities. At present local people use the waterfall for recreation and fishing.

Tourism development potential

The tourism development potential for Thac Mo Waterfalls is medium.

Easy accessible from the National Highway 15.

The Thac Mo Waterfalls can not be considered a destination on its own but be seen as an attraction along the along the historic and scenic touring of National Highway 15.

The parking area adjacent to the highway could be developed into a rest stop area. Visiting the waterfalls would be an addition to the rest stop.

The walking trail to the waterfalls is sufficient. At the waterfall, there is no need to develop any additional infrastructure apart from a boardwalk would support the ease of walking to the swimming area of the waterfalls.

Key tourism development activities would be swimming and enjoying the natural surroundings.

Target Markets

Visitors travelling along National Highway 15.

Domestic market – FIT or groups travellers passing through this area looking for a rest/recreational stopping point.

International market – FITs, backpackers and regional caravanning travellers.

Tourism Activities/Attractions Development Rating - Very Low (✓) to Very High (✓✓✓✓✓)

General tourism development potential (✓✓✓✓✓)

Swimming (✓✓✓✓✓)

Walking (✓✓✓✓)

Picnicking/Outdoor Leisure) (✓✓✓✓)

Scenic Sightseeing (✓✓✓✓)

Shopping/Souvenirs (✓✓✓✓)

Potential contribution to conservation objectives and community development - Very Low (✓) to

Very High (✓✓✓✓✓)

General conservation and local development potential (✓✓✓✓✓)

The adjacent village could benefit from visitors stopping at the site and potentially buying refreshments, meals, local produce and souvenirs.

Information and interpretation panels could describe the historical importance about the site and provide information about the PNKB NP Region.

Limiting factors

Lack of interpretation and signage.

Lack of tourism awareness amongst local residents.

The site is a stopping site as part of a tourism route but not a destination itself.

Indicative carrying capacity and key management priorities

Up to 100 visitors at any one time at the waterfall site in order to avoid crowding which would diminish the visitor experience. With more tourism facilities developed at/near the parking would increase the site's carrying capacity.

Parking at the rest stop area should be sufficient for two medium sized buses and up to ten cars.

Immediate action guidelines for management and development

Site planning, develop the parking area as a designated rest stop of the National Highway 15.

Key infrastructure needs at the rest area are:

Signage to the parking area and waterfall.

Toilets and rubbish facilities.

Facilities for catering to tourist such as refreshments, relaxing, souvenirs selling.

Develop site-specific interpretation and information about the region.

Develop the site as part of other tourism route development for National Highway 15.

Appendix 7: List of Tourism Activities by Tourism Site and Target Market

The following list matches the tourism activities with the tourism sites and target markets. More detailed information to the specific tourism sites is referred to in Appendix 6.

Tourism Activity	Tourism Development Locations and Tourism Development Potential - Very Low (✓) to Very High (✓✓✓✓✓)	Tourism Target Markets
<p>Walking</p> <p>Walking activities range from short walks of five minutes to longer walks of two to three hours. Walking means that no special equipment is needed. Most walking routes should be walkable with normal footwear.</p>	<ul style="list-style-type: none"> ▶ Phong Nha Cave and Dong Tien Son Cave (✓✓✓✓) ▶ Bamboo Valley (✓✓✓✓) ▶ Primate Rescue Centre (✓✓✓✓✓) ▶ Botanical Garden (✓✓✓✓) ▶ Nuoc Mooc Eco-Trail (✓✓✓✓✓) ▶ Gao Forest (✓✓✓) ▶ Thac Gio Waterfalls (✓✓✓) ▶ A Rem Minority Village and surrounding caves (✓✓✓) ▶ U Bo Peak (✓✓✓) ▶ Ruc Minority Village (✓✓✓) ▶ Phong Nha township (✓✓✓) ▶ Chay Lap Village (✓✓✓) ▶ To Cave 36 and Xuan Son Ferry (✓✓✓✓) ▶ Phu Dinh Waterfall (✓✓) ▶ En Cave/Heavens Gate (✓✓✓) ▶ Other communes and villages (✓✓✓✓✓) ▶ Thac Mo Waterfalls (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.
<p>Trekking</p> <p>Trekking activities are longer walks ranging from half a day to multi day trips. Solid footwear is needed to walk on trekking trails and for multi day trips special equipment such as tents and cookery is needed.</p>	<p>Trekking routes to:</p> <ul style="list-style-type: none"> ▶ Hang E (✓✓✓✓✓) ▶ Bamboo Valley (✓✓✓✓) ▶ Hang Thien Duong (✓✓✓✓✓) ▶ Me Bong Con and Hang Vom (✓✓✓) – needs to be developed ▶ A Rem Village and surrounding caves (✓✓✓) – needs to be developed ▶ Ruc Minority Village (✓✓✓) ▶ Hang En (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>Adventure Caving</p> <p>Adventure caving activities refer to the exploring of remote and sensitive caves. These caves are not</p>	<ul style="list-style-type: none"> ▶ Hang E (✓✓✓✓✓) ▶ Hang Toi (Dark Cave) (✓✓✓✓✓) ▶ Hang Thien Duong (✓✓✓✓✓) ▶ Me Bong Con and Hang Vom 	<ul style="list-style-type: none"> ▶ Domestic market – Education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and

Tourism Activity	Tourism Development Locations and Tourism Development Potential - Very Low (✓) to Very High (✓✓✓✓✓)	Tourism Target Markets
developed as high volume sightseeing caves. In order to experience the cave, the visitor may have to trek to the cave, climb in the cave or swim parts the cave.	(✓✓✓✓) ▶ Hang En (✓✓✓✓✓)	expatriates travelling in Vietnam.
Sightseeing Caves Sightseeing caving means visiting a caves that are easy accessible either by foot or by boat.	▶ Phong Nha Cave – main cave entrance (✓✓✓✓✓) ▶ Phong Nha Cave – deeper cave area (✓✓✓✓✓) ▶ Dong Tien Son Cave (Dry Cave) (✓✓✓✓✓) ▶ Eight Heroic Volunteers Cave (✓✓✓✓✓) ▶ To Cave 36 and Xuan Son Ferry (✓✓✓✓) ▶ Cha Loi Cave (✓✓✓✓) ▶ En Cave/Heavens Gate (✓✓✓✓✓)	▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.
Wildlife watching Wildlife watching activities means watching the wildlife from a safe distance both for the visitor and the animals or birds.	▶ Primate Rescue Centre (✓✓✓✓✓) ▶ Bamboo Valley (✓✓✓✓) ▶ Nuoc Mooc Eco-Trail (✓✓✓) ▶ Song Chay River (✓✓✓) ▶ Trooc River (✓✓✓) ▶ Gao Forest (✓✓✓) ▶ Thac Gio Waterfalls (✓✓✓) ▶ Thac Mo Waterfalls (✓✓✓) ▶ A Rem Minority Village and surrounding caves (✓✓✓)	▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.
Swimming Swimming refers to swimming activities in rivers and lakes.	▶ Hang E (✓✓✓✓) ▶ Nuoc Mooc Eco-Trail (✓✓✓✓✓) ▶ Song Chay River (✓✓✓✓✓) ▶ Trooc River (✓✓✓✓✓) ▶ Thac Mo (Dream) Waterfalls (✓✓✓✓) ▶ Thac Gio Waterfalls (✓✓✓)	▶ Domestic market – Independent leisure/holiday travellers, Visiting friends and relatives and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers, expatriates travelling in Vietnam and regional caravanning travellers
Picnicking Picnicking means eating a meal in the outdoors. Generally this refers to having lunch at a scenic location.	▶ Primate Rescue Centre (✓✓✓✓✓) ▶ Nuoc Mooc Eco-Trail (✓✓✓✓✓) ▶ Song Chay River (✓✓✓✓✓) ▶ Trooc River (✓✓✓✓✓) ▶ Thac Gio Waterfalls (✓✓✓) ▶ Chay Lap Village (✓✓✓)	▶ Domestic market – Independent leisure/holiday travellers, Visiting friends and relatives and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers,

Tourism Activity	Tourism Development Locations and Tourism Development Potential - Very Low (✓) to Very High (✓✓✓✓✓)	Tourism Target Markets
	<ul style="list-style-type: none"> ▶ Phong Nha township (✓✓✓) ▶ Thac Mo (Dream) Waterfalls (✓✓✓✓✓) ▶ Other communes and villages (✓✓✓) 	<ul style="list-style-type: none"> ▶ expatriates travelling in Vietnam and regional caravanning travellers
<p>River kayaking or canoeing</p> <p>Kayaking means travelling across water or a river while using a paddle. Kayaking is somewhat different from canoeing by the fact that a kayak has a closed paddling area and a canoe has an open paddling area. Kayakers sit in a seat on the bottom of the boat with their legs extended out in front of them. Canoeists will either sit on an elevated bench seat or kneel directly on the bottom of the boat.</p>	<ul style="list-style-type: none"> ▶ Song Chay River (✓✓✓✓✓) ▶ Trooc River (✓✓✓✓✓) ▶ Song Long Dai River (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>River tubing</p> <p>River tubing means floating in an inner tube down a river. People wear swimsuits or other gear that can be comfortably worn in the water. Life jackets are worn for additional safety.</p>	<ul style="list-style-type: none"> ▶ Hang E (✓✓✓✓) ▶ Song Chay River (✓✓✓✓✓) ▶ Trooc River (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>River cruising on a boat</p> <p>River cruising using the current long boats.</p>	<ul style="list-style-type: none"> ▶ Phong Nha Cave (✓✓✓✓✓) ▶ Song Chay River (✓✓✓✓✓) ▶ Trooc River (✓✓✓✓✓) ▶ Song Long Dai River (✓✓✓✓✓) ▶ Other communes and villages (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.
<p>Mountain biking/cycling</p> <p>Mountain biking and cycling on the roads and paths around the region. Mountain biking involves also the cycling on unpaved roads.</p>	<ul style="list-style-type: none"> ▶ Generally: Selected roads in the PNKB NP and the Bufferzone. ▶ Other communes and villages (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>Flying Fox/Zip Lines</p> <p>A flying fox or zip line is a small cable car attached with a harness system that is</p>	<ul style="list-style-type: none"> ▶ Bamboo Valley (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers.

Tourism Activity	Tourism Development Locations and Tourism Development Potential - Very Low (✓) to Very High (✓✓✓✓✓)	Tourism Target Markets
propelled by gravity. A flying fox or zip line can span across valleys of tree.		<ul style="list-style-type: none"> ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>Motorbike touring</p> <p>This means touring with the motorbike on roads, both unpaved and paved.</p>	<ul style="list-style-type: none"> ▶ Generally: Selected roads in the PNKB NP and the Bufferzone. ▶ Other communes and villages (✓✓✓✓✓) ▶ Bai Dinh Historical Site (✓✓✓✓) ▶ Khe Gat Airfield (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ International market – FITs, backpackers and expatriates travelling in Vietnam.
<p>War-time History</p> <p>Sightseeing involving historical themes referring to the wartime history.</p>	<ul style="list-style-type: none"> ▶ Phong Nha Cave and Dong Tien Son Cave (✓✓✓✓) ▶ Eight Heroic Volunteers Cave (✓✓✓✓✓) ▶ To Cave 36 and Xuan Son Ferry (✓✓✓✓) ▶ Cha Loi Cave (✓✓✓✓) ▶ Bai Dinh Historical Site (✓✓✓✓) ▶ En Cave/Heavens Gate (✓✓✓✓) ▶ Khe Gat Airfield (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.
<p>Ethnic Minority Culture</p> <p>Activities and experiences with Ethnic Minority cultures. This can range from interpretative stories to cooking classes.</p>	<ul style="list-style-type: none"> ▶ A Rem Minority Village and surrounding caves (✓✓✓✓✓) ▶ Ruc Minority Village (✓✓✓✓✓) ▶ Chay Lap Village (✓✓✓✓✓) ▶ Other communes and villages (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>Visiting villages and experience village activities</p> <p>Visiting village experiences and engaging with village activities. This can range from walking through a village to engaging with villagers on daily activities such as ploughing ricefields or cooking.</p>	<ul style="list-style-type: none"> ▶ A Rem Minority Village and surrounding caves (✓✓✓✓✓) ▶ Ruc Minority Village (✓✓✓✓✓) ▶ Chay Lap Village (✓✓✓✓✓) ▶ Other communes and villages (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam.
<p>Scenic Sightseeing</p> <p>Enjoying and experiencing the natural landscape.</p>	<ul style="list-style-type: none"> ▶ Phong Nha Cave and Dong Tien Son Cave (✓✓✓✓) ▶ Bamboo Valley (✓✓✓✓) ▶ Primate Rescue Centre (✓✓✓✓) ▶ Nuoc Mooc Eco-Trail (✓✓✓✓✓) ▶ Song Chay River (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.

Tourism Activity	Tourism Development Locations and Tourism Development Potential - Very Low (✓) to Very High (✓✓✓✓✓)	Tourism Target Markets
	<ul style="list-style-type: none"> ▶ Trooc River (✓✓✓✓✓) ▶ Gao Forest (✓✓✓) ▶ Thac Gio Waterfalls (✓✓✓) ▶ Chay Lap Village (✓✓✓) ▶ Song Long Dai River (✓✓✓✓✓) ▶ Other communes and villages (✓✓✓) ▶ Thac Mo Waterfalls (✓✓✓✓✓) 	
<p>Homestay experience and activities</p> <p>Overnight experience with a local family and engaging in daily life activities.</p>	<ul style="list-style-type: none"> ▶ A Rem Minority Village and surrounding caves (✓✓✓✓) ▶ Ruc Minority Village (✓✓✓✓✓) ▶ Chay Lap Village (✓✓✓✓✓) ▶ Other communes and villages (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Independent leisure/holiday travellers and education/science travellers. ▶ International market – FITs, backpackers, small western tour group travellers and expatriates travelling in Vietnam
<p>Shopping and souvenirs</p> <p>Buying locally made souvenirs.</p>	<ul style="list-style-type: none"> ▶ Phong Nha Cave and Dong Tien Son Cave (✓✓✓✓) ▶ Phong Nha township (✓✓✓✓✓) ▶ Phong Nha Visitor Centre (✓✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – all market segments for selected sites. ▶ International market – all market segments for selected sites.
<p>Scientific research</p> <p>Visiting areas for scientific research and educational purposes.</p>	<ul style="list-style-type: none"> ▶ Hang E (✓✓✓✓) ▶ Hang Toi (Dark Cave) (✓✓✓✓) ▶ Me Bong Con and Hang Vom (✓✓✓✓) ▶ Hang En (✓✓✓✓) ▶ Hang Son Doong (✓✓✓✓✓) ▶ Bamboo Valley (✓✓✓✓) ▶ Primate Rescue Centre (✓✓✓✓✓) ▶ Nuoc Mooc Eco-Trail (✓✓✓) ▶ Gao Forest (✓✓✓✓✓) ▶ Thac Gio Waterfalls (✓✓✓✓) 	<ul style="list-style-type: none"> ▶ Domestic market – Education/science travellers.

Appendix 8: Tourism business operations, Concession Policies and Regulations

1. Introduction

Currently, the major tourism activities in the PNKB NP Region are visiting the Phong Nha Cave Cave (including Dong Tien Son Cave) and the Eight Heroic Volunteers Cave. These sites receive a high volume of visitors, especially during the summer season. Visitors rarely or only occasionally visit other areas of the PNKB NP Region.

Tourism activities in PNKB NP are regulated under Decision No 104/2007/QĐ/BNN of the Ministry of Agriculture and Rural Development regarding the regulations on eco-tourism activities and management in national parks and reserves. At present, Flora and Fauna International (FFI) is developing in partnership with the PNKB NP a 'Regulatory framework for management of tourism activities in Phong Nha Ke Bang National Park' which is based on Decision No 104/2007/QĐ/BNN.

Both, Decision No 104/2007/QĐ/BNN and the draft 'Regulatory framework for management of tourism activities in Phong Nha Ke Bang National Park' address the management of tourism activities inside the National Park. However, there are shortcomings in both documents, in particular it comes to a system to manage tourism activities.

Decision No 104/2007/QĐ/BNN allows the PNKB NP to be land managers, but also to be tourism operators in the protected area environment. This can often lead to a potential conflict of interest in terms of conservation and tourism development aims as the independent regulatory and enforcement agency is also the development agency.

International best practise models for tourism management in protected areas suggest the use of a tourism concession system. The concession system aims to separate 'tourism management' and 'tourism operational activities'. The tourism concession system could be easily integrated with 'Regulatory framework for management of tourism activities in Phong Nha Ke Bang National Park' (referring to Article 5) and it would also align to the regulatory principles of Decision No 104/2007/QĐ/BNN.

2. Background on tourism concession system

What is a tourism concession?

A tourism concession is an official authorisation to operate a commercial tourism activity in National Park, protected area or community. A tourism concession should be seen as a co-operative agreement between two beneficiaries – the management and regulatory authority and the tourism operator and investor. The tourism concession may in the form of a lease, licence, permit or easement.

A tourism concession system helps to ensure that the tourism activities are compatible with the primary aim of protecting the land, resources and cultural integrity of the National Park, protected area or community. It also helps to make sure that services and facilities provided for visitors are appropriate, of a suitable standard and that other activities do not conflict with the visitor experience.

What are the strengths of tourism concession system?

A tourism concession system fosters public and private sector partnerships and makes the best out of the skill levels from all the stakeholders involved. The following table briefly

summarises the skills strengths of the PNKB NP and the potential business sector – tourism operators, investors and community entrepreneurs.

Table 75: Strengths of a tourism concession system

Strengths of the PNKB NP	Strengths of the business sector – Tour operators, investors and community entrepreneurs
<ul style="list-style-type: none"> ➤ Management authority. ➤ Policymaker. ➤ Independent regulator. ➤ Policing and enforcement agency. ➤ Expert stewards of natural, cultural, historic tourism assets. 	<ul style="list-style-type: none"> ➤ Expert in tourism operations and investments – tourism business experience. ➤ Understanding and access to tourism target markets and tourism marketing experience. ➤ Expert skills in tourism activities – such as cave guiding, trekking, kayaking or boat operations. ➤ Financial means, a ways to seek investment for sustainable business ideas.

What are the benefits of a tourism concession system?

A tourism concession system provides considerable benefits to the involved stakeholders. Table 31 outlines the benefits to the PNKB NP and the potential business sector – tourism operators, investors and community entrepreneurs.

Table 76: Benefits of a tourism concession system

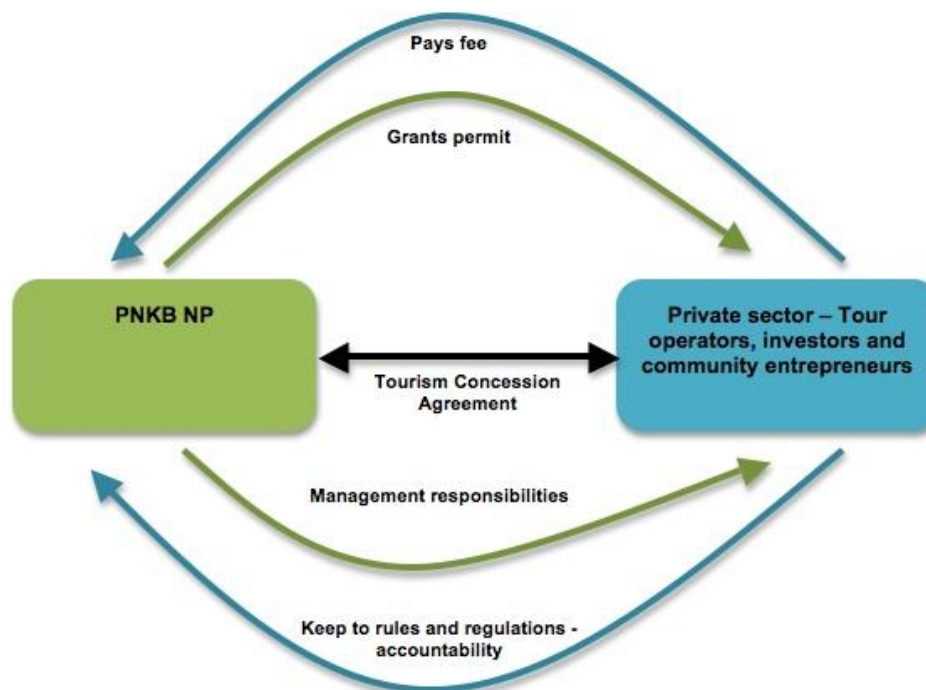
Benefits of a tourism concession system for the PNKB NP	The benefits of a tourism concession system for the business sector – Tour operators, investors and community entrepreneurs
<ul style="list-style-type: none"> ➤ Avoiding conflict of interest of being an enforcement authority and tourism operator at the same time. ➤ Saving time and resources to focus on management with the aim to conserve and protect the environment. ➤ Receiving revenues from tourism activities without operating them, but regulating them so they conform to the National Parks conservation objectives. ➤ Having accountability from tourism operators and investors, including regular monitoring and survey activities. ➤ Having a streamlined regulatory framework for managing tourism activities. ➤ Having an assessment process for tourism activities. ➤ Having the means to strictly enforce operational requirements. 	<ul style="list-style-type: none"> ➤ A legal right to carry out a proposed tourism activity in the PNKB NP. ➤ A formal relationship between the business sector and the PNKB NP so that both parties are aware of their responsibilities and commitments. ➤ Security of tenure for the term of the tourism concession provided that the concessionaire complies with the conditions the tourism concession.

How does the tourism concession system work?

As indicated above, the tourism concession should be seen as a co-operative agreement between two beneficiaries – the management and regulatory authority – the PNKB NP and the tourism operator, investor or community entrepreneur.

With the agreement in place, the PNKB NP would grant permission to a tourism operator, investor or community entrepreneur to operate a tourism activity on the land of the National Park. In return the tourism operator, investor or community entrepreneur would pay a fee to operate a tourism activity on the land of the National Park. The agreement would also include certain responsibilities on both sides. For example, the PNKB NP responsibility would be to ensure the management of the area in which the tourism activity takes place. This may also include the establishment of safety guidelines or the track management. The tourism operator, investor or community entrepreneurs responsibility would be to adhere to the rules and regulations stipulated in the agreement and to be accountable for any activities on the land of the National Park. The following illustration depicts the system.

Figure 12: Tourism concession system



3. Tourism concessions policies and regulations for PNKB NP

Concession process responsibilities

The following policies and regulations are only relevant for the PNKB NP. The PNKB NP is responsible for implementing the concession process. The concession agreements will be between the PNKB NP and the tourism business operator. The final authority of the concession process is with the PPC of Quang Binh.

Types of tourism concessions

Tourism concessions are required for all commercial tourism activities and developments in PNKB NP. The tourism concessions for PNKB NP are organised as described in Table 32. Some concessions may be combined, for example a trekking concession that includes a cave visit.

Table 77: Types of tourism business operating concessions for PNKB NP

Concession Category	Concession Type	Brief Description
A: Tourism Accommodation Operation	A1: Permanent accommodation concession	This includes permanent accommodation facilities. For example houses that already exist and are transformed in homestays.
	A2: Non-permanent accommodation concession	This includes accommodation facilities that are established non-permanently. For example tent or camping sites for trekking trips.
B: Tourism Activity Operation	B1: Trekking concession	This includes trekking related activities such as multi day walks. Specific route will need to be identified.
	B2: Kayaking, Canoeing and Tubing concession	This includes river activities. Specific rivers will need to be addressed.
	B3: Sightseeing Tours concession	This includes any commercial guided tours to the attractions inside the PNKB NP.
	B4: Cave Tour concession	This includes commercial visits to caves.
	B5: Other Tourism Activity concession	This includes any other commercial tourism activities in the PNKB NP.
C. Site/Service Operation	C1. Food and Beverage concession	This includes food and beverage stalls at specific sites in the PNKB NP.
	C2. Souvenirs sales and photographer concession	This includes souvenir stalls and photographer activities in the PNKB NP.

Fee structure and timeframe for tourism concessions

Every concessionaire would be required to pay concession fees for the privilege of obtaining commercial or other benefits from PNKB NP. These fees depend on the specific operation and requirement and will be the result of negotiations. The fee structure may be charged as a percentage of the gross revenue of commercial operations (generally between 5 to 10 percent), per hectare of land developed, per head or per trip charge, a fixed fee, or a combination of these depending on the activity and the market rates.

The duration of concession should be long enough to provide the tourism operator with a long-term outlook of developing and sustaining a business but short enough to react to potential impacts and to mitigate potential issues. Generally concessions can range from 2 years to up to 10 years. If the concession term is up, the tourism operator or investor has to reapply for the concession.

Table 33 provides an indicative fee structure and timeframes for the tourism concessions for PNKB NP.

Table 78: Indicative fee structure and timeframes for tourism concessions for PNKB NP

Concession Type	Fee Structure	Timeframe
A1: Permanent accommodation concession	Negotiated yearly lease on the property.	Between five to ten years.
A2: Non-permanent accommodation concession	Negotiated yearly lease on site.	Up to five years.
B1: Trekking concession	Per person fee.	Up to three years.
B2: Kayaking, Canoeing and Tubing concession	Per person fee.	Up to three years.
B3: Sightseeing Tours concession	Per person fee.	Up to three years.
B4: Cave Tour concession	Per person fee.	Up to three years.
B5: Other Tourism Activity concession	Per person fee.	Up to three years.
C1. Food and Beverage concession	Negotiated yearly lease on site.	Up to five years.
C2. Souvenirs sales and photographer concession	Negotiated yearly lease on site.	Up to five years.

Requirements of a tourism business operating agreement

Tourism business operating agreements vary depending on the type of agreement and on the type of activity that is to be provided. Table 34 lists the minimum requirements for a tourism business operating agreements.

Table 79: Requirements for a tourism business operating agreement for PNKB NP

Requirements for a Tourism Business Operating Agreement
<ul style="list-style-type: none"> ➤ A clear and detailed description of the relevant tourism activities – the description includes equipment used, visitor numbers, number of trips per day, specific sites that are used etc. ➤ The conditions of the agreement – limitations for example for trips or visitors per day, will the agreement be fee based or revenue based? and the term of the agreement. ➤ A detailed list of the potential impacts of the tourism activity. ➤ A method how the concessionaire will monitor and evaluate the impacts and possibly mitigate the impacts of the tourism activity. ➤ A statement that the proposed activity is in accordance with all current planning documents. ➤ A detailed health and safety plan for the tourism activity. ➤ A description of how the tourism activity will contribute to the conservation of the PNKB NP. ➤ A list of responsibilities of the PNKB NP.

Applications process for tourism business operating permission

The process to obtain a tourism business operating permission would be structured in six key steps:

Step One - Application – Proposal for a specific tourism activity

- The tourism operator, investor or community entrepreneur would need to fill in a standardised application form for the proposed activity. A business plan and any additional information such as an environmental impact assessment may be included to the application form.

Step Two - Review of the application by PNKB NP

- Qualified staff of the PNKB NP would review the application form and check if all the necessary information is provided. This may also include a preliminary assessment if the proposal is suitable for the PNKB NP.

Step Three - Clarify additional comments

- If there are any documents missing or if there are any parts unclear in the proposal, the PNKB NP would clarify these with the tourism operator, investor or community entrepreneur

Step Four - Consultation with relevant stakeholders

- The application information would be forwarded to the PPC of Quang Binh and relevant government departments. It is important to note that if the proposed activity is related to the Bufferzone of the PNKB NP, the community should also be integrated in the consultation process. Ideally the proposal would be notified publicly advertised so that there is an opportunity for interested people to make submissions. A public hearing or wider consultation process may also be necessary to allow people to present their views in more detail.

Step Five - Decision making

- After the consultation process the PNKB NP in discussion with the PPC of Quang Binh will make a decision if the concession could be granted or not. A draft concession agreement will be developed that clearly states the responsibilities and conditions of all parties involved.

Step Six - Finalising the concession agreement

- The draft concession agreement will need to be negotiated and then finalised so the tourism activity can start in the PNKB NP.

4. Tourism operating agreements for the Bufferzone

Tourism operating agreement responsibilities

The legislation and organisation of tourism in the Bufferzone is different to the PNKB NP. In the PNKB NP, the National Park authority is a manager of tourism development with the aim to protect and conserve the environment. In the Bufferzone, the relevant district and communes authorities manage tourism, however the management requirements are considerably lower. Here the community itself plays a core role and generally acts as a

partner for tourism developers and investors. Moreover, with CBT development the community actively engages in tourism development with a tourism operator.

The Bufferzone includes 13 communes and tourism can affect a variety of villages. Communes and villages can engage with tourism operations independently. Commercial tourism operators working with the communities need to formulate cooperative agreements with the specific communities, communes and relevant district authorities – community tourism management boards. The final authority for tourism operations in the Bufferzone is with the DPC and PPC of Quang Binh

Types of tourism operating agreements

Tourism operating agreements between communities and tourism operators are required for all commercial tourism activities and developments in Bufferzone. An operating agreement may include more than one type of agreement. The tourism operating agreements for the Bufferzone can be organised as described in Table 35.

Table 80: Types of tourism business operating agreements for the Bufferzone

Agreement Category	Agreement Type	Brief Description
A: CBT Operating Agreement	A1. Homestay operation	This includes any agreements relevant to homestay operations.
	A2. Community tourism activities	This includes any agreements relevant to community tourism activities.
	A3. Cultural performances/activities	This includes any agreements relevant to cultural performances/activities.
B: Other Tourism Activities	B1: Other tourism activities	This includes agreements that do not relate directly to CBT

Fee structure and timeframe for tourism operating agreements

Tour operators engaging with the community are required to pay a fair price for the services and experiences they receive from the community. It is expected that tour operators deal responsibly with the community especially in the fee negotiations process. Often communities are inexperienced in terms of pricing for tourism activities. It is expected that tour operators from agreements based on at least markets rates for activities and experiences. It is generally suggested that fee's should be based on a per person basis for CBT activities.

The duration of a business agreement should be long enough to provide the tourism operator with a long-term outlook of developing and sustaining a business but short enough for the community to react to potential impacts and to mitigate potential issues. At this stage, the business agreements should not be longer than up to two years. This should ensure that fee's can be adjusted to market rates.

Table 36 provides an indicative fee structure and timeframes for the tourism business agreements in the Bufferzone.

Table 81: Indicative fee structure and timeframes for tourism operating agreement for the Bufferzone

Agreement Type	Fee Structure	Timeframe
A1. Homestay operation	Per person fee.	Up to two years.
A2. Community tourism activities	Per person fee.	Up to two years.
A3. Cultural performances/activities	Per person fee.	Up to two years.
B1: Other tourism activities	Per person fee.	Up to two years.

Requirements of a tourism business operating agreement

The tourism operating agreement is in essence a business agreement between the tourism operator and the community. By signing the agreement the tourism operator gains the privilege to work with the community, while the community gains to privilege to work with a responsible tourism operator.

The principles of CBT planning and development dictate that local communities must be in a position of determining the conditions of tourism activities that take place in their communities (the approach and processes of CBT development are further elaborated on in Section 4.6.). This requires that local communities, typically represented by a Local Tourism Management Committee, are able to determine, discuss, and decide the terms of tourism business activities in their communities. Effective and equitable operating arrangements between local communities providing tourism services and tour operators that bring visitors to these communities is very important as it supports efficiently operated and well coordinated tourism services, equitable distribution of benefits, quality tourism experiences, and friendly host-guest and business operating relations.

Annex 6 provides an example of an operating agreement between a local community tourism management board and tourism operate to facilitate clear understanding and mutual responsibilities to provide quality tourism experiences with an equitable sharing of benefits.

Appendix 9: Operating Agreement for Community Based Tourism in the Bufferzone

Operating Agreement: ("X") Community Tourism Management Board (CTMB) and Responsible Tour Operator

1. Objective and Intent

The objective is to develop of a rewarding, high quality and sustainable tourism experience through efficient operations with equitable sharing of benefits, clear expectations and responsibilities and shared interests.

Both parties recognise and realise the importance of sustaining a healthy tourism experience; for local community members, tourists, and tourism businesses. For the local community a healthy tourism experiences contributes to an overall improved quality of life with an equitable distribution of benefits. For tourists this means a genuine, high quality, well valued, safe and enjoyable experience. For tour operators this means a high quality, consistent, authentic and viable tourism product.

For tourism activities in ("X") village to evolve in a well-managed and healthy manner, it is seen as appropriate to formalise expectations and working arrangements between the Community Tourism Management Board and Responsible Tour Operators to ensure that these objectives are met. The intent of this agreement is to create a formal understanding between the parties to support these mutual interests in an open and fair manner.

2. Parties: (Name and legal status)

The Community Tourism Management Board (further to referred to as the CTMB) was incorporated as a ("X") on ("Y") and consists of ("X") members and is represented by its Chairperson:

Mr/s ("Y")

Tour Operators (further to referred to as the Tour Operator) is a registered company, established by ("X") on ("Y"), represented here by:

Mr/s ("W")

3. Duration:

The duration of this Agreement is ("X") year(s) from the date of signing. This agreement will be reviewed by both parties on an annual basis at a mutually agreeable time and monitored intermittently.

4. Agreements and Contributions

1. General Agreements that both parties agree to:

- Look out for the mutual best interests of both parties.
- Maintain open and clear lines of communication and sharing of information.
- Seek to provide a quality experience for visitors and members of the host community.
- Respect and uphold the contractual obligations as set out in the Operational Agreement.
- Adhere to supporting the Visitor Codes of Conduct.

2. Specific Agreements on values-based objectives

2.1 Conserving culture and customs

Core values and objectives:

Tourism activities will contribute to the preservation and enhancement of local cultures and customs.

Agreements:

Tour operators agree to listen to and respect requests and suggestions of the CTMB or community members regarding culture and customs, and ask for permission and seek clarification before engaging in local customs or cultural practices.

The community agrees to provide a high quality, authentic, and safe experience for visitors that respects and presents cultural and customary activities in a fair and healthy way.

2.2 Environmental protection and waste management

Core values and objectives:

Respect and conservation of the local environment is a fundamental priority in the development and maintenance of a healthy and sustainable tourism experience.

Agreements:

Tour operators agree to: minimise natural resource consumption created by tourist visits, ensuring that local resources are not put under undue strain, avoid the use of chemicals, and dispose of waste properly using a “best practices” approach.

The community agrees to: Maintain a clean local environment, seek to conserve natural resources consumed in supporting tourism activities, and manage local waste in responsible manner.

2.3 Local economic benefits

Core values and objectives:

The creation and fair distribution of local economic benefits is an important objective for the development and maintenance of a high quality tourism experience.

Agreements:

Tour operators agree to participate and contribute to the local economy, and encourage their clients as well, by purchasing products and services and contributing to local economies in a manner that distributes benefits as fairly as possible.

The local community members agree to contribute to a fair distribution of economic benefits from tourism that includes enhanced opportunities for the more disadvantaged members of the community.

3. Supporting Codes of Conduct and Operational Agreement:

3.1 Visitor’s Codes of Conduct (Annex 1)

Positive visitor and host experiences is of fundamental importance. In order to support this a Visitor’s Codes of Conduct that describes the expected behaviours for visitors developed

by the CTMB. These are to be distributed to visitors by the Tour Operator prior to their arrival. These codes will also be made readily available in the village by the CTMB.

3.2 Operational Agreement (Annex 2)

Effective operations benefits both local communities and tour operators as it promotes efficiencies, reliable and quality experiences, and ease of operations. An Operational Agreement has been developed with the intent to provide detailed understanding and working arrangements between both parties on all relevant matters pertaining to the fair and efficient delivery of tourism services and activities.

4. Cost-Benefit Distribution

The CTMB regulations set forth a clear system for distributing the cost and benefits of tourism activities. Tour operators are expected to support and contribute to this system. An annual open meetings when accounting books are presented. Signatories to Operating Agreement can request this annual report.

5. Liabilities – Responsibilities

Tour Operators maintain the liability and responsibility for the safety and health of their customers. Tour Operators are ultimately responsible for the behaviours and actions of their clients and will be held accountable for any damages caused to local facilities and equipment as a result of both their and their clients actions.

The CTMB is responsible for ensuring that tourism facilities and services are maintained and delivered at a high level of quality and reliability. All members of the commune will seek to ensure the safety and health of all visitors to their best abilities.

6. Dispute Resolution

Both sides will make all efforts to resolve any conflicts or difference through mutual agreements and shared understandings. If an amicable resolution can not be achieved through these efforts, then the laws pursuant to the country of Vietnam will be applied.

7. Modifications and Terminations

Proposals for modification of the Agreement can be made by either party for the consideration of the other at any time. When both parties are amenable, modification to this agreement will be made through an amending document to be signed by both parties.

Either party can terminate this agreement at any point through clearly expressing their reasons and why termination is the desired option. In the event of an agreement termination both parties will seek to find an equitable and fair solution.

Signatures:

The Community Tourism Management Board:

Mr/s. (“Y”) is the Chairperson

Tour Operators, represented here by:

Mr/s (“Z”)

Annexed

1. Visitor’s Codes of Conduct

2. Operational Agreement

Appendix 10: List of Potential Tourism Development Indicators

Adapted from: "Community-Based Tourism Monitoring and Management Toolkit. Developed for SNV Asia's Regional Tourism Knowledge Network. Developed and published in cooperation with SNV, Dr Louise Twining-Ward, ST-CRC and the University of Hawaii, 2007.

I. Environmental Indicators

Conservation

ISSUE	No	POTENTIAL INDICATOR
FOREST CONSERVATION	1.	Percentage of forest under sustainable use programme
	2.	Extent of protected areas square km
	3.	Degree of degradation in areas designated as critical for biodiversity
	4.	Change in state of forest resources in sample areas
	5.	Percentage change in primary forest cover
	6.	Presence of key species
	7.	Number of species known to be in decline
	8.	Number of threatened or extinct species as percentage of all known species
TOURISM & NATURE	1.	Perceived value of key species to tourism
	2.	Perceived value of forest resources to tourism
	3.	Number of days tourists spend on nature tourism activities out of total number of days holiday
	4.	Number of tourists visiting designated sites per month
	5.	Income earned from tourism in conservation areas and parks
	6.	Number of donor agencies supporting ecotourism projects
	7.	Percentage of protected area managers estimating tourism provides fifty percentage or more of total revenues to the area
	8.	Number of villages with by-laws concerning the careful management of forest resources
	9.	Number of ecotourism activities in sampled conservation areas
TOURISM PRACTICES	1.	Number of hotels with environmental policy
	2.	Number of tour operators who have taken steps to address their environmental impact
	3.	Percentage of EIAs for which follow-up studies have been carried out

Waste

ISSUE	No	POTENTIAL INDICATOR
REGIONAL WASTE	1.	Waste generation intensity expressed per capita or per unit of GDP
	2.	Hazardous waste per unit of GDP
	3.	Percentage of villages with public litter bins
	4.	Change in reported tidiness of villages by beautification committee inspection
	5.	Percentage of households keeping pigs fenced in
	6.	Legislation in place for the management of human waste
	7.	Change in regional expenditure on rubbish collection per capita
	8.	Environmental awareness campaigns conducted
	9.	Number of shops actively seeking to reduce plastic packaging
	10.	Number of drop toilets (pit latrines) in use over lagoon areas
	11.	Number of NGO activities focused on the reduction of waste
	12.	Number of villages with by-laws/committees for keeping village clear of litter
TOURISM & WASTE	1.	Change in volume of litter produced at designated tourist sites
	2.	Change in percentage of sewage from tourist facilities receiving treatment
	3.	Number of composting toilets in use by tourism industry
	4.	Number of hotels separating their wastes
	5.	Tourist perception of littering/waste problems
	6.	Quantity of waste strewn in public areas (garbage counts)
	7.	Faecal coliform count in rivers/lakes
	8.	Number of hotels with waste management policies
	9.	Number of operators who actively encourage guests to take their non-biodegradable rubbish home with them
	10.	Number of beach clean-ups per week at designated sites
	11.	Number hotels (separating) composting/recycling 25% or more of their waste products
	12.	Number of reported contamination events per annum linked to tourism developments
	13.	Hotel expenditure on sewage treatment
	14.	Change in waste management evaluation given to selected sites during site inspection
	15.	Number of tourist sites which have been targeted by environmental awareness campaigns

Water

ISSUE	No	POTENTIAL INDICATOR
WATER QUALITY	1.	Demand/supply ratio for water
	2.	River water quality by amount of oxygen and nitrogen in water
	3.	Domestic water consumption per capita
	4.	Price for water per cubic meter
	5.	Intensity of use of water resources (annual water withdrawal/available water resources)
	6.	Faecal coliform and heavy metal count in water supply
	7.	Frequency of water-borne diseases: number/percentage of reports
	8.	Ratio between use of non-renewable and renewable water supply
	9.	Annual withdrawal of ground and surface water
	10.	Number of reports of water leakages per year
	11.	Expenditure on repairs and upgrading of water pipes
	12.	Percentage population served by recycled water
	13.	Water availability per capita
	14.	Water saving (% reduce, recaptured or recycled)
	15.	Percentage of commercial water users with water meters
WATER SUPPLY	1.	Access to safe water
	2.	Number of reported development incursions into water catchment areas
	3.	Number of catchments used for livestock grazing
	4.	Percentage water catchment areas protected from inappropriate uses
	5.	Number of hotels located in catchment areas
	6.	Awareness campaigns conducted about keeping water catchment areas clean
	7.	Number of schools including the importance of water catchment areas in their curriculum
	8.	Change in number of landowners with livestock in catchment areas
	9.	Number of villages with by-laws to protect catchment areas
	10.	Number of inappropriate activities in water catchment areas
WATER USE	1.	Number of hotels with dual flush toilets
	2.	No of hotels on metered water
	3.	Number of tourism developments in catchment areas
	4.	Number of identified water efficiency measures commonly used by tourism facilities
	5.	Change in ratio of water volume used by tourists / used by residents per head
ELECTRICITY USAGE	1.	Per capita consumption of energy from all sources
	2.	Electricity usage per tourist per day
	3.	Electricity usage per tourist per year by type and/or category of the tourist establishment
	4.	Percentage of businesses participation in energy conservation programmes
	5.	% of energy consumption from renewable resources

II. ECONOMIC INDICATORS

ISSUE	No	POTENTIAL INDICATOR
TOURISM INCOME	1.	Average wage rates in tourism jobs hotels/restaurants/others
	2.	Number of local people employed in tourism (men and women)
	3.	Revenues generated by tourism as % of all revenues generated in the community
	4.	Percentage of visitors who overnight in local tourist accommodation
	5.	Annual expenditure by souvenir outlets on village-produced goods
	6.	Income from tourism in designated villages
	7.	Number of community-run tourism ventures
	8.	Number of village groups in designated villages directly or indirectly involved in tourism
	9.	Annual value of national goods consumed by the tourism sector/Total consumption by the sector
	10.	Number of people in rural areas primarily occupied at tourist accommodation facilities
	11.	Number of rural residents (by gender) employed directly in tourism
SUPPLYING TOURISM	1.	Number of rural residents engaged in supplying goods to tourists or tourist facilities
	2.	Percentage of products and services consumed by tourists which are supplied locally
	3.	Longevity of tourism businesses (rate of turnover)
	4.	Strength of membership of local tourism associations
	5.	Percentage of hotels with a majority local staff
	6.	Percentage of non-local-made souvenirs stocked by main souvenir outlets
	7.	Number of hotels under expatriate management
REGIONAL TM EARNINGS	1.	Percentage of employment provided by tourism
	2.	Average annual growth in direct employment in tourism
	3.	Average hourly earnings (male/female/part-time) in tourism compared to regional average
	4.	Average growth in total tourism expenditure per visitor
	5.	Total expenditure per tourist per day
	6.	Percentage of GDP provided by tourism
	7.	Change in number of visitor arrivals
	8.	Average tourist length of stay
	9.	Annual investment spend of tourism sector as a percentage of total turnover
	10.	New tourism businesses as a percentage of all new businesses
	11.	Percentage change in number of hotel rooms in existing establishments
LOCAL TOURISM EARNINGS	1.	Percentage of exchange leakage from tourism revenues
	2.	Import duties collected from tourism sources
	3.	Aid/grant money into the tourism industry as percentage of total revenues
	4.	Contribution of tourism to local economy (measure of dependency)
	5.	Ratio of foreign to local partners in hotels
	6.	Percentage of tourism ventures registered to local community owners
	7.	Reliance of tourism industry on foreign aid and grants
	8.	Percentage of registered tourism businesses with Samoan managers

III. POVERTY INDICATORS

ISSUE	No	POTENTIAL INDICATOR
COMMUNITY INCOME	1.	Annual income generated by the community
	2.	Ration of income attributable to tourism versus traditional income generating activities
	3.	Ratio of time dedicated to tourism versus traditional income generating activities
	4.	Ratio of time dedicated to tourism versus tourism income
	5.	Annual financial contribution by tourism to community projects
MICRO ENTERPRISES	1.	Total number of SMEs operating in the community
	2.	Incentives for SMEs in the community
	3.	Community survey of the usefulness and success of various development programmes
	4.	Number and type of development programmes in place (education, training)
LOCAL EMPLOYMENT	1.	% workers in the community directly employed by tourism, % full time, % part time)
	2.	Ratio of top to the lowest paid local tourism worker
	3.	Annual audit of the contribution of different activities to household needs
	4.	% indigenous people employed directly in tourism
	5.	Ratio of locals to "outsiders" employed in tourism

IV. EQUITY INDICATORS

ISSUE	No	POTENTIAL INDICATOR
OPPORTUNITIES FOR WOMEN	1.	Women/men as a % of all tourism employment
	2.	Women/men as a % of all formal tourism employment
	3.	Women/men as a % of all informal tourism employment
	4.	% women/men in part-time employment
SENIORITY	1.	% of women/men in different tourism income earning categories
	2.	% of women/men in unskilled, semi-skilled, and professional positions in the industry
ENTREPRENEURS	1.	% of owner-operator tourism businesses run by women/men
	2.	% of tourism businesses registered under women/men
TRAINING	1.	% women/men tourism employees with formal tourism training
	2.	% women/men employees sent on training programmes
COMMUNITY TOURISM	1.	% women/men involved directly (providing services) in village-based tourism projects

ISSUE	No	POTENTIAL INDICATOR
	2.	% women/men involved indirectly (supplying goods) in village-based tourism projects
OWNERSHIP	3.	% women/men owning/controlling village tourism businesses
REWARDS	1.	Average income for Women/men working in village-based tourism businesses
	2.	% women/men involved in village-base tourism satisfied with their work and rewards
LAND OWNERSHIP	1.	% women/men with rights to land in tourism development areas
	2.	% women/men holding rights to tourism leases
LOANS	1.	% bank loans issues to women/men for tourism ventures
	2.	% women/men defaulting on bank loans
	3.	% donor grants issued to women/men for tourism ventures

V. SOCIAL AND CULTURAL INDICATORS

ISSUE	No	POTENTIAL INDICATOR
RESIDENT CONFLICTS	1.	Number of complaints from tourists about local behaviour
	2.	Number of tourist-related crimes reported
	3.	Local satisfaction with tourism
	4.	Number of villages where tourism-related problems have been addressed
	5.	Satisfaction with tourism in villages with tourism/without tourism activities
CRIME	1.	Number of crimes reported by tourists in the destination / Total number of tourists per year
	2.	% tourists who regard the destination as safe
	3.	Number of beaches with security/beach patrol
	4.	Number of visitors charged with crime
	5.	Number of crimes reported by tourists in the destination / Total number of tourists per year
	6.	Number of child prostitution cases detected/tourists
HANDICRAFTS	1.	Quality rating of souvenirs sold at main souvenir outlets
	2.	Tourist satisfaction with quality of souvenirs
	3.	Change in quality of arts and crafts produced for tourist market at key source villages
	4.	Number of known carvers supplying the souvenir trade
	5.	Percentage of sampled villages using a traditional meeting house

ISSUE	No	POTENTIAL INDICATOR
	6.	Number of new houses which are built in the traditional style in sampled villages
	7.	Income from souvenir trade
PERFORMING ARTS	1.	Authenticity of dances and songs evaluated at tourism festivals
	2.	Assessment on the degree of participation, in cultural expressions within the tourist destination (gastronomy, design and adaptation, shows, entertainment, handicraft)
	3.	Change in quality of specific song and dance performances
	4.	Number of training programmes available in performing arts
	5.	Number of competitions for traditional dance performances
	6.	Number of events including traditional dance performances per year
	7.	Income generated by dance nights at designated hotels
	8.	Expenditure per day from tourists during festivals compared to other times

VI. TOURISM BUSINESS OPERATIONS INDICATORS

ISSUE	No	POTENTIAL INDICATOR
VISITOR FLOWS	1.	Average expenditure/length of stay = average spend per visitor by type
	2.	Occupancy rates of licenced accommodation per month
	3.	Total number of tourist arrivals (mean, monthly, peak periods)
	4.	Change in Number guest nights at commercial accommodation
TOURIST SATISFACTION	1.	Level of satisfaction of visitors
	2.	Percentage of returning visitors
	3.	Perception of value for money
MARKETING IMPACT	1.	% share of arrivals from largest market
	2.	Amount spent on marketing per visitor
	3.	Change in number of hits to promotional website
BUSINESS PERFORMANCE	1.	Businesses offering tourism services as % of all businesses
	2.	Value of new foreign/resident applications for hotel development per year
	3.	Longevity of tourism businesses (rate of turnover)
	4.	Cost/price ratios of accommodation, attractions, tours and packages compared to industry/ competitors

VII. AWARENESS RASINING

ISSUE	No	POTENTIAL INDICATOR
REGIONAL AWARENESS	1.	Percent age of individuals who have participated in tourism awareness programmes
	2.	Number of formal tourism awareness programmes which provide people with information about what to expect from tourism and how to interact with tourists
	3.	Number of TV and radio "short spots" on appropriate tourism awareness
	4.	Number of media features focused on tourism issues over sample period
	5.	Number of letters to the editor of local newspaper on tourism issues
TRAINING AVAILABILITY	1.	Funds spent on tourism training
	2.	Percentage of tourism employees with formal tourism training
	3.	Percentage of tourism training which takes place in rural areas
	4.	Number of people (by age/gender and rural/urban residence) completing designated tourism training courses per year
	5.	Number of places available on formal and informal tourism training courses
	6.	Number of tourism industry association members with formal tourism training
COURSE CONTENT	1.	Number of tourism courses including environmental education in their curriculum
	2.	Percentage of tourism courses including some degree of cultural education in their curriculum
	3.	Percentage change in amount of emphasis given to specific aspects of sustainable tourism in formal tourism education
	4.	Awareness amongst tourism course graduates of sustainable tourism issues
TOURIST LEARNING	1.	Percentage of visitors who leave the area with some understanding of local culture
	2.	Percentage of visitors taking tours
	3.	Percentage of visitors choosing cultural instead of scenic tours
	4.	Percentage of visitors taking part in in-depth cultural experiences or home stays
	5.	Number of families providing homestays
	6.	Number of villages organising specific cultural programmes for tourism
	7.	Number of initiatives for educating tourists about correct behaviour in villages
	8.	Percentage of marketing collaterals produced by inbound tour operators, providing information to tourists about appropriate behaviour and dress
	9.	Number of hotels providing information about village rules

VIII. MONITORING SCHEME PERFORMANCE INDICATORS

ISSUE	No	POTENTIAL INDICATOR
SUSTAINABLE TOURISM OBJECTIVES	1.	Knowledge of objectives amongst tourism operators
	2.	Knowledge of objectives by Minister of Tourism and Board of Directors
	3.	Number of Tourism Ministry publications with information about the objectives
	4.	Level of support for objectives from Tourism Department staff
	5.	Level of satisfaction of Monitoring Working Group members with use of objectives
INDICATOR USE	1.	Number of times indicator results have been published
	2.	Knowledge of monitoring programme by key stakeholder groups
	3.	Indicator Working Group satisfaction with the measurement of indicators
	4.	Number of projects initiated due to indicator results
	5.	Number of activities undertaken by the Tourism Department during the year, which focus on one or more aspects of sustainability (as defined in the objectives)
	6.	Number of times indicators have been monitored
	7.	Number of reviews of indicator list undertaken

IX. TOURISM MANAGEMENT INDICATORS

ISSUE	No	POTENTIAL INDICATOR
ATTRACTIONS	1.	Expenditure on cultural and historical monuments
	2.	Number of attraction sites managers who have had tourism training
	3.	Number of sites with appropriate directional signage and interpretation boards
	4.	Number historical and cultural sites protected by village or national law
	5.	Number of hotels sending employees on staff training
FACILITIES & SERVICES	1.	Percentage of staff who have attended tourism training courses
	2.	Tourist satisfaction with sites facilities and services
	3.	Percentage of overseas visitors making return trips
	4.	Change in quality valuation of designated tourism facilities and services
	5.	Number of hotels with undertaking guest satisfaction questionnaires
TOURISM DEVELOPMENT	1.	Percentage of new developments using local architecture
	2.	Existence of land use or development planning processes
	3.	% area subject to development control
	4.	Percentage of new developments using low rise facilities which blend into the existing surroundings

ISSUE	No	POTENTIAL INDICATOR
	5.	Existence of environmental review procedure or controls over site development
	6.	Percentage of new tourism developments that are screened
	7.	Number of tourism developments not in compliance with tourism plan
	8.	Number of developments required to change size or form due to screening
	9.	Percentage difference between planned and actual growth of tourism in survey year
LANDSCAPES	1.	Amount of land under protection as percentage of all land
	2.	Planning legislation for development in significant areas
	3.	Percentage of critical tourist landscapes protected by national or village law
	4.	Current state of important natural and historic landscapes
	5.	Number of inappropriate developments in landscapes identified as being of key importance to tourism
	6.	Amount of land under protection as percentage of all land
	7.	Planning legislation for development in significant areas
STAKEHOLDER ROLE	1.	Number of communities satisfied with their role in tourism developments in their villages
	2.	Degree of stakeholder involvement in preparation of major planning documents
	3.	Percentage of industry stakeholders who feel they are adequately/regularly consulted about tourism planning and policy-making
	4.	Number of identified stakeholder groups who participated in the preparation of major planning documents and degree of consultation
	5.	Representation of diverse stakeholder interest on tourism decision-making bodies
	6.	Number of villages within designated tourism development zones that have received some awareness information about tourism development
	7.	Number of villages that have drawn up their own tourism plan
	8.	Degree of consultation between investors and village land owners
	9.	Number of village councils with tourism land lease agreements, who are satisfied with the arrangement
USE INTENSITY	1.	Number of tourists per square metre of the site and per Km of the destination
	2.	Ratio of locals to tourists on peak days

Appendix 11: List of key participants in the planning process

Full name	Organization	Position
Mr. Tran Cong Thuat	People's Committee of Quang Binh province	Vice Chairman
Mr. Le Van Phuc	Department of Planning and Investment of Quang Binh province	Director
Mr. Nguyen Van Ha	Department of Planning and Investment of Quang Binh province	Vice Director, Former Director of the PNKB Region project
Mr. Le Hung Phi	Department of Culture, Sport and Tourism of Quang Binh province	Director
Mr. Nguyen Van Ky	Department of Culture, Sport and Tourism of Quang Binh province	Vice Director
Mr. Luu Minh Thanh	Phong Nha - Ke Bang National Park	Director
Mr. Dang Dong Ha	Phong Nha - Ke Bang National Park	Vice Director, Head of the STDP Task Force Group
Mr. Le Thanh Tinh	People's Committee of Quang Binh province	Specialist, Member of the STDP Task Force Group
Mr. Le Thanh Binh	Tourism Information and Promotion Center (Department of Culture, Sport and Tourism)	Director, Member of the STDP Task Force Group
Mr. Le The Luc	Sustainable Tourism Development in Mekong Sub-region Project	Director, Member of the STDP Task Force Group
Mr. Trang Hieu Tuong	Ilumtics Training and Consultancy Company	Director, Member of the STDP Task Force Group
Mr. Arnoud Steeman	PNKB Region Project (KfW Component)	Former Chief Technical Advisor
Mr. Luong Quang Hung	PNKB Region Project (KfW Component)	CTA Deputy, Member of the STDP Task Force Group
Mr. Joachim Esser	PNKB Region Project (GTZ Component)	Former Chief Technical Advisor
Mr. Truong Si Hong Chau	PNKB Region Project (GTZ Component)	Project Coordinator, Member of the STDP Task Force Group
Mr. Le Van Lanh	Tourism Resource Consultants New Zealand - TRC	Author of the STDP for the PNKB NP Region
Mr. Achim Munz	Tourism Resource Consultants New Zealand - TRC	Author of the STDP for the PNKB NP Region
Mr. Douglas Hainsworth	Tourism Resource Consultants New Zealand - TRC	Author of the STDP for the PNKB NP Region



by

The Herpetology Team & Phong Nha – Ke Bang Nature Conservation Project
of Cologne Zoo

11 – 2011

A report for

The Nature Conservation and Sustainable Natural Resource Management in
Phong Nha – Ke Bang National Park Region Project, Quang Binh



VIETNAM-GERMANY DEVELOPMENT COOPERATION (BMZ 2004 65 989)

Research Team: Nguyen Quang Truong, Pham The Cuong,
Institute of Ecology and Biological Resources, Hanoi, Vietnam
Nguyen Van Dai, An Thi Hang
Vietnam National Museum of Nature, Hanoi, Vietnam
Dang Ngoc Kien, Dinh Huy Tri
Science Research and Rescue Centre,
Phong Nha – Ke Bang National Park, Quang Binh, Vietnam

Project Director: Nguyen Trung Thuc
Nature Conservation and Sustainable Natural Resource
Management in Phong Nha-Ke Bang National Park Region
Project
Dong Hoi, Quang Binh, Vietnam

Project Chief
Technical Advisor: Bas van Helvoort
Nature Conservation and Sustainable Natural Resource
Management in Phong Nha-Ke Bang National Park Region
Project
Dong Hoi, Quang Binh, Vietnam

Map: Phong Nha – Ke Bang Nature Conservation Project of Cologne Zoo
and Institute of Ecology and Biological Resources

Project Funding: Kredit-anstalt für Wiederaufbau – German Development Bank
Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ)
GmbH - German International Cooperation
People’s Committee of Quang Binh Province

Available from: Project Office
Nature Conservation and Sustainable Natural Resource Management
in Phong Nha-Ke Bang National Park Region Project
No. 9 Quang Trung Road, Dong Hoi City, Quang Binh, Vietnam
Phone: +84 52 3850835 Fax: +84 52 3844143

Citation: Nguyen Quang Truong et al. (2011): Diversity of reptiles and
amphibians in and around the Phong Nha – Ke Bang National Park,
Quang Binh, Vietnam. A scientific report of the Nature Conservation
and Sustainable Natural Resource Management in Phong Nha-Ke
Bang National Park Region Project.

TABLE OF CONTENT	2
ACRONYMS AND ABBREVIATIONS.....	4
EXECUTIVE SUMMARY	5
ACKNOWLEDGEMENTS.....	7
1. INTRODUCTION.....	8
1.1 Overview of the report	8
1.2 Phong Nha – Ke Bang National Park and the PNKB Regional Project.....	8
1.2.1 Brief history of the Phong Nha – Ke Bang National Park.....	8
1.2.2 Project background	9
1.3 Physical conditions and climate of PNKB NP	10
1.3.1 Topography and hydrology.....	10
1.3.2 Climate.....	10
1.4 Previous biodiversity survey work on the herpetofauna in and around PNKB NP....	11
1.4.1 Diversity of the herpetofauna	11
1.4.2 New species discovered from PNKB NP and adjacent area.....	12
2. OBJECTIVES OF THE SURVEY ON REPTILES AND AMPHIBIANS	14
2.1 Aims of the survey	14
2.2 Specific objectives of the survey	14
3. RESULTS OF THE SURVEYS ON REPTILES AND AMPHIBIANS	15
3.1 Overview	15
3.2 Survey sites and Methods.....	15
3.2.1 Schedule of activities	15
3.2.2 Methods.....	16
3.2.3 Data analysis	17
3.2.4 Survey sites	17
3.3 Results and Discussion.....	19
3.3.1 Species diversity	19
3.3.2 New discoveries.....	22
3.3.3 Threatened species of reptiles and amphibians recorded from PNKB NP and extension area.....	23

3.3.4 Threats and conservation concerns	26
4. CONCLUSIONS AND RECOMMENDATIONS	29
4.1 Conclusions	29
4.2. Recommendations for the NP Management Plan	29
4.2.1 Further studies	29
4.2.2 Conservation activities	30
5. REFERENCES	32
Annex 1. Report on the training for park and survey staff	35
Annex 2. List of reptiles and amphibians recorded from Phong Nha – Ke Bang National Park and extension area	37
Annex 3. Schedule of activities	49
Annex 4. GPS readings for survey sites in and around the Phong Nha – Ke Bang National Park	51
Annex 5. Map of survey sites in Phong Nha – Ke Bang NP and extension area	53
Annex 6. Landcover map of Phong Nha – Ke Bang NP and extension area	54
Annex 7. List of survey participants and reporting contributors	55
Annex 8. Illustrational color plates	56

Acronym	Meaning
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPMU	Commune Project Management Unit
CTA	Chief Technical Advisor
CZ	Cologne Zoo
DPI	Provincial Department of Planning and Investment
DPMU	District Project Management Unit
FFI	Flora and Fauna International
FPD	Forest Protection Department
FZS	Frankfurt Zoological Society
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH - German International Cooperation
IEBR	Institute of Ecology and Biological Resources, Hanoi
KfW	Kredit-anstalt für Wiederaufbau – German Development Bank
NGO	Nongovernment Organisation
PPMU	Provincial Project Management Unit
PNKB NP	Phong Nha – Ke Bang National Park
PPC	Provincial People’s Committee
PSC	Project Steering Committee
SRRC	Science Research and Rescue Centre (of PNKB NP)
TA	Technical Assistance
VNMN	Vietnam National Museum of Nature, Hanoi

The photographs used on the cover page of this report are:

Above: The karst forest in Thuong Hoa Commune, Minh Hoa District, Quang Binh

Below left: *Protobothrops sieversorum*, collected from Thuong Hoa Commune

Below right: *Rhacophorus rhodopus*, collected from Hoa Son Commune

Photo by Nguyen Quang Truong, 2011

This is the final report of a biodiversity research, which was commissioned by the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region Project. The herpetology research team carried out two field trips in three sites within PNKB NP and two sites in the extension area in July and September 2011.

Based on the specimen identification and direct observation in the wild, we recorded a total of 81 species (40 species of reptiles and 41 species of amphibians) from PNKB NP and extension area. To combine with the results from previous studies, the species number of the herpetofauna of PNKB NP and adjacent areas is 161 (107 species of reptiles and 54 species of amphibians). Among five survey sites Thuong Hoa has the highest number of recorded species (70), followed by Hoa Son (57), Dai A – Dai Cao (48), Cha Noi (41), and Tro Mong (37). The research team discovered eight new records for the herpetofauna of PNKB NP and adjacent areas: Red-tailed Ground Skink *Scincella rufocaudata*, Annam Keelback *Parahelicops annamensis*, Chinese Habu *Protobothrops mucrosquamatus*, Big-eared Toad *Ingerophrynus macrotis*, Zhushihe Mountain Toad *Ophryophryne pachyproctus*, Chapa Frog *Babina chapaensis*, Tonkin Bug-eyed Frog *Theloderma corticale*, and Taylor's Bug-eyed Frog *Theloderma stellatum*. Remarkably, the specimen of caecilian collected in Hoa Son Commune may represent a new species (*Ichthyophis* sp.).

Statistic analysis showed that herpetofauna of Thuong Hoa is similar to that of Cha Noi and of Hoa Son is similar to that of Dai A – Dai Cao. A number of endemic species known from core zone of PNKB NP were also found in the extension area.

Among 161 species recorded from PNKB NP and extension area, 30 species are globally or nationally threatened: 24 species listed in the Vietnam Red Data Book (2007), 15 species listed in the IUCN Red List (2011), 14 species listed in the Governmental Decree No. 32 (2006), and 14 species listed in the appendices of CITES (2011). Although the number of threatened species is high (about 20% of the total species), they are very rare in the wild.

Based on the results of our surveys and referred to the published literature, we defined the following hot spots for herpetofauna conservation in and around PNKB NP: Cha Noi (Xuan Trach Commune), U Bo (Tan Trach Commune), Dai A – Dai Cao (Thuong Trach Commune), Hang E (Son Trach Commune), Da Lat 2 (Thuong Hoa Commune), and adjoining area between Hoa Son and Dan Hoa communes.

At present, two major threats to reptile and amphibian conservation in and around PNKB NP are illegal wildlife hunting and habitat loss/alteration.

Recommendations for further studies:

- Support for a monitoring program at the hot spots of herpetofauna diversity in and around PNKB NP within the next 3–5 years, which can be done by the staff of SRRC.
- Carry out a rapid evaluation of wildlife hunting and trade in and around the national park.
- Support for taxonomic identification.
- Support for SRRC to maintain and manage the scientific collection.

Recommendations for the national park's management plan:

- Protection of landscape ecology.
- Creating the green corridor for linking isolated forest patches.
- Identification of priority areas for biodiversity conservation.
- Investment for forest rangers (providing patrolling equipment, documents, capacity strengthening).
- Establishment of an additional ranger station or sub-station near Cha Lo Village (Dan Hoa Commune, Minh Hoa District).
- Improvement of the cooperation between national park and local agencies on forest protection, wildlife trade control, and legislation enforcement.
- Promotion of community awareness campaign.

This report has been produced as a result of biodiversity research, which was commissioned by the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region Project with funding from the Vietnam-Germany Development Cooperation. The authors of the report would like to take this opportunity to thank the following officers and individuals for their support during the field survey in and around the Phong Nha – Ke Bang National Park and reporting in Hanoi.

The Nature Conservation and Sustainable Natural Resource Management in Phong Nha-Ke Bang National Park Region Project has invited us to take part in this study, and has financially supported the field work in the Phong Nha – Ke Bang National Park and extension area, especially Mr. Nguyen Trung Thuc - Project Director, Mr. Bas van Helvoort - Chief Technical Advisor, and Mr. Le Duc Duong - Coordinator.

Mr. Luu Minh Thanh (Director of PNKB NP), Mr. Le Thuc Dinh (Vice Director of the Science Research and Rescue Centre), Mr. Phan Hong Thai (Head of the Forest Protection Unit) for supporting the survey team. Thanks to the forest rangers for participating in this survey: Mr. Nguyen Van Luong (Thuong Hoa Station), Mr. Nguyen Minh Thanh (Hoa Son Station), Mr. Hoang Huu Ha (Cha Noi Station), Mr. Pham Ngoc Huu (Station 27), and Mr. Hoang Van Tinh (Tro Mong Station).

The research team would like to thank Assoc. Prof. Dr. Thomas Ziegler (Cologne Zoo) for commenting on the first draft of this report, Ms. Sladjana Miskovic and staff of the Phong Nha – Ke Bang Nature Conservation Project of Cologne Zoo for cooperation and support for our survey.

We would also like to thank local people from Mo O Village (Thuong Hoa Commune) and Cha Lo Village (Hoa Son Commune) for their hospitality and for providing information.

We also wish to thank our host institutions who made it possible for us to participate in the field study and analyze information collected: Department of Vertebrate Zoology, Department of Molecular Systematics and Conservation Genetics, Institute of Ecology and Biological Resources. In particular, thanks are due to Assoc. Prof. Le Xuan Canh - Director of IEBR and Assoc. Prof. Dr. Nguyen Xuan Dang, and Dr. Dang Tat The.

1.

1.1

In the framework of the baseline surveys on the diversity of reptiles and amphibians in the Phong Nha – Ke Bang National Park and extension area, a short training course was delivered for capacity strengthening for national park's staff and two field surveys were conducted in Thuong Hoa and Hoa Son communes (Minh Hoa District), Son Trach, Tan Trach, Thuong Trach and Xuan Trach communes (Bo Trach District) by the research team from the Institute of Ecology and Biological Resources and the Vietnam National Museum of Nature. This is a biodiversity report as a result of work in accordance with the contract between the Research Team and the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region Project (Contract No. 01/6-011/HDTV-PNKB).

1.2

1.2.1

According to the Sourcebook of Existing and Proposed Protected Areas in Vietnam (Birdlife 2004, second edition), Phong Nha was included on Decision No. 194/CT of the Chairman of the Council of Ministers, dated on 9 August 1986, which decreed the establishment of a 5,000 ha cultural and historical site. The principal objective of the cultural and historical site was not biodiversity conservation but the protection of the extensive cave systems at the site. In 1992, an investment plan was prepared for the site, which proposed the establishment of a 41,132 ha nature reserve. Following the approval of the investment plan, a nature reserve management board was established by Quang Binh Provincial People's Committee on 5 December 1993, based on Decision No. 964/QD-UB.

In 1998, the site was nominated as a UNESCO World Heritage Site. As well as its biodiversity values, the justification for inscription included the outstanding cave systems and limestone karst landscape at the site. In 2003, Phong Nha – Ke Bang National Park was inscribed as Vietnam's fifth World Heritage Site (Sourcebook, Birdlife 2004).

In 1999, the Forest Inventory and Planning Institute prepared a revised investment plan for the site. This investment plan proposed extending the site to incorporate the Ke Bang limestone area to the north-west, and revising the management category from nature reserve to national park. Following the approval of this investment plan, the establishment of Phong Nha – Ke Bang National Park was decreed by Decision No. 189/2001/TTg of the Prime Minister, dated on 12 December 2001. According to the Prime Minister's decision, the total

area of the national park is 85,754 ha, comprising a strict protection area of 64,894 ha, a forest rehabilitation area of 17,449 ha, and an administration and services area of 3,411 ha. The boundaries of the national park decreed by the Prime Minister do not include an approximately 60,000 ha section of the Ke Bang limestone area in Minh Hoa district (now is considered as extension area), which was proposed for inclusion within the national park in the investment plan. Following the revision of the establishment of Phong Nha – Ke Bang National Park, the nature reserve management board was restructured as a national park management board, by Decision No. 24/QD-UB of Quang Binh Provincial People's Committee, dated on 20 March 2002.

1.2.2

The Phong Nha – Ke Bang project area consists of the core zone of the Phong Nha – Ke Bang National Park (PNKB NP) with an area of 116,824 ha (including extension area of 31,070 ha) and a buffer of 225,000 ha, consisting of parts of 13 adjacent communes in three districts of Bo Trach, Minh Hoa and Quang Ninh situated in the west of Quang Binh Province, Vietnam. The communes are Truong Son Commune, Quang Ninh District, Thuong Hoa, Trung Hoa, Hoa Son, Dan Hoa and Trong Hoa communes, Minh Hoa District, Thuong Trach, Tan Trach, Phu Dinh, Hung Trach, Son Trach, Phuc Trach and Xuan Trach communes, Bo Trach District. The entire Tan Trach Commune, Bo Trach District is located inside the core zone of Phong Nha – Ke Bang National Park. The total population of these 13 communes comprising 146 villages is 12,828 households, 61,256 people of which about 11,000 are ethnic minorities of Van Kieu and Chut and the rest belong to the majority ethnic group of Kinh.

Phong Nha – Ke Bang NP not only harbours an important biodiversity value but also is a famous tourist sites with an annual amount of about 350,000 domestic and foreign visitors. Therefore, the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang Region, Vietnam, KfW component, aims to improve the management of Phong Nha – Ke Bang National Park and reduce the pressure on its natural resources. The Project is a cooperation between Quang Binh PPC and KfW. The project owner is the Provincial People Committee (PPC) of Quang Binh Province. It is funded through the German Development Bank (KfW), GIZ, and the Quang Binh PPC. The project is designed for eight years and is in tandem with the Nature Conservation and Sustainable Natural Resource Management in Phong Nha-Ke Bang National Park Region Project, Vietnam, GIZ component. The GIZ component is originally planned for three years phase I, and currently prepared for phase II.

Two components of KfW and GIZ jointly implement the Project. GIZ's responsibility is mainly in technical cooperation, leading bufferzone and tourism planning. KfW's responsibility is largely investment, complementing and scaling up GIZ's pilot projects, in addition to leading the development and implementation of a management plan for PNKB NP and complementary technical assistance to improve management, in particular law enforcement.

In the context of management formulation and improvement, the Project will organize biodiversity baseline surveys. These surveys will have the following functions:

- To inform the management plan and management implementation.
- To form the basis of long term biodiversity monitoring, and/or to assess the impact of improved management.
- To provide a basis to apply for World Heritage status on biodiversity grounds for the extended PNKB NP.

1.3

1.3.1

Phong Nha – Ke Bang National Park is located in western Bo Trach District, close to the international border with Laos. The national park is situated in one of the largest areas of contiguous limestone karst in the Indochina region, which also includes Hin Namno National Protected Area in Laos. The limestone massif is located in a transitional zone between the northern and central Annamite mountains. As a result, the limestone karst is almost entirely forested, apart from steep cliff faces. The only clearance of forest has been in flat valleys within the limestone massif, and in lowland areas bordering it. Natural forest covers the majority of the national park. The most widespread forest type is limestone forest but there are also significant areas of lowland evergreen forest distributed on non-calcareous substrates in valleys among the limestone karst (Birdlife 2004).

The topography of the national park is characterized by precipitous karst ridges, which rise to elevations of around 400 m. Scattered among these ridges are narrow valleys and pockets of igneous rock formations. Because of the limestone topography, drainage is complex and there are few permanent water courses. There are, however, the Chay, Son and Trooc rivers, all of which are fed by underground streams, which emerge from the En, Vom, Toi, and Phong Nha cave systems. All three rivers flow into the Gianh river, which empties into the East Sea at Ba Don (Birdlife 2004).

1.3.2

According to Nguyen K. V. et al. (2000) PNKB NP is located in the region where is characterized by the monsoon tropical climate with cool winter and summer-autumn-winter rains. The dry season is from April to August and rainy season is from September to March. The hot and dry weather in summer result from the arrival of southwestern monsoon winds blowing from the highlands of Laos. Based on the data of Ba Don and Dong Hoi climate stations, average annual temperature in the region is from 24.3–24.6°C, average annual rainfall varies from 1932.4–2160.2 mm, and the average annual humidity ranges between

83–84%. The coldest month is January with monthly average temperature of 18.3–19°C and the hottest month is July with monthly average temperature of 29.5–29.7°C.

1.4

During recent years, a number of biodiversity surveys have been conducted within Phong Nha – Ke Bang NP and in the extension area. Since 2000 many publications have been published and most of them result from the biodiversity research of the Cologne Zoo. These papers not only recorded a high level of the diversity of reptiles and amphibians with many species endemic to central Vietnam and central Laos but also described a series of new species.

1.4.1

Phong Nha – Ke Bang NP not only has a large area of natural forest but also contains different habitat types (limestone forest and lowland evergreen forest). Thus this national park is known as one of the most famous areas in terms of herpetofaunal diversity in Vietnam. The recent papers relevant to the herpetofauna of the national park are as the following:

- In 2000, Ziegler & Hermann recorded 111 species, comprising 34 species of amphibians and 77 species of reptiles.
- Ziegler et al. (2004) reported a total of 132 species, comprising 40 species of amphibians and 92 species of reptiles.
- Ziegler et al. (2006) recorded 140 species, comprising 42 species of amphibians and 98 species of reptiles (14 species of turtles, 34 species of lizards and 50 species of snakes)
- Ziegler et al. (2007) reported nine additional species of snakes for the herpetofauna of Phong Nha – Ke Bang NP, which brought the species number of snakes up to 59.
- In 2008, Hendrix et al. recorded a total of 47 amphibian species from this national park.
- Ziegler & Vu (2009) provided an updated list of reptiles and amphibians from PNKB NP and adjacent areas with a total of 138 species (45 species of amphibians and 93 species of reptiles). This list excluded some historical records because they were not rediscovered during recent surveys in the national park and extension area. Several records of Ziegler et al. (2006), Hendrix et al. (2008) and other authors with question-marks were removed from the list of Ziegler & Vu (2009) such as: *Bombina maxima*, *Eutropis chapaensis*, *Scincella rupicola*, *Sphenomorphus buenloicus*, *Dendrelaphis pictus*, and *Malayemys subtrijuga*.

1.4.2

During the last decade, Phong Nha – Ke Bang NP has been known as a cradle of the new discoveries with 16 new species and one new subspecies have been described since 2000, comprising one species of amphibians, seven new species of lizards, and seven species and one subspecies of snakes, and one species of turtle. Many of them were described by Assoc. Prof. Dr. Thomas Ziegler and his working group from Cologne Zoo, who discovered 13 new species and one new subspecies from this national park and adjacent area.

1.

TT	Common name	Scientific name
1.	Quyêt's Treefrog	<i>Gracixalus quyeti</i> (Nguyen, Hendrix, Boehme, Vu & Ziegler, 2008)
2.	Hidden Bent-toed Gecko	<i>Cyrtodactylus cryptus</i> Heidrich, Roesler, Vu, Boehme & Ziegler, 2007
3.	Phongnhakebang Bent-toed Gecko	<i>Cyrtodactylus phongnhakebangensis</i> Ziegler, Roesler, Hermann & Vu, 2002
4.	Roesler's Bent-toed Gecko	<i>Cyrtodactylus roesleri</i> Ziegler, Nazarov, Orlov, Nguyen, Vu, Dang, Dinh & Schmitz, 2010
5.	Phongnhakebang Gecko	<i>Gekko scientiaventura</i> Roesler, Ziegler, Vu, Hermann & Boehme, 2005
6.	Boehme's Supple Skink	<i>Lygosoma boehmei</i> Ziegler, Schmitz, Heidrich, Vu & Nguyen, 2007
7.	Four-fingered Skink	<i>Sphenomorphus tetradactylus</i> (Darevsky & Orlov, 2005)
8.	Nogge's Water Skink	<i>Tropidophorus noggei</i> Ziegler, Vu & Bui, 2005
9.	Bourret's Cat Snake	<i>Boiga bourreti</i> Tillack, Ziegler & Le, 2004
10.	Thanh's Reed Snake	<i>Calamaria thanhi</i> Ziegler & Le, 2005
11.	Ruhstrat's Wolf Snake	<i>Lycodon ruhstrati abditus</i> Vogel, David, Pauwels, Sumonth, Norval, Hendrix, Vu & Ziegler, 2009
12.	Andrea's Keelback	<i>Amphiesma andreae</i> Ziegler & Le, 2006
13.	White-lipped Keelback	<i>A. leucomystax</i> David, Bain, Nguyen, Orlov, Vogel, Vu & Ziegler, 2007
14.	Smith's Snake	<i>Fimbrios smithi</i> Ziegler, David, Miralles, Doan & Nguyen, 2008

TT	Common name	Scientific name
15.	Sievers' Three Horn-scaled Pitviper	<i>Protobothrops sieversorum</i> (Ziegler, Herrman, David, Orlov & Pauwels, 2000)
16.	Truongson Pitviper	<i>Viridovipera truongsonensis</i> (Orlov, Ryabov, Bui & Ho, 2004)
17.	Cyclornated Box Turtle	<i>Cuora cyclornata</i> Blank, McCord & Le, 2006

Notes: Summarized after Nguyen et al. (2009), Ziegler & Vu (2009), Ziegler & Nguyen (2010), and Ziegler et al. (2010).

2.

2.1

The national consultant team has the main task of elaborating information already available and collecting new field data as necessary to create a baseline for long-term biodiversity conservation and future monitoring of key species of reptiles and amphibians at the Phong Nha – Ke Bang NP and extension area. Training will also be delivered to staff of the PNKB authority to create the capacity for monitoring of populations of several important species.

2.2

Assessment of the herpetofaunal diversity in and around PNKB NP:

- a. The surveys will assess the diversity of the herpetofauna of PNKB NP with special focus on threatened and important species of rare or endemic species.
- b. These surveys may involve checking on priority sites already surveyed in the past to determine if reptilian and amphibian populations are still present or to verify threats.
- c. It is likely to involve checking/verification of potentially important sites for which few data exist.
- d. Investigation of the geographical coverage of the species away from the already surveyed into other sections of the PNKB NP where populations of these species are likely to occur and which are appropriate for future monitoring.

Threat evaluation and conservation implications

- e. Major threats to the herpetofauna will be evaluated based on direct observations (e.g., habitat loss and degradation, hunting activities) and through discussions with the local authority.
- f. Based on the results of the biodiversity assessment and threat evaluation, conservation priorities will be proposed.

Deliver training to selected staff of the SCCR, PNKB NP in baseline surveys and ensure that they are familiar with all procedures and sites elaborated in the training document. The training course will focus on the following skills:

- a. Developing of a simple monitoring plan,
- b. Setting up survey transects,
- c. Data collecting in the field and key species identification,
- d. Monitoring reports

3.

3.1

Two field surveys were undertaken in the forest with a total of 40 working days. Besides direct observations of encountered species in the natural habitat, the research team also collected the representative scientific collection. Threats to the herpetofauna were evaluated based on the data collected from the field surveys and discussions with the local authority. Field surveys were undertaken both in and around the national park by the research team consisting of five members.

- Extension area: Three sites are located in Thuong Hoa and Hoa Son communes (Minh Hoa District). These are remote sites and the herpetofauna is poorly studied.
- Inside national park: Cha Noi (Xuan Trach Commune) is known as a center of herpetofaunal diversity of PNKB NP. The species composition of reptiles and amphibians of two other sites, Dai A – Dai Cao (Thuong Trach Commune) and Tro Mong (Son Trach Commune), are incompletely studied.

3.2

3.2.1

Two field trips were carried out by the research team in and around PNKB NP: the first trip (22 days) from 12nd July to 2nd August 2011 and the second trip (20 days) from 12 September to 1 October 2011. The following activities have been done during our field work:

1. Training course on the survey skills in herpetological study for NP's staff from 13–14 July 2011.
2. Field survey on the diversity of reptiles and amphibians: The survey team was divided into two groups and simultaneously worked along different transects.
 - Forest in Thuong Hoa Commune, Minh Hoa District: 14–26 July 2011.
 - Forest in Hoa Son Commune, Minh Hoa District: 20–25 July 2011.
 - Forest in Cha Noi Area, Xuan Trach Commune, Bo Trach District: 27–31 July 2011.
 - Forest in Hoa Son Commune, where bordering with Dan Hoa Commune, Minh Hoa District: 13–18 September 2011.
 - Forest in Thuong Trach Commune, Bo Trach District: 19–24 September 2011.
 - Forest in Son Trach Commune, Bo Trach District: 25–28 September 2011.

3.2.2

Site selection: Survey transects were set up along the streams, pools, small ponds or along the forest paths, particularly in remote sites. Lizards and snakes usually inhabit rock crevices, the leaf litter or the tree branches, we thus also surveyed the forest near the cave entrances and cliffs. The coordinates were determined by using the GPS Garmin 60CX.

Collecting time: Snakes, turtles, lizards, and few species of amphibians (e.g., toads) can be found or observed in the daytime. However, most of amphibians and snakes are nocturnal, therefore the bulk of our search effort was carried out in the evening from 19:00 to approximately 24:00.

Collecting method: Most of specimens were collected by hand. Venomous snakes were collected by snake hook or snake tong, and lizards were collected by forceps.

Specimen fixing: Collected amphibians were kept in plastic bags, while snakes and lizards were kept in cloth bags. After photographing, common species (e.g., Gecko, Common Toad) were released, other ones were preserved for voucher specimens.

Specimen preserving:

- Anaesthetization: Amphibians and reptiles were anaesthetized within 24 hours after collecting with a closed vessel with a piece of cotton wool containing chloroform or ethyl acetate. For molecular analysis, tissue samples of muscle and liver were preserved in 95% ethanol and they must be separated from formalin.
- Collection tag: The field tags should be labelled with an Indian ink, which are not ethanol- and water-soluble; furthermore the labels and thread should be tearproof, ethanol- and waterproof. The field tags were attached with a tearproof twine at the knee bend of lizards and amphibians or around the neck in snakes.
- Fixation: The fixation is necessary to keep the good shape for morphological analysis. Specimens were arranged in a natural position and covered by tree-cloth or blotting-paper, they were preserved in 80–90% ethanol for 8–10 hours. Specimens of reptiles and large-sized amphibians were injected with 80% ethanol with a hypodermic needle into the body cavity to prevent internal rotting processes.
- Specimen management: Specimens were subsequently transferred into 70% ethanol. Preserved specimens must be kept in high quality vessels or jars. The vessels must be absolutely closed over a longer period for preventing the vaporescence of ethanol and a subsequent desiccation of specimens. Specimens should be deposited in the room with good climatic conditions (e.g. low temperature and humidity, with sunlight shields and cabinet).

3.2.3

Specimen identification: Morphological comparisons were made with the voucher specimens which are deposited in the collections of the Institute of Ecology and Biological Resources and Vietnam National Museum of Nature in Hanoi. For taxonomic identification, we used the following documents: Bourret (2009), Hendrix et al. (2008), Inger et al. (1999), Nguyen V. S. et al. (2009), Nguyen Q. T. et al. (2011 a,b), Pope (1935), Smith (1935, 1943), Taylor (1963), Vogel et al. (2009), Ziegler et al. (2007) and recent relevant papers. Species names followed Nguyen et al. (2009).

Statistic analysis: Statistic software PAST Statistics (Hammer et al. 2001) was used for diversity and distance indices or cluster analysis. The comparison of species diversity between the sites in and around the national park was also made based on statistic results.

3.2.4

a. Thuong Hoa Commune, Minh Hoa District

Forest near Mo O Village: This field site is located in the southwest of Mo O Stream, bordering with the boundary of the extension area. The hill slopes are covered by good limestone forest with big and small hardwoods mixed with shrub. The natural forest somehow is disturbed by timber logging and firewood collecting. Habitat types in the valley near Mo O Stream are open grasslands and agricultural land. Night excursions were conducted along streams, Hang Tinh Cave, limestone cliffs, and forest paths to the mountain tops: Dinh 1 (350 m), Dinh 2 (396 m) near Ca Xeng Border Station, Ma Nghi (513 m).

Da Lat Forest: A main transect was set up from Mo O Village westwards to the international border with Laos. The main habitat is limestone forest, more human disturbances in outer area and thicker overgrowth in the remote area (Da Lat 1, 2), with big/medial hardwoods and shrub. Patches of the lowland evergreen forest occur in the valleys. Specimens were collected along streams, small pools, limestone cliffs, and trails in the forest: Da Lat 1 (312–540 m) and Da Lat 2 (448–520 m).

Forest near Ban On Village: We surveyed in the forest around Hang Lon Cave and Old House (Camp Site 3) in the direction to Hung Lau Valley. The habitat is secondary forest on karst rehabilitating after timber logging and cultivation activities. The habitat here is mixed forest of medial and small hardwoods, bamboo, and shrub. Several night excursions were made around Hang Lon Cave and Camp Site 3 at elevations between 250–490 m.

b. Hoa Son Commune, Minh Hoa District

Forest near Camp Site 4: This camp site is adjoining with the border of the extension area. The main habitat is lowland evergreen forest connected with the limestone forest in the core zone. Although the forest is affected by timber logging and non-timber forest products collecting but it is still good. The main habitat is disturbed primary forest with big/medial/small hardwoods and liane with patches of mixed forest of rattan, bamboo, and banana. We surveyed along several small rocky streams, small pools and marsh in the forest at elevations between 490–570 m.

Adjoining area between Hoa Son and Dan Hoa communes: This is a large area of good lowland evergreen forest with a few emerged karst hills. A transect was made from Cha Lo Village (Dan Hoa Commune) to the remote forest of the extension area. The main habitat is disturbed primary forest with big/medial hardwoods and liane. Specimens were collected along the streams, paths, and bomb craters in the forest at elevations between 300–734 m.

c. Xuan Trach Commune, Bo Trach District

Cha Noi Forest: This is a center of species diversity of reptiles and amphibians in the PNKB NP. There are existing both forest types in this area: lowland evergreen forest distributed on non-calcareous substrates and limestone forest. Thought the natural habitat was affected by the logging activities, the forest is still good with medial/small hardwoods, herbaceous, and liane. Night excursions were conducted along Khe Khai and Khe Ma streams, Cha Noi Cave, and forest paths to Hung Dang Valley, at elevations between 130–561 m.

d. Thuong Trach Commune, Bo Trach District

Forest around Station 27: The main forest type is limestone forest but there are also some patches of lowland evergreen forest in valleys among the limestone karst. Forest along the Road 20 is heavily impacted by timber logging and road construction. Only one excursion was conducted at the first night along several small streams and road soakage pits at elevations between 400–600 m.

Dai A – Dai Cao Forest: The limestone forest is alternated with lowland evergreen forest. Although effected by timber logging and cultivation activities in the past, the forest in this area is rehabilitating and still very good with big/medial hardwoods and liane. Along the forest paths to Dai A and Dai Cao caves, there are some patches of mixed secondary forest of small hardwoods, bamboo, and banana. Specimens were collected along forest paths, small streams, dry stream beds, and small ponds in the valley nearby Dai A and Dai Cao caves at elevations between 240–500 m. The survey effort around Camp Site 5 was somewhat affected by the bad weather (heavy rain and flood).

e. Son Trach Commune, Bo Trach District

Hung Lau area: A long transect was made from Ho Chi Minh Road to the Hung Lau Valley. The forest nearby Ho Chi Minh Road (Chay Bridge) is mixed of bamboo and shrub. The habitat above 300 m is lowland secondary forest with medial and small hardwoods, and it is better at higher elevation with bigger trees and more dense liane. We surveyed along rocky streams, forest paths, and caves in Hung Lau area at elevations between 320–480 m.

Hang E area: The main habitat is limestone forest with medial/small hardwoods and liane. There are some steep limestone cliffs, covered by dense forest, on the way to Hang E and some patches of bamboo, rattan and shrub nearby Hang E. The occurrences of reptiles and amphibians were searched along forest paths from Ho Chi Minh Road to Hang E, caves and limestone cliffs at elevation between 80–180 m.

3.3

3.3.1

a. Scientific collection

A collection of 230 specimens was collected from different survey sites in the research area. The voucher specimens are important evidences for taxonomic identification and further study in future. We did not collect specimens of common species (e.g., Gecko, House Gecko, Common Toad, Common Lowland Frog, Rice Frog), however, the records were made based on direct observation or photograph. A part of this collection (103 specimens) was transferred to the SRRC, PNKB NP, for exhibition or research purposes.

b. Species composition

Based on the specimen identification and direct observation during two surveys we recorded a total of 81 species, comprising 40 species of reptiles and 41 species of amphibians. To combine with the results from previous studies, the species number of the herpetofauna of PNKB NP and adjacent areas is 161, consisting of 107 species of reptiles and 54 species of amphibians. However, it is noted that some unidentified species are still under examination (e.g., *Ichthyophis* sp., *Odorrana* sp.). Moreover, some species complex, which are morphologically similar, may contain several species forms such as species of *Scincella*, *Lycodon*, *Hylarana*, *Odorrana*, and *Kurixalus*. Compared with published data, the species composition of the extension area is relatively similar to that in the core zone of the national park.

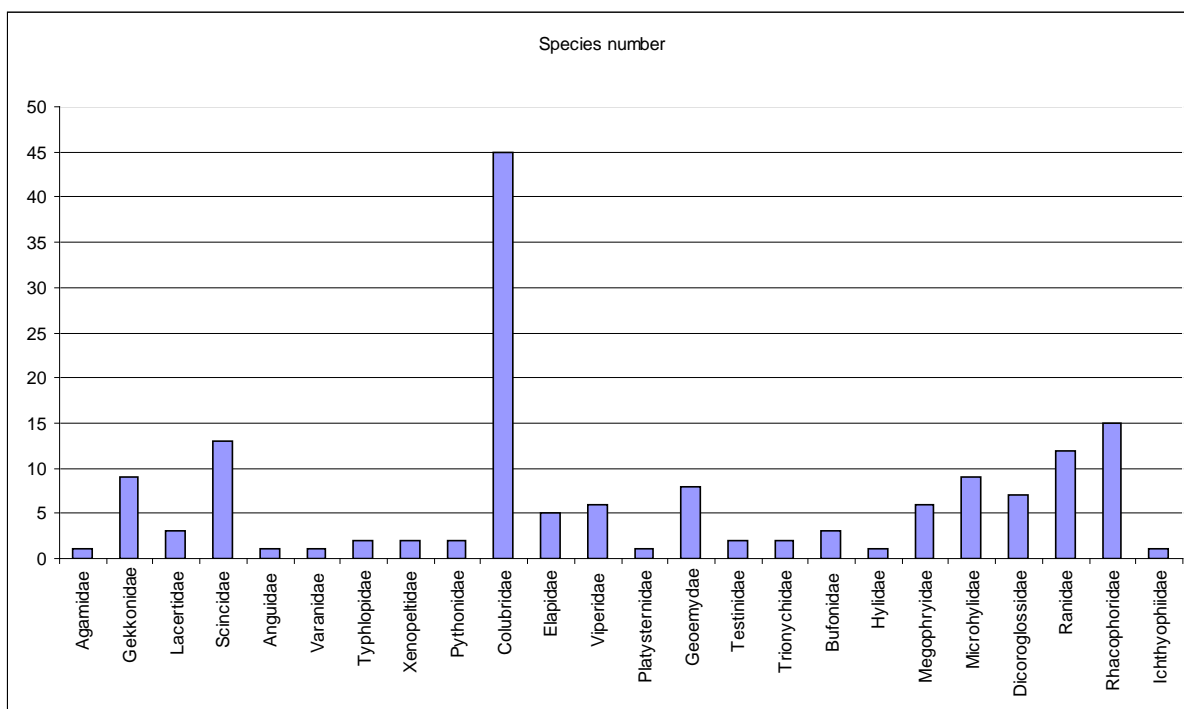


Figure 1. Species diversity of herpetofauna families in and around PNKB NP

In terms of species diversity, Colubridae is the most dominant family with 45 recorded species, followed by Rhacophoridae (15 species), Scincidae (13 species), and Ranidae (12 species). Among five survey sites Thuong Hoa has the highest number of recorded species (70: 34 species of reptiles and 36 species of amphibians), followed by Hoa Son (57: 20 species of reptiles and 37 species of amphibians), Dai A – Dai Cao (48: 17 species of reptiles and 31 species of amphibians), Cha Noi (41: 20 species of reptiles and 21 species of amphibians), and Tro Mong (37: 13 species of reptiles and 24 species of amphibians). Statistic results using software PAST (Hammer et al. 2001) showed that the diversity indices (i.e. Shannon_H, Simpson_1-D, and Margalef) are the same as above, respectively. Species diversity in Thuong Hoa and Hoa Son is higher than those in the other sites, and it can be explained by the longer time for surveying, better weather conditions in the first field trip in July than in the second trip in the rainy season in September.

Table 2. Diversity indices of reptiles and amphibians of survey sites

Diversity index	Thuong Hoa	Hoa Son	Cha Noi	Dai A – Dai Cao	Tro Mong
Taxa_S	70	57	41	48	37
Shannon_H	4.25	4.03	3.71	3.87	3.61
Simpson_1-D	0.985	0.982	0.976	0.979	0.973
Margalef	16.24	13.66	10.77	12.14	9.97

Because the herpetofauna is highly diverse (161 species) and it is difficult to identify the exact names for all species in the field, it is impossible to estimate the population size or abundance of each species. However, we tried to define the species which has a high frequency of occurrence (encountered more than 15 individuals during two surveys) in and around PNKB NP:

- Reptiles: *Acanthosaura lepidogaster*, *Physignathus cocincinus*, *Cyrtodactylus phongnhakebangensis*, *C. roesleri*, *Gekko scientiadventura*, *Amphiesma leucomystax*, *Cyclophiops multicinctus*, and *Psammodynastes pulverulentus*.
- Amphibians: *Ingerophrynus macrotis*, *Leptobrachium* cf. *chapaense*, *Xenophrys major*, *Microhyla butleri*, *Micryletta inornata*, *Limnonectes kuhlii*, *Limnonectes limborgi*, *Hylarana maosonensis*, *H. nigrovittata*, *O. chloronota*, *Rana johnsi*, *Kurixalus verrucosus*, *Polypedates mutus*, *Rhacophorus annamensis*, *R. orlovi*, and *R. rhodopus*.

c. Similarity in species diversity of survey sites

Statistic data using software PAST (Hammer et al. 2001) also showed that herpetofauna of Dai A – Dai Cao is most similar to that of Hoa Son (distance index 4.0), the highest difference is between Thuong Hoa and Tro Mong (distance index 6.2). The cluster analysis grouped Thuong Hoa and Cha Noi in one clade and three rest sites in one clade, however, Hoa Son and Dai A – Dai Cao are sister linages.

Table 3. Distance index of the herpetofauna diversity of survey sites

Locality	Thuong Hoa	Hoa Son	Cha Noi	Dai A – Dai Cao	Tro Mong
Thuong Hoa	0	–			
Hoa Son	5.1	0	–		
Cha Noi	5.4	5.9	0	–	
Dai A – Dai Cao	5.3	4.0	5.2	0	–
Tro Mong	6.2	5.0	5.5	4.8	0

The similarity in species diversity of the survey sites may be explained by the belonging to the same geographic unit (Central Truong Son Region), driven by climatic and ecological factors. The dominant habitat type in Thuong Hoa and Cha Noi is limestone forest, while it is lowland evergreen forest mixed with limestone forest in Hoa Son and Dai A – Dai Cao. Some species inhabit forest habitat such as: Bent-toed geckos *Cyrtodactylus* spp., Phongnhakebang Gecko *Gekko scientiadventura*, Nogue's Water Skink *Tropidophorus noggei*, Annam Keelback *Parahelicops annamensis*, Big-eared Toad *Ingerophrynus macrotis*, Annam Flying Frog *Rhacophorus annamensis*, Bug-eyed Frogs of the genus *Theleiderma*. Another habitat type, which found in all survey sites, is disturbed secondary forest in the valleys or near the villages. This is the habitat of many common species: Forest

Crested Lizard *Calotes emma*, Sunskinks of the genus *Eutropis*, Many-banded Green Snake *Cyclophiops multicinctus*, Red-necked Keelback *Rhabdophis subminiatus*, Common Toad *Duttaphrynus melanostictus*, Narrow-mouthed frogs of the genus *Microhyla*, Rice Frog *Fejervarya limnocharis*, Puddle frogs of the genus *Occidozyga*, and Treefrogs of the genus *Polypedates*.

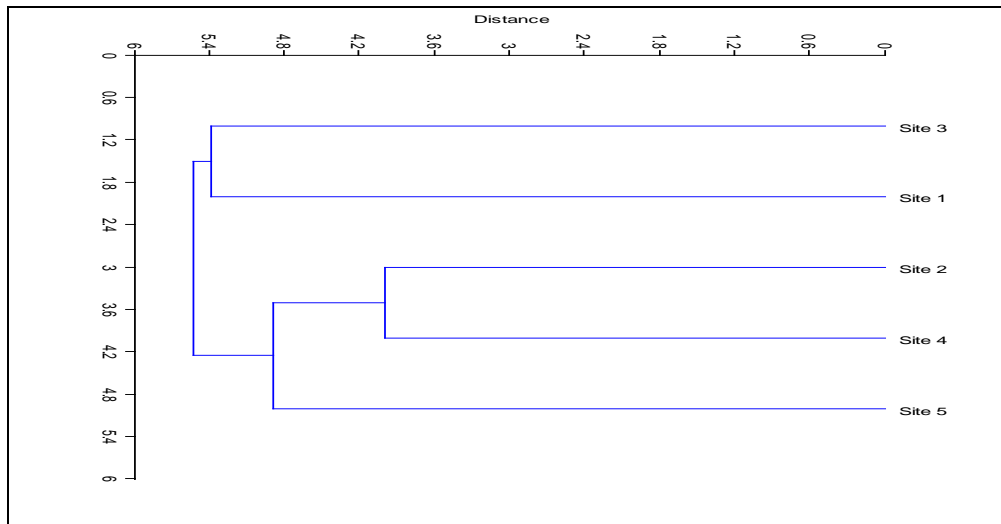


Figure 2. Similarity cluster analysis of the herpetofauna of different survey sites (Site 1: Thuong Hoa, Site 2: Hoa Son, Site 3: Cha Noi, Site 4: Dai A – Dai Cao, Site 5: Tro Mong)

d. Key species account

Although the weather was not very good during second field trip and it was difficult to access the forest in the core zone, the records of 81 species of reptiles and amphibians showed that both national park and extension area have a high potential of the herpetofauna diversity. A number of endemic species were also discovered in the extension area: Phongnhakebang Bent-toed Gecko *Cyrtodactylus phongnhakebangensis*, Phongnhakebang Gekko *Gekko scientiadventura*, Annam Keelback *Parahelicops annamensis*, Horned Pitviper *Protobothrops cornutus*, Sievers' Three Horn-scaled Pitviper *Protobothrops sieversorum*, Four-fingered Skink *Sphenomorphus tetradactylus*, Nogge's Water Skink *Tropidophorus noggei*, Annam Flying Frog *Rhacophorus annamensis*, Tonkin Bug-eyed Frog *Theleiderma corticale*. The number of encountered animals of aforementioned species was relatively high proved that the nature habitats in Thuong Hoa and Hoa Son communes are suitable for reptiles and amphibians.

3.3.2

Remarkably, we found a specimen of caecilian *Ichthyophis* sp. in the lowland evergreen forest in Hoa Son Commune, Minh Hoa District. The external morphological characters of this specimen revealed that it differs from other caecilian species in the Indochina region and

therefore, this may represent a new species. The description of the new species will be published separately based on further morphological examination and molecular analysis. We also collected the second specimen of the Four-fingered Skink *Sphenomorphus tetradactylus* since it was described by Darevsky & Orlov in 2005. Furthermore, we discovered eight new records for the herpetofauna of PNKB NP and adjacent areas:

- Red-tailed Ground Skink *Scincella* cf. *rufocaudata* was recorded from Thuong Hoa Commune, Minh Hoa District.
- Annam Keelback *Parahelicops annamensis* was found in Hoa Son Commune, Minh Hoa District.
- Chinese Habu *Protobothrops mucrosquamatus* was recorded from Thuong Hoa Commune, Minh Hoa District.
- Big-eared Toad *Ingerophrynus macrotis* was collected from Thuong Hoa and Hoa Son communes, Minh Hoa District, as well as from Thuong Trach and Son Trach communes, Bo Trach District.
- Zhushihe Mountain Toad *Ophryophryne pachyproctus* was recorded from Hoa Son Commune, Minh Hoa District.
- Chapa Frog *Babina chapaensis* was found in Hoa Son Commune, Minh Hoa District.
- Tonkin Bug-eyed Frog *Theloderma corticale* was recorded from Thuong Hoa Commune, Minh Hoa District and Cha Noi forest, Xuan Trach Commune, Minh Hoa District.
- Taylor's Bug-eyed Frog *Theloderma stellatum* was found in Cha Noi forest, Xuan Trach Commune, Minh Hoa District.

The new discoveries mentioned above showed that PNKB NP and its extension area harbour a high level of herpetofauna diversity. The research team will publish these important findings in academic journals in future.

3.3.3

A total of 30 threatened species (or 18.63% of the species number) of reptiles and amphibians were recorded from PNKB NP and extension area, comprising:

- 24 species listed in the Red Data Book of Vietnam (2007): four critically endangered species, 10 endangered species, and 10 vulnerable species.
- 15 species listed in the IUCN Red List of Threatened Animals (2011): two critically endangered species, seven endangered species, five vulnerable species, and one near threatened species.
- 14 species listed in the Governmental Decree No. 32 (2006): two species listed in the Group IB and 12 species listed in the Group IIB.

- 14 species listed in the CITES appendices (2011): one species listed in the Appendix I and 13 species listed in the Appendix II.

With a high percentage of threatened species (almost 20% of the species number), PNKB NP is an important location for habitat and population conservation of reptiles and amphibians in Central Vietnam. However, the occurrence of threatened species during the survey time was relatively rare. Except for several species of lizards and amphibians we did not find species which have high economic value such as monitor lizards, venomous snakes, and turtles: Water Monitor *Varanus salvator*, Pythons *Python* spp., Chinese Cobra *Naja atra*, and all species of turtles.

Table 4. List of threatened species of reptiles and amphibians recorded from PNKB NP and extension area

No	Species name	Common name	Decree 32 (2006)	RBVN (2007)	IUCN (2011)	CITES (2011)
1.	<i>Ingerophrynus galeatus</i>	Cambodian Toad		VU		
2.	<i>Odorrana andersoni</i>	Anderson's Frog		VU		
3.	<i>Rhacophorus kio</i>	Kio Whipping Frog		EN	VU	
4.	<i>Theلودerma corticale</i>	Tonkin Bug-eyed Frog		EN		
5.	<i>Physignathus cocincinus</i>	Indochinese Water Dragon		VU		
6.	<i>Gekko gekko</i>	Gecko		VU		
7.	<i>Varanus salvator</i>	Water Monitor	IIB	EN		II
8.	<i>Python molurus</i>	Burmese Python	IIB	CR	LR/nt	I
9.	<i>Python reticulatus</i>	Reticulated Python	IIB	CR		II
10.	<i>Coelognathus radiatus</i>	Radiated Rat Snake	IIB	VU		
11.	<i>Gonyosoma prasinum</i>	Green Tree Racer		VU		
12.	<i>Oreocryptophis porphyraceus</i>	Red Bamboo Snake		VU		
13.	<i>Ptyas korros</i>	Indochinese Rat Snake		EN		
14.	<i>Ptyas mucosa</i>	Common Rat Snake	IIB	EN		II
15.	<i>Bungarus candidus</i>	Blue Krait	IIB			

No	Species name	Common name	Decree 32 (2006)	RBVN (2007)	IUCN (2011)	CITES (2011)
16.	<i>Bungarus fasciatus</i>	Banded Krait	IIB	EN		
17.	<i>Naja atra</i>	Chinese Cobra	IIB	EN		II
18.	<i>Ophiophagus hannah</i>	King Cobra	IB	CR	VU	II
19.	<i>Platysternon megacephalum</i>	Big-headed Turtle	IIB	EN	EN	II
20.	<i>Cuora bourreti (C. galbinifrons)</i>	Bourret's Box Turtle		EN	CR	II
21.	<i>Cuora cyclornata (C. trifasciata)</i>	Cyclornated Box Turtle	IB	CR	CR	II
22.	<i>Cuora mouhotii</i>	Keeled Box Turtle			EN	II
23.	<i>Heosemys grandis</i>	Giant Asian Pond Turtle	IIB	VU	VU	II
24.	<i>Mauremys mutica</i>	Asian Yellow Pond Turtle			EN	II
25.	<i>Mauremys sinensis</i>	Chinese Stripe-neck Turtle			EN	
26.	<i>Sacalia quadriocellata</i>	Four-eyed Turtle			EN	
27.	<i>Indotestudo elongata</i>	Elongated Tortoise	IIB	EN	EN	II
28.	<i>Manouria impressa</i>	Impressed Tortoise	IIB	VU	VU	II
29.	<i>Palea steindachneri</i>	Wattle-necked Softshell Turtle		VU	EN	
30.	<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle			VU	
	30		14	24	15	14

Notes:

- Decree 32 (2006) = Governmental Decree No 32/2006/ND-CP dated on 30 March 2006 by the Government of Vietnam on the management of endangered wild flora and fauna. Group IB: prohibit exploitation and use for commercial purpose and Group IIB: limit exploitation and use for commercial purpose.
- RBVN (2007) = Vietnam Red Data Book. Part I. Animals. Descriptions of nationally endangered species of wild animals. CR = Critically endangered, EN = Endangered, VU = Vulnerable.
- IUCN (2011) = The IUCN Red List of Threatened Species. CR = Critically endangered, EN = Endangered, VU = Vulnerable, LR/nt = Lower risk/near threatened.
- CITES (2011) = Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), valid from 27 April 2011. I, II = species listed in the Appendix 1 and Appendix II, respectively.

3.3.4

a. Hot spots of the herpetofauna diversity

We based on the results of our surveys and referred to the published literature to define the hot spots for herpetofauna conservation in and around PNKB NP. Criteria for hot spot identification are: 1) species richness, 2) number of rare and/or threatened species, 3) forest area and habitat quality, and 4) human disturbance factors. In each category, a higher number represents a better score (ranking score from 1 to 6). According to our evaluation, the relative value of each site is ranked as follows: Da Lat 2 with 23 points, both Cha Noi and Hoa Son with 15 points, and Hang E with the lowest value of six points.

Table 5. Evaluation of the hot spots for herpetofauna conservation value in and around PNKB NP

Criterion	Species richness	Number of rare/ threatened species	Forest area/ habitat quality	Human disturbance	Total
Cha Noi	5	6	3	1	15
U Bo	4	1	5	4	14
Dai A – Dai Cao	2	4	2	3	11
Hang E	1	2	1	2	
Da Lat 2	6	5	6	6	23
Hoa Son	3	3	4	5	15

In the core zone of national park:

- Cha Noi (Xuan Trach Commune): This area is known as a center of new species discovery. We recorded a total of 40 species from this area during 5-day excursion. The forest in Cha Noi area contains both types, limestone forest and lowland evergreen forest, and good habitat quality, both create favourable conditions for a diverse herpetofauna.
- U Bo (Tan Trach Commune): Because a number of field surveys were done in the past, we did not conduct an additional survey in this area. Results of previous studies stated that the herpetofauna has a high level of diversity and several new species were discovered from this area. The main habitat type in U Bo is primary lowland evergreen forest with many streams along Ho Chi Minh Road.
- Dai A – Dai Cao (Thuong Trach Commune): The forests in the valley located between Road 20 and Dai A / Dai Cao caves are good with a dense network of streams. Like in Cha Noi area, the forest in this area comprises both types. The species

composition is thus relatively diverse with 40 species recorded in 6-day excursion. We also observed the King Cobra *Ophiophagus hannah* and Banded Krait *Bungarus fasciatus* in the rehabilitation secondary forest.

- Limestone cliffs near Hang E Cave (Son Trach Commune): Though the species diversity is not high, the limestone cliffs and small caves house a number of endemic species with relatively large populations: Phongnhakebang Bent-toed Gecko *Cyrtodactylus phongnhakebangensis*, Roesler's Bent-toed Gecko *C. roesleri*, Phongnhakebang Gecko *Gekko scientiaventura*, and Truongson Pitviper *Viridovipera truongsonensis*.

In the extension area:

- Da Lat 2 (Thuong Hoa Commune): The forest in this area is good and undisturbed. The dominant habitat type is limestone forest but a small area of lowland evergreen forest can be found in valleys among the limestone karst. We recorded about 40 of 70 species known from Thuong Hoa Commune. Specimens of some new recorded species were also collected from this area.
- Adjoining area between Hoa Son and Dan Hoa communes: This is a large area of primary lowland evergreen forest with many small rocky streams, ponds, and small swamps. We recorded 30 of 56 recognized species from Hoa Son Commune. Remarkably, several new records were discovered from this area.

b. Threats to the herpetofauna

Two major threats to reptile and amphibian conservation in and around PNKB NP are illegal wildlife hunting and habitat loss/alteration.

Habitat loss and degradation: Natural forest in Thuong Hoa and Hoa Son was affected by the human impacts:

- Timber logging of the Minh Hoa Forest Enterprise in the past.
- Timber logging for house construction and firewood, at a small scale.
- Nontimber forest products (e.g., bamboo, rattan) collecting.
- Forest alteration and forest fire caused by local communities establishing cultivation.

Forest products harvesting and forest land alteration are direct impacts that cause habitat fragmentation and degradation. The comparison of species richness between inside and outside the extension area (near Mo O and Ban On villages in Thuong Hoa Commune) showed that there is a distinct difference. In the degraded habitat the species diversity is lower and most of them are common or widespread species.

Illegal wildlife hunting: The high economic value species are major subjects of hunting (e.g. turtles, snakes and geckos). During the survey time we saw ample evidence of human activity in the forest (i.e. small mammal trapping, hunting huts and excellent footpaths). A group of hunters with the dogs for was met in the forest in Hoa Son Commune. Although the detailed information about wildlife hunting and trade are not available, wildlife harvesting is the primary cause of reptile population decline. It is noted that many threatened species are very rare in and around PNKB NP because we did not find any monitor lizards, pythons, and all turtle species in the wild during the survey time.

c. Demarcation

Although the border of the extension area was outlined on the map, the actual landmarks are still not determined. All visited ranger stations (Thuong Hoa, Hoa Son, Cha Noi, and Tro Mong) do not have management maps with patrolling routes due to the unclear demarcation. Probably the planning map for the extension area of the NP was only based on the topographic factor but did not take notice of the landscape ecology. Several forest patches should be included in the extension area in order to ensure the continuousness of the ecological habitat, i.e. a large patch of karst forest in the southwest of Mo O Village in Thuong Hoa Commune.

4.

4.1

Herpetofauna diversity: During two surveys we recorded a total of 81 species (40 species of reptiles and 41 species of amphibians) from five sites in and around PNKB NP. To combine with the results from previous studies, the species number of the herpetofauna of PNKB NP and adjacent areas is 161 (107 species of reptiles and 54 species of amphibians). Among five survey sites Thuong Hoa has the highest number of recorded species (70), followed by Hoa Son (57), Dai A – Dai Cao (48), Cha Noi (41), and Tro Mong (37). The research team also found seven new records for the herpetofauna of PNKB NP and adjacent areas. Remarkably, the specimen of caecilian collected in Hoa Son Commune may represent a new species (*Ichthyophis* sp.).

Similarity in species diversity of survey sites: Statistic analysis showed that herpetofauna of Thuong Hoa is similar to that of Cha Noi and of Hoa Son is similar to that of Dai A – Dai Cao. A number of endemic species known from the core zone of PNKB NP were also found in the extension area.

Threatened species: Among 161 species recorded from PNKB NP and extension area, 30 species are being globally or nationally threatened: 24 species listed in the Vietnam Red Data Book (2007), 15 species listed in the IUCN Red List (2011), 14 species listed in the Governmental Decree No. 32 (2006), and 14 species in the appendices of CITES (2011). Although the number of threatened species is high (ca. 20% of the total species), they are very rare in the wild.

Based on the results of our surveys and previous studies, we define the following hot spots for herpetofauna conservation in and around PNKB NP: Cha Noi (Xuan Trach Commune), U Bo (Tan Trach Commune), Dai A – Dai Cao (Thuong Trach Commune), Hang E (Son Trach Commune), Da Lat 2 (Thuong Hoa Commune), and adjoining area between Hoa Son and Dan Hoa communes.

Two major threats to reptile and amphibian diversity in and around PNKB NP are illegal wildlife hunting and habitat loss/alteration.

4.2.

4.2.1

A monitoring program is required for the aforementioned hot spots of herpetofauna diversity in and around PNKB NP. This program can be done by the staff of SRRC (PNKB NP) with the support of herpetology experts for species identification. It should be lasting between 2–4 days for each hot spot and to be repeated within the next 3–5 years. This will be essential to assess the trend of the status of the herpetofauna of PNKB NP and extension area.

It is necessary to carry out a rapid evaluation of wildlife hunting and trade in and around the national park, especially the restaurants in the buffer zone in the tourist season. This work should be done by a group of independent consultants to collect information about hunting and trade status, particularly for mammals, birds, reptiles, amphibians, and fishes. These data are very important for wildlife trade control in the project area.

It should be considered to publish the field guide to the species of wild flora and fauna of PNKB NP and extension area, particularly for endemic and threatened species. Furthermore, or comprehensive knowledge about the conservation value of the herpetofauna of PNBK NP and extension area, SRRC needs the support for taxonomic identification. Staff of SRRC can correspond with experts for taxonomic identification of newly found specimens, monitoring program, and publishing research results.

The herpetology collection, which is deposited at SRRC (PNKB NP), needs the support for maintainance (e.g., providing ethanol, cabinets, and jars). SRRC should also provide more manpower and upgrade the infrastructure for the collection management at the national park (e.g., store room, better care conditions).

4.2.2

Phong Nha – Ke Bang NP is one of the most famous national parks in Vietnam in terms of the herpetofauna diversity with a high level of endemic species. Therefore, it requires to draw up a biodiversity conservation strategy for the national park. This strategy should focus on the following points:

- Protection of landscape ecology: First of all, the demarcation needs to be re-planned based on the landscape ecology. Several forest patches should be included in the extension area in order to ensure the continuousness of the ecological habitat, i.e. a large patch of karst forest in the southwest of Mo O Village in Thuong Hoa Commune. When the new boundary is defined, landmarks should be planted with the priority in the area of herpetofauna hot spots or high level of human disturbance.
- Creating the green corridor for linking isolated forest patches: Timber logging, forest alteration for establishing cultivation and road construction are causes of forest fragmentation in and around PNKB NP. In order to create the possibility for linking the isolated forest patches and rehabilitation, forest protection need to be improved and strengthened in Dai A – Dai Cao, Tro Mong, and Thuong Hoa.

- Identification of priority areas for biodiversity conservation (center of species diversity): Several studies have been carried out in the project area (e.g. botanical, mammal, ornithological, herpetological, and ichthyological surveys). Hence, an overall ranking for conservation value should be carried out to define important sites (hot spots) in the PNKB NP and extension area. The same categories can be used to rank the conservation value included here: 1) diversity of species, 2) number of rare and/or threatened species, 3) forest area, 4) habitat quality, and 5) human disturbance. For the categories 3 and 4, GIS is likely useful tool for ranking process.
- Investment for forest rangers:
 - All visited ranger stations (Thuong Hoa, Hoa Son, Cha Noi) do not have management maps. Therefore, maps with patrolling routes and patrolling datasheet are required to provide for all ranger stations. In addition, FPU of the national park also needs a database management system for collecting data and storing the information about forest status and violation control. This is essential to the forest protection and conservation plan of the NP in future.
 - Capacity strengthening for rangers: Further training courses should be delivered for rangers in order to improve the legislation knowledge and technical skills (e.g. GPS, GIS, database) for selected rangers from headquarters office as well as from stations.
 - Another priority requirement of ranger stations is the support for patrolling equipment such as motorbike, GPS, and pocket camera (few stations were provided with GPS by the conservation project, e.g. Station 27).
 - An additional ranger station or sub-station should be established near Cha Lo Village (Dan Hoa Commune, Minh Hoa District) to protect a large area of remaining lowland evergreen forest and control illegal activities in the adjoining area between Hoa Son and Dan Hoa communes.
 - National park authority should closely cooperate with other local agencies (e.g., border station, commune people's committee, district forest protection unit) for improving forest protection and legislation enforcement.
- Community awareness: Besides development programs for local community, an awareness campaign should be made to: 1) mitigate the human impacts (e.g., illegal timber logging, wildlife hunting and trade) to the natural resources in and around the national park and 2) encourage the local community to be involved in forest protection activities. Different approaches can be applied for this campaign as the following: television, broadcast, sign board, poster, signing forest protection convention with villages or wildlife product elimination commitment with local restaurants.

5.

- Birdlife International (2004): Sourcebook of existing and proposed protected areas in Vietnam. Second edition, CD.
- Bourret, R. (2009, reprint): Les lézards de l'Indochine. Edition Chimaira, Frankfurt am Main, 624 pp.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2011): Appendices, <http://www.cites.org>, valid from 27 April 2011.
- Darevsky, I. S. & Orlov, N. L. (2005): New species of limb-reduced lygosomine skink genus *Leptoseps* Greer, 1997 (Sauria, Scincidae) from Vietnam. Russian Journal of Herpetology, 12: 65–68.
- David, P., Bain, R. H., Nguyen, Q. T., Orlov, N. L., Vogel, G., Vu, N. T., and Ziegler, T. (2007): A new species of the natricine snake genus *Amphiesma* from the Indochinese Region (Squamata: Colubridae: Natricinae). Zootaxa, 1462: 41–60.
- Hammer, Ø., Harper, D. A. T. & Ryan, P. D. (2001): PAST: Paleontological Statistics Software Package for education and data analysis. http://palaeo-electronica.org/2001_1/past, accessed in March, 2011.
- Heidrich, A., Rösler, H., Vu, N. T., Böhme, W., and Ziegler, T. (2007). Another new *Cyrtodactylus* (Squamata: Gekkonidae) from Phong Nha - Ke Bang National Park, central Truong Son, Vietnam. Zootaxa, 1445: 35–48.
- Hendrix, R., Nguyen, Q. T., Boehme, W. & Ziegler, T. (2008): New anuran records from Phong Nha – Ke Bang National Park, Truong Son, central Vietnam. Herpetology Notes, 1: 23–31.
- Inger, R. F., Orlov, N. L., and Darevsky, I. S. (1999): Frogs of Vietnam: a report on new collections. Fieldiana: Zool., new ser., 92: 1–46.
- IUCN (2011): The IUCN Red List of Threatened Species, <http://www.iucnredlist.org>, accessed in October, 2011.
- Nguyen, K. V., Nguyen, T. H., Phan, K. L. & Nguyen, T. H. (2000): Bioclimatic diagrams of Vietnam. Vietnam National University Publishing House, Hanoi, 126 pp.
- Nguyen, Q. T., Böhme, W., Nguyen, T. T., Le, K. Q., Pahl, K. R., Haus, T. & Ziegler, T. (2011a): Review of the genus *Dopasia* Gray, 1853 (Squamata: Anguidae) in the Indochina subregion. Zootaxa, 2894: 58–68.
- Nguyen, Q. T., Schmitz, A., Nguyen, T. T., Orlov, N. L., Böhme, W. & Ziegler, T. (2011b): A review of the genus *Sphenormorphus* Fitzinger, 1843 (Squamata: Sauria: Scincidae) in Vietnam, with description of a new species from northern Vietnam and Hainan Island, southern China and the first record of *S. mimicus* Taylor, 1962 from Vietnam. Journal of Herpetology, 45(2): 145–154.
- Nguyen, V.S., Ho, T. C. & Nguyen, Q. T. (2009): Herpetofauna of Vietnam. Edition Chimaira,

- Frankfurt am Main, 768 pp.
- Orlov, N. L., Ryabov, S. A., Bui, N. T., and Ho, T. C. (2004): A new species of *Trimeresurus* (Ophidia: Viperidae: Crotalinae) from karst region in central Vietnam. *Russ. Jour. Herpetol.*, 11(2): 139–149.
- Pope, C. H. (1935): The reptiles of China. Turtles, Crocodylians, Snakes, Lizards. *Nat. Hist. Central Asia. Amer. Mus. Nat. Hist.*, New York, 10: 1–604.
- Smith, M. A. (1935): The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Volume 2-Sauria. Taylor and Francis, London, xiii + 440 pp + 1 pl.
- Smith, M. A. (1943): The fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese subregion. Reptiles and Amphibians, Vol. 3-Serpentes. Taylor and Francis, London, 525 pp.
- Taylor, E. H. (1963): The lizards of Thailand. *University of Kansas Science Bulletin*, 44: 687–1077.
- The Government of Vietnam (2006): The Governmental Decree No. 32/2006/ND-CP on management of endangered, precious, and rare species of wild plants and animals; dated on 30 March 2006, 13 pp. (in Vietnamese).
- Tran, K., Ho, T. C., Nguyen, V. S. & Pham, T. (2007): Reptiles and Amphibians. *In*: Dang, N. T., Tran, K., Dang, H. H., Nguyen, C., Nguyen, N. T., Nguyen, H. Y. & Dang, T. D. (Eds.). *Vietnam Red Data Book, Part 1. Animals*, pp. 219–276 + 8pls. Publishing House for Science and Technology, Hanoi (in Vietnamese).
- Vogel, G., David, P., Pauwels, O. S. G., Sumontha, M., Norval, G., Hendrix, R., Vu, N. T. & Ziegler, T. (2009): A review of *Lycodon ruhstrati* (Fischer 1886) auctorum (Squamata Colubridae), with the description of a new species from Thailand and a new subspecies from the Asian mainland. *Tropical Zoology*, 22: 131–182.
- Ziegler, T. & Herrmann, H.-W. (2000): Preliminary list of the herpetofauna of the Phong Nha – Ke Bang Area in Quang Binh Province, Vietnam. *Biogeographica*, 76(2): 49–62.
- Ziegler, T. & Nguyen, Q. T. (2010): New discoveries of amphibians and reptiles from Vietnam. *Bonn zoological Bulletin*, 57(2), 137–147.
- Ziegler, T. & Vu, N. T. (2009): Ten years of herpetodiversity research in Phong Nha – Ke Bang National Park, central Vietnam. *In*: Vo, V. T., Nguyen, T. D., Dang, N. K. & Pham, T. H. Y. (eds), *Phong Nha – Ke Bang National Park and Cologne Zoo, 10 year of cooperation*: 103–124.
- Ziegler, T., Herrmann, H.-W., Vu, N. T., Le, K. Q., Nguyen, T. H., Cao, X. C., Luu, M. T. & Dinh, H. T. (2004): The amphibians and reptiles of the Phong Nha – Ke Bang National Park, Quang Binh Province, Vietnam. *Hamadryad*, 28(1&2): 19–42.
- Ziegler, T., Hendrix, R., Vu, N. T., Vogt, M., Forster, B. & Dang, N. K. (2007): The diversity of a snake community in a karst forest ecosystem in the central Truong Son, Vietnam, with an identification key. *Zootaxa*, 1493: 1–40.

- Ziegler, T., Nazarov, R., Orlov, N., Nguyen, Q. T., Vu, N. T., Dang, N. K., Dinh, H. T. & Schmitz, A. (2010): A third new *Cyrtodactylus* (Squamata: Gekkonidae) from Phong Nha – Ke Bang National Park, Truong Son, Vietnam. *Zootaxa*, 2413: 20–36.
- Ziegler, T., Ohler, A., Vu, N. T., Le, K. Q., Nguyen, X. T., Dinh, H. T. & Bui, N. T. (2006): Review of the amphibian and reptile diversity of Phong Nha – Ke Bang National Park and adjacent areas, central Truong Son, Vietnam. *In*: Vences, M., Koehler, J., Ziegler, T. & Boehme, W. (eds), *Herpetologia Bonnensis II*: 247–262.

1.

1.

A document entitled “A guide to the survey skills in reptile and amphibian study” was prepared for the training course. This document comprises two parts:

- Part 1: Introduction of the diversity and conservation value of reptiles and amphibians in the Phong Nha – Ke Bang National Park.
- Part 2: Skills in herpetological survey, methods, organization, and practice.

2.

Theoretical training for four staff of the Center for Scientific Research and Wildlife Rescue was conducted on 13 July 2011.

1. Dang Ngoc Kien
2. Nguyen Quang Vinh
3. Nguyen Van Dai
4. Tran Ngoc Anh

Species identification was subsequently made with the collection, which is deposited at the Phong Nha – Ke Bang National Park. A detailed plan for field survey was developed on 14 July 2011 in Thuong Hoa Commune, Minh Hoa District.

3. Training results:

The following skills were delivered during the training course for the technical staff of the national park:

- Basic information about the herpetofauna of Phong Nha – Ke Bang NP:
 - Diversity of reptiles and amphibians of the NP;
 - Endemic and new species discovered from the NP;
 - Hot spots of herpetofauna diversity in the NP.
- Developing a simple monitoring plan and surveying skills:
 - Survey planning;

- Preparation of equipment, relevant documents, and logistics;
- Determination of survey or monitoring transects;
- Collecting and preserving specimens.
- Identification of some common species in the NP:
 - Identification of some common species;
 - Identification of some key species of the NP.

Dang Ngoc Kien, who was involved in both field surveys, has very good skills in collecting specimens, transect determination, and species identification. After the field trip, he could also prepare a preliminary report.

4.

A monitoring program is required at the hot spots of herpetofauna diversity in and around PNKB NP: Cha Noi (Xuan Trach Commune), U Bo (Tan Trach Commune), Dai A – Dai Cao (Thuong Trach Commune), Hang E (Son Trach Commune), Da Lat 2 (Thuong Hoa Commune), and adjoining area between Hoa Son and Dan Hoa communes.

Support for taxonomic identification: For more comprehensive knowledge about the conservation value of the herpetofauna of PNBK NP and extension area, SRRC can correspond with experts for taxonomic identification of newly collected specimens, monitoring program, and publishing research results.

The herpetology collection, which is deposited at SRRC (PNKB NP), needs the support for maintenance (e.g., providing ethanol, cabinets, and jars).

2.

1.	<i>Acanthosaura lepidogaster</i>	Scale-bellied Tree Lizard	Z1, Z2	S	S	P	P	O	
2.	<i>Calotes emma</i>	Forest Crested Lizard	Z1, Z2	S	O	-	S	O	
3.	<i>Calotes versicolor</i>	Garden Fence Lizard	Z1, Z2	-	-	-	-	-	
4.	<i>Draco maculatus</i>	Indochinese Flying Lizard	Z1	-	-	-	-	-	
5.	<i>Physignathus cocincinus</i>	Indochinese Water Dragon	Z1, Z2	P	P	O	O	-	
6.	<i>Cyrtodactylus cryptus</i>	Hidden Bent-toed Gecko	Heidrich et al. 2007, Z2	-	O	-	-	-	
7.	<i>Cyrtodactylus phongnhakebangensis</i>	Phongnhakebang Bent-toed Gecko	Z1, Z2	S	S	S	P	P	
8.	<i>Cyrtodactylus roesleri</i>	Roesler's Bent-toed Gecko	Ziegler et al. 2010	S	S	S	S	S	
9.	<i>Gehyra mutilata</i>	Common Four-clawed Gecko	Z1, Z2	-	-	-	-	-	
10.	<i>Gekko gekko</i>	Gecko	Z1, Z2	V	P	V	V	V	

11.	<i>Gekko palmatus</i>	Palm Gecko	Z1, Z2	S	-	-	-	-	
12.	<i>Gekko scientiadventura</i>	Phongnhakebang Gecko	Z1, Z2	S	S	O	S	S	
13.	<i>Hemidactylus frenatus</i>	Common House Gecko	Z1, Z2	-	-	-	-	O	
14.	<i>Hemidactylus garnoti</i>	Garnot's House Gecko	Z1	-	-	-	-	-	
15.	<i>Takydromus hani</i>	Green Grass Lizard	Z1, Z2	-	-	-	-	-	
16.	<i>Takydromus kuehnei</i>	Thompson's Grass Lizard	Z1, Z2	-	-	-	-	-	
17.	<i>Takydromus sexlineatus</i>	Asian Grass Lizard	Z1, Z2	-	-	-	-	-	
18.	<i>Eutropis longicaudatus</i>	Long-tailed Mabuya	Z1, Z2	O	-	-	-	O	
19.	<i>E. macularius</i>	Bronze Mabuya	Z1, Z2	-	-	-	-	-	
20.	<i>E. multifasciatus</i>	Common Sun Skink	Z1, Z2	O	O	-	-	O	
21.	<i>Lygosoma boehmei</i>	Boehme's Supple Skink	Ziegler et al. 2007, Z2	-	-	-	-	-	
22.	<i>Lygosoma quadrupes</i>	Short-limbed Supple Skink	Z1, Z2	-	-	-	-	-	
23.	<i>Plestiodon elegans</i>	Shanghai Elegant Skink	Z1, Z2	-	-	-	-	-	
24.	<i>Plestiodon quadrilineatus</i>	Four-striped Skink	Z1, Z2	O	-	-	-	-	
25.	<i>Scincella melanosticta</i>	Black Ground Skink	Z1, Z2	S	S	-	S	S	
26.	<i>Scincella rufocaudata</i>	Red-tailed Ground Skink		S	-	-	-	-	New record

27.	<i>Sphenomorphus indicus</i>	Indian Forest Skink	Z1, Z2	-	-	S	-	-	
28.	<i>Sphenomorphus tetradactylus</i>	Four-fingered Skink	Darevsky & Orlov 2005, Z2 Nguyen et al. 2011b	S	-	-	-	-	Formerly recorded as <i>Leptoseps tetradactylus</i>
29.	<i>Tropidophorus cocincinensis</i>	Cochinchinese Water Skink	Z1, Z2	-	-	-	-	-	
30.	<i>Tropidophorus noggei</i>	Nogge's Water Skink	Z1, Z2	S	-	O	-	-	
31.	<i>Dopasia gracilis</i>	Asian Glass Lizard	Nguyen et al. 2011a	-	-	-	-	-	
		Monitor Lizards							
32.	<i>Varanus salvator</i>	Water Monitor	Z1, Z2	-	-	-	-	-	
33.	<i>Ramphotyphlops braminus</i>	Common Blind Snake	Z1, Z2	-	-	-	-	-	
34.	<i>Typhlops diardi</i>	Indochinese Blind Snake	Z1	-	-	-	-	-	
35.	<i>Xenopeltis hainanensis</i>	Hainan Sunbeam Snake	Z1, Z2	-	-	-	-	-	
36.	<i>Xenopeltis unicolor</i>	Common Sunbeam Snake	Z1, Z2	-	-	-	-	-	
37.	<i>Python molurus</i>	Burmese Python	Z1, Z2	-	-	-	-	-	

38.	<i>Python reticulatus</i>	Reticulated Python	Z1, Z2	-	-	-	-	-	
39.	<i>Ahaetula prasina</i>	Oriental Whip Snake	Z1, Z2	-	-	-	-	-	
40.	<i>Amphiesma andreae</i>	Andrea's Keelback	Z1, Z2	-	-	-	-	-	
41.	<i>Amphiesma boulengeri</i>	Boulenger's keelback	Z1, Z2	-	-	-	-	-	Formerly recorded as <i>Amphiesma khasiense</i>
42.	<i>Amphiesma leucomystax</i>	White-lipped Keelback	David et al. 2007, Z2	S	-	S	P	-	
43.	<i>Amphiesma stolatum</i>	Buff-striped Keelback	Z1, Z2	-	-	-	-	-	
44.	<i>Boiga bourreti</i>	Bourret's Cat Snake	Z1, Z2	-	-	-	-	-	
45.	<i>Boiga guangxiensis</i>	Guangxi Cat Snake	Z1, Z2	S	O	S	-	-	
46.	<i>Boiga multomaculata</i>	Many-spotted Cat Snake	Z1, Z2	-	-	-	-	-	
47.	<i>Calamaria pavementata</i>	Collared Reed Snake	Z1	-	-	-	-	-	
48.	<i>Calamaria septentrionalis</i>	Northern Reed Snake	Z1	-	-	-	-	-	
49.	<i>Calamaria thanhi</i>	Thanh's Reed Snake	Z1, Z2	-	-	-	-	-	
50.	<i>Chrysopelea ornata</i>	Golden Flying Snake	Z1, Z2	-	-	-	-	-	
51.	<i>Coelognathus radiatus</i>	Copperhead Racer	Ziegler et al. 2007, Z2	-	-	-	-	-	
52.	<i>Cyclophiops major</i>	Chinese Green Snake	Z1, Z2	-	-	-	-	-	
53.	<i>Cyclophiops multicinctus</i>	Many-banded Green Snake	Z1, Z2	S	S	-	O	-	

54.	<i>Dendrelaphis ngansonensis</i>	Nganson Bronzeback	Z1, Z2	S	-	-	-	-	
55.	<i>Dinodon cf. rufozonatum</i>	Red-banded Snake	Z1, Z2	S	S	S	O	O	
56.	<i>Dinodon septentrionalis</i>	White-banded Wolf Snake	Z1	-	-	-	-	-	
57.	<i>Dryocalamus davisonii</i>	Bridle Snake	Z1, Z2	S	-	-	-	-	
58.	<i>Enhydryis plumbea</i>	Plumbeous Water Snake	Z1, Z2	-	-	-	-	-	
59.	<i>Fimbrios smithi</i>	Smith's Snake	Ziegler et al. 2008, Z2	-	-	-	-	-	
60.	<i>Gonyosoma prasinum</i>	Khasi Rat Snake	Ziegler et al. 2007, Z2	-	-	-	-	-	
61.	<i>Liopeltis frenatus</i>	Frenated Ringneck	Ziegler et al. 2007, Z2	-	-	-	-	-	
62.	<i>Lycodon cf. fasciatus</i>	Banded Wolf Snake	Z1, Z2	S	-	O	-	-	
63.	<i>Lycodon futsingensis</i>	Futsing Wolf Snake	Z2, Vogel et al. 2009	O	-	O	-	-	
64.	<i>Lycodon paucifasciatus</i>	Rendahl's Wolf Snake	Z1, Z2	-	-	-	-	S	
65.	<i>Lycodon ruhstrati</i> complex	Ruhstrat's Wolf Snake	Z1, Z2	S	S	-	-	-	
66.	<i>Oligodon chinensis</i>	Chinese Kukri Snake	Z1, Z2	-	-	-	-	-	
67.	<i>Oligodon taeniatus</i>	Striped Kukri Snake	Z1, Z2	-	-	-	-	-	
68.	<i>Oreocryptophis porphyraceus</i>	Red Bamboo Snake	Z1, Z2	S	-	-	-	-	
69.	<i>Orthriophis moellendorffi</i>	Moellendorff's Rat Snake	Z1	-	-	-	-	-	
70.	<i>Pareas carinatus</i>	Keeled Slug Snake	Z1, Z2	-	-	-	-	-	
71.	<i>Pareas hamptoni</i>	Hampton's Slug Snake	Ziegler et al. 2007, Z2	S	O	O	S	-	

72.	<i>Pareas macularius</i>	Spotted Slug Snake	Ziegler et al. 2007, Z2	-	-	-	-	-	
73.	<i>Pareas margaritophorus</i>	White-spotted Slug Snake	Z1, Z2	-	-	-	-	-	
74.	<i>Parahelicops annamensis</i>	Annam Keelback		-	S	-	-	-	Formerly recorded as <i>Amphiesma</i> sp. by Ziegler et al. (2009)
75.	<i>Psammodynastes pulverulentus</i>	Mock Viper	Z1, Z2	S	S	O	S	O	
76.	<i>Pseudoxenodon macrops</i>	Big-eyed Bamboo Snake	Ziegler et al. 2007, Z2	-	-	-	-	-	
77.	<i>Ptyas korros</i>	Indochinese Rat Snake	Z1, Z2	-	-	-	-	-	
78.	<i>Ptyas mucosa</i>	Common Rat Snake	Z1, Z2	-	-	-	-	-	
79.	<i>Rhabdophis chrysargos</i>	Speckle-bellied Keelback	Z1, Z2	-	-	-	S	-	
80.	<i>Rhabdophis subminiatus</i>	Red-necked Keelback	Z1, Z2	S	S	-	-	-	
81.	<i>Sibynophis collaris</i>	Common Black-headed Snake	Ziegler et al. 2007	-	-	-	-	-	
82.	<i>Sinonatrix percarinata</i>	Mountain Water Snake	Z1, Z2	S	S	-	-	-	
83.	<i>Xenochrophis flavipunctatus</i>	Yellow-spotted Keelback	Z1, Z2	-	-	-	-	-	
84.	<i>Bungarus candidus</i>	Blue Krait	Z1, Z2	-	-	S	-	-	
85.	<i>Bungarus fasciatus</i>	Banded Krait	Z1, Z2	O	-	-	O	-	
86.	<i>Naja cf. atra</i>	Chinese Cobra	Z1, Z2	-	-	-	-	-	
87.	<i>Ophiophagus hannah</i>	King Cobra	Z1, Z2	-	-	-	O	-	

88.	<i>Sinomicrurus macclellandi</i>	MacClelland's Coral Snake	Z1	-	-	-	-	-	
89.	<i>Cryptelytrops albolabris</i>	White-lipped Pitviper	Z1, Z2	-	-	-	-	-	
90.	<i>Protobothops cornutus</i>	Horned Pitviper	Z1, Z2	S	-	S	-	-	
91.	<i>Protobothops mucrosquamatus</i>	Chinese Habu		S	-	-	-	-	New record
92.	<i>Protobothrops sieversorum</i>	Sievers' three Horn-scaled Pitviper	Z1, Z2	S	-	S	-	-	
93.	<i>Viridovipera truongsoneensis</i>	Truongson Pitviper	Z1, Z2	-	-	-	-	-	
94.	<i>Viridovipera cf. vogeli</i>	Vogel's Green Pitviper	Z1, Z2	S	S	S	O	-	
95.	<i>Platysternon megacephalum</i>	Big-headed Turtle	Z1, Z2	-	-	-	-	-	
96.	<i>Cuora bourreti</i>	Bourret's Box Turtle	Z1, Z2	-	-	-	-	-	Formerly recorded as <i>Cuora galbinifrons</i>
97.	<i>Cuora cyclornata</i>	Cyclornated Box Turtle	Z1, Z2	-	-	-	-	-	Formerly recorded as <i>Cuora trifasciata</i>
98.	<i>Cuora mouhotii</i>	Keeled Box Turtle	Z1, Z2	-	-	-	-	-	
99.	<i>Cyclemys oldhami</i>	Oldham's Leaf Turtle	Z1, Z2	-	-	-	-	-	Formerly recorded as <i>Cuora tcheponensis</i>

100.	<i>Heosemys grandis</i>	Giant Asian Pond Turtle	Z1, Z2	-	-	-	-	-	
101.	<i>Mauremys mutica</i>	Asian Yellow Pond Turtle	Z1, Z2	-	-	-	-	-	
102.	<i>Mauremys sinensis</i>	Chinese Stripe-neck Turtle	Z1, Z2	-	-	-	-	-	
103.	<i>Sacalia quadriocellata</i>	Four-eyed Turtle	Z1, Z2	-	-	-	-	-	
104.	<i>Indotestudo elongata</i>	Elongated Tortoise	Z1	-	-	-	-	-	
105.	<i>Manouria impressa</i>	Impressed Tortoise	Z1, Z2	-	-	-	-	-	
106.	<i>Palea steindachneri</i>	Wattle-necked Softshell Turtle	Z1, Z2	-	-	-	-	-	
107.	<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle	Z1, Z2	-	-	-	-	-	
108.	<i>Duttaphrynus melanostictus</i>	Black-spined Toad	H1, Z2	O	P	O	O	O	
109.	<i>Ingerophrynus galeatus</i>	Cambodian Toad	H1, Z2	-	-	-	-	-	
110.	<i>Ingerophrynus macrotis</i>	Big-eared Toad		S	S		O	O	New record
111.	<i>Hyla simplex</i>	Annam Treefrog	H1, Z2	-	-	-	-	-	

112.	<i>Brachytarsophrys intermedia</i>	Annam Spadefoot Toad	H1, Z2	-	-	-	-	-	
113.	<i>Leptobrachium cf. chapaense</i>	Sapa Eyebow Toad	H1, Z2	S	S	O	S	S	
114.	<i>Leptolalax cf. pelodytoides</i>	Thao Asian Toad	H1, Z2	S	S	-	S	-	
115.	<i>Ophryophryne hansii</i>	Hans' Mountain Toad	H1, Z2	S	S	S	S	S	
116.	<i>Ophryophryne cf. pachyproctus</i>	Zhushihe Mountain		-	S	-	-	-	New record
117.	<i>Xenophrys major</i>	Anderson's Eyebow Toad	H1, Z2	S	S	O	S	O	
118.	<i>Kalophrynus interlineatus</i>	Northern Sticky Frog	H1, Z2	-	-	-	-	-	
119.	<i>Kaloula pulchra</i>	Asiatic Painted Frog	H1, Z2	-	O	-	O	-	
120.	<i>Microhyla bedmorei</i>	Berdmore's Narrow-mouthed Frog	H1, Z2						
121.	<i>Microhyla butleri</i>	Butler's Rice Frog	H1, Z2	S	S	-	O	O	
122.	<i>Microhyla fissipes</i>	Ornate Pigmy Frog	H1, Z2						
123.	<i>Microhyla heymonsi</i>	Black-flanked Pigmy Frog	H1, Z2	S	S	O	S	O	
124.	<i>Microhyla marmorata</i>	Marble Pigmy Frog	H1, Z2	S	S	S	O	O	
125.	<i>Microhyla pulchra</i>	Guangdong Rice Frog	H1, Z2	S	S	O	O	O	
126.	<i>Micryletta inornata</i>	Jewel Pigmy Frog	H1, Z2	S	S	O	S	O	

127.	<i>Fejervarya limnocharis</i>	Rice Frog	H1, Z2	O	S	O	O	O	
128.	<i>Hoplobatrachus rugulosus</i>	Common Lowland Frog	H1, Z2	O	O	O	O	O	
129.	<i>Limnonectes kuhlii</i> complex	Kuhl's Creek Frog	H1, Z2	S	S	O	S	S	
130.	<i>Limnonectes limborgi</i>	Limborg's Frog	H1, Z2	S	S	S	S	S	Formerly recorded as <i>Limnonectes hascheanus</i>
131.	<i>Limnonectes poilani</i>	Poilan's Frog	Z1, Z2	-	S	-	-	S	
132.	<i>Occidozyga lima</i>	Rough-skinned Floating Frog	H1, Z2	-	-	-	-	-	
133.	<i>Occidozyga martensii</i>	Martens' Frog	H1, Z2	S	S	-	-	S	
134.	<i>Amolops cremnobatus</i>	Laotian Sucker Frog	Ziegler & Vu 2009	-	-	-	-	-	Formerly recorded as <i>Amolops ricketti</i> by Hendrix et al. (2008)
135.	<i>Babina chapaensis</i>	Chapa Frog		-	S	-	-	-	New record
136.	<i>Hylarana attigua</i>	Similar Frog	H1, Z2	S	S	-	S	S	
137.	<i>Hylarana guentheri</i>	Guenther's Frog	H1, Z2	S	S	-	-	-	
138.	<i>Hylarana macrodactyla</i>	Guangdong Frog	H1	-	-	-	-	-	
139.	<i>Hylarana maosonensis</i>	Mauson Frog	H1, Z2	S	S	-	S	-	
140.	<i>Hylarana nigrovittata</i>	Black-striped Frog	H1, Z2	S	S	S	S	S	
141.	<i>Hylarana taipehensis</i>	Taipei Frog	H1	-	-	-	-	-	

142.	<i>Odorrana andersoni</i>	Anderson's Frog	H1	-	-	-	-	-	
143.	<i>Odorrana chloronota</i>	Green Cascade Frog	H1	S	S	S	S	S	
144.	<i>Odorrana tiannanensis</i>	Tiannan Frog	Z2	S	S	-	S	S	
145.	<i>Rana johnsi</i>	Johns' Frog	H1, Z2	S	S	S	S	S	
146.	<i>Chiromantis vittatus</i>	Striped Asian Treefrog	H1, Z2	S	-	-	-	-	
147.	<i>Gracixalus quieti</i>	Quiet's Treefrog	Nguyen et al. 2008, Z2	-	-	-	-	-	
148.	<i>Kurixalus banaensis</i>	Bana Bubble-nest Frog	H1, Z2	S	S	S	S	S	
149.	<i>Kurixalus verrucosus</i>	Small Rough-armed Treefrog	H1, Z2	S	S	-	S	S	
150.	<i>Polypedates mutus</i>	Burmese Whipping Frog	H1, Z2	S	S	S	S	S	
151.	<i>Polypedates</i> sp.	Whipping Frog	H1, Z2	S	S	-	-	-	Formerly recorded as <i>Polypedates leucomystax</i>
152.	<i>Rhacophorus annamensis</i>	Annam Flying Frog	H1, Z2	S	S	S	O	-	
153.	<i>Rhacophorus dennysi</i>	Dennys' Whipping Frog	H1, Z2	S	-	-	S	-	
154.	<i>Rhacophorus exechopygus</i>	Tramlap Flying Treefrog	H1, Z2	-	-	-	-	-	
155.	<i>Rhacophorus kio</i>	Kio Whipping Frog	H1, Z2	S	S	-	S	-	
156.	<i>Rhacophorus orlovi</i>	Orlov's Treefrog	H1, Z2	S	S	S	S	-	
157.	<i>Rhacophorus rhodopus</i>	Red-webbed Treefrog	H1, Z2	S	S	-	S	-	

158.	<i>Theلودerma asperum</i>	Hill Garden Bug-eyed Frog	H1, Z2	S	S	S	S	-	
159.	<i>Theلودerma corticale</i>	Tonkin Bug-eyed Frog		S	-	S	-	-	New record
160.	<i>Theلودerma stellatum</i>	Taylor's Bug-eyed Frog		S	-	S	-	-	New record
161.	<i>Ichthyophis sp.</i>	Asian Caecilian		-	S	-	-	-	New record
				0	5	41	48	3	

Notes:

- Reference sources: H1 = Hendrix et al. 2008, Z1 = Ziegler et al. 2006, Z2 = Ziegler & Vu 2009.
- Species recorded by Ziegler et al. (2006), Hendrix et al. (2008) and other authors with a question-mark (?) but were removed from the list of Ziegler & Vu (2009): *Bombina maxima*, *Eutropis chapaensis*, *Scincella rupicola*, *Sphenomorphus buenloicus*, *Dendrelaphis pictus*, *Malayemys subtrijuga*.
- Data source: S = specimen, P = photograph, O = observation, V = call.

3.

Date	Activity	Location
15–21 June	Meetings and pre-survey	Quang Binh
24–29 June	Preparing training documents Signing contract with PPMU / KfW	Hanoi Quang Binh
30 June–1 July	Contact with Phong Nha – Ke Bang NP about working plan and training course	Hanoi
2–5 July	Preparation: equipment, chemical	Hanoi
12 July	Travel from Hanoi to Phong Nha – Ke Bang	Quang Binh
13 July	Training course for technical staff of the national park Paper work	Quang Binh
14 July	Practice training Paper work in Thuong Hoa Travel to the field site Survey in the forest near Mo O Village	Thuong Hoa
15 July	Survey in Da Lat 1 forest	Thuong Hoa
16 July	Survey in the forest near Yen Hop Village	Thuong Hoa
17 July	Survey in the forest and caves near Mo O Village	Thuong Hoa
18–19 July	Survey in the forest on Ma Nghi Mountain	Thuong Hoa
20 July	Group 1: Working in the forest in Hoa Son Group 2: Working in the forest around Hang Lon, near Ban On Village	Hoa Son Thuong Hoa
21–22 July	Survey in the Da Lat 2 forest	Thuong Hoa
23 July	Group 1: Working in the forest in Hoa Son Group 2: Working in the forest around Hang En	Hoa Son Thuong Hoa
24–26 July	Group 1: Working in the forest in Hoa Son	Hoá Son
24–26 July	Group 2: Working in the Da Lat 2 and Da Lat 3 forest	Thuong Hoa
27 July	Survey in the Cha Noi forest	Xuan Trach
28–31 July	Survey in the Cha Noi forest	Xuan Trach
1 August	Working with the directorate of the SRRC, Phong Nha – Ke Bang NP Travel to Dong Hoi Reporting with PPMU in Dong Hoi	Quang Binh

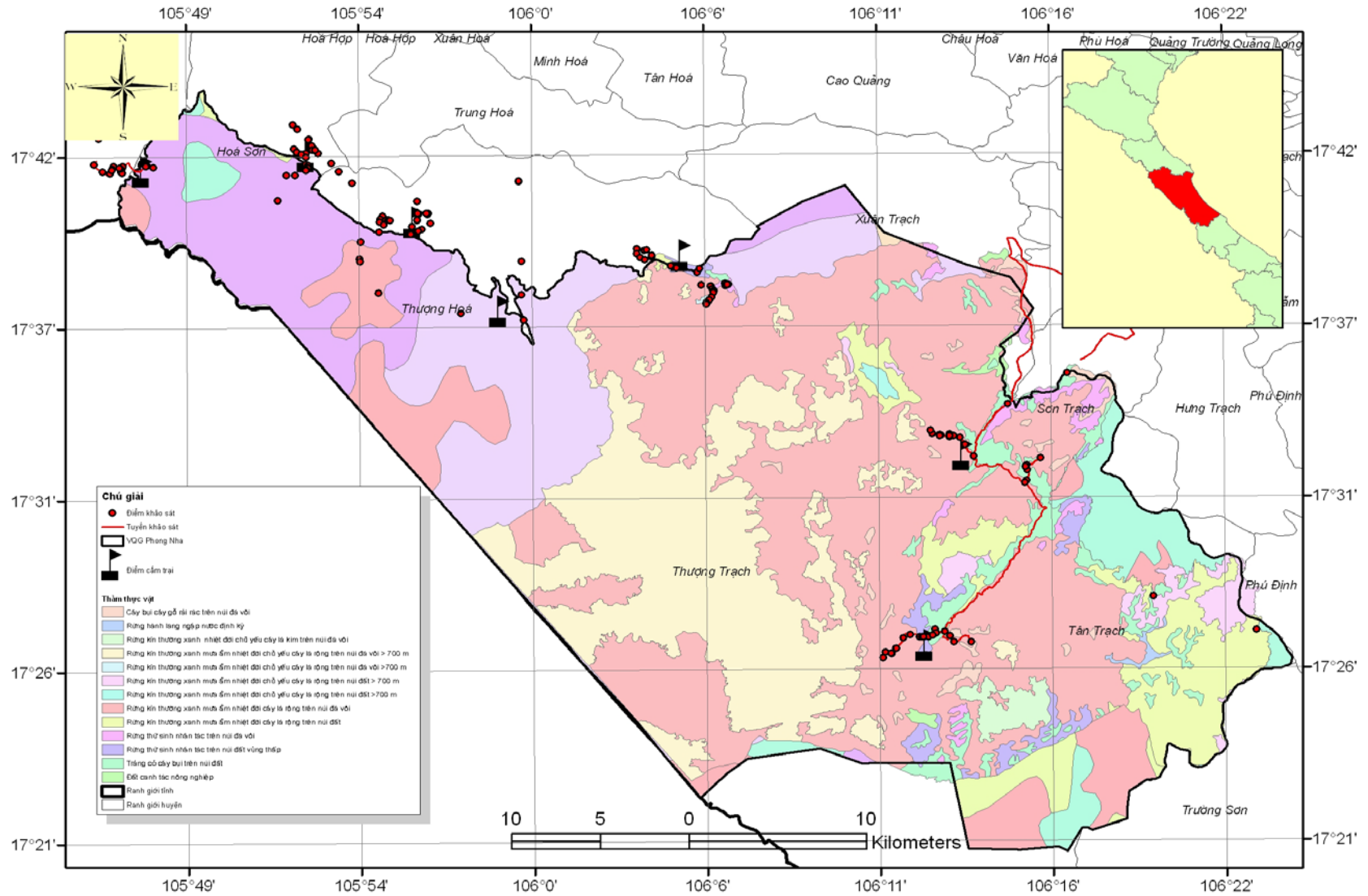
2 August	Travel back to Hanoi	
15–30 August	Data analysis Specimen identification Reporting	Hanoi
3–6 September	Preparation	Hanoi
12 September	Travel from Hanoi – PNKB	NP
13–18 September	Field survey in Hoa Son, accessed from Cha Lo Village, Dan Hoa Commune	Hoa Son
19–24 September	Field survey around Station 27 and in Dai A – Dai Cao forest	Thuong Trach
25–28 September	Field survey in Tro Mong forest (karst forest)	Son Trach
29 September	Travel back to the NP Headquarters (Hurricane effect) Working with the directorate of the Center for Scientific Research and Wildlife Rescue, Phong Nha – Ke Bang NP Paper work	
30 September	Reporting with PPMU	Dong Hoi
1 October	Travel back to Hanoi	
15 October–10 November	Data analysis Specimen examination	Hanoi
11–30 November	Reporting: Draft report in English and Vietnamese	Hanoi
20–31 December	Revising final report	Hanoi

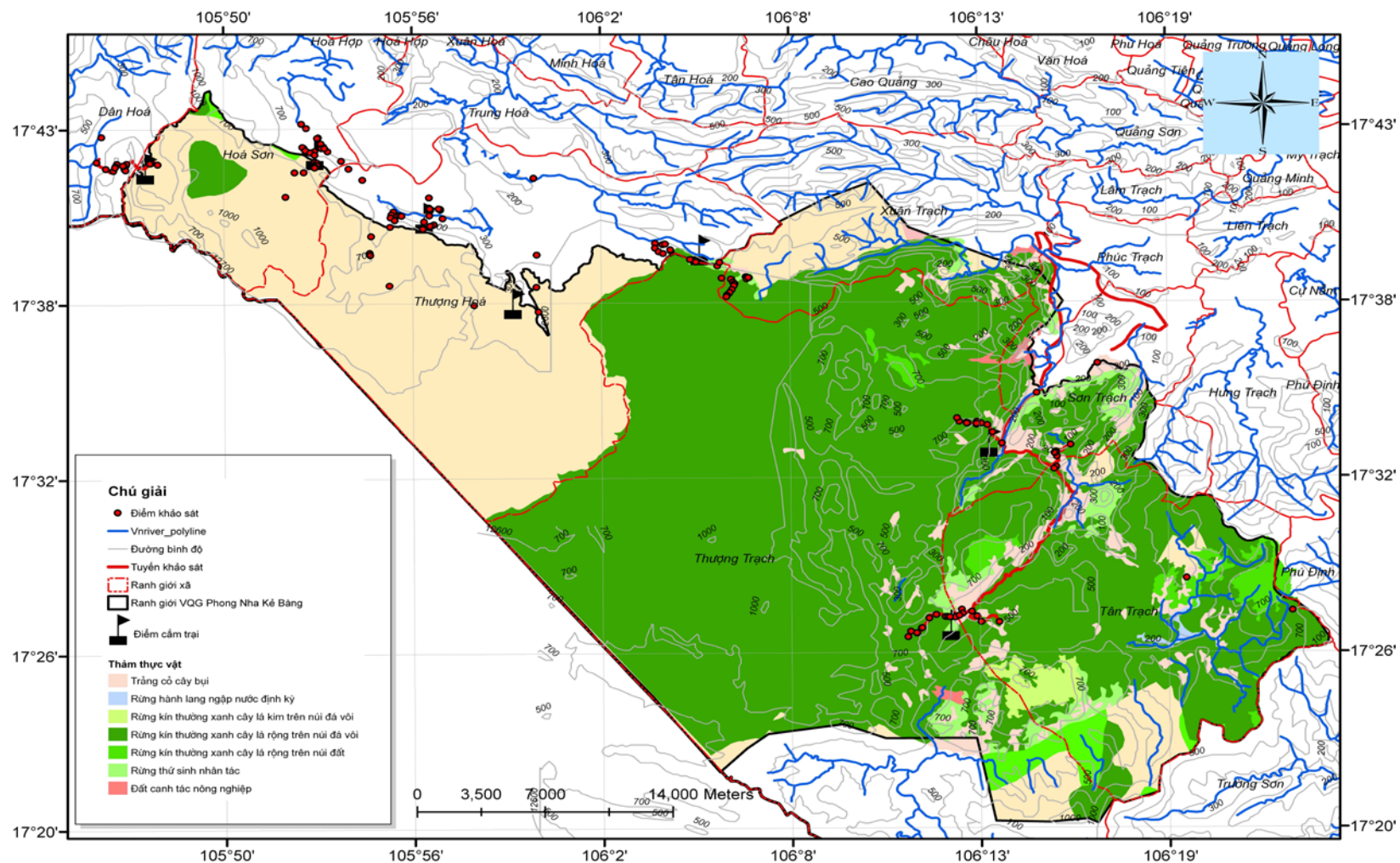
4.

Location	Coordinate	Elevation	Commune
Camp Site 1 (CAMP1)	17°40.506'N, 105°56.248'E	313 m	Thuong Hoa
Mountain Peak 1 near Ca Xeng Border Station	17°40.438'N, 105°55.047'E	330 m	Thuong Hoa
Da Lat 1 Forest	17°40.124'N, 105°55.031'E	312 m	Thuong Hoa
Hang Tinh Cave	17°40.152'N, 105°56.277'E	310 m	Thuong Hoa
Ma Nghi Peak	17°40.057'N, 105°56.049'E	513 m	Thuong Hoa
Forest near Ban On Village	17°39.120'N, 105°59.678'E	250 m	Thuong Hoa
Camp Site 2 Old House (CAMP 2)	17°38.057'N, 105°59.129'E	280 m	Thuong Hoa
Bomb Crater near CAMP2	17°37.228'N, 105°59.726'E	283 m	Thuong Hoa
Da Lat 2 Forest	17°39.665'N, 105°54.800'E	458 m	Thuong Hoa
Stream 1 in Da Lat 2 forest	17°38.169'N, 105°55.008'E	503 m	Thuong Hoa
Camp Site 3 (CAMP3)	17°39.108'N, 105°54.755'E	493 m	Thuong Hoa
Camp Site 4 (CAMP 4)	17°42.754'N, 105°53.009'E	510 m	Hoa Son
Stream 1 near CAMP 4	17°42.612'N, 105°52.571'E	537 m	Hoa Son
Stream 2 near CAMP 4	17°42.534'N, 105°52.704'E	529 m	Hoa Son
Valley near CAMP 4	17°42.112'N, 105°52.706'E	554 m	Hoa Son
Hill near Ba Dinh Forest	17°43.423'N, 105°52.446'E	521 m	Hoa Son
Khai Stream, Cha Noi	17°38.387'N, 106°05.285'E	292 m	Xuan Trach
Cha Noi Cave	17°38.357'N, 106°06.056'E	135 m	Xuan Trach
Forest path to Hung Dang	17°37.649'N, 106°06.056'E	567 m	Xuan Trach
Khe Ma Stream	17°39.066'N, 106°03.845'E	320 m	Xuan Trach
Camp Site 5 (CAMP 5)	17°42.135'N, 105°46.906'E	645 m	Hoa Son
Bomb Crater 1 near CAMP 5	17°42.213'N, 105°47.748'E	570 m	Hoa Son
Bomb Crater 2 near CAMP 5	17°42.195'N, 105°46.989'E	621 m	Hoa Son
Stream 1 near CAMP 5	17°42.166'N, 105°47.957'E	450 m	Hoa Son
Stream 2 near CAMP 5	17°41.979'N, 105°46.961'E	734 m	Hoa Son

Stream 3 near CAMP 5	17°42.135'N, 105°46.977'E	658 m	Hoa Son
Ranger Station 27	17°26.853'N, 106°13.924'E	426 m	Thuong Trach
Camp Site 6 (CAMP 6)	17°27.100'N, 106°11.977'E	445 m	Thuong Trach
Dai A Cace	17°26.369'N, 106°11.102'E	247 m	Thuong Trach
Dai Cao Valley	17°27.372'N, 106°11.552'E	327 m	Thuong Trach
Tro Mong Station	17°34.477'N, 106°15.124'E	327 m	Son Trach
Hung Lau Valley	17°33.464'N, 106°12.957'E	368 m	Son Trach
Stream 1 near Hung Lau	17°33.527'N, 106°12.724'E	388 m	Son Trach
Stream 2 near Hung Lau	17°33.642'N, 106°12.654'E	471 m	Son Trach
Stream 3 near Hung Lau	17°33.476'N, 106°12.983'E	382 m	Son Trach
Stream 4 near Hung Lau	17°33.357'N, 106°12.716'E	450 m	Son Trach
Limestone cliffs near Hang E Cave	17°32.517'N, 106°15.713'E	60 m	Son Trach
Hang E Cave	17°32.747'N, 106°16.161'E	40 m	Son Trach

5.





Note: Landcover data of Thung Hoa and Hoa Son communes are unavailable.

No	Name	Address
1.	Dr. Nguyen Quang Truong	Institute of Ecology and Biological Resources
2.	BSc. Pham The Cuong	Institute of Ecology and Biological Resources
3.	Eng. Nguyen Van Dai	Vietnam National Museum of Nature
4.	BSc. An Thi Hang	Vietnam National Museum of Nature
5.	Eng. Dang Ngoc Kien	Science Research and Rescue Centre, PNKB NP
6.	M.Sc Dinh Huy Tri	Science Research and Rescue Centre, PNKB NP
7.	Mr. Nguyen Van Luong	Thuong Hoa Ranger Station, PNKB NP
8.	Mr. Hoang Huu Ha	Cha Noi Ranger Station, PNKB NP
9.	Mr. Nguyen Minh Thanh	Hoa Son Ranger Station, PNKB NP
10.	Mr. Pham Ngoc Huu	Ranger Station 27, PNKB NP
11.	Mr. Hoang Van Tinh	Tro Mong Ranger Station, PNKB NP

8.

(All photographs by Nguyen Quang Truong, except for photographs 6b and 13e by Pham The Cuong)

1. a) *Duttaphrynus melanostictus* from Hoa Son Commune; b & c) *Ingerophrynus macrotis* from Thuong Hoa and Hoa Son communes; d & e) *Leptobrachium chapaense* complex from Thuong Hoa and Son Trach communes; f) *Leptolalax pelodytoides* from Son Trach Commune

2. a) *Ophryophryne hansii* from Hoa Son Commune; b) *Ophryophryne pachyproctus* from Hoa Son Commune; c & d) *Xenophrys major* from Hoa Son and Son Trach communes; e) *Microhyla bedmorei* from Thuong Hoa Commune; f) *M. butleri* from Thuong Hoa Commune

3. a) *Microhyla fissipes* from Thuong Hoa Commune; b) *M. heymonsi* from Thuong Hoa Commune; c & d) *M. marmorata* from Thuong Hoa and Hoa Son communes; e) *M. pulchra* from Thuong Hoa Commune; f) *Micrylleta inornata* from Thuong Hoa Commune

4. a & b) *Limnonectes kuhlii* complex Hoa Son Commune; c) *L. limborgi* from Hoa Son Commune; d) *L. poilani* from Hoa Son Commune; e) *Babina chapaensis* from Hoa Son Commune; f) *Hylarana maosonensis* complex from Thuong Hoa Commune

5. a & b) *Hylarana nigrovittata* complex from Thuong Hoa and from Hoa Son communes; c) *Odorrana sp1.* from Hoa Son Commune; d) *Odorrana sp2.* from Hoa Son Commune; e) *Odorrana cf. chloronota* from Thuong Hoa Commune; f) Éch ti-an-nan *O. cf. tiannanensis* from Son Trach Commune

. a) *Rana johnsii* from Thuong Hoa Commune; b) *Chiromantis vittatus* from Thuong Hoa Commune (Photograph by Pham The Cuong); c & d) *Kurixalus cf. banaensis* from Thuong Hoa Commune; e & f) *K. cf. verrucosus* from Thuong Hoa and Hoa Son communes

. a & b) *Polypedates mutus* from Hoa Son Commune; c & d) *Rhacophorus annamensis* from Thuong Trach and Thuong Hoa communes; e & f) *R. dennysi* from Thuong Hoa and Thuong Trach communes

8. a & b) *Rhacophorus kio* from Hoa Son and Thuong Trach communes; c, d & e) *R. orlovi* from Thuong Hoa and Thuong Trach communes

9. a & b) *Rhacophorus rhodopus* from Hoa Son Commune; c) *Theioderma asperum* from Thuong Hoa Commune; d) *T. corticale* from Thuong Hoa Commune; e) *T. stellatum* from Xuan Trach Commune; f) *Ichthyophis* sp. from Hoa Son

10. a & b) *Acanthosaura lepidogaster* from Thuong Hoa Commune; c) *Calotes emma* from Thuong Trach Commune; d & e) *Physignathus cocincinus* from Hoa Son Commune

11. a) *Cyrtodactylus phonghakebangensis* from Thuong Hoa Commune; b & c) *C. roesleri* from Thuong Hoa and Thuong Trach communes; d) *Gekko gecko* from Hoa Son Commune; e & f) *Gekko scientiadventura* from Thuong Hoa and Thuong Trach communes

12. a) *Scincella melanosticta* from Thuong Hoa Commune; b & c) *Scincella rufocaudata* from Thuong Hoa Commune; d) *Sphenomorphus indicus* from Thuong Hoa Commune; e) *Sphenomorphus tetradactylus* from Thuong Hoa Commune; f) *Tropidophorus noggei* from Thuong Hoa Commune

13. a & b) *Amphiesma leucomystax* from Thuong Hoa and Thuong Trach communes; c) *Boiga quangxiensis* from Xuan Trach Commune; d) *Cyclophiops multicinctus* from Thuong Hoa Commune; e) *Dendrelaphis ngansonensis* from Thuong Hoa Commune; f) *Dinodon rosozonatum* from Thuong Hoa Commune

14. a) *Dryocalamus davisoni* from Thuong Hoa Commune; b) *Lycodon* cf. *paucifaciatus* from Thuong Trach Commune; c, d & e) *Lycodon fasciatus* complex from Thuong Hoa Commune; f) *Oreocryptophis porphyraceus* from Thuong Hoa Commune

15. a & b) *Parahelicops annamensis* from Hoa Son Commune; c) *Pareas hamptoni* from Thuong Hoa Commune; d) *Psammodynastes pulverulentus* from Thuong Hoa Commune; e) *Rhabdophis chrysargos* from Thuong Trach Commune; f) *Sinonatrix percarinata* from Hoa Son Commune

1 . a) *Bungarus candidus* from Xuan Trach Commune; b) *Protobothrops cornutus* from Xuan Trach Commune; c) *P. mucrosquamatus* from Thuong Hoa Commune; d) *P. sieversorum* from Thuong Hoa Commune; e) *Viridovipera* cf. *vogeli* from Xuan Trach and Thuong Trach communes

1 . a) Venomous snake collecting; b) Specimen preserving in the field; c) Night excursion in Cha Noi Cave, Xuan Trach Commune; d) Night excursion in Da Lat forest, Thuong Hoa Commune; e) Excursion in Dai Cao forest, Thuong Trach Commune

18. a) Moving to the camp site in Thuong Trach Commune by a German truck; b) Camping in the Dai A – Dai Cao forest; c) Dang Ngoc Kien (PNKB NP) collected a lizard specimen in the forest in Hoa Son Commune; d) Dinner in the forest in Hoa Son Commune; e) Night excursion in the forest in adjoining area between Hoa Son and Dan Hoa communes

19. Human disturbances: a) Timber logging in Hoa Son forest; b) A hunting hut in Cha Noi forest, Xuan Trach Commune; c) Collecting tree oil in the forest in Hoa Son Commune; d) Forest alteration for establishing cultivation near Mo O Village, Thuong Hoa Commune

20. Landscape and habitat types: a) Karst forest near Mo O Village, Thuong Hoa Commune; b) Stream near CAMP 4, Hoa Son Commune; c) Forest in Da Lat 2, Thuong Hoa Commune; d) Forest near CAMP 2, Thuong Hoa Commune; e) Lowland evergreen forest in U Bo area, Tan Trach Commune

BIODIVERSITY SURVEY OF RODENTS, INSECTIVORES, SMALL CARNIVORES AND LORIS IN AND AROUND THE PHONG NHA – KE BANG NATIONAL PARK, QUANG BINH, VIETNAM

Implimented By
Fauna & Flora International
Vietnam Conservation Support Programme

With the support of

KfW
and
The People's Committee of Quang Binh Province

December 2012

A report for the Nature Conservation and Sustainable Natural Resource Management in
Phong Nha ó Ke Bang National Park Region Project, Quang Binh



EDITORS AND CONTRIBUTORS

Nguyen Xuan Dang

Institute of Ecology and Biological Resources

Nguyen Manh Ha

Centre for Natural Resources and Environmental Studies (CRES)
Vietnam National University Hanoi

Nguyen Xuan Nghia

Institute of Ecology and Biological Resources

Do Tuoc

Forest Inventory and Planning Institute

Nguyen Ngoc Tuan

Forest Protection Department of Quang Tri province

Le Van Dung

Cuc Phuong National Park

Le Trong Dat, Benjamin Miles Rawson

Editors:

Nguyen Xuan Dang, Nguyen Manh Ha and William V. Bleisch

Translation: XXX

EXECUTIVE SUMMARY	1
1.1 Overview of the report	8
1.2 Context and brief history of the Phong Nha - Ke Bang National Park	8
1.3 PNKB physical structure and climate	9
1.4 Previous biodiversity survey work on mammals in and around the PNKB NP	10
2. OBJECTIVES AND SCOPE OF THE SURVEY	10
2.1 Aims and objectives	10
2.2 Scope of the surveys	11
3. OVERVIEW	12
3.1 Small carnivores and loris: Overview	12
3.2 Rodents and insectivores: Overview	13
3.3 Camera Trapping: Overview	15
3.4 Gibbons: Overview	16
4. METHODS	17
4.1 Small Carnivores and Loris: Methodology and survey locations	17
4.1.1 Survey methods: Small carnivores and Loris	17
4.1.2 Survey area: Small carnivores and loris	18
4.1.3 Survey effort: Small carnivores and loris	19
4.2 Insectivores and Rodents: Methodology and survey locations	19
4.2.1 Survey methods: Insectivores and rodents	19
4.2.2 Survey area: Insectivores and rodents	22
4.2.3 Survey effort: Insectivores and rodents	23
4.3 Camera trapping: Methodology and survey locations	23
4.3.1 Survey methods: Camera trapping	23
4.3.2 Survey area: Camera trapping	24
4.3.3 Survey effort and limitations: Camera trapping	24
4.4 Gibbons: Methodology and survey locations	25
4.4.1 Survey methods: Gibbons	25
4.4.2 Survey area and effort: Gibbons and other primates	26
5. RESULTS	28
5.1 Small Carnivore and Loris Survey Results	28
5.1.1 Accounts of important species	31
Yellow-bellied Weasel, <i>Mustela kathiah</i>	31
Stripe-backed Weasel, <i>Mustela strigidorsa</i>	31
Yellow-throated Marten, <i>Martes flavigula</i>	31
Hog Badger, <i>Arctonyx collaris</i>	32
Small-toothed Ferret Badger, <i>Melogale moschata</i>	32
Large-toothed Ferret Badger, <i>Melogale personata</i>	33
Eurasian Otter, <i>Lutra lutra</i>	34
Smooth-coated Otter, <i>Lutrogale perspicillata</i>	34
Oriental Small-clawed Otter, <i>Aonyx cinerea</i>	34
Large Indian Civet, <i>Viverra zibetha</i>	35
Large-spotted Civet, <i>Viverra megaspila</i>	35
<i>Viverra tainguensis</i>	36

	36
	37
	37
	37
Masked Palm Civet, <i>Paguma larvata</i>	37
Binturong, <i>Arctictis binturong</i>	38
Small-toothed Palm Civet, <i>Arctogalidia trivirgata</i>	38
Owston's Civet, <i>Chrotogale owstoni</i>	39
Small Asian Mongoose, <i>Herpestes javanicus</i>	39
Crab-eating Mongoose, <i>Herpestes urva</i>	40
Cats, Felidae	40
5.2 Insectivores and Rodents Survey Results	41
5.2.1 Insectivores and rodents in the PNKB NP and region	41
5.2.2 First record of <i>Laonastes aenigmamus</i> in Vietnam	43
5.2.3 Rodent species abundance	45
5.3 Camera Trapping Survey Results	49
5.3.1 Accounts of important species	50
Annamite Striped Rabbit, <i>Nesolagus timminsi</i>	50
Large Mammal Species	50
Other records of Ungulates	51
5.4 Primates and their relatives	51
Bengal Slow Loris, <i>Nycticebus bengalensis</i>	51
Pygmy Loris, <i>Nycticebus pygmaeus</i>	51
Southern White-cheeked Gibbon, <i>Nomascus siki</i>	52
Hatinh langur, <i>Trachypithecus hatinhensis</i>	52
Red-shanked Douc, <i>Pygathrix nemaus</i>	53
Bear Macaque, <i>Macaca arctoides</i>	53
Assam Macaque, <i>Macaca assamensis</i>	53
Allied arboreal species	53
5.5 General threats to and management concerns for nonvolant mammals in the PNKB National Park and region	54
5.5.1 Hunting	54
5.5.2 Logging	56
5.5.3 Other activities	57
5.5.4 Threats specific to small carnivores	58
5.5.5 Threats specific to insectivores and rodents	59
5.6 Ranking and identification of areas of high threat	60
5.7 Current conservation management in the survey areas	63
5.8 Use of mammals as indicators of change	63
6. CONCLUSIONS AND RECOMMENDATIONS	65
6.1 The status of nonvolant mammal biodiversity in the PNKB National Park	65
6.1.1 Status of small-carnivores and loris	65
6.1.2 Status of insectivores and rodents	65
6.1.3 Status of large mammals and primates	67
6.2 Threat assessment	68
6.3 Recommendations	68
References	71

INDEX FOR PARK STAFF AND SURVEY TEAMS	- 1 -
MODULE OF MAMMAL SURVEYS	- 7 -
Annex 2a. Survey area and schedule for small carnivores and loris and location of main camps	7 -
Annex 2b. Location of insectivore and rodent survey sites	- 7 -
Annex 2c. Trapline location and trapping effort of insectivore and rodent survey	- 8 -
Annex 2d. List of transects for rodent survey and effort of transect survey	- 9 -
Annex 2e. Schedule of insectivore and rodent surveys	- 10 -
Annex 2f. Detail information on camera trap survey in Ma Rinh, Hoa Son commune	- 11 -
Annex 2g. Detail information on camera trap survey in Da Lat, Thuong Hoa commune	- 16 -
Annex 2h. Detail information on camera trap survey in Ca Con-Hung Tri, Xuan Trach commune	- 20 -
Annex 2i. Gibbon Listening Posts set up during the field survey	- 23 -
ANNEX 4. LISTS OF NONVOLANT MAMMALS RECORDED IN THE PNKB REGION BEFORE 2010	- 25 -
Annex 4a. List of small carnivores recorded in Phong Nha-Ke Bang before 2010	- 25 -
Annex 4b: List of Insectivores and Rodents recorded before 2010	- 28 -
ANNEX 5. SPECIES RECORDS DURING THESE SURVEYS (2011)	- 30 -
Annex 5a. Location of individual small carnivore and loris records	- 30 -
Annex 5b. Location of individual insectivore and rodent records	- 37 -
Annex 5c. Insectivore and rodent specimens trapped during surveys	- 38 -
Annex 5d. Detail camera trap survey records by area	- 39 -
Annex 5e. Gibbons recorded during the surveys	- 43 -
Annex 5f. Records of Hatinh Langur in surveyed areas of Phong Nha-Ke Bang National Park	44 -
Annex 5g. Records of Red-shanked Douc Langur field in surveyed areas of Phong Nha-Ke Bang National Park	- 45 -
ANNEX 6. RELATIVE ABUNDANCE AND TRAP SUCCESS OF RODENTS	- 46 -
ANNEX 7. THREATS RECORDED IN AND AROUND THE PARK	- 47 -
Annex 7a. Threats recorded by the Small Carnivore and Loris survey team	- 47 -
Annex 7b. Threats recorded by the Insectivore and Rodent Survey team	- 51 -
Annex 7c. Record of human and impact by camera trapping team	- 54 -
ANNEX 8. MAPS	- 55 -
Map 1. Location of Insectivore and Rodent Survey Sites	- 55 -
Map 2. Location of Records of threatened rodent species	- 56 -
Map 3. Location of hunting/snaring signs recorded during survey period	- 57 -
Map 4. Map of Gibbon Listening Posts and gibbon records	- 58 -
ANNEX 9. IMAGES OF HABITATS AND ANIMALS RECORDED DURING THE SURVEYS	- 59 -
ANNEX 10. LIST OF PARTICIPANTS AND CONTRIBUTORS	- 70 -

and Conventions

Ass. Prof. Dr.	ó Associate Professor Doctor
FFI	ó Fauna & Flora International
IEBR	ó Institute of Ecology and Biological Resources
KfW	ó KreditanstaltfürWiederaufbau
Laos PDR	ó Laos People Democratic Republic
MonRE	ó Ministry of Resources and Environment
NCBA	ó National Conservation Biodiversity Area (Laos)
NTFP	ó Non Timber Forest Products
PNKB NP	ó Phong Nha Ke Bang National Park
SFE	ó State Forestry Enterprise
USA	ó United State of America
VRTC	ó Vietnam Russian Tropical Centre
WWF	ó World Wide Fund for Nature

All nomenclature for species is consistent with the IUCN Redlist when available (IUCN, 2012). All binomial species names are given in italics. Proper family names are presented in upper case or bold face. All common English names for species are capitalized, but English names for genera and families are not.

Executive Summary

Surveys of mammalian diversity in the Phong Nha ó Ke Bang National Park. In addition to a critical review of past literature on mammals found in and adjacent to the Park, the report provides new information collected during intensive surveys carried out in 2011 of sites in the National Park, especially in the newly added Extension Area. These surveys focused in particular on lesser studied taxa, including rodents, insectivores and small carnivores, and introduced camera trapping as a survey and monitoring tool.

Briefly summarizing the findings of the studies:

- É The Rodent fauna in PNKB NP is quite rich and diverse. So far, 35 rodent species of 20 genera and 5 families have been recorded in PNKB NP. These account for 50% of total species number, 69 % of total genera number and 100% of total family number of Vietnam's rodent fauna.
- É Species composition and abundance of rodent fauna is indicative of the good quality forest habitat in the survey sites: overall trap success of 1.949 is typical for old-growth forest; 8 strict-forest species accounted for 64.5% of total specimen number with a trap success of 1.256 specimen / 100 trap.nights; 2 highly forest dependent genera (*Leopoldamys* and *Maxomys*) had highest specimen percentage and abundance
- É The survey revealed the first record of the "Kne-cung" or Laotian Rock Rat *Laonastes aenigmamus* in Vietnam. This record is important as it increases the chance for conservation of this little-known endemic species, which was previously only known from a restricted area in Lao PDR.
- É Comparison of species number and trap success between the 3 survey sites shows that the biodiversity values of the 2 survey sites in the extension area (Ma Rin and Hang En areas) is not less and may be even higher than those of the survey site in the original core zone of PNKB NP (the Hung Dang area). Moreover, "Kne-cung" *Laonastes aenigmamus* was found in Hang En area and reported to occur also in Ma Rin area, but was not found in the Hung Dang area. These results indicate the importance of the extension area for biodiversity conservation in the landscape.
- É In all the presence of 16 species of global conservation concern were confirmed in the 2011 surveys, including 4 species that are considered globally Endangered with extinction, 5 species that are globally Vulnerable, 4 species that are globally Near Threatened and 3 species for which data is globally deficient (IUCN, 2012). 3 species not previously recorded, the Laotian Rock Rat (IUCN globally Endangered; see above) and the Large-toothed Ferret Badger *Melogale personata* and Hairy-footed Flying Squirrel *Belomys personii* (both considered Data Deficient by IUCN, 2012).
- É In addition, interviews and examination of remains collected by hunters suggest the continued presence of an additional 8 species of global concern, including 1 species that is considered globally Critically Endangered with extinction, 1 species that is globally Endangered, 3 species that are globally Vulnerable, and 3 species that are globally Near Threatened.
- É Six rodent species of high conservation concern were found including 5 species listed in the Red Data Book of Vietnam and 2 species listed in IUCN Red List as globally threatened species (IUCN 2012).
- É The surveys thus confirm the global importance of Phong Nha ó Ke Bang National Park for conservation of mammals. All these species, however, are facing intensive threats in PNKN NP from human activity, including direct off-take by hunting/snaring and habitat degradation caused by logging and other activities.

Insectivores and Rodents:

conducted from 25 August 2011 to 23 September 2011 in 3 areas of Phong Nha-Ke Bang National Park (PNKB NP), including the Ma Rinh area of Hoa Son Commune, the Hung Dang area of Thuong Trach Commune and the Hung Dang area of Thuong Trach Commune. The first two of these areas are in the newly added extension area of the National Park and the third is in the core zone of the PNKB NP World Heritage Site as currently approved. In total, 10 transects were set and daytime surveys covered 87.2 km of transect, while night surveys covered 50.2 km of transect. Two hundred (200) rodent traps were set in each survey areas, resulting in a total of 3,900 trap-nights. Fifty two (52) pitfalls were set for capture of insectivores.

Survey results showed that rodent fauna in PNKB NP is quite rich and diverse. To date (2011), 35 rodent species of 20 genera and 5 families have been recorded in PNKB NP. These account for 50% of total species number, 69 % of total genera number and 100% of total family number of all the rodents in Vietnam. Only 5 species of insectivores have been recorded in PNKB NP. Heavy rains during the survey period much reduced trapping efficiency of pitfalls. Out of these 40 species recorded, 29 species of rodents and 4 species of insectivores were confirmed during this survey.

During this survey, 4 specimens of a mysterious living-fossil, the "*Kne-cung*" or Laotian Rock Rat (*Laonastes aenigmamus*), were collected. This is the first record of this species in the Park, and also the first record of this species in Vietnam. With this record, not only is one more new species (*Laonastes aenigmamus*) added to the mammal checklist of Vietnam, but also a new genus (*Laonastes*) and a new family (Diamtomyidae). More importantly, this record increases the chances for conservation of this. This species was confirmed in Thuong Hoa Commune and reported to exist also in Hoa Son Commune. Both these communes have a strong tradition on trapping rats for food. "*Kne-cung*" is seriously threatened by snaring activities of local residents. It is probable that the species may also occur in other limestone areas of the park as they share the same habitat and are contiguous.

Overall trap success (an indicator of abundance) of rodents was 1.949 specimens / trap-night, which is fully consistent with results of studies in other areas of Vietnam. Encounter rate of 4 species of flying squirrels ranged from 1.99 ind./100 km (*Petaurista elegans*) to 9.96 for *Belomys pearsonii*. Out of 18 diurnal squirrels and murid species recorded, 8 species are strict-forest species. Their specimens account for 64.5% of total specimen number, and their trap success was 1.256. The remaining 10 species are not strict-forest species. They account for only 35.5% and their trap success is only 0.692. Moreover, 2 highly restricted forest genera (*Leopoldamys* and *Maxomys*) have highest frequency among the specimens and abundance. These data on faunal composition correspond closely to the impressions of intact and undisturbed forest in the study sites.

Out of 34 rodent species recorded for all 3 survey sites, the Hung Dang area harbors 19 species (8 strict-forest species and 11 not strict-forest species) while Ma Rinh area harbors 21 species (10 species and 11 species respectively) and Hang En area harbors 24 species (10 species and 14 species respectively) Hang En area has highest species number because of more habitat diversity, including intact primary forest, affected forests, bushland and agricultural fields. Hung Dang area has lowest species diversity, possibly because of less habitat diversity and much more forest degradation. In relation to trap success, the highest value is in the Hang En area (3.0), then followed by Hung Dang area (2.526) and Ma Rinh area (2.211). Trap success in Ma Rinh and Hung Dang area is not significantly different, but higher in Hang En area, indicating higher abundance of rodents in this area. Comparison of species number (strict-forest species and not strict-forest species) and trap success between 3 survey sites shows that biodiversity values and abundance of 2 survey sites in the extension area was even higher than those of survey sites in the core zone of NP.

Six rodent species of high conservation concern were found in PNKB NP, including 5 species listed in Red Data Book of Vietnam (2007) as nationally threatened and 2 species enlisted in global Red List (IUCN, 2012) as globally threatened species. All these species are facing considerable threats from hunting, snaring and habitat disturbance.

red rodent species recorded in PBKB NP

	Scientific name	VRDB	IUCN RL
Black Giant Squirrel	<i>Ratufa bicolor</i>	VU	NT
Hairy-Footed Flying Squirrel	<i>Belomys pearsonii</i>	CR	DD
Particoloured Flying Squirrel	<i>Hylopetes alboniger</i>	VU	Lc
Lesser Giant Flying Squirrel	<i>Petaurista elegans</i>	EN	Lc
Red Giant Flying Squirrel	<i>Petaurista philippensis</i>	VU	Lc
Laotian Rock Rat	<i>Laonastes aenigmamus</i>	n.c.	EN

Note: VRDB ó Vietnam's Red Data Book (2007), IUCN RL ó IUCN Global Redlist (IUCN, 2012)

CR ó Critical endangered, EN ó Endangered, VU ó Vulnerable,

NT ó Near threatened, DD ó Data deficient, Lc - Least concern, n.c. ó not considered

Small carnivores: For surveys of small carnivores and also loris, key informant semi-structured interviews were carried out in 20 villages in 3 communes, focusing on the knowledge of hunters and loggers on key mammal species. A total of 30 hours of diurnal transect surveys were carried out, covering over 30 kilometers. A total of 26 hours of night-time transect surveys were conducted, covering over 26 kilometers. Transects were from 1-3 km in length, and were walked at a speed of 500-1000 meters/hr during the day, and 500 meters/hr at night. In addition to direct observations, diurnal surveys allowed examination and photography of tracks and sign. Additional information was collected from specimens collected by hunters, and from camera trapping (see below).

The surveys confirmed the presence of 12 species of the 20 species of small carnivores previously reported from the Park. All but one of these species was confirmed to occur in the newly extended area of the Park, confirming its importance for conservation of small carnivores. The Binturong *Arctictis binturong* is considered globally Vulnerable to extinction, while the Hog Badger *Arctonyx collaris* is considered globally Near Threatened and too little data is available about the Large-toothed Ferret Badger *Melogale personata* to determine its global conservation status (Data Deficient; IUCN, 2012). In addition, evidence from interviews suggests the continued presence of the other 8 species of small carnivores that were previously recorded in the Park, 3 of which are considered globally Vulnerable and 2 of which are considered globally Near Threatened. Thus the surveys confirmed the high conservation value of Phong Nha ó Ke Bang National Park, including its extended area, for small carnivores, despite evidence of serious on-going threats from hunting/snaring and forest degradation (see below).

Table 2 List of endangered small carnivore species recorded in PBKB NP

Common name	Scientific name	VRDB	IUCN RL
<i>Arctonyx collaris</i>	Hog Badger		NT
<i>Melogale personata</i>	Large-toothed Ferret Badger		DD
<i>Lutra lutra</i>	Eurasian Otter	VU	NT
<i>Lutrogale perspicillata</i>	Smooth-coated Otter	EN	VU
<i>Aonyx cinerea</i>	Asian Small-clawed Otter	VU	VU
<i>Viverra zibetha</i>	Large Indian Civet		NT
<i>Arctictis binturong</i>	Binturong	EN	VU
<i>Chrotogale owstoni</i>	Owston's Civet	VU	VU

Note: VRDB ó Vietnam's Red Data Book (2007), IUCN RL ó IUCN Global Redlist (IUCN, 2012)

EN ó Endangered, VU ó Vulnerable, NT ó Near threatened, DD ó Data deficient

ate fauna, with a particular focus on a census of gibbons in the survey sites using robust methods. This involved triangulation of gibbon groups heard from listening posts to determine their location accurately. Towards this end, 2 or more morning were spent at each of 21 listening posts, listening for the loud morning calls of the gibbons. In addition, loris were a special focus of nocturnal surveys also carried out for small carnivore observation (see above). All records of all primates observed by all teams were and checked and collated.

The results confirmed the presence of 7 of the 10 species of primate previously reported from the Park, 3 of which are considered globally Endangered with extinction (Southern White-cheeked Gibbon *Nomascus siki*, Red-shanked Douc *Pygathrix nemaeus* and Hatinh Langur *Trachypithecus hatinhensis*), 3 of which are globally Vulnerable, and the final one of which is considered Near Threatened (IUCN, 2012). All seven of these species were confirmed to occur in the newly added extension area of the Park, demonstrating its importance for primate conservation. 1 additional species of global concern is believe to be present in the Park, but was not recorded in these surveys. There has been no recent record of the Black Langur *Trachypithecus eburnus* in the Park. The gibbon census confirmed the presence of gibbons in the extension area, however densities and calling frequencies were very low. Only 4 groups of gibbons were heard in total from the 21 listening posts.

Table 3 List of endangered primate species recorded in PBKB NP

Common name	Scientific name	VRDB	IUCN RL
Bengal Slow Loris	<i>Nycticebus bengalensis</i>	VU	VU
Pygmy Slow Loris	<i>Nycticebus pygmaeus</i>	VU	VU
Assam Macaque	<i>Macaca assamensis</i>	VU	NT
Stump-tailed Macaque	<i>Macaca arctoides</i>		VU
Pig-tailed Macaque	<i>Macaca leonina</i>	VU	VU
Hatinh Langur	<i>Trachypithecus hatinhensis</i>	EN	EN
Red-shanked Douc Langur	<i>Pygathrix nemaeus</i>	EN	EN
Southern White-cheeked Gibbon	<i>Nomascus siki</i>	EN	EN

Note: Abbreviations as above

Large Mammals and Felids:

Camera trapping was specifically targeted at large mammals, however, only one species of ungulate was recorded directly by this and other survey methods; the prolific Wild Board *Sus scrofa*. Remains collected by hunters suggested the continued presence of Soala *Pseudoryx nghetinhensis* (IUCN globally Endangered), Large-antlered Muntjac *Muntiacus vuquangensis* (IUCN globally Vulnerable), and Northern Serow *Capricornis milneedwardsii* (IUCN Globally Near Threatened). Observations of tracks suggested that the Clouded Leopard *Neofelis nebulosa* (IUCN globally Vulnerable) and Golden Cat *Pardofelis temminckii* (IUCN globally Near Threatened) may still be present in the extension area. However, all survey results suggest that the densities of large mammals and wild cats in the surveyed areas are very low, while hunting pressure on these species is extremely high.

Camera trap surveys:

Camera trapping has been recommended as an appropriate technology for survey and monitoring of mammals, and this has already been introduced and implemented successfully in many protected areas in Vietnam. In order to fill the information gap as well as introducing this advantageous technology to build up the park's staff's capacity on surveying and conserving endangered species, a brief camera trapping survey was carried out. Besides building up working capacity, the survey also aimed to provide better understanding of the mammals, especially large mammals and those listed as threatened

nt information for further conservation interventions. The survey in three areas within PNKB NP. The survey focused on the newer less well-known part of the park. Each area was surveyed continuously for 20 to 25 days with a maximum of 30 camera trap units, and then the units were moved to survey in other sites.

The camera trap survey effort has produced 6,761 pictures that confirm the presence of at least 17 species of mammals in PNKB National Park, including 9 identifiable to species level. These include globally threatened species such as the Bear Macaque (globally Vulnerable to extinction, IUCN, 2012), Annamite Striped Rabbit (IUCN Data Deficient), and Black Giant Squirrel (IUCN Near Threatened). Five (5) of these species would not have been confirmed during the surveys otherwise, confirming the utility of the camera trapping method for presence-absence surveys. However, the survey result has indicated a low mammal density in PNKB national park, with a limited number of individuals and species recorded in the three survey areas. In addition, technical problem with the cameras provided caused the limitation of the results, as 25% of the camera units malfunctioned after each survey and many did not work properly in the field. This survey, however, was considered successful as a pilot study and training activity.

Threats and Issues:

All of the surveys demonstrated the high importance of PNKB NP for conservation of nonvolant mammal fauna, including the newly added extension area. The results also demonstrated, however, that nearly all nonvolant mammals in PNKB NP are under serious threat from hunting/snaring and forest degradation. Signs of human activity were found in all survey sites, including trapping/snaring, hunter camps, encroachment, timber cutting, honey harvesting, NTFP collecting, agricultural fields and domestic cattle raising. Hunting/snaring represents the most serious threat in all 3 survey sites; timber removal is another most serious threat in the Ma Rin area. Cattle raising was found only in Hung Dang area of Xuan Trach, but was quite intensive there.

By one assessment, Hung Dang in Xuan Trach Commune was considered to have the highest overall threat level and forests here had been much degraded, converted into mixed bamboo forests. Hunting and cattle raising are the most serious threats in this area. The Hang En area in Thuong Hoa Commune had the second highest threat level. Good forests remained there but valuable trees had been removed and hunting was intensive. The Ma Rin survey area of Hoa Son Commune had the lowest threat level, due to being very far from villages. Forest there was little affected by past logging, however, timber removal and hunting pressure were found to be very high now.

Recommendations:

Based on the information which was collected, the survey teams offer the following recommendations for priority activities for biodiversity surveys, as well as for improved conservation management in PNKB:

- Carry out a longer camera trapping survey for endangered large mammals, which will be implemented over several months and years.
- Further surveys should be conducted to characterize the species diversity and ecology of Insectivore fauna in PNKN NP.
- Use rodent species composition and abundance indexes (encounter rate, trap success), especially, those of *Maxomys surifer*, to monitor levels of anthropogenic impacts on forests of PNKB NP.
- In relation to the key species, Kne-cung (*Laonastes aenigmamus*), further study is necessary to understand its population size, distribution, ecology (microhabitat, food, behaviour, reproduction, etc.) and also estimate snaring pressure (animal offtake) by local people. An educational campaign should be initiated for residents of Hoa Son and Thuong Hoa Commune

importance of conservation of this species and urge them to stop. Extension activities should also support them to find alternative compatible with conservation, such as raising domestic animals for meat, in order to reduce demand for rat and other wildlife meat, so as to reduce hunting by these villagers.

- Special conservation efforts should be focused on 6 endangered rodent species (*Laonastes aenigmamus*, *Belomys pearsonii*, *Hylopetes alboniger*, *Petaurista elegans*, *Petaurista philippensis* and *Ratufa bicolor*) and on all primates, small carnivores, felids and large mammals. In addition to enforcement activities, a monitoring programme should be initiated to monitor the conservation status, population trends and threats for these species.
- Strengthen patrol and enforcement effort in all areas to reduce threats to the forest and its biodiversity. In particular, increase law enforcement in key conservation areas and hot-spots to reduce pressure on biodiversity in general and endangered species in particular. Recommended measures include gun control, snare removal, prosecution of hunters and those cutting and transporting timber, and control of domestic cattle raising inside PNKB NP.
- Increase management of the wildlife trade both inside and around the Park. Hunting and trading of illegal wildlife can still be observed in the forest and in local villages, and it is rarely affected by law enforcement activity.
- Step up conservation education, which it seems has not yet been implemented regularly in and around the park. This is a priority action that should raise understanding of local people toward the law on forest protection and conservation and the law on biodiversity conservation, and also raise their understanding of the value of the forest and biodiversity for their long-term benefit and livelihood.

The The Nature Conservation & Sustainable Natural Resource Management in Phong Nha - Ke Bang Region, Vietnam Project, KfW Component with funding from Vietnam-German Development Cooperation, and implemented through a contract with Fauna and Flora International Vietnam. We are most grateful to Fauna & Flora International in Vietnam for awarding us this valuable engagement in this interesting study. We would therefore like to thank the management unit of the project, the KfW project team, and the staff of FFI Vietnam for their support to our team in this study.

The insectivore and rodent surveys were carried out under the leadership of Associate Professor Dr. Nguyen Xuan Dang ó Head of the Department of Vertebrate Zoology, Institute of Ecology and Biological Resources, with assistance from Nguyen Xuan Nghia from the Institute of Ecology and Biological Resources, and Nguyen Thanh Binh and Nguyen Thanh Huyen from PNKB NP. The small carnivore and loris surveys were carried out by Nguyen Manh Ha, Centre for Natural Resources and Environmental Studies (CRES), Vietnam National University Hanoi and Do Tuoc of the Forest Inventory and Planning Institute, Hanoi, with the assistance of Tran The My and Tran Mung from the PNKB NP. The camera trapping surveys were carried out by Nguyen Manh Ha, Nguyen Ngoc Tuan, Le Van Dung and Do Tuoc with the participation and support of Tran The My, inh Hoàng Tu n, Nguy n Tri Ph ng, Ngô ình Hi u, Ph m Minh Hùng, and Nguy n Thanh T i. The Primate Survey team consisted of Le Trong Dat, Do Tuoc, Nguyen Tri Phuong, who benefitted from the advice of Dr. Benjamin M. Rawson of Conservation International and the support of Nguyen Viet Doai (PNKB NP Scientific Officers) and Pham Van Sau and Tran The My (PNKB NP Rangers).

Our special thanks also go to the Management Board of PNKB NP, especially, Mr. Luu Minh Thanh ó Director of PNKB NP, Mr. Nguyen Van Huyen - Vice Director of PNKB NP, Mr. Dinh Huy Tri ó Director of the Centre for Science Research and Rescue of PNKB NP and Mr. Le Thuc Dinh - Vice Director of Scientific and Wildlife Rescue Center of PNKB NP for their kind permission and valuable support during our fieldwork in PNKB NP. The team would also like to thank Mr. Le Thuc Dinh for his support and advice on planning and preparation for this survey. Our sincere thanks also go out to local frontier stations, the staff of the people's committees and the many residents of Hoa Son, Thuong Hoa, Thuong Trach and Xuan Trach communes Commune who provided their kind help during our fieldwork, particularly those participants who provided services during our field survey, such as the porters and guides. We would like to express our sincere thanks to Nguyen Duy Luong ó Manager of FFI Phong Nha - Ke Bang Conservation Programme for his excellent organization of and valuable support to our survey work, and for his tremendous assistance and support for our team in all steps of this survey. We thank Ilona Johnston and William V. Bleisch, who advised on the design of the biodiversity surveys. This study was commissioned by the PNKB NP Region Project with funding from Vietnam-Germany Development Cooperation, and under contract with FFI Vietnam. We would finally like to thank the Project Management Unit of the project and the staff of FFI Vietnam for their support to our team in this study.

1.1 Overview of the report

This report represents the results of biodiversity assessment of nonvolant mammals in PNKB NP. Survey methods included transect surveys for direct observation, camera trapping, and specimen collecting by rodent traps and insectivore pitfall traps. The report provides information on species diversity, records of recently discovered species, species abundance, and records of threats to wildlife and their habitat. Comparative analysis of biodiversity values and threat assessment was made to assess the value of the newly added extension area of the Park and to identify hotspots for biodiversity conservation in PNKB NP. In addition, the surveys led to recommendations of relevant actions to conserve mammal biodiversity in PNKB NP, as well as on how to use mammals in monitoring anthropogenic impacts on forest and wildlife of PNKB NP.

1.2 Context and brief history of the Phong Nha - Ke Bang National Park

Phong Nha was initially declared a small reserve of 5,000 ha in 1986, followed by major extension (41, 132 ha) and a management planning process in 1991/1992 consolidating the area as Phong Nha Nature Reserve. Biodiversity surveys during the period of 1994 - 2000 revealed the high national and global biodiversity significance of both Phong Nha and Ke Bang areas and the need to enlarge the Phong Nha Nature Reserve was recognized (Eames et al., 1994; Nguyen Xuan Dang et al., 1998; Timmins, et al., 1999; VRTC-WWF, 1999 and others). In 2001, the area under protection was expanded to 85,754 ha and designated Phong Nha - Ke Bang National Park (PNKB NP). The National Park was certified at this size as a World Natural Heritage Site in 2003 based on its geology and geomorphology, particularly its karst landscapes and an extensive cave system of outstanding universal value. Because of its obvious biodiversity importance, the site has also been proposed by the Vietnamese government for the World Heritage Site List under Criterion x for its outstanding biodiversity values. Partly as preparation for this nomination, the area under protection was extended by the Quang Binh Provincial People's Committee in 2012 to a total size of 123,326 ha. Due to concerns over substantial threats to the sites integrity and biodiversity, however, the nomination for World Heritage Status for biodiversity has not yet been approved by the World Heritage Committee.

"Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha – Ke Bang National Park Region" is a joint venture by the Vietnam Government and the German Government. Its implementing partners are the Provincial People's Committee of Quang Binh Province, Vietnam and KfW Entwicklungsbank, German Development Service, with an implementation period of 6 years (2007 - 2013). The overall goal of the Project is to contribute to the conservation of the Northern Annamite Region, its biodiversity and ecological services in close relation with sustainable socio-economic development for communities living adjacent to the Park. The objective of the Project is to improve the management and conservation in the Phong Nha Ke Bang region. The Project will introduce both sustainable resource utilisation and conservation of the natural environment, as well as approaches for improving the livelihoods of the local population living within the buffer zone. The following results are expected to be achieved by this Project:

- Improvement of Park Management and protection;
- Extension of the area of the Park;
- Rehabilitation and sustainable use of forests in the Buffer zone outside the Park;
- Alternative livelihood development in the Buffer zone outside the Park;
- Further development of ecologically sound tourism activities;
- Addressing cross-cutting issues: gender equality, environmental sustainability, participatory development and good governance, poverty reduction, public private partnership.

ulation and improvement, the Project organized biodiversity the following functions:

- To inform the management plan and management implementation;
- To form the basis of long-term biodiversity monitoring, so as to assess the impact of improved management;
- To provide a basis to apply for World Heritage designation for the extended PNKB NP for its biodiversity values.

In this context, this survey of the mammals of Phong Nha ó Ke Bang NP was carried out, focusing particularly on little studied taxa (rodents, insectivores and small carnivores) and on the newly added extension area of the Park in its northwest.

1.3 PNKB physical structure and climate

PNKB NP is located in Quang Binh Province, North Central Vietnam. The PNKB NP is situated within Truong Son Range, which is also known as the Annamite Mountain Range. The Truong Son range is recognized as globally significant for biodiversity. It is a transitional region between the subtropical communities of the North and the tropical ones of the South, and it harbors many endemic species (Vu Van Dung et al. 1993, Pham Mong Giao et al. 1998, Timmins et al. 1998, Averyanov et al. 2000, Ziegler et al. 2009). PNKB NP together with Hin Namno NCBA in Laos PDR constitutes the largest protected area of karst habitat in mainland Southeast Asia. The biodiversity of undisturbed limestone ecosystems under wet tropical conditions, including cave systems, is often highly diverse, and PNKB is an outstanding example of this principle.

Climate in the PNKB region is tropical and humid, but locally influenced by the Hai Van Pass 100 km south of the Park, which prevents warm monsoon weather of southern Vietnam from moving freely northwards and results in cold cloudy winters. In addition summer months are made rather arid because of hot winds that blow from Lao PDR, and surface rivers partly dry up. In the karst system, which covers more than half of the total project area, the topography is strongly divided and difficult to access. Otherwise slopes remain moderate in the 25-30% range apart from a few narrow alluvial valleys where rivers stay above the land surface. In the karst area, most rivers have dropped below ground level forming long riverine cave systems. Soils are mostly feralites with poor to medium fertility, except in narrow alluvial bands in valley bottoms and on the Bo Trach lowland plain. Much of the project area is covered in limestone rendzina.

Forest cover over the whole project area is very high, variously estimated at >90% but including significant open or bare forest lands in the buffer zone. Nine forest types are recognized. Most of the karst area is covered in limestone forests with lower tree density, volume and diversity than the lowland non-limestone evergreen forests. Vegetation and plant surveys describe PNKB NP as a global center for plant diversity (Kuznetsov & Luong 2001 in GFA 2006). Habitats such as primary broad-leaved plus mixed broadleaf and coniferous forests on rocky limestone and primary broad-leaved forests on high mountains composed with silicate rocks are especially diverse and very rich in orchids including numerous endemic forms. About 2,651 vascular plant species have been recorded in PNKB NP, of which about 116 species are nationally and/or globally threatened (Luu Minh Thanh, 2009).

Fauna in PNKB NP is correspondingly very diverse. About 139 mammal species, 390 birds, 93 reptiles, 45 amphibians and 162 fish species have previously been recorded. Out of these, about 88 species were listed in the Vietnam Red Data Book (2007), 73 species are listed in the 2011 IUCN Red List and 14 species are endemic to Vietnam (Nguyen Xuan Dang, 2011). All in all, PNKB NP protects an outstanding refuge of biodiversity for Asia and the world.

Biodiversity survey work on mammals in and around PNKB NP

Several faunal surveys in and around PNKB NP were conducted before the year 2000, by Birdlife International (Eames et al., 1994), World Wide Fund for Nature - WWF (Le Xuan Canh et al., 1997; Do Tuoc & Truong Van La, 1999), Fauna & Flora International - FFI (Nguyen Xuan Dang et al., 1998; Timmins et al., 1999) and the Vietnam-Russian Tropical Centre - VRTC (VRTC-WWF, 1999). Biodiversity surveys focusing on mammals in PNKB seemed to be most intense in the five year period 1997-2002, when it was proposed that the reserve be upgraded to national park status. Previous surveys of mammals in the area focused mainly on primates, felids and ungulates (Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Meijboom and Ho Thi Ngoc Lanh, 2002). Mammal records of these studies were summarized by Meijboom and Ho Thi Ngoc Lanh (2002) in a report "Fauna, Flora in Phong Nha ó Ke Bang and Hin Nam No" under the LINC ó WWF Project.

Before the surveys reported here, there had been little data collected on rodents, insectivores or small carnivores in Phong Nha ó Ke Bang. This is the consequence of a lack of recognition of these groups as a conservation priority. Previous studies did confirm the presence of most species of carnivores and ungulates now known from the area, but the status of the populations as well as key habitats and distribution areas were poorly recorded and described in the reports.

In contrast, primates have been more comprehensively studied, as they fall within the priority conservation group of the Park. However, even the information on primates was still poorly documented, and only minor attempts were made to collect solid data on lorises as part of a general primate survey in PN-KB.

Very few records of insectivores and rodents were obtained during past surveys; Only 3 species of insectivores and 29 species of rodents were recorded in PNKB NP by these surveys (see Annex 2 for the list of recorded species). Between 2000 and 2011, there was almost no study of Insectivores and Rodents in and around PNKB NP except 2 short surveys on small mammals conducted by the Institute of Ecology and Biological Resources (IEBR) in 2007-2008. Although a few specimens of insectivores and rodents were collected during these surveys, they remained without completed taxonomical identification. These specimens were examined by the current team and the data were incorporated in this report, together with data from new surveys carried out in 2011.

2. Objectives and scope of the survey

2.1 Aims and objectives

The aims of the current biodiversity surveys are to inform long-term protected area management and provide information to establish a baseline for monitoring diversity and assessing the impacts of the PNKB NP region project in the future.

The specific objectives of the survey of nonvolant mammals were to:

- Improve the technical skills of the Scientific Research and Rescue Centre and Forest Protection staff through on-the-job training;
- Determine the presence/absence and abundance of small carnivore species, especially that of rare and endemic species of regional and global value in PN-KB;
- Identify and locate rodent and insectivore biodiversity values that must be protected and conserved within PNKB NP as a World Natural Heritage site;

the location of mammalian biodiversity to assist with zoning of

mammalian biodiversity for management planning, by defining

their habitat preferences and threats to them;

- Analyze threats relevant to nonvolant mammals in the survey areas;
- Establish a baseline for monitoring biological diversity, information that in turn can then in turn be correlated with threat levels (hunting, snaring), and thus;
- Establish a biological baseline for assessing the impacts of the PNKB NP Region Project;
- Offer recommendations to improve the conservation measures for nonvolant mammals in PNKB National Park.

In addition to the general aims and objectives of the FFI-led biodiversity survey, the camera trap survey group had additional specific objectives:

- Conduct pre-surveys to inform the development of the survey methodology, and to adapt the survey implementation plan specifically for camera trapping;
- Develop training material, datasheets, data collection forms and a field survey guide manual for camera trap survey.

The aims of the gibbon surveys also included two specific objectives:

- To determine the presence/absence and abundance of gibbon for monitoring gibbon population.
- Establish a biological baseline on the gibbon population for assessing the impacts of the PNKB NP Region Project.

2.2 Scope of the surveys

The surveys covered key areas of the newly added extension area of the protected area, as well as lesser studied areas of the original PNKB NP World Heritage Site. Each survey team focused on a particular taxon or methodology. The Small Carnivore and Loris team focused on weasels, civets, mongooses and their relatives, (MUSTELIDAE, VIVERRIDAE and HERPESTIDAE) and loris (*Nyctycebus* sp.). The Insectivore and Rodent team focused on those two taxa, the primate team focuses on obtaining a density estimate of gibbons, while the Camera Trap team focused on larger mammals. Because higher primates were the focus of several previous surveys in the Park, therefore this survey did not focus intensively on these species. However, occasional records on these species were recorded as well, particularly by the Small Carnivore and Loris and the Gibbon survey team. Bats were the subject of a previous survey, and were not considered in this survey.

Data collection for small carnivores was carried out in both day and night time through daylight transect and nocturnal transect surveys. Survey time for loris was limited to the night-time due to the typical activity cycle of loris. Due to limitations of time (ten days for each survey area), and a large number of species (around 20 species of small carnivore and 2 species of loris), the survey focused mainly on verifying the presence of species, as well as estimating relative abundance of the focal species when possible.

Outputs of the Small Carnivore and Loris Team included:

- Pre-survey report to inform the development of the survey methodology, and to adapt the survey implementation plan specifically for monitoring of small carnivores and loris.
- Training material, datasheets, data collection forms and a field survey guide manual for small carnivores and loris.

all carnivores and loris in Hoa Son, Thuong Hoa (Minh Hoa Trach district) communes.

focusing on small carnivore survey methodology, species identification, use of field survey equipment, and use of datasheets and data collection forms for the staff of the Science Research and Rescue Centre and rangers of PNKB.

The scope of the survey on rodents and insectivores was to:

- Make a preliminary assessment of the abundance of rodents and insectivores species, especially that of rare and endemic species of regional and global values;
- Develop a list and a distribution map of threatened and rare rodents and insectivore species.
- Initiate the development of a database on rodents and insectivores biodiversity for National Park;
- Suggest protection, management and utilization measures for rodent and insectivore biodiversity values of a natural World Heritage.

Outputs of the survey on rodents and insectivores were to:

- Survey scoping report, comprising specific survey locations, survey means, field survey methods, sampling techniques/methods, data processing and analysing methods, resources plans, and implementation plans;
- Report on survey results, comprising summary, overall goals and specific objectives, background information, contents and methods, results and comments, conclusions and recommendations, references, and annexes;
- Training materials, research and field survey guide manuals, comprising specific guides on research, survey and sampling methods, field skills as well as data analyzing and processing methods;
- Hard and soft copies of distribution map for valuable and rare species, photographs and specimens collected or obtained during the surveys, digital database incorporating comprehensive survey information that can be used for long term management.

The scope and outputs of the survey on gibbon were to:

- To determine the gibbon population in the survey area included Thuong Trach, Thuong Hoa and Hoa Son.
- Develop a distribution map of gibbon in surveyed areas.
- Initiate the development of a database on gibbon for long-term monitoring.
- Suggest protection, management and monitoring measures for gibbon population within PNKB National Park.

3. Overview

3.1 Small carnivores and loris: Overview

Small carnivores are a group of animals that are mostly nocturnal and semi- or entirely arboreal. They often range widely and occur at low densities, and tend to be solitary. Due to their typical behavior and activity patterns, small carnivores are considered to be one of the more difficult animal groups to study. The biological, economic, and cultural significance of these groups have been well documented (Schreiber et al., 1989). In Vietnam, the economic value of small carnivores is well-known through widespread illegal hunting and the trade of wild animals nationally and locally (Roberton, 2007, Long and Minh Hoang, 2006, Nguyễn Minh Hà, 2004, Roberton, 2004). Illegal hunting and trade has led

of the most threatened groups in Vietnam. Moreover, due to high demand in the snare trap market for this group of animal, numerous snare traps and traps are set in the forest for small carnivores, particularly civets and otters, in order to fulfill the demand. During our survey in PNKB, we noted that small carnivores are the most frequent species captured by snare trap. In addition, the civets (here represented by *Paradoxurus hermaphroditus*, *Paguma larvata*, *Arctogalidia trivirgata*, *Arctictis binturong*) are the preferred species for local hunters as the price for these species can reach approximately \$60 per kilo at local wildlife retailers in Hoa Son, Thuong Hoa and Xuan Trach communes. For wild mammals, this is second only to the price of pangolin (*Manis* spp.).

Hunting and the wildlife trade have created many difficulties for study of small carnivores, as their population has been severely reduced by illegal hunting, particularly through snare traps. In addition, frequent hunting has made the animals more aware of human presence, and has restricted their ranges to more remote or difficult terrain. Taken together, these difficulties made it difficult for the team to record small carnivores during the survey.

Wildlife hunting and habitat destruction has decimated the wildlife fauna in Vietnam (Vietnam's Government 2004, MoNRE, 2005). Most small carnivore species, especially those species of high economic value, have been significantly reduced in number and habitat area, and 10 species of small carnivores are considered threatened or are too poorly known to assess (IUCN Redlist, 2012; Table 4). Three additional species are considered at Lesser Risk, but their populations are believed to be in decline worldwide.

Table 4 A list of globally threatened or near-threatened species of small carnivores in Vietnam

No.	Scientific name	Common name	VRDB (2007)	IUCN RL (2012, Ver 3.1)
1.	<i>Arctonyx collaris</i>	Hog Badger		NT
2.	<i>Melogale personata</i>	Large-toothed Ferret Badger		DD
3.	<i>Lutra lutra</i>	Eurasian Otter	VU	NT
4.	<i>Lutrogale perspicillata</i>	Smooth-coated Otter	EN	VU A2acd
5.	<i>Aonyx cinerea</i>	Asian Small-clawed Otter	VU	VU A2acd
6.	<i>Viverra zibetha</i>	Large Indian Civet		NT
7.	<i>Viverra megaspila</i>	Large-spotted Civet	VU	VU A2cd+3cd
8.	<i>Arctictis binturong</i>	Binturong	EN	VU A2cd
9.	<i>Chrotogale owstoni</i>	Owston's Civet	VU	VU A2cd

Note: VRDB ó Vietnam's Red Data Book (2007), IUCN RL ó IUCN Redlist (2012). CR ó Critical endangered, EN ó endangered, VU ó Vulnerable, NT ó Near threatened, DD ó Data deficient.

Two species of loris are the only nocturnal primate taxa known to occur in Vietnam. Due to their highly nocturnal and arboreal behavior, studies on loris require a good understanding of their behavior and habitat, as well as skill in use of spotlights. The difficulty of tracking the animals in high karst terrain such as that found in PNKB NP has meant that previous documentation on loris in PNKB was sparse. Previous studies had difficulty in recording the species in the field, suggesting that the population of loris in PNKB is generally quite low (Haus et al., 2009, Le Trong Dat et al., 2009, Timmins et al., 1999).

3.2 Rodents and insectivores: Overview

Among the 29 orders of extant world mammal fauna, that of Rodents (Rodentia) has the highest species diversity, with about 2,277 known species, accounting for about 42% of all known mammal

05). As one of most abundant animal groups in tropical forest habitat types, all forest stories and also the underground environment, they play a key role in maintaining tropical forest ecosystems health. They consume botanical and zoological materials and, in turn, serve as an important food source for many animals in the forest. They participate in various ecological processes such as pollination, seed dispersal, carnivorous, etc. Locally, many rodent species also have high economical values (for food, traditional medicines, etc.).

Insectivores (Insectivora) are also a high species diversity group. About 452 insectivore species of 55 genera are known, accounting for 8.3% of total world mammal species number. Formerly, Insectivora included both Erinaceomorphs (Hedgehogs, Gymnures) and Soricomorphs (Shrews, Moles, Selenodonts, Nesophontes). However, recent genetic studies show the paraphyletic nature of the Insectivora, and the two orders are now separated instead (Wilson et al., 2005). Very little is known about the ecology of insectivores. Insectivores inhabit various habitat types such as montane forests, mangrove forests, grasslands and agricultural upland fields. They forage in the ground forest storey and also underground, feeding mainly on small insects and their larvae and eggs (Dang Huy Huynh et al. 2007).

Biodiversity assessment of rodents and insectivores often is difficult due to their cryptic behaviours and taxonomic identification problems. Due to high morphological similarity, several taxa can not be identified by a traditional morphological approach, and this leads to an underestimate of full biodiversity values of study fauna. Recent use of principal component analysis methods (PCA) and genetic molecular analysis show that actual taxonomic diversity of rodents and insectivores is much higher than those estimated by traditional morphological classifications (Oshida et al. 2000, Oshida et al. 2001, Motokawa 2004, Motokawa 2005, Kawada 2005, Sanchez-Villagra et al. 2006, Balakirev 2009).

Rodent fauna in Vietnam is rich and diverse. About 70 species belonging to 29 genera and 5 families have been described (Dang Ngoc Can et al, 2008, Nguyen Xuan Dang et al, 2010). Nevertheless, the fauna is still poorly studied. Many species were recorded only during recent decades (Lunde et al. 2003, Lunde et al. 2004, Jenkins et al. 2005, Abramov 2008) and new species will continue to be discovered in future studies. Insectivore fauna in Vietnam is also poorly studied. Only 24 species of 13 genera have been recorded so far. Future studies will discover more species of the fauna in Vietnam

Wildlife hunting and habitat destruction has decimated the wildlife fauna in Vietnam, including Insectivore and Rodents (Vietnam's Government 2004, MoNRE, 2005). Many rodent species, especially, species of high economic value, have been significantly reduced in number and habitat area, and 8 species of are faced with the danger of extinction or are two poorly known to assess (Vietnam's Red Data Book, 2007; IUCN Redlist, 2011; Table 5).

Table 5 A list of threatened species of rodents in Vietnam

No.	Common name	Scientific name	VRDB (2007)	IUCN RL (2012)
10.	Black Giant Squirrel	<i>Ratufa bicolor</i>	VU	NT
11.	Hairy-Footed Flying Squirrel	<i>Belomys pearsonii</i>	CR	DD
12.	Particoloured Flying Squirrel	<i>Hylopetes alboniger</i>	VU	
13.	Grey-Cheeked Flying Squirrel	<i>Hylopetes lepidus</i>	VU	DD
14.	Phayre's Flying Squirrel	<i>Hylopetes phayrei</i>	VU	
15.	Lesser Giant Flying Squirrel	<i>Petaurista elegans</i>	EN	
16.	Red Giant Flying Squirrel	<i>Petaurista philippensis</i>	VU	
17.	Finlayson's Squirrel	<i>Callosciurus finlaysonii</i>	LR	
18.	Horse-tailed squirrel	<i>Sundasciurus hippurus</i>		NT
19.	Millard's Rat	<i>Dacnomys millardi</i>		DD
20.	Lesser Marmoset Mouse	<i>Hapalomys delacouri</i>		VU

3.3 Camera Trapping: Overview

Despite the fact that PNKB National Park is one of the most important biodiversity strongholds in Vietnam, there has been relatively little research work on mammal species. Research in this region has predominantly given priority for primate species and, research activity for other mammal species seems to be neglected. There are several reports and surveys that provide a good picture of the primate species in the Park, their distribution and the threats to them (see Table 6). Reports on other mammal species mainly focus on identification. Camera trap surveys could provide a much better understanding on the large mammal populations of Phong Nha ó Ke Bang, perhaps better than any other method of survey.

Table 6 List of mammal reports for Phong Nha Ke Bang

No.	Target group	Related documents
1	Primate	(Nguyen Xuan Dang et al., 1998, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999)
2	Other mammals	(Nguyen Xuan Dang et al., 1998, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Le Khac Quyet et al., 2002)

Camera-traps have been used for documentation of wildlife, especially terrestrial animals, since the early 1900s. As soon as they were introduced, the technology had a significant scientific, conservation and management advantage for survey and monitoring of a wide range of species from large animal such as elephants to the smallest mammals and birds (Shiras, 1906; Seydack, 1984; Karanth, 1995).

The recent advent of inexpensive thermal and infrared sensors and digital cameras has improved the camera trap advantage to a new height of effectiveness, especially for nocturnal tropical animals. The price for has been reduced significantly, which provides a great help for applying this technology in a wider range, especially in developing countries such as Vietnam.

In Vietnam, camera trapping was introduced in the early 1990s, first to monitor the Javan Rhino in Cat Tien National Park (Schaller et al. 1990; Bui Huu Manh, 2001). The result of the Java Rhino camera trapping made a good impression of the application of the new method in Vietnam, where many species of animal are under serious threat of hunting, habitat lost and population decline, making them very difficult to track and assess by ordinary survey methods. Since then, camera trapping has been used in many other places throughout the country. For instance, camera trapping survey in Pu Mat National Park in late 1990 has successfully photographed some globally endangered mammals in the park such as Indochinese Tiger (*Panthera tigris corbetti*), Saola (*Pseudoryx nghetinhensis*), and Annamite Muntjac (*Muntiacus truongsensis*) (SFNC, 2001). Camera trap surveys in Bi Dup Nui Ba National Park confirmed the presence of endangered Large-antlered Muntiac (*Muntiacus vuquangensis*) and many other important species (Bi Dup-Núi Bà national park, 2011) In the most recent use of camera trapping, the CEPF has been intensively using the technique to verify endangered pheasants in Quang Binh and Quang Tri Provinces, recording a significant number of other endangered animals at the same time (Nguyen Ngoc Tuan, 2012).

Prior to this camera trap survey, two previous camera trap surveys were attempted in PNKB National Park during the period 2001-05, undertaken by FFI Vietnam. However, there was no significant record

available on this activity. The most recent activity was made in focused only on the pheasant group (Phasianidae) with only five a good record on the presence and population of the Siamese Fireback Pheasant *Lophura diardi* (Le Thuc Dinh et al., 2010).

3.4 Gibbons: Overview

Previously, there were considered to be two taxon / sub-species of White-cheeked Crested Gibbon (*Nomascus leucogenys*) in Vietnam; *N. leucogenys siki* and *N. leucogenys leucogenys* (Pham Nhat, 2002). More recently *N. siki* was provisionally classified as a subspecies of *N. leucogenys* (Roos et al, 2007). However, a recent DNA analysis proposes the species be separated as *N. leucogenys* and *N. siki* which in turn has a northern form (with white cheeks) and southern form (with yellow cheeks) and the dividing line between these two forms is east to west between Bach Ma National Park and Phong Dien Nature Reserve of Thua Thien-Hue (Thin and Roos, pers.comm. 2008). According to this study the gibbon in Phong Nha-Ke Bang NP is the *Nomascus siki* northern form. However, recent work by Nadler et al. suggests that these southern populations may in fact be another new species, *N. annamensis*, the Northern Yellow-checked Gibbon. If so, this would mean that PNKB may be the most important remaining range area for *N. siki* (Nadler et al., in lit.).

Recently, this separate species was named the Southern White-cheeked Crested Gibbon *Nomascus siki* and is listed as Endangered in the IUCN Red List of Threatened Species (IUCN, 2012), in Appendix I in CITES (2011); as Endangered in the Red Data Book of Vietnam (2007) and Group IB in Government Decree 32 of Vietnam (2006).

Considering the distribution of gibbon species from north to south in western Vietnam, *N. leucogenys* has a natural distribution in northwest Vietnam from Lai Chau and Son La provinces (western side of the Black River) to Thanh Hoa and Nghe An provinces (north of the Ca River) while *N. siki* is distributed south of this, from Nghe An (south of the Ca River), Ha Tinh, Quang Binh, Quang Tri, Thua Thien-Hue (north of Hai Van mountain pass; Geissmann, et al., 2000; Dang Ngoc Can, et al., 2008). *N. siki* may even extend to southern Quang Nam and northern Kon Tum, overlapping with some of the natural distribution areas of the Yellow-cheeked Crested Gibbon *N. gabriella* (Nadler, et al., 2000; Nadler, et al., 2008; Dang Ngoc Can, et al., 2008). However, these southern populations may in fact belong to *N. annamensis* (see above).

Several surveys had recorded *N. siki* in areas of in PN-KB NP (Nguyen Xuan Dang et al., 1998; Pham Nhat and Nguyen Xuan Dang, 2000; Pham Nhat, et al., 2000; Pham Nhat, 2002; Van Ngoc Thinh, 2008; Haus, et al., 2008) and adjacent areas (Le Trong Dat, et al., 2006). Most recently in 2009, there is a separate gibbon census had been conducted in U Bo area of PN-KB NP for an overview assessing the gibbon population here (Le Trong Dat, et al., 2009).

4.1 Small Carnivores and Loris: Methodology and survey locations

4.1.1 Survey methods: Small carnivores and Loris

Interview survey

Interviews were conducted in village numbers 3, 4, and 5 of the Xuan Trach Commune (8 villagers); in On and Yen Hop villages of Thuong Hoa commune (7 villagers); and in Dang Hoa village of Hoa Son commune (5 villagers). The interviews focused on the experience of local hunters and foresters who often go to the forest to collect wood, and carry out occasional snare trapping, in close proximity to the survey areas.

Key informant semi-structured interviews were carried out. The team focused on the interviewees' knowledge of focus species, such as their presence and absence in the area and short descriptions of the species. Guide books such as the *Field Guide to the Large Mammals of Vietnam* (Parr and Hoang Xuan Thuy, 2008), the *Field Guide to the Key Mammal Species of Phong Nha-Ke Bang* (Pham Nhat and Nguyen Xuan Dang, 2000), and the *Identification Guide to Protected Species of Vietnam* were used to assist in identification of species during the interviews.

Interviewees were asked to provide information on local hunting (method, preferred time, preferred species, price, and trade networks) and consumption of wildlife, focusing particularly on hunting and snaring of small carnivores and lorises. This information is vital for the post-survey report and analysis of the threats to wildlife in the area.

The interviews also focused on collecting information on the most recent records of small carnivores and lorises found in the survey areas, and on information about the forest areas that would be most appropriate for the survey team's work. Information was collected on forest type, presence of focus species in the area, dominant terrain, accessibility, and time of travel to get to the area. This information was crucial for planning of the field work.

Diurnal transect survey

A total of 30 diurnal transect surveys were made in the three survey areas. Diurnal surveys are aimed mostly at observing diurnally active small carnivore (martens, mongooses, weasels, badger). However, the diurnal transects were also the most important way to record sign of (tracks, droppings) of small carnivores during the survey.

The transects were not selected randomly, but generally followed a compass direction. Most of the transects were established on existing old jungle trails, logging trails, and even on existing hunting or old snare trapping lines. Due to the rugged karst terrain of the survey area, the transects were established mostly at the bottom of valleys or parallel with the limestone mountain range. Transects were also made along streams, both to target otters, and also to opportunistically observe other small carnivores, as the soft sand and mud often preserved footprints and animal tracks better than dry soil or rocky terrain. The terrain limited the length of the transects to a distance of 1-3 km, as they were otherwise interrupted by ridge and karst terrain.

The diurnal transect survey protocol was as follows: two surveyors quietly walked along the transect at a speed of 500m to 1000m per hour, carefully searching the ground, fallen trees and canopy for sight of or tracks of small carnivores. Sightings such as tracks, droppings, feces, and footprints of focus species were all carefully noted in the transect datasheet, with UTM and photo reference.

dangered species of animal were also noted on the datasheet. The
ted from 0600 to 1100 and 1500 to 1800 when animals are most
identify animal tracks.

Human impact data was collected simultaneously. Any evidence of illegal logging, hunting, or collection of non-timber forest products was noted in a human impact datasheet for each survey transect.

Nocturnal transect survey

A total of 23 nocturnal transect surveys were made for the three areas. The nocturnal transects were mostly made in the areas where the diurnal transect surveys had indicated new evidence of small carnivores in the area (i.e, it was not random). Old trails, dry streams, and snare trap-lines, all of which provided good space for moving and observing the forest canopy, were selected and marked for the nocturnal survey. The nocturnal transect lengths were similar to those of the diurnal transects, 1-3km.

The nocturnal transect survey were as follows: two surveyors quietly walked 15 to 20m apart at a speed of 500m per hour. Using a headlamp (Petzl 4.5v Zoom, Petzl 6v Duo headlamps and Pelican 6v spotlight), they carefully searched the ground and canopy for a sightings of eyes. Once an animal was sighted, a stronger spotlight (6V Pelican spotlight) was used to highlight it, then binoculars (10x40 Carl Zeiss) were used to help species identification. In addition, the team used a camera (Nikon 70-300mm lens and SB-800 Speedlight) to take pictures of the animals observed. Most of the pictures taken were of good quality, and could be used to provide reference for species identification. The nocturnal transect survey time was limited from 1900 to 2100 during the full-moon phase (after which the moonlight got too bright), and from 1900 to 2400 for other days with no full moon. The average nocturnal survey time per night was 4 hours for each of 2 groups of surveyors. All animal sightings were carefully noted in the nocturnal transect survey datasheet as well as other relevant information, such as UTM coordinates, date, time, weather, name of surveyor, and moon phase (see Appendix 5a).

Data analysis

All recorded information noted in the datasheets was documented with detailed coordinates to allow future site identification, analysis, and further monitoring. The abundance of small carnivores and loris was assessed on a three point scale based on encounter frequency, and taking into account the appropriateness of methods to detect a species, and other factors including ecology that affect a species' observability. This was a method that was successfully used in a previous assessment of the Conservation Importance and Conservation Priorities of the Phong Nha-Ke Bang (Timmins et al., 1999).

Human impact information was also analyzed in this report in order to provide a clear description of impacts and threats associated with small carnivore and loris conservation in Phong Nha ó Ke Bang.

4.1.2 Survey area: Small carnivores and loris

The survey area was selected based on the results of pre-survey activities with appropriate consultation with the park (see attached pre-survey report). Three survey areas were selected, namely Ma Rinh Moi (Hoa Son), Hang En-Ma Ma (Thuong Hoa), and Hung Dang-Ca Tot (Xuan Trach).

The Ma Rinh Moi area, Hoa Son commune (extended area).

This area is situated northeast of the Hoa Son commune in the extension area of PNKB NP and shares its border with the Minh Hoa State Forest Enterprise (SFE) to the East. It is at the southern end of the SFE, where there is little impact from hunting and logging. Vegetation cover includes primary

st. No survey was conducted in this area before. According to the rangers and local people of Hoa Son commune, this area is an ty as it is located away from residential areas and is difficult to access. To access this area, the team left from Dan Hoa village passing Ma Rin Cu (Hoa Son SFE) and then arrived at Ma Rin Moi after about 8-10 hours walking. Two camps were established in the area during the survey.

Hang En-Ma Ma area, Thuong Hoa commune (extended area)

This area is southeast of Thuong Trach Commune, within the extension area of the PNKB NP. In this area there is a large cave with a colony of swallows or swifts (hence the name Hang En). Vegetation cover includes primary limestone and lowland evergreen forest. No survey was conducted in this area before. According to the information from the local commune, the Hang En and its adjacent area is the most important area for animals in Thuong Trach Commune. However, recently people have gotten to know this area better, and some have entered to hunt and set snare trap. The area is well-known by local people, especially local hunters and loggers. The area is formed by a series of flat valleys that connect with each other, and were probably once cultivated by local people but are mostly abandoned now. To assess this area, the team departed from the On village and walked southeast for about 5-6 hours. Two camps were established in the area during the survey.

Hung Dang- Ca Ton, Xuan Trach Commune (data deficient area of the PNKB NP WHS)

The Hung Dang-Ca Ton area is in the northeast corner of the PNKB NP World Heritage Site. The area is considered as a data deficient gap in the park, as very few surveys have been made here. The area presents karst terrain with a very narrow and rocky valley. Much of the valley, especially around Hung Dang and Cat Tot, is seasonally flooded (September to November). However, in other months the areas suffers a shortage of water due to its karst terrain. This area is also well-known by most of the local people as their primary hunting area. Two camps were established in the area during the survey.

4.1.3 Survey effort: Small carnivores and loris

A total of 23 nocturnal transects and 30 diurnal transects. Table 7 shows the survey effort for each site.

Table 7 Transect survey effort

Location	Nocturnal transects	Diurnal transects
Ma Rin Moi, Hoa Son Commune	5	11
Nag En- Ma Ma, Thuong Hoa Commune	13	13
Hung Dang-Ca Ton, Xuan Trach Commune	5	6
Total	23	30

4.2 Insectivores and Rodents: Methodology and survey locations

4.2.1 Survey methods: Insectivores and rodents

from 21-24 July 2011 in the new extended area and adjacent core areas of Hoa Son, Thuong Hoa, Hoa Son and Thuong Trach communes, were requested to be surveyed. The aim of the pre-survey was to identify survey sites and to develop appropriate survey methodology and work plan. As a result, the following methods and survey sites were selected for the main survey.

É *Trapping specimens*

A variety of small mammal traps, including live cage traps and snap-traps were used to collect as many species as possible. Traps were set where small animals are likely to occur such as on liana and tree branches (about 5-10 m high), in dense vegetation, and along animal pathways. Each trapline consists of 30-50 trap sites and distance between two consecutive traps was about 10m for on-ground traps and 20m for on-tree traps. The type of trap employed and the length of time that a trap was allowed to remain in one place depended on the judgment of the trapper. Traps were baited with cassava, banana and pineapple. All traps were checked every day to collect trapped animals and replace bait.

Pitfall traps were used mainly for capture of insectivores (shrews). Pitfall traps consisted of plastic buckets 40 cm deep and 30 cm in diameter, buried flush with the ground surface. Pitfall traps were set in traplines in conjunction with a plastic drift fences to increase capture capacity. All traps were checked every day to collect trapped animals.

From all captured animals, the following information was taken: species identification; standard body measurements including TL (total length), HB (head & body length), T (tail length), HF (high foot length), E (ear length) and Wt (weight); sex, age and reproductive status; DNA samples (from footpad or tail-tip blood) and photographs; along with other supplementary information such as micro-habitat, capture date, location coordinates and elevation, etc.

After obtaining all necessary information, the animals were released back to places where they were caught. Because it is difficult to get exact species identification of rodents and insectivores, 2 - 4 specimens (2 males and 2 females) of each species were used to prepare voucher specimens for further identification in laboratory. Pregnant or lactating animals were not collected as voucher specimens.

Two types of voucher specimens were prepared: Dried skin & skull specimens and fluid whole alcoholic specimens. For dry skin & skull specimen preparation, the animals were humanely killed using diethyl ether, then the skin and skull carefully removed from the animal's carcass for preparation. For fluid whole alcoholic specimens, the animals were humanely killed using diethyl ether, and subsequently soaked and in the case of large specimens also injected with 10% formalin for about 24 hours prior to storage in 70% ethanol solution (see Lunde et al., 2001 for details). Each specimen was given a specimen tag with related information, including specimen code, common name, scientific name, collecting date, collecting place, map coordinates, sex, and body measurements.

É *Transect survey for direct observation of diurnal species*

Many species of squirrels and shrews are diurnal. Transect survey methods were used to get direct observation of these species as well as their signs (vocalizations, nests, sign of feeding, etc.). In each survey site, a number of line transects were established, each 3 ó 5 km long and passing through various habitat types. Due to the complicated terrain and thick forest in the survey sites, existing trails were used as the baseline and then new transects were cut off-trail perpendicular to the baseline for up to 1 km. Survey time was morning (6:00 to 10:00) and late afternoon (14:00 ó 18:00). Equipment for wildlife observation and recording include binoculars, cameras, pens, field books and pre-prepared data sheets.

É *Spot-lighting survey for direct observation of nocturnal species*

Night spotlighting techniques were used to get direct observation along the same survey routes defined for diurnal surveys. Once the animals were detected, spotlights (3.5v) with a strong light beam were turned on to get better observations of the animal. Equipment used for wildlife observation and recording included binoculars, cameras, pens, field books and pre-prepared data sheets.

É *Species identification*

Species identification of rodents and insectivores were based mostly on external morphological characters and skull measurements using available identification manuals and by comparison with specimens from museums in Vietnam (Institute of Ecological Resources, National University of Hanoi, Education University of Hanoi, etc.). Main literature used for species identification and systematic references are Corbet and Hill (1992), Dang Huy Huynh et al. (2008), Francis (2008), Lekagul and McNeeley (1988), Lunde et al. (2001), Smith and Yan Xie (2008) and Wilson and Reeder (2005).

Specimens of potentially new species were further studied using DNA sequencing techniques and Principal component analysis of external morphological and skull measurements. Skull measurements follow Musser (1979; in Pan et al. 2001).

É *Relative estimate of abundance*

Capture-mark-recapture methods are commonly used techniques for estimating population size of rodents but were not applied in this study due to short survey duration. Single-capture trapping method used in this survey can only allow calculation of relative estimates of population abundance. Relative estimates of population abundance do not give any absolute value for population size, but they do allow comparisons between localities and between time periods (Aplin et al., 2003).

Relative abundance can be measured by trap success. Trap success is calculated as number of rodent specimens captured (S) divided by trapping effort (T_e). Trapping effort is calculated as number of traps set (T) multiplied by number of nights of trapping (N). Trap success value is usually multiplied by 100 to give percentage of trap success:

$$E = (S/T_e) \times 100 = (S/(T \times N)) \times 100$$

Where, E is trap success in units of specimens/100 trap-nights.

Regarding to Transect surveys, Relative abundance can be measured by encounter rate. Encounter rate (F) is calculated as number of animals sighted during transect survey (A) divided by total length actually covered on the transect (L); then multiplied by 100 to get rate per 100 km of transect length.

$$F = (A / L) \times 100$$

Where, F is encounter rate in units of animal encounters/100km.

É *Recording of threats*

During transect surveys on mammals, all evidence of threats to animals and habitats were recorded as quantitatively as possible. Recorded information on threats included:

- *Campsites*: New (<30 days) or old (>30 days), who used (hunters, forest product collectors, etc.), estimated number of people using
- *Gun shots*: Number of shots heard, approximate location (compartment, etc.)
- *Traps/ snares*: Types, number found, length of traplines, animal remains
- *Animal parts*: Species name, likely cause of death (gunshot, snaring, natural cause)

people seen in the protected area, tasks being carried out, purpose
(to village, commune, etc.)

trees felled, species name, volume of round wood, stem diameter,
origin of persons involved.

- *Forest product harvest*: Type of products (rattan, bamboo, honey), type of harvest methods and impact, identity of collectors, volume of products observed or confiscated.
- *Forest clearing*: area (ha), forest status (primary, secondary, etc.), species of timber trees felled, purpose of clearing, origin of hired labors and/or owners.
- *Free ranging cattle*: Species of livestock, number of individuals, attended or not, origin of owners.
- *Forest fire*: Area burned, forest type, reasons (wild or by people).
- *Other* (specified)

4.2.2 Survey area: Insectivores and rodents

This survey on Insectivores and Rodents was carried out in 2 locations in the new extension area and one location in the PNKB NP World Heritage property next to the new extension area (see map in Figure 1 and Annex 4a).

É *Survey site 1 - The Ma Rinh Moi area, Hoa Son commune*

As described above, this area is in the extension area next to Minh Hoa State Forest Enterprise. The camping site of the Insectivore and Rodent Team was located just on the boundary between montane/lowland forest and karst forest (0591326; 1958490, alt.650m) and the survey was conducted in both habitats. The montane/lowland forest was primary evergreen forest with some selected timber removal. The karst forest was primary forest.

É *Survey site 2 – Hang En (Swallow Cave) area, Thuong Hoa commune*

As described before, this area was in the extension area of the protected area. The camp site for the Insectivore and Rodent team was located in a relatively flat area with secondary lowland evergreen forest intersected by limestone mountains and nearby primary karst forest (UTM: 0605048; 1949015, alt.270m). Surveys were conducted in both lowland and karst forest, but more effort was spent in lowland forest.

É *Survey site 3 - Thung Dang area, Thuong Trach Commune*

The Thung Dang area falls in the northeast of the PNKB NP World Heritage Site. There is very little information on biodiversity, especially on mammals from this corner of the park except a short primate survey conducted by staff of PNKB NP in 2008. Karst mountain and forest on limestone is the dominant terrain in this area. Due to the karst terrain, water is often scarce in the area, which makes the area very inaccessible for hunters and loggers. However, the water scarcity has actually saved the animal diversity in the area. To assess this area, the team departed from Cha Noi Village and walked for 7-8 hours. The camp site was located in the boundary between lowland/montane forest and karst forest (UTM: 0614259; 1951077, Alt.340m). The survey was conducted in both habitats. Lowland evergreen forest in this valley was affected severely by selective timber removal, converting it into mixed wood-bamboo forest. Montane evergreen forest was primary forest with some selected timber removal.

Civets and rodents

was conducted from 25 August 2011 to 23 September 2011 (see ...).

É Trapping effort

Detailed information about trap arrangement and trapping effort are shown in Annex 2c. Summary trapping effort information are as follows:

- In Ma Rinh area: 200 traps were set and 950 trap.nights were obtained
- In Hang En area: 200 traps were set and 1,000 trap.nights were obtained
- In Hung Dang area: 200 traps were set and 950 trap.nights were obtained
- A total of 3,900 trap.nights were obtained for all 3 survey sites

É Transect survey effort

Detailed information about transect arrangement and coverage are shown in Annex 10. Summary transect survey effort information are as follows:

- In Ma Rinh area: 4 transects were set; daytime survey covered a total length of 29.4 km, and nocturnal survey covered a total length of 20.8 km
- In Hang En area: 3 transects were set; daytime survey covered a total length of 28.2 km, and nocturnal surveys covered a total length of 19.2 km
- In Hung Dang area: 3 transects were set; daytime survey covered a total length of 29.6 km, and nocturnal survey covered total length of 10.2 km
- Totally, in all 3 survey sites, 87.2 km were covered by daytime transect survey and 50.2 km were covered by nocturnal survey

É Pitfalls

Totally, 52 pitfall traps were set but only 3 specimens were caught. Frequent heavy rain during the survey disturbed pitfall traps greatly, resulting in their low capture efficiency.

4.3 Camera trapping: Methodology and survey locations

4.3.1 Survey methods: Camera trapping

Camera trap sites were located in the area that was identified during the preliminary site survey (often undertaken over the first three days). The site was often the area where mammal tracks such as foot prints, feces (of civets), mineral licks (for ungulates), fruit trees or travel paths (of serow) were identified, and areas with high probability of mammal occurrence.

No baits or lures were used and camera trapping areas were left undisturbed without any intervention such as vegetation clearance or manipulation. However semi-open and flat areas were preferred in order to provide a better horizontal view for the cameras.

A total of 40 infrared camera trap units (Wildview, 5MP, 32 illuminated infrared beams, 4D battery) were provided by the project. 30 units were used for each set-time, and 10 units were kept as replacement units for a following set-time in case of lost or damage.

Cameras were set 300-400m apart depending on the conditions of the survey area. Most of the areas were long and narrow valleys, therefore the cameras were set on a long trap line rather than in a square block. In most of the areas, 30 cameras were set in two valleys that run parallel, in an attempt to maximize the records.

the general ground of the picture field, close to the height of most occur in the area. Due to the limit of the sensor range of sensitive area of 20 m² or less. Therefore 30 units covered approximately 600m² or less.

4.3.2 Survey area: Camera trapping

Survey areas were selected based on the results of pre-survey activities with appropriate consultation with the park and previous mammal surveys (Nguyen Manh Ha and Do Tuoc, 2011, Nguyen Xuan Dang and Nguyen Xuan Nghia, 2011). Three survey areas were selected, namely Ma Rinh (Hoa Son), Da Lat (Thuong Hoa), and Hung Tri-Ca Con (Xuan Trach).

The Ma Rinh area, Hoa Son Commune (extension area).

As described above.

Da Lat area, Thuong Hoa commune (extension area)

This area is located west of On Village, Thuong Trach Commune, and falls within the newly extended area of the PNKB NP. The area presents an earth hill terrain area mixed with karst and is well-known by local people, especially local hunters and loggers. The area is formed by a series of flat valleys at an elevation of 700 m above sea level. Typical habitat was evergreen forest on both earth and limestone mountains.

Hung Tri- Ca Con valley, Xuan Trach Commune (data deficient area of PNKB NP WHS)

The Hung Tri-Ca Con areas are in the northeast corner of the PNKB NP World Heritage Site. The area is considered to be a data deficient area of the Park, as very few survey attempts have been made here. The area represents an earth hill valley that fall within and dominated by karst terrain. The valley is covered by evergreen forest and some parts are seasonally flooded (September to November). The area has a good water supply with two streams running parallel east to west that might provide good habitat for larger mammals. However, the area is also well-known by the local people as their key hunting area and source of precious wood (*Dalbergia tonkinensis*).

4.3.3 Survey effort and limitations: Camera trapping

Due to the limit of battery capacity, cameras were left 20-25 days in the field for each survey area then removed. So an area of 600m² was surveyed continually for a period of 20-25 days (Table 8).

Due to the high humidity and rain, approximately 25% of the cameras were nonfunctional when recovered after each survey. There were also many others problems with the sensors, therefore some of the cameras (about 10%) did not work during the survey period. A total 3 of cameras were removed and destroyed by local people.

Table 8 Camera trapping survey effort in each area

Survey area	Number cameras	Number of day	Number of cameras lost
Ma Rinh	30	20	2
Da Lat	27 (three did not work while testing in the field and were then be removed)	20	1

18 operational units were for the last survey)	25	0

A high level of human activity in the forest of PNKB not only caused a direct decline of the animals by hunting and snaring, but also created disturbance and scared the animals, making the survey more difficult.

Limited survey time led to a low number of camera trapping records. A survey of 20-25 days (one battery charge) seems just enough for the animal to habituate with the presence of the camera or enough for the wind and humid to erase the scent that left by the survey team when searching for the site or setting the camera.

Another reason for the low record of animals during the survey was technical issues with the cameras. The given camera model seems quite basic and poorly humid and water resistant. More than 25% of the cameras were broken after 20 days of survey in the field. In addition, the sensors performed poorly in the field with more than 15% of the cameras sensor malfunctioning. (See Annex 2f, 2g and 2h for detailed records).

Loss of cameras by damage or removal by local people was not a serious problem during the survey. Only three cameras were lost or destroyed. Five cameras were discovered by local hunters (and even captured photos of the hunters) but were not destroyed by those people. This problem may pose difficulty for future camera surveys in the park.

4.4 Gibbons: Methodology and survey locations

4.4.1 Survey methods: Gibbons

Auditory survey is the most effective method for gibbon population surveys (e.g. O'Brien et al.2004; Rawson et al. 2009; Whittaker 2005). The method utilizes a point count approach (Brockelman & Ali 1987; Buckland et al. 2001) and takes advantage of the loud calls of gibbon groups to determine group numbers. As gibbons are territorial, calls coming from similar locations across days can be assessed to come from the same or different groups, making cumulative counts possible.

A random stratified survey methodology was used to assess gibbon density and to make population estimates for Phong Nha-Ke Bang National Park. To meet minimum sample statistical requirements, at least 16 listening posts were established and used (at least 2 day collected audio survey data for each post). For a stratified survey, thus the density and population is estimated for each strata independently and then combined.

Posts were located at least 3 km apart from each other, avoiding double counts of gibbons from multiple posts. An online random number generator will be used to select one square in which the first listening post was placed. Additional listening posts were placed in 1km² squares at equal distances across the survey areas. Listening posts were placed on high points (peaks or ridges) within selected squares. The precise location of each listening post within each square was chosen using a topographic map.

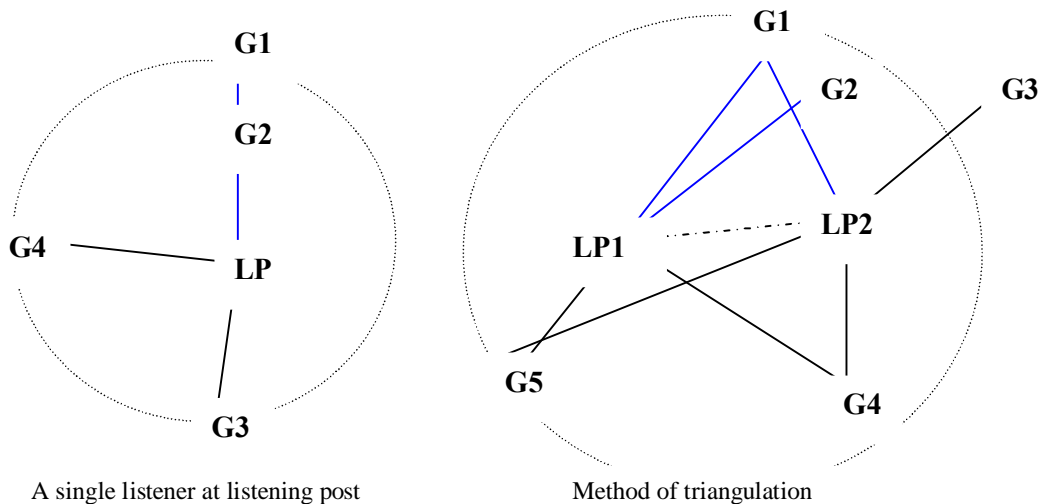
Field survey is to clarify interview information and collect more detailed data such as location, number of groups and individuals, composition of groups etc. Basing on interview information, surveyors determine areas/forests and make plans for field work.

gibbon singing from 5:00 AM until 8:00 AM then left only one listening and recording data at the listening post (LP). This individual surveyor was responsible for and observation of gibbons until 11:00 AM after this time this person can survey on their own to 2:00-3:30 PM. All others surveyed for group observations in the surrounding areas. The surveyors need to collect data on Date; Calling time (beginning and ending); number of singing animals (male, female, sub-adult); bearing (direction); estimated distances and level of loudness of the song using a three point scale: 1 near (loud); 2 clear (medium); 3 faint (weak). The listeners also noted any vocal features of each group, including the number of great calls and other features

Setting up Listening Posts: LPs were on prominent terrain (top or ridge of mountain) from which listeners can hear gibbons over large distances (2 km or further) and from all directions. For this survey each LP was at least 3 km away from others.

In early morning, the surveyors arrive at LPs before the time gibbons call (05:00) and sit at the listening posts with the necessary equipment and materials (compass, GPS, wrist-watch, pen/pencil and data forms/ tables, note book).

Locations of calling gibbons were determined based on the LP/OP coordinates, directions and distances. Triangulation method is used to better determine positions of calling gibbon groups, at the same time, at least two listening posts were set up. Data from the listeners can then be compared and combined (see the illustration below). Surveyors used a transparent compass to record direction of gibbon calls.



4.4.2 Survey area and effort: Gibbons and other primates

The survey area included Xuan Trach, Thuong Hoa and Hoa Son Communes. 21 listening posts were set up to collect data, with at least 2 days for each LP in this survey (details of positions are provided in Annex 2i and Map 4).

The survey was conducted during 3 trips to PN-KB NP:

- Trip 1: Preliminary trip to PN-KB NP for general preparation (Field Sites selecting; Planning...)

surveying in Xuan Trach
; Hoa and Hoa Son

The preliminary trip was 2 days; training was conducted for 1 day, and field surveying took for 27 days. A list of participants is presented in Annex 10. A summary itinerary is given in Table 9 below:

Table 9 Summary itinerary for the Southern White-cheeked Crested Gibbon survey

Date	Activity	Location
30/7-1/8/2011	Trip 1 (2 days): Preparation (Field Sites selecting; Planning...).	PN-KB NP (Thuong Trach, Thuong Hoa, Hoa Son communes)
21/8-4/9/2011	Trip 2 (13 days): Survey training and Field surveying	PN-KB NP (Thuong Hoa communes)
	- Classroom training in PN-KB NP (21/8/2011).	PN-KB NP office
	- Field surveying (22/8-4/9/2011)	Thuong Hoa forest
18/9-1/10/2011	Trip 3 (14 days): Field surveying (2 team surveying at the same time)	- Thuong Trach forest (Mr.Dat's team) - Hoa Son forest (Mr. Tuoc)

5.1 Small Carnivore and Loris Survey Results

This study has obtained evidence for the presence of 2 loris species, 9 species of mustelids, 9 species of viverrids, and 2 species of herpestids in PNKB NP. However, the team was only able to directly confirm (through direct observation and/or specimen collection) the presence of 13 of these 22 species (Table 10). The presence of other species was confirmed through interviews and critically reviewed records from previous surveys (see Annex 4a).

Of the 22 species of loris and small carnivore, 6 are listed in Annex I (prohibited to use and exploit for commercial purposes), and 7 are listed in Annex II (limits to use) of the Government Decree 32 (Decree 32/2006/ND-CP). 11 species are listed as Near Threatened, Vulnerable, or Data Deficient in the IUCN Red List (IUCN, 2012), which indicates high threat levels for the small carnivores and loris found in PNKB.

The presence of 19 small carnivore species indicates that PNKB is home to the highest number of small carnivore species found in any protected area of Vietnam. PNKB NP should therefore be seen as one of the most important areas for small carnivore conservation in Vietnam, as North Vietnam itself was identified as one of the world's priority sites for small carnivore conservation (Schreiber et al., 1989).

Table 10 Small carnivores and loris recorded during the survey

No.	Scientific name	Common name	Conservation status			Record location/Evidence type		
			VNRDB ¹	IUCN ²	Decree 32 ³	Hoia Son	Thuong Hoa	Xuan Trach
	PRIMATE	Primate						
	Loridae	Loris						
1	<i>Nycticebus bengalensis</i>	Slow loris	VU	VU	IB	Obs.	Int.	Int.
2	<i>Nycticebus pygmaeus</i>	Pygmy loris	VU	VU	IB	Obs.	Obs.	Obs.
	CARNIVORA	Carnivore						
	Mustelidae	Weasels and Martens						
3	<i>Mustela kathiah</i>	Yellow-bellied weasel		LC	IIB	Spe.		
4	<i>Mustela strigidorsa</i>	Stripe-backed weasel		LC	IIB	Obs.	Obs.	
5	<i>Martes flavigula</i>	Yellow-throated Marten		LC		Cam.	Int.	Int.
6	<i>Arctonyx collaris</i>	Hog-badger		NT		Spe.	Spe.	Int.
7	<i>Melogale personata</i>	Large-tooth Ferret-badger		DD		Int.	Obs., Spe.	Int.
8	<i>Melogale moschata</i>	Small-tooth Ferret-badger		LC		Spe.	Obs., Spe.	Spe.
9	<i>Lutra lutra</i>	Eurasian Otter	VU	NT	IB	Int.	Int.	Int.
10	<i>Lutrogale perspicillata</i>	Smooth-coated Otter	EN	VU	IB	Int.	Int.	Int.
11	<i>Aonyx cinerea</i>	Oriental Small-clawed Otter	VU	VU	IB	Int.	Int.	Int.
	Viverridae	Civets						
12	<i>Viverra zibetha</i>	Large Indian Civet		NT	IIB	Int.	Int.	Int.
13	<i>Viverra megaspila</i>	Large-spotted Civet	VU	VU	IIB	Int.	Int.	Int.
14	<i>Viverricula indica</i>	Small Indian Civet		LC	IIB	Int.	Int.	Int.
15	<i>Prionodon pardicolor</i>	Spotted Linsang		LC	IIB	Int.	Int.	Int.
16	<i>Paradoxurus hermaphroditus</i>	Common Palm Civet		LC		Obs., Spe.	Obs., Spe.	Obs., Spe.
17	<i>Paguma larvata</i>	Masked Palm Civet		LC		Obs.	Obs.	Obs.

	Common name	Scientific name	Conservation status			Record location/Evidence type		
			VNRDB ¹	IUCN ²	Decree 32 ³	Hoa Son	Thuong Hoa	Xuan Trach
18	<i>Arctictis binturong</i>	Binturong	EN	VU	IB	Obs.	Trac.	Trac.
19	<i>Arctogalidia trivirgata</i>	Small-toothed Palm Civet		LC		Obs.	Int.	Int.
20	<i>Chrotogale owstoni</i>	Owston's Banded Civet	VU	VU	IIB	Int.	Int.	Int.
	Herpestidae	Mongoose						
21	<i>Herpestes javanicus</i>	Small Asian Mongoose		LC		Obs.	Spe.	Int.
22	<i>Herpestes urva</i>	Crab-eating Mongoose		LC		Cam.	Int.	Spe.

Note:
 Obs. ó Direct observation or camera trap image
 Int. ó Interview information
 Spe. ó Specimen
 Trac. ó Tracks

1. Vietnam Red Data Book
and
2. IUCN Red List of Threatened Species (IUCN, 2012).

EN ó Endangered
 VU ó Vulnerable
 NT ó Near Threatened
 LC ó Least Concern
 DD ó Data Deficient

3. Decree 32/2003/ND-CP of the Government of Vietnam on list of Endangered Species and its management regulation
 Annex I: strictly prohibited for exploitation and use for commercial purposes
 Annex II: protected and with limitation for use and trade

species

Yellow-bellied Weasel, *Mustela kathiah*

The Yellow-bellied Weasel occurs from Hoang Lien to Quang Binh and Quang Nam provinces (Ng Huy Hu nh et al., 1994, Long and Minh Hoang, 2006). The weasel occurs mostly in the northern part of Southern Asia (Nowak, 2005, Corbet and J.E. Hill, 1992, Duckworth and Robichaud, 2005). In PNKB there was previously no record of this species. However, during our survey, one skin specimen of *M. kathiah* was collected in Ruc cave, Ma Rinh Moi area (0592462/1955140), and three footprints of one animal were observed in a termite colony (0595915/1955843), both in Hoa Son commune. This is apparently the first specimen of *M. kathiah* collected and documented in PNKB.

Interviews confirmed the presence of the species in all three areas, however due to its tiny size and quiet activity, very little information on this species was collected during the survey. It seems that local people do not intend to hunt this small animal, which could give it a better chance of survival.

Stripe-backed Weasel, *Mustela strigidorsa*

The Stripe-backed Weasel (formerly known as Back-striped weasel) is one of the least known weasels in Vietnam, and there is very little information available on this species. It was confirmed in Le Thuy district, near to PNKB, in a 1991 study (Ratajczak and Cox, 1991). The weasel also occurs in Phong Dien Nature Reserve, Thua Thien Hue province (Nguyen Manh Ha per. comm., 2005).

There is no other previous information about this species in PNKB. During our survey, one adult Stripe-backed weasel was observed in a limestone ridge (forest on limestone) in Hoa Son commune. Interviews indicated that the species occur in all three areas, but that it has never been a common species. As is the case for other weasels, the Stripe-backed weasel is not of interest to local people and hunters, therefore there is little information on hunting and trade in this species.

Yellow-throated Marten, *Martes flavigula*

The Yellow-throated Marten is one of the small carnivores that has a distribution range throughout the country (Ng Huy Hu nh et al., 1994). It was recorded as one of the most frequently observed species of small carnivore in Quang Nam, to the south of Quang Binh province (Long and Minh Hoang, 2006). In PNKB, the yellow-throated marten was confirmed to exist in all previous biodiversity surveys (Nguyen Xuan Dang et al., 1998, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009). However, although it was reported as a common species in the National Park, there was little detailed information about the population. During our survey, no Yellow-throated martens were observed, however interviews confirmed their presence in all three areas. A local hunter in Hoa Son also informed the team that this species is rarely caught in snare traps, and in his ten years of snaring experience, he recalls only one being caught (2007). However, this may be because the species is primarily arboreal. Local hunters generally do not hunt the animal as its meat is considered to have a bad taste, so wildlife traders do not buy the animals. These considerations may help to give the animal more chance of survival.

The Hog Badger is one of the most common small carnivores in Vietnam. It has been recorded throughout the country, from the northern to the south-east provinces, wherever there is natural forest (Ng Huy Hu nh et al., 1994). In PNKB, the hog badger was confirmed in previous biodiversity surveys (Nguyen Xuan Dang et al., 1998, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999). However, no detailed information on their abundance or distribution was given.

In this survey, one adult hog badger was observed in Nhai Moi area, Thuong Hoa Commune (10:23, 30 August 2011, 0604248/1949985). In addition, a footprint was observed at a water hole next to Ma Ma Lake, Thuong Hoa Commune (16:13, 26 August 2011, 0603807/1950611). Skin and bones (part of the skull and lower jaw) was collected in Hang Ruc, Hoa Son commune (0592462/1955140), where the animal was snared and probably eaten by a local hunter (a knife cut was clearly visible in the skull and bones). Interviews indicated that the animal occurs in all three survey areas; however, the population was deemed to be very low as the result of illegal hunting. The footprints of this and other animals were hard to see in rocky and hard surfaces such as at Hung Dang-Ca Tot and Hoa Son areas, therefore very little information on this species was collected in the two survey sites.

According to local hunters, the hog badger's behaviors (terrestrial, based in flat areas) make the animal easy to catch by snare trap, especially in the dry season when trapping lines are often set around key water holes. Local hunters also told us that hog badgers are often consumed by local people, as it is a relatively large animal. Its gall bladder is considered a good medicine, which increases its value for many hunters.

Small-toothed Ferret Badger, *Melogale moschata*

The Small-toothed Ferret Badger is most commonly reported in the northern part of Vietnam (Ng Huy Hu nh et al., 1994). However, recent observations of the species were confirmed in Quang Nam province (south of the 16th parallel) (Long and Minh Hoang, 2006). In PNKB the presence of the small-toothed ferret badger was confirmed and it is reported to be one of the most common small carnivores in the area (Nguyen Xuan Dang et al., 1998, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999).

During this survey, the small-toothed ferret badger was observed in all three areas. In total 6 animals (2 alive in Hoa Son, 2 dead in Thuong Hoa, and 2 alive in Xuan Trach) were observed, and 2 skulls (Hoa Son) were collected in the three survey areas. This was the most frequently observed small carnivore in the park. According to local hunters, this is the most common small carnivore caught by snare trap in all areas of Phong Nha - Ke Bang. One hunter informed us that with 100 snare traps set-up, he could probably catch two or three animals per week. This provides interesting information on the badger's abundance, however it also indicates that a high number of Small-toothed ferret badgers are being lost from the forest due to illegal snaring. The Small-toothed ferret badger's meat is not considered good to eat, and it is therefore not collected by wildlife traders. Local people will however eat it. During our survey, small-toothed ferret badger's bones were commonly found in old hunting camps, as well as in active snaring camps and local villages. (A freshly killed pair of both

ferret badgers were discovered at The On village on 29

Large-toothed Ferret Badger, *Melogale personata*

The Large-toothed Ferret Badger is distributed throughout the country, and specimens of the badger have been collected from Yen Bai province down to Ho Chi Minh city (Ng Huy Hu nh et al., 1994). It may be one of the most wide-ranging small carnivores in the country. The presence of Large-toothed ferret badgers in PNKB was provisionally confirmed in 2009 in the U Bo area in the south of the National Park (Le Trong Dat et al., 2009, Le Khac Quyet et al., 2002), but there has been no previous information on this species from the limestone areas that were the targeted areas of this survey.

In this survey, only one specimen of the Large-toothed ferret badger was observed in The On village (20 August 2011). The animal was freshly killed, together with a Small-toothed ferret badger, by a local villager. The two animals were very similar but for size and skin colour - the Large-toothed ferret badger (970 gram) has darker blackish color skin, and the small-toothed ferret badger has lighter skin and a relatively smaller size (540 gram). The identical large molars of *Melogale personata* was the most important identifying characteristic. This is the first specimen of a Large-toothed ferret badger confirmed in Phong Nha-Ke Bang, as other previous records noted only that it had been observed, without any other detail (Le Trong Dat et al., 2009, Le Khac Quyet et al., 2002).

According to the hunter, the two animals were captured in the same snare trap line that was set-up in lowland evergreen forest (a valley surrounded by limestone mountain). This information indicates that the animals might share the same habitat in this area. The hunter also informed us that the Large-toothed ferret badger has a smaller population in the area than the Small-toothed ferret badger, as it is less frequently captured. In fact, in this area, locals report that the Small-toothed ferret badger is the most frequently captured animal by snare trapping. Perhaps these two species have a better reproductive rate, as well as wider ranges of habitat, in comparison with other small carnivore species in the area. In addition, they are not collected for the wildlife trade, and are only consumed by local people, therefore there is no active trapping or hunting activity specifically targeting these two species. They are mostly captured by chance, which may be another reason why these two species still have larger populations than other small carnivores in the area.

Otters

The Ma Ma Lake, Thuong Trach commune was the only major dry-season water source (permanent water) in all three survey areas. It covers approximately 3 ha of water surface during the rainy season and 1 ha during the dry season. There is no stream going in or out of the lake, so it is likely that the lake is supplied by underground water, which is common in karst areas like PNKB. Therefore, if otters do occur in the area, the lake could only support a small otter population.

The other two areas (Hoa Son and Xuan Trach communes) are predominantly karst areas, where water only exists in the rainy season. No information was therefore collected on otters in these areas. However, around the major residential areas in all three communes there are streams which could be suitable habitats for otters. In addition, there are many other good

the park and in the bufferzone, which could be critical

Eurasian Otter, *Lutra lutra*

The Eurasian Otter occurs mostly in the central and northern part of Vietnam, from Lao Cai to Quang Tri and other central provinces (Ng Huy Hu nh et al., 1994). In PNKB the presence of the Eurasian otter was confirmed in all previous surveys, however most of the records come from the Xuan Trach commune where key water sources are found, such as the Chay and Son Rivers and Cha Ang and Rao Thuong streams (Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000).

During our survey, no information on Eurasian otter was collected in the field. Information from interviews indicated that this otter used to occur in Ma Ma Lake and in streams in On and Dang Hoa, however recently they all disappeared from the area because of hunting. Interviews in Xuan Trach commune indicated that a small population of Eurasian otters still occurs along the Son and Chay Rivers, and there may be some in Rao Thuong and Cha Ang streams, but there was no attempt to confirm their presence as the area fell outside the area of this survey.

Smooth-coated Otter, *Lutrogale perspicillata*

The Smooth-coated Otter is one of the least known otters in Vietnam, and its range is not clearly defined in the country. It is believed to be distributed mostly in southern and central provinces (Ng Huy Hu nh et al., 1994). Evidence and specimens of the otter have mostly been documented in the southern part of the country, in Quang Nam, Dak Lack Province (Long and Minh Hoang, 2006, Duckworth and Le, 1998). A specimen of a juvenile male of *Lutrogale perspicillata* was collected in Vu Quang, Ha Tinh province in July 2011, and this is perhaps the only specimen collected in the north central provinces (Nguyen Manh Ha in pre. 2011). The presence of the Smooth-coast otter in PNKB was confirmed once in 1998, without any detail on location or population (Nguyen Xuan Dang et al., 1998).

This survey found no evidence of the Smooth-coated otter in the field. Interviews indicated possible presence in Hoa Son and Thuong Trach, but the animal was described in exactly the same way as other otters by local hunters and fishermen in Xuan Trach. It is possible that a small population of this species remains in that commune, as it holds the key water systems of the park (Chay, Son Rivers, Rao Thuong and Cha Ang streams).

Oriental Small-clawed Otter, *Aonyx cinerea*

The Oriental Small-clawed Otter is perhaps the most common otter in Vietnam, and the animal has been confirmed throughout the country, from Lao Cai to Ca Mau provinces (Ng Huy Hu nh et al., 1994). However, most of the confirmed presence and specimens have been from central and southern provinces. The presence of Oriental small-clawed otters was confirmed in PNKB, however no detailed information on their distribution and population was given (Nguyen Xuan Dang et al., 1998, Kouznetsov et al., 1999).

presence of the otter was found. Interview information was collected in these areas. However, most villagers in Hoa Son and Thuong Son were present for at least five years in those areas, because of illegal hunting. The majority of information on the Oriental small-clawed otter comes from Xuan Trach commune, where we were told that the small river in Co Giang Village (a stream running to Son River) and Cha Ang and Rao Thuong Stream were the most important strongholds for this otter. However, there was generally little information on this species - it is possible that there is still a small population in Rao Thuong and upstream of the Son river (Tro Muong), as these areas are located deep in the park and receive better patrol and protection by park rangers. In areas such as Phong Nha, Tram, Me and Co Giang villages, it is likely that the animal has been wiped out due to hunting.

Large Indian Civet, *Viverra zibetha*

The Large Indian Civet is one of the most widespread civet species in Asia, and it has been recorded from India to Vietnam to Malaysia (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam, the species is distributed throughout most regions of the country, however it is mostly restricted to the upland and hilly areas (Nguyen Huy Hu nh et al., 1994). The large Indian civet's presence was confirmed in PNKB and was previously considered as a common species, however there is no information on population or abundance (Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Le Xuan Canh et al., 1997).

During our survey, no evidence of the Large Indian civet was collected in the field. In addition, tracks of this species are similar to other similar species such as *Viverra megaspila*, *Viverricula indica*, *Paguma larvata* that may also occur in the same area, which made our attempt to confirm its presence even more difficult. We heard of only one recent capture of the civet in secondary forest close to a corn plantation in Hoa Son commune (July 2011). Interviews indicated that the civet occurs in all three survey areas, but mainly in the adjacent areas of primary and secondary forest. According to local hunters, the Large Indian civet's population has been much reduced in the last 10 years in all areas of PNKB as the consequence of snare trapping. This highly terrestrial carnivore is easily captured by local snare trappers, which has caused severe damage to the civet population. As a result they are now rarely captured by local people. According to local people, the large Indian civet is not a preferred item for local wildlife traders, but they are still purchased. For instance, one dead male large Indian civet was observed in a restaurant in Da Nang town, Hoa Son (23 July 2011), being advertised as Common Palm Civet (*Paradoxurus hermaphroditus*) by the restaurant owner.

Large-spotted Civet, *Viverra megaspila*

The Large-spotted Civet is one of the least known species of small carnivore in Vietnam. It occurs mainly in the southern provinces (Nguyen Huy Hu nh et al., 1994), but until now there has been very little information about it. The most recent record of the Large-spotted civet in the field was from Quang Nam in 2005 (Long and Minh Hoang, 2006). In PNKB the species was confirmed to occur in the park in three previous survey reports, however these did not record their exact location in the park (Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999).

In our survey, no information on the animal was collected in the field. Interviews showed that local people did not differentiate between *Viverra megaspila*, *Viverra zibetha* and the *V.*

is a new species or a form of *Viverra zibetha*; Walston and Pham Trong Anh, 1999, Boonratana, 2004). Local people recognize only one civet called ðCh n H uõ (ie., deer civet). In addition, it is not possible to differentiate between tracks of *Viverra megaspila*, and *Viverra zibetha* in the field. A single specimen of *Viverra megaspila* was observed in Dong Hoi in 2003, originally collected in the Phong Nha area (Nguyen Manh Ha per.com. 2003), so it is possible that there is a population of *Viverra megaspila* in the Park. However, this needs to be confirmed in a future study, possibly using camera trap methodology (Please refer to camera trap survey report).

Tainguen Civet, *Viverra tainguensis*

This newly described species of civet is found in central Vietnam, and across most of the country from Lang Son to South-East provinces (Rozhnov and Pham Trong Anh, 1999, Sokolov et al., 1997). However, the taxonomy of the species is still under debate, and it is unclear whether it is a new species or a form of *Viverra zibetha* (Walston and Veron, 2001). There is no record of this civet in Phong Nha, but it may previously have been recorded as *Viverra megaspila* or *Viverra zibetha* in the park (Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999).

Interviewees could not differentiate between the *Viverra tainguensis*, *V. megaspila*, and *V. zibetha*. Local people recognized the three species under the same name ðCh n H uõ (deer civet). There needs to be further study to verify the presence of this species in PNKB, together with further work on the taxonomy of the different civet groups.

Small Indian Civet, *Viverricula indica*

The Small Indian Civet is one of the most widespread civets in Asia (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam the species is distributed throughout the country, and is found in a variety of habitats from old-growth forest, to shrub land and secondary forest (Nguyen Huy Hu nh et al., 1994). The presence of the Small Indian Civet in Phong Nha was confirmed in previous biodiversity studies in the park (Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Le Trong Dat et al., 2009, Le Khac Quyet et al., 2002), and it was considered to be common in the park (Nguyen Xuan Dang et al., 1998).

During our survey, no observation or specimen was collected of this species in PNKB. Their tracks are difficult to find in such rocky and dry terrain. However, interviews indicated that the species occurs in all three survey areas, but mostly in the secondary forest rather than primary forest. In the previous survey, evidence of the Small Indian Civet was also mostly from secondary forest areas (Nguyen Xuan Dang et al., 1998). Local hunters informed us that this civet and other highly terrestrial viverids have been severely impacted by snare trapping in the area, and they have therefore become quite rare in the last five years. A local hunter recommended that we do surveys in secondary forest or in areas of adjacent forest and cultivated land to track the Small Indian Civet. It is quite possible that there is a population of the small Indian civet in PNKB, however it is likely to be a small population due to the severe impact of snare trapping.

pardicolor

The Spotted Linsang is one of the most widely distributed viverrids in Vietnam. Its presence has been confirmed in most provinces, in a variety of forests from lowland to montane (Ng Huy Hu nh et al., 1994, Long and Minh Hoang, 2006). In PNKB the Spotted Linsang was confirmed in two reports, but no detail on the population and status was given (Kouznetsov et al., 1999, Le Khac Quyet et al., 2002).

During our survey, no information or specimens of the Spotted Linsang was collected in the field. However, interviews indicated that the spotted linsang occurs in all three areas, although it is quite rare and apparently has never been a common species here. Due to its distinctive shape and skin color, most local hunters described it in the same way. Local villagers also informed us that due to its beautiful color, the animal was often stuffed and sold in markets and at road junctions. However, they have rarely been seen in the last five years because of intensive snaring. Recorded sightings of the Spotted Linsang are quite rare in the park, with only one record being documented in the last 12 years. It may be that this species is and always has been rare, or that it is restricted to a very specific habitat in the park.

Common Palm Civet, *Paradoxurus hermaphroditus*

The Common Palm Civet is the most widespread species of civet in Asia (Corbet and J.E. Hill, 1992, Nowak, 2005) and in Vietnam, where it is found in a variety of habitats (Ng Huy Hu nh et al., 1994). The presence of the Common Palm Civet is confirmed in PNKB, and it is considered as one of the most common civets in the park (Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009).

In this survey, the Common Palm Civet was observed and bone specimens were collected in all three areas (Hang Ruc, Ma Rinh Moi, Ma Ma valley, Hung Dang). Four observations of the civet were made in nocturnal survey transects, and a number of track and fecal signs were also observed in all three area (see Appendix). It seems that, in the survey areas at least, the Common Palm Civet is one of the most abundant species in the park, despite intense hunting pressure.

Masked Palm Civet, *Paguma larvata*

The Masked Palm Civet is one of the most widespread civets in Asia, especially in Southeast and East Asia (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam the animal has been recorded in most provinces, including in lowland and mountainous areas (Ng Huy Hu nh et al., 1994). In PNKB, the presence of Masked Palm Civets was confirmed in all previous survey attempts, and it was considered a common species in some of the reports (Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009).

In this survey, only one Masked Palm Civet was observed and one bone specimen (Ruc Cave) was collected in the field (see Appendix). Previous recorded sightings of palm civet (1998) were in the same area, Ma Rinh stream, and in the earth-hill areas. (Nguyen Xuan Dang et al., 1998). Interview information indicated that the species occurs in all three areas,

earth-hill areas rather than the limestone areas. Local Smalltoothed Palm Civet used to be common, but have become rarer due to hunting.

Binturong, *Arctictis binturong*

The Binturong has a restricted distribution in South-East Asia (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam the species has been recorded in most of the forest areas from Lai Chau to Dong Nai province (Nguyen Huy Hu nh et al., 1994). The presence of Binturong was confirmed in Phong Nha-Ke Bang in an early biodiversity surveys (1997), however no detailed information on population or status was given (Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000).

During this survey, the team observed Binturong in the field once, in Hoa Son. A few old tracks (approximately 1-2 months old) of the animal were found in Ma Rin and Ma Ma valley. The tracks were clearly marked on the trunk of a *Dracontomelum* sp. tree and *Azadirachta indica* tree, which the animal was probably climbing for their fruit (see Appendix). Interview information in all three areas indicated that the animal has become very rare now due to hunting and snare trapping. It is clear that the Binturong is a rare species in PNKB, and there are very few records of them in the park. In our survey, tracks of the animal were only found in two areas, which may represent just two animals. It seems clear that if the snare trapping and trade in wild animal in PNKB cannot be effectively controlled, then Binturong in PNKB will soon be in a critical condition.

Smalltoothed Palm Civet, *Arctogalidia trivirgata*

The Smalltoothed Palm Civet has a limited distribution in mainland South East Asia (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam, it is one of the least-known civets. The presence of the civet is poorly recorded, but sightings and specimen collection have mostly been in the northern and central highland provinces (Nguyen Huy Hu nh et al., 1994). Recently the animal was recorded in Quang Nam and Dong Nai provinces (Birissenko et al., 2004, Long and Minh Hoang, 2006). The presence of the Smalltoothed Palm Civet in Phong Nha-Ke Bang was confirmed in 1998 (cave in hillside, 17°05'N, 107°18'E), but later biodiversity surveys gave no further information on this species (Nguyen Xuan Dang et al., 1998).

During our survey, one Smalltoothed Palm Civet was observed in Ma Rin (20:21, 15 August 2011, 0591856/1958109) in the canopy of the forest, 530m above sea level, in an earth hill area. The animal was aware of the human presence and moved continuously in the canopy. However, the three identical back stripes and white hair in the ear was observed quite easily when the animal tried to climb up the tree. Local hunters informed us that the species often travel in groups, however on this occasion only one animal was observed at the time. Interview information indicated that the species occurs only in the earth hill area of Hoa Son, and there was no other information on the species in the two limestone areas of Thuong Hoa and Xuan Trach. The previous records of the Smalltoothed Palm Civet in PNKB was also in the earth hill area of the park (Nguyen Xuan Dang et al., 1998) living in a cave in the hillside and eating land snails, however, this should not be considered typical habit for this arboreal

that the animal is mostly in the earth hill area of the park,

The Smallótoothed Palm Civet is under pressure from hunting, but according to interviews, not from snare-trapping. Local hunters interviewed in the survey informed us that there were no Smallótoothed Palm Civets caught by snare trapping. In Hoa Son and Thuong Hoa, however, hunting using guns at night seems quite common (see below).

Owstonø Civet, *Chrotogale owstoni*

The vulnerable Owstonø Civet is a civet with a very limited distribution range, restricted to the north part of Vietnam, a very small part of central Lao, and a very small area of Yunnan and Guangxi provinces, China. The largest population reported to date is in northern Vietnam (Robertson et al., 2008). In Vietnam the species has been mostly recorded in northern provinces, but reports have recently extended to the southern provinces (ng Huy Hu nh et al., 1994, Robertson et al., 2008, Robertson, 2007, Rozhnov et al., 1992, Rozhnov et al., 1993, Long and Minh Hoang, 2006). In PNKB, the presence of this civet was confirmed in two reports (Kouznetsov et al., 1999, Timmins et al., 1999), but no other information on this animal has been recorded in the Park since then.

During our survey, no evidence of Owstonø Civets was observed in the field. Interview information confirmed their presence in all three areas, although sightings are rare, according to local hunters. We were informed that this highly terrestrial species might have suffered badly from snare trapping in PNKB. Their meat and body parts were on sale in local markets over the last ten years, but it has hardly been seen recently. Although local people were able to describe this civet very distinctly from other species, there was little information about captured animals through snare trapping. It is possible that the tiny population size and severe impact of snare trapping has led to sightings being so rare.

Small Asian Mongoose, *Herpestes javanicus*

The Small Asian Mongoose is a widespread species in Asia, distributed mainly in shrubland and grassland from Afghanistan to Vietnam to Thailand (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam the species is present in most of the provinces, however it is restricted to grassland, secondary forest, mixed deciduous forest and shrubland (Dang Huy Huynh et al., 1997; VanPeenen, *et al.* 1970). In Phong Nha the Small Asian mongooseø presence was confirmed and there is now data on its status in the park (Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Le Trong Dat et al., 2009).

During our survey only one Small Asian Mongoose was observed, in Hoa Son commune, when the animal tried to cross the road from tall grassland in Da Nang to Dang Hoa commune. Another dead animal was discovered at Ma Ma Lake - the animal had been killed by a dog and was then cooked for food by local villagers. Very little information on this species was collected as our survey areas were mainly in primary forest, which is not the usual habitat of the mongoose. Interview information indicated that the animal occurs mostly in grassland and shrubland close to residential areas. Local people also complain that their poultry is lost as prey to the Small Asian mongoose and other small carnivores.

It is probable that there is still a population of the small Asian mongoose in PNKB, however their distribution is restricted to grassland and shrub, mostly close to residential areas. Its

Why the mongoose suffers less from hunting and snare traps in the park. In addition, the local hunters informed us that it has a bad taste, so is not purchased by wildlife traders. However, they are sometimes caught by dogs. The population may be stable or even expanding, as their grassland and shrub habitat is expanding annually due to deforestation.

Crab-eating Mongoose, *Herpestes urva*

The Crab-eating Mongoose is distributed widely from Bangladesh throughout mainland South East Asia and southern China (Corbet and J.E. Hill, 1992, Nowak, 2005). In Vietnam the species' presence was confirmed in a variety of habitats, particularly stretching from Lao Cai to Dong Nai provinces (Dang Huy Huynh et al., 1997). In PNKB the presence of the crab-eating mongoose was only confirmed in a single mammal survey report in 1998 (Nguyen Xuan Dang et al., 1998).

During our survey, there was no direct observation of the mongoose, however one fecal sign and one track of the animal were observed in Ma Rin region (see appendix). However, our survey was done in the dry season, and there were water shortages in every part of the forest, which may have been the reason for not seeing the animal directly. A clear picture of a snared Crab-eating Mongoose was recorded in Hung Dang (Le Thuc Dinh per.com.), confirming its presence in the park. According to local hunters, the crab-eating mongoose is quite rare in the jungle, but observations are more frequent in the hilly shrubland and secondary forest that are close to important water resources such as key streams and permanent water holes. Local hunters also informed us that they do not attempt to hunt or snare the Crab-eating Mongoose because it will not be purchased by wildlife retailers as it does not have a good taste. However, the animal is sometimes caught by dogs. It is quite possible that in PNKB the mongoose and weasel populations will remain strong in comparison to the civets and otters, as they suffer less from hunting, wildlife trade, and habitat loss.

Cats, Felidae

The only records of cats (Felidae) collected during these surveys were tracks. Tracks of felids are unmistakable, however, it is difficult to tell apart species within the group. Since size is the main differentiating factor, a small young animal of one species may be confused with a large animal of a smaller species. The records below are therefore only considered putative.

Golden Cat

Previous surveys have recorded Golden Cat in PNK. This survey found putative footprints of Golden Cat in Thuong Hoa and Hoa Son survey areas on day time transect, indicating that the species may also be present in the extension area.

Clouded Leopard

Previous surveys have recorded Clouded Leopard (*Neofelis nebulosa*) in PNKB NP World Heritage Site. This survey found putative footprints of Clouded Leopard in both Thuong Hoa and Hoa Son survey areas on day time transects, thus indicating that it may be present in the extension area. In addition, one possible track of Leopard was found on a transect in Ma Rin, Hoa Son.

dents Survey Results

5.2.1 Insectivores and rodents in the PNKB NP and region

Totally, 6 specimens of Insectivores and 83 specimens of Rodents were trapped during this survey. Analysis of these specimens resulted in confirmation of 4 species of Insectivores and 20 species of rodents (see Annex 2b for number of specimens by species and survey sites). In addition to species which are identified based on trapped specimens, 4 more rodent species were recorded by transect survey, and 5 more species were identified by examination of hunted remains and interviews of local residents. Totally, 30 species of rodents and 4 species of insectivores were found by our surveys. Previous surveys have recorded 2 species of Insectivores and 29 species of Rodents (Annex 4b). Combination of all these data gives a list of 6 Insectivore species and 34 rodent species recorded in PNKB NP (Table 11).

Table 11 List of Insectivore and Rodent species recorded in PNKB NP

No.	Scientific Name	Vietnamese name	English name	Before 2010	This survey		
					M R	H E	H D
	ERINACEOMORPHA	Bộ Chuột voi	ERINACEOMORPHS				
	Erinaceidae	1. Họ Chuột voi	Hedgehogs and Gymnures				
1.	<i>Hylomys suillus</i>	Chu t voi i	Short-tailed Gymnure	X	S		
	SORICOMORPHA	Bộ Chuột chù	SORICOMORPHS				
	Soricidae	1. Họ Chuột chù	Shrews				
2.	<i>Crocidura attenuata</i>	Chu t chù uôi en	Asian Gray Shrew			S	
3.	<i>Crocidura fuliginosa</i>	Chu t chù uôi tr ng	Southeast Asian Shrew				S
4.	<i>Suncus murinus</i>	Chu t chù nhà	Asian House Shrew	X			
	Talpidae	2. Họ Chuột chũi	Moles				
5.	<i>Euroscaptor longirostris</i>	Chu t ch i m i dài	Long-nosed Mole		S		
	RODENTIA	Bộ Gặm nhấm	RODENTS				
	Sciuridae	1. Họ Sóc	Squirrels				
6.	<i>Belomys pearsonii</i>	Sóc bay lông chân	Hairy-footed Flying Squirrel		S	O	O
7.	<i>Hylopetes alboniger</i>	Sóc bay en tr ng	Particolored Flying Squirrel	X		O	
8.	<i>Petaurista philippensis</i>	Sóc bay trâu	Indian Giant Flying Squirrel	X	O	O	O
9.	<i>Petaurista elegans</i>	Sóc bay sao	Spotted Giant Flying Squirrel		O		
10.	<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	X	O	O	O
11.	<i>Callosciurus erythraeus</i>	Sóc b ng	Pallas's Squirrel	X	S	S	O
12.	<i>Callosciurus inornatus</i>	Sóc b ng xám	Inornate Squirrel	X			
13.	<i>Menetes berdmorei</i>	Sóc v n l ng	Indochinese Ground Squirrel	X		S	
14.	<i>Dremomys rufigenis</i>	Sóc mõm hung	Asian Red-cheeked	X	S		

	Vietnamese	English name	Before 2010	This survey			
				M R	H E	H D	
		Squirrel					
15.	<i>Tamiops maritimus</i>	Sóc chu t h i nam	Maritime Striped Squirrel	X	S	S	
16.	<i>Tamiops rodolphii</i>	Sóc chu t l a	Cambodian Striped Squirrel	X			S
	Spalacidae	2. Họ Dúi	Bamboo Rats				
17.	<i>Rhizomys pruinosus</i>	Dúi m c l n	Hoary Bamboo Rat	X	R	R	H
18.	<i>Rhizomys sumatrensis</i>	Dúi má vàng	Indomalayan Bamboo Rat	X	R	R	R
	Muridae	3. Họ Chuột	Murids				
19.	<i>Bandicota indica</i>	Chu t t l n	Greater Bandicoot Rat	X		H	
20.	<i>Bandicota savilei</i>	Chu t t bé	Savileø Bandicoot Rat	X			
21.	<i>Berylmys bowersi</i>	Chu t m c l n	Bowerø Berylmys	X	S	S	S
22.	<i>Leopoldamys sabanus</i>	Chu t núi uôi dài	Indomalayan Leopoldamys	X	S	S	S
23.	<i>Leopoldamys edwardsi</i>	Chu t h u l n	Edwardø Leopoldamys		S		S
24.	<i>Maxomys moi</i>	Chu t xu-ri lông m m	Indochinese Mountain Maxomys	X		S	
25.	<i>Maxomys surifer</i>	Chu t xu-ri	Indomalayan Maxomys	X	S	S	S
26.	<i>Chiropodomys gliroides</i>	Chu t nh t cây	Indomalayan Pencil-tailed Tree Mouse		S	S	S
27.	<i>Mus caroli</i>	Chu t nh t ng	Ryukyu Mouse	X			
28.	<i>Mus cervicolor</i>	Chu t nh t ho ng	Fawn-colored Mouse	X		S	S
29.	<i>Mus musculus</i>	Chu t nh t nhà	House Mouse	X			
30.	<i>Mus pahari</i>	Chu t nh t n ng	Indochinese Shrewlike Mouse	X		S	
31.	<i>Niviventer fulvescens</i>	Chu t h u bé	Indomalayan Niviventer	X	S	S	S
32.	<i>Niviventer langbianis</i>	Chu t lang bi an	Indochinese Arboreal Niviventer		S	S	
33.	<i>Niviventer tenaster</i>	Chu t núi ông d ng	Indochinese Mountain Niviventer	X	S	S	S
34.	<i>Rattus argentiventer</i>	Chu t b ng b c	Ricefield Rat	X			
35.	<i>Rattus nitidus</i>	Chu t bóng	White-footed Indochinese Rat	X	S		
36.	<i>Rattus tanezumi</i>	Chu t nhà	Oriental House Rat	X			
	<i>Rattus andamanensis</i>	Chu t r ng	Indochinese Forest Rat	X		S	S
37.	Hystricidae	4. Họ Nhím	Porcupines				
38.	<i>Atherurus macrourus</i>	on	Asiatic Brush-tailed Porcupine	X			H
39.	<i>Hystrix brachyura</i>	Nhím uôi ng n	Malayan Porcupine	X	R	R	R
	Laonestidae	5. Họ Nê củng	Laotian Rock Rat				
40.	<i>Laonastes aenigmamus</i>	Nê c ng	Kha-noy			S	
	Total (species)		39	31	21	24	19

...a (Hoa Son Commune), HE ó Hang En area (Thuong Hoa
...ong Trach Commune. Evidence: x ó species recorded before
specimen, R ó reported by local residents

In comparison with the list before 2010, this survey did not record 6 species, namely *Suncus murinus*, *Callosciurus inornatus*, *Bandicota savilei*, *Mus caroli*, *Mus musculus*, *Rattus tanezumi* and *Rattus argentiventer*. The explanation for this is that these species (except for *Callosciurus inornatus*) prefer to live close to human settlements and agricultural fields, while our survey sites are far away from these habitats. On the other hand, our study added to the list 9 species (*Crocidura attenuata*, *Crocidura fuliginosa*, *Euroscaptor longirostris*, *Belomys pearsonii*, *Petaurista elegans*, *Leopoldamys edwardsi*, *Chiropodomys gliroides*, *Niviventer langbianis*, *Laonastes aenigmamus*). Especially significant, we obtained the first specimens of Laotian Rock Rat (*Laonastes aenigmamus*). This species was first discovered for science in 2005 based on specimens from Khammoune Province, Lao PDR and represents the only representative of a mono-specific family that is endemic to the Annamite Limestone Landscape. Our record is the first record of this species in Vietnam.

5.2.2 First record of *Laonastes aenigmamus* in Vietnam

Between the years 1996 - 1999, two scientists, M.F. Robinson from United Kingdom and R. J. Timmins from USA were engaged in biodiversity survey work in and around the Khammouane Limestone National Biodiversity Conservation Area (17°33'45"N 104 49'10"E), Khammouane Province, Laos PDR. During these surveys, they obtained about 12 specimens (bodies, skins, heads) of an unusual-looking rodent on sale from local markets in Thakhek District, Khammouane Province. The local name of this animal is *Kha-nyou*. Based on analysis of morphological data and of 12S rRNA and cytochrome *b* of these specimens, Jenkins and coauthors considered the animal to be so distinct from all living rodents that they placed it in a new family Laonastidae with the monotypic genus *Laonastes* and species name of *Laonastes aenigmamus* (Jenkins et al. 2005).

Later, Dawson et al. (2006) compared the specimens to known rodent fossils and found that Laotian Rock Rat belonged to a previously described family which had only been known from fossils, the Diatomyidae. They state: "*Laonastes* is actually a surviving member of the otherwise extinct rodent family Diatomyidae, known from early Oligocene (about 32.5 million years ago) to late Miocene (about 11 mya) sites in Pakistan, India, Thailand, China, and Japan. *Laonastes* is a particularly striking example of the "Lazarus effect" in recent mammals, whereby a taxon that was formerly thought to be extinct is rediscovered in the extant biota, in this case after a temporal gap of roughly 11 million years". Thus, *Laonastes aenigmamus* is a living fossil of the family Diatomyidae and mysterious endemic species restricted to the Annamite Limestone Landscape. Protection of *Laonastes aenigmamus* is vital, as it would conserve an ancient mammalian family.

As described in Jenkins et al. 2005, Laotian Rock Rat inhabits rocky terrain. It has a vaguely squirrel-like appearance with an elongated head, long whiskers, black to grizzled pelage, a fringe of bristly hairs around the claws on the feet, and a densely haired tail approximately half of head and body length. The limbs are nonspecialized, indicating that the species employs a scampering mode of locomotion. Length of head and body averages about 26 cm (21.25 ó 28.46 cm), the tail length is about 14 cm (12.28-16.14cm) and the body weight is 334 - 414g. The morphological characters considered to set it apart from other rodents included the combination of the skull with an enlarged infraorbital foramen, lower jaw lacking a coronoid process and having the mandibular angle offset laterally, one premolar and three molars in each jaw, a transversely bilophodont pattern of the cheek teeth (that is, having two transverse ridges), and four roots on the lower molar teeth.

During our survey in Thuong Hoa Commune, we could obtain 4 rodent specimens trapped by hunters of Ban On village. Careful analysis of their morphological characteristics shows that they completely

Laonastes aenigmamus (Table 12, Figures 1). Thus, *Laonastes* Vietnam, where local Ruc people know of it as *kne-cung*.

Table 12 Measurements of *Laonastes aenigmamus*

Measurements (mm)	Our specimens			Lao specimens (Jenkins et al, 2005)
	PBKB19	PNKB20	PNKB21	
Sex	Unknown	Unknown	Male	
Head and body length	255.0	300.0	240.0	212.56284.6
Tail length	140.0		127.0	122.86161.4
Hind foot length	43.2	43.3	43.9	37.3644.0
Ear length	21.9	23.3	20.0	21.0625.8
Weight (g)	309.0	320.0	325.0	334.0, 414.0
Occipitonasal length	64.85	69.32	58.13	60.99670.77
Condylolincisive length	44.32	51.55	43.95	53.3661.85
Nasal length	22.99	23.82	19.48	21.9626.06
Diastema length	13.24	15.36	11.46	12.45615.75
Palatal length	28.78	32.15	26.38	22.84628.62
Incisive foramina length	4.93	5.92	4.57	4.0465.13
Length of upper molars at alveolus	9.63	10.30	9.16	13.22614.81
Rostral height	11.51	13.47	11.63	10.18612.26
Rostrum length	24.45	25.54	20.23	-
Interorbital breadth	17.50	18.40	14.66	14.64617.38
Zygomatic breadth	26.30	29.19	25.44	23.59627.83
Braincase breadth	24.13	26.69	23.33	23.54625.36
Braincase height	15.63	17.22	15.81	14.06615.98
Mandible length	35.85	39.38	32.06	33.31639.55
Length of lower molars at alveolus	10.07	9.62	9.86	11.62613.12
Length of Auditory bulla process	8.37	8.22	8.59	-



Figure 2. Skull and body of Kne-cung *Laonastes aenigmamus*, specimen PNKB 21
(All photos are from Nguyen Xuan Nghia)

Our discovery of *Laonastes aenigmamus* in PNKB NP is quite important because it provides more information about the species distribution range and more chance for conservation of this mystery endemic species. For Vietnam, It adds not only one more new species but also a new family and new genus to the mammal checklist of Vietnam. This species entered Vietnam's Mammal Checklist under the name of "*Kne Cung*", the name given by local Ruc ethnic tribe.

As with the "*kha-nyou*" in Lao PDR, Kne-cung *Laonastes aenigmamus* in Vietnam was found in tropical evergreen forest within the Annamite limestone landscape. Local Ruc ethnic people (Ban On village) traditionally trap rats for their food, and they occasionally catch kne-cung and use them as bushmeat. As they reported, this species was trapped on the ground at the base of limestone mountains or in caves on their slopes. We did visit some localities where kne-cung specimens were trapped. The animals used small natural rock holes/cavities of about 30 cm wide and 50-60 cm deep in ground surface of the limestone mountain base for their dens. Surrounding vegetation consists of tall moist evergreen forest with dense ground storey at elevation of 270 ó 400 m a.s.l.

5.2.3 Rodent species abundance

Many vocalizations of diurnal squirrels were heard during survey period, indicating their high abundance in all 3 survey sites. During this survey, total of 87.2 km of transect length were covered by daytime survey. However, due to very dense forest canopy and wet weather, direct observation of diurnal squirrels was very difficult. Only about 20 direct squirrel sightings were obtained, while several hundred squirrel vocalizations were heard during the survey. This indicates that the number of our direct sightings does not reflect the actual abundance of the squirrel populations in the study areas, so encounter rate of diurnal squirrels were not estimated here.

Totally, 50.2 km of transect length were covered by night survey and 4 species of flying squirrels were recorded. Location of these records are shown in Annex 3. Encounter rates for each species are shown in Table 13.

		Scientific name	A	F
		<i>Hylopetes pearsonii</i>	5	9.96
2.	Sóc bay en tr ng	<i>Hylopetes alboniger</i>	1	1.99
3.	Sóc bay râu	<i>Petaurista philippensis</i>	4	7.97
4.	Sóc bay sao	<i>Petaurista elegans</i>	1	1.99

Note. A ó number of animal sightings (*animals*); F ó Encounter rate (*animal/ 100km*).

With a total of 3,900 trap.nights, we trapped 76 specimens of 18 species of diurnal squirrels (Sciuridae) and Murids (Muridae). Specimen percentage and trap success of each species by survey sites were shown in Annex 11. Summary is shown in Table 14.

Table 14 Specimen percentage and trap success of Rodents

No.	Scientific name	Vietnamese name	S	P (%)	E
Strict-forest species					
	<i>Chiropodomys gliroides</i>	Chu t nh t cây	4	5.26	0.103
1.	<i>Leopoldamys edwardsi</i>	Chu t h u l n	2	2.63	0.051
2.	<i>Leopoldamys sabanus</i>	Chu t núi uôi dài	12	15.79	0.308
2.	<i>Maxomys moi</i>	Chu t xu-ri lông m m	1	1.32	0.026
3.	<i>Maxomys surifer</i>	Chu t xu-ri	12	15.79	0.308
4.	<i>Niviventer fulvescens</i>	Chu t h u bé	10	13.16	0.256
1.	<i>Niviventer langbianis</i>	Chu t lang bi an	2	2.63	0.051
2.	<i>Niviventer tenaster</i>	Chu t núi ông d ng	6	7.89	0.154
	Subtotal:		49	64.5%	1.256
Not strict-forest species					
3.	<i>Callosciurus erythraeus</i>	Sóc b ng	2	2.63	0.051
4.	<i>Menetes berdmorei</i>	Sóc v n l ng	1	1.32	0.026
5.	<i>Dremomys rufigenis</i>	Sóc môm hung	1	1.32	0.026
6.	<i>Tamiops maritimus</i>	Sóc chu t h i nam	2	2.63	0.051
7.	<i>Tamiops rodolphii</i>	Sóc chu t l a	1	1.32	0.026
8.	<i>Berylmys bowersi</i>	Chu t m c l n	9	11.84	0.205
9.	<i>Mus cervicolor</i>	Chu t nh t ho ng	3	3.95	0.077
10.	<i>Mus pahari</i>	Chu t nh t n ng	2	2.63	0.051
11.	<i>Rattus nitidus</i>	Chu t bóng	1	1.32	0.026
12.	<i>Rattus andamanensis</i>	Chu t r ng	4	5.26	0.103
	Subtotal:		27	35.5%	0.692
	Overall total:		76	100%	1.949

Note: S - number of specimens captured; P ótotal specimens as proportion of all species (%); E ó trap success (*specimen/100 trap.night*); Trapping effort (Te) = 3,900 *trap.nights*,

Number of squirrel specimens trapped are very low due to often heavy rain during survey periods. Consequently, trap success for squirrels is low and does not reflect their actual abundance in the study areas. The black giant squirrel is the only squirrel that was photographed by the camera traps. This squirrel still has a fairly average population in the area as they were observed in every forest and area of the survey.

Based on habitat, rodents can be divided into 2 large ecological groups: 1) Strict-forest species which live only in primary and secondary forests with little damage by human activities and 2) Not strict-forest species which can survive in much degraded forests or none forest habitats. Out of 18 species of diurnal squirrels and rats/mice, 8 species are strict-forest species. Specimens of these species account for 64.47% of total specimen number, and their trap success (as an abundance indicator) is 1.256 specimen / 100 trap-nights while specimens of 10 not strict-forest species account for only 35.52%

er, 2 very strict forest genera (*Leopoldamys* and *Maxomys*)
and abundance. This is indicative of the high degree of integrity

Primary tropical forest is characterized by a low abundance of rodent species. Moderate damage of primary forests leads to increase of both their species number and their abundance due to adding new ecological niches to the forests (Kuznetsov 1992, 2006; Kuznetsov et al. 1998, Sokolov et al. 1998). For example, trap success of rodents was 1.6 specimens per 100 trap.nights in Pu Mat NR of Nghe An Province (SFNC, 2000); about 2.0 in Buon Luoi of Gia Lai Province (Sokolov et al, 1998), 2.5 in Ba Vi NP of Hanoi (Kuzetsov et al., 1998) and 3.7 in Vu Quang NP of Ha Tinh Province (Kuznetsov et al 2001). In our study, overall trap success of rodents in PNKB NP was 1.949 that fully complies with the results of above mentioned studies.

5. Hotspot identification

Insectivore and Rodent surveys were conducted in 3 localities; one (Hung Dang Area) is inside core zone of PNKB NP and 2 others (Ma Rinh area and Hang En area) are in the approved extension area of PNKB NP. Comparison of biodiversity values between these localities can serve as an indication of the importance of the extension area for biodiversity.

Out of 34 species recorded for all 3 survey sites, Hung Dang area harbors 19 species (8 strict-forest species and 11 not strict-forest species) while Ma Rinh area harbors 21 species (10 species and 11 species respectively) and Hang En area harbors 24 species (10 species and 14 species respectively; Table 15). Difference in species number is not significant, but of more importance is difference in species composition, both for strict-forest species and not strict-forest species. Studies of Kuznetsov et al. (1998) and Kuznetsov (2006) showed that species composition of small mammals in tropical forest were affected mainly by two factors: specific features of habitats and level of human impact to the habitats. Hang En area has the highest species number because of more habitat diversity, including intact primary forest, affected forests, bushland and agricultural fields. Some species that prefer open and agricultural land were found in this area (*Menetes berdmorei*; *Mus cervicolor*; *Mus cervicolor*; *Bandicota indica*, *Rattus andamanensis*). Ma Rinh area had less species diversity than Hang En area due to lack of agricultural land leading to lack of species that prefer this habitat. Hung Dang area has lowest species diversity possible because of less habitat diversity and much more forest degradation. Primary valley forests have been affected by logging and cattle raising converting old-growth forests into mixed bamboo-wood forest.

Table 15 List of Insectivore and Rodent species by survey sites

No.	Scientific name	Vietnamese name	MR	HE	HD
Strict forest species					
1.	<i>Chiropodomys gliroides</i>	Chu t nh t cây	x	x	x
2.	<i>Leopoldamys edwardsi</i>	Chu t h u l n	x		x
3.	<i>Leopoldamys sabanus</i>	Chu t núi uôi dài	x	x	x
4.	<i>Maxomys moi</i>	Chu t xu-ri lông m m		x	
5.	<i>Maxomys surifer</i>	Chu t xu-ri	x	x	x
6.	<i>Niviventer fulvescens</i>	Chu t h u bé	x	x	x
7.	<i>Niviventer langbianis</i>	Chu t lang bian	x	x	
8.	<i>Niviventer tenaster</i>	Chu t núi ông d ng	x	x	x
9.	<i>Belomys pearsonii</i>	Sóc bay lông chân	x	x	x
10.	<i>Hylopetes alboniger</i>	Sóc bay en tr ng		x	
11.	<i>Petaurista philippensis</i>	Sóc bay trâu	x	x	x
12.	<i>Petaurista elegans</i>	Sóc bay sao	x		
Subtotal:			10	10	8
Not strict forest species					

		Sóc b ng	x	x	x
		Sóc v n l ng		x	
		Sóc m m hung	x		
4.	<i>Tamiods maritimus</i>	Sóc chu t h i nam	x	x	
5.	<i>Tamiods rodolphii</i>	Sóc chu t l a			x
6.	<i>Berylmys bowersi</i>	Chu t m c l n	x	x	x
7.	<i>Mus cervicolor</i>	Chu t nh t ho ng		x	x
8.	<i>Mus pahari</i>	Chu t nh t n ng		x	
9.	<i>Rattus nitidus</i>	Chu t b ng	x		
10.	<i>Rattus andamanensis</i>	Chu t r ng		x	x
11.	<i>Ratufa bicolor</i>	Sóc en	x	x	x
12.	<i>Rhizomys pruinosus</i>	Dúi m c l n	x	x	x
13.	<i>Rhizomys sumatrensis</i>	Dúi má vàng	x	x	x
14.	<i>Atherurus macrourus</i>	on			x
15.	<i>Hystrix brachyura</i>	Nhím uôi ng n	x	x	x
16.	<i>Laonastes aenigmamus</i>	Nê c ng		x	
17.	<i>Bandicota indica</i>	Chu t t l n		x	
18.	<i>Hylomys suillus</i>	Chu t voi i	x		
19.	<i>Crocidura attenuata</i>	Chu t chù uôi en		x	
20.	<i>Crocidura fuliginosa</i>	Chu t chù uôi tr ng			x
21.	<i>Euroscaptor longirostris</i>	Chu t ch i m i dài	x		
	Total species number		21	24	19
	Trap success of 18 rodent species (see annex 11)		2.211	3.000	2.526

Note: Survey sites: **MR** ó Ma Rin area (Hoa Son Commune), **HE** ó Hang En area (Thuong Hoa Commune), **HD** ó Hung Dang area (Thuong Trach Commune).

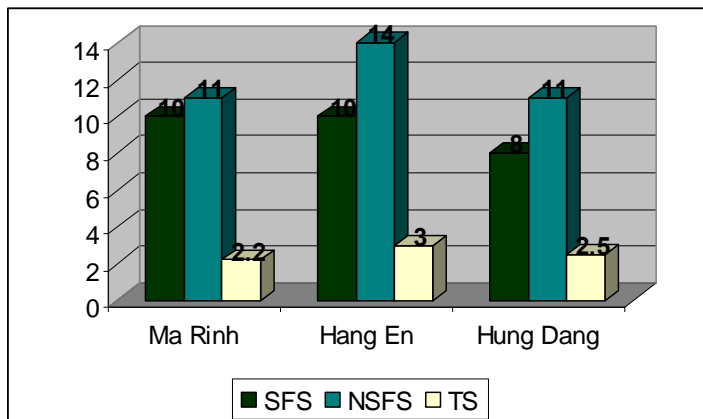


Figure 3. Comparative biodiversity values of 3 survey sites
(SFS ó Strict forest species, NSFS ó Not strict forest species
TS ó trap success of 18 species)

Note: Survey sites: Ma Rin area is in Hoa Son Commune, Hang En area is in Thuong Hoa Commune, and Hung Dang area is in Thuong Trach Commune.

In relation to trap success, the highest value was in Hang En area (3.0), then follows Hung Dang area (2.526) and Ma Rin area (2.211). Trap success in Ma Rin and Hung Dang area were not significantly different, but was higher in Hang En area indicating higher abundance of rodents in this area. Comparison of species number (strict-forest species and not strict-forest species) and trap success between the 3 survey sites shows that biodiversity values of 2 survey sites in the extension

those of the survey site in the original core zone of the NP

5.3 Camera Trapping Survey Results

A total 6,176 pictures were captured in the three survey areas. The survey confirmed the presence of 17 species of mammal and one bird (see Table 16). There was a few more species of mammals that were unidentifiable, due to the low quality of pictures or because they only captured part of the animal, therefore the team could not identify to the exact species.

The record has shown a very low mammal density in the survey areas, with only 60 individuals photographed in the whole survey. The results also suggest the absence of most of the important large mammal in the survey area. Wild boar was the only ungulate captured on camera during the survey.

No signs of cats, bears, deer or saola were identified in the pre-survey and none of these animals were captured on camera subsequently.

Table 16 List of species recorded in the camera trap survey

No.	Common name	Latin name	Conservation status		
			IUCN ¹	RDB ²	Decree 32 ³
1.	Unidentified jungle rat	<i>Leopoldamys, Niviventer, Rattus, Maxomys, Chiropodomys, Chiropodomys or Berymys sp.</i>	NA	No	No
2.	Masked Palm Civet	<i>Paguma larvata</i>	Lc	No	No
3.	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	Lc	No	No
4.	Yellow-throated Marten	<i>Martes flavigula</i>			
5.	Unidentified mustelid #1	MUSTELIDAE sp. #1	NA	NA	NA
6.	Annamite Striped Rabbit	<i>Nesolagus timminsi</i>	DD	EN	IB
7.	Crab-eating Mongoose	<i>Hepstes urva</i>	Lc	No	No
8.	Unidentified mustelid #2	MUSTELIDAE sp. #2	NA	NA	NA
9.	Unidentified mustelid #3	MUSTELIDAE sp. #3	NA	NA	NA
10.	Wild Boar	<i>Sus scrofa</i>	Lc	No	No
11.	Ferret badger #1	<i>Melogale sp. #1</i>	NA	NA	NA
12.	Ferret badger #2	<i>Melogale sp. #2</i>	NA	NA	NA

¹ IUCN Red List of threatened Species; IUCN, 2012

² Red Data Book of Vietnam 2007

³ Decree no. 32/2006/ND-CP on List of Endangered species of Fauna and Flora

		VIVERRIDAE sp.	NA	No	No
		<i>ioneus</i>		No	No
15.	Unidentified civet #2	VIVERRIDAE sp. #2	NA	NA	NA
16.	Northern Treeshrew	<i>Tupaia belangeri</i>	Lc	No	No
17.	Bear Macaque	<i>Macaca arctoides</i>	VU	VU	IIB
18.	Black Giant Squirrel	<i>Ratufa bicolor</i>	NT	VU	

IUCN Threat categories (IUCN, 2012): VU ó Vulnerable, NT ó Near Threatened, DD ó Data Deficient, Lc- Least concern, NA ó not applicable. Vietnam Redlist categories: EN ó Endangered, VU ó Vulnerable.

5.3.1 Accounts of important species

Only three of the species of mammal recorded by camera trapping are listed in the IUCN Red List of Threatened Species (IUCN, 2012), the Red Data Book of Vietnam or Vietnam Government Decree No. 32/2006/ND-CP on endangered species. Among those Annamite striped rabbit is the most important species, ranked as Globally Endangered by IUCN. Bear Macaque (Stump-tailed Macaque) and Black Giant Squirrel are listed as Vulnerable on the IUCN Redlist. All other recorded, including jungle rat, hog badger, civets and wild boar not listed under serious conservation concern.

Annamite Stripped Rabbit, *Nesolagus timminsi*

IUCN: DD
RDV: EN
IB: Ib

Annamite striped rabbit was one of the most recently discovered mammal species in the world. Phong Nha-Ke Bang was the place where the first specimen was collected and photographed (Surrige, 1999). Since then very little research on this species has been done even though it was highlighted as one conservation flagship for the Annamite range.

In this survey, several clear pictures of two individuals were captured, all at night time. This record again confirms the nocturnal behaviour and the fact that intact forest is preferred habitat of the species. In addition, according to hunters, the rabbit was not very common and rarely captured by snare trapping as they often has jumping tendency when facing any barrier (such as snare trapping line), this behaviour perhaps makes them more difficult to capture by snare, which are common in the region.

Large Mammal Species

The Camera Trap Survey was targeted at some endangered large mammal species such as Northern Serow *Capricornis milneedwardsii*, Saola *Pseudoryx nghetinhensis*, Annamite Muntjac *Muntiacus truongsonensis*, bear (*Ursus* spp.), cats (FELIDAE), and wild canids (CANIDAE). However, no sign of these species was identified in the pre-survey attempt, as well as in previous biodiversity surveys in these areas (Nguyen Manh Ha & Do Tuoc, 2011, Nguyen Xuan Dang & Nguyen Xuan Nghia, 2011).

These large species have apparently have become very rare now in the park. In the face of high hunting and snaring pressure, the decline of terrestrial animal populations is understandable. Moreover, the shortage of time of the survey would also limit the number of captures. In order to

25 days of survey and several battery charges would be

The site selected for this survey was not made on the basis of the criterion of high density of large animals, but rather based on selecting areas that were data deficient. Based on reports from (Nguyen Xuan Dang et al, 1998, Le Trong Dat et al, 2009), the southwestern area of the Park (around U Bo), the Southeast (near Rao Thuong-Hang En) and the middle-west (Co Khu-Dai Cao) are the likely areas that may serve as refugia for large mammals in the Park. Those areas consist of earth hills, with less karst terrain and sufficient water year round, which is more favourable to large mammal and ungulate populations. Limestone areas often dry out in the dry season and experience seasonal flooding in the rainy season.

Other records of Ungulates

Skulls and horns of Saola (*Pseudoryx nghetinhensis*), Large-antlered Muntjac (*Muntiacus vuquangensis*) and Common Muntjac (*Muntiacus muntjak*, or possibly Annamite Muntjac) were found in a local house in Hoa Son Commune. The skull and bones of a serow were found in a hunter's camp in Hung Cau forest, Thuong Hoa and 5 hunters were encountered in Thuong Trach with the bones of another serow. This suggests that these four species are present in the newly added extension area of the National Park.

5.4 Primates and their relatives

Bengal Slow Loris, *Nycticebus bengalensis*

The presence of Bengal Slow Loris in Phong Nha Ke Bang had been confirmed in previous surveys (Nguyen Xuan Dang et al., 1998, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999). However, there was no detailed information on the population, its specific habitat, and distribution area. In this survey, only one adult male was observed in secondary forest in the Hang En area, Thuong Hoa commune (22:04, 28 August 2011, 0605358/1949101). Several other nocturnal surveys were undertaken, however most of them were in primary forest which is not believed by most local people to be a preferred habitat for loris. Interview information also indicated that two slow loris were captured and killed by local children in Hoa Son commune just days before the team got to the area. It seems that slow loris have become very rare in the survey area, and there have been very few records of this species since 1999 (Nguyen Xuan Dang et al., 1998, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999).

Pygmy Loris, *Nycticebus pygmaeus*

The Pygmy Loris seems to be the most common species of loris in PNKB. The presence of this species has been confirmed over time in the park, most recently in 2009 (Le Trong Dat et al., 2009 (Le Khac Quyet et al., 2002)). However, as is the case for the slow loris, information on the Pygmy Loris in PNKB has never been clearly documented; there is no specific information on their habitat or distribution in PNKB. Information on this species was also not available from any other location in Vietnam (Streicher, 2009), so it is clearly one of the poorest-known species of primate. During our survey, two adult Pygmy Loris were observed in secondary forest (photo taken) in Nhai Cu area, Thuong Hoa commune (19:56, 30 August 2011, 0605251/1949539; 21:40 31 August 2011, 0605392/1951123). Interview information indicated that the pygmy loris mostly occur in secondary forest, and even in plantations and areas that are close to agricultural areas. There may be a larger population of Pygmy Loris than of Bengal Slow Loris, as according to local people, the majority of loris captured are the former.

among the primates found in PNKB, so little survey efforts so there status is poorly known. The continuing deforestation due to illegal logging in PNKB will have an impact on the loris population. In addition, hunting and other threats such as collecting loris for pets will also have a serious impact on the population. Inappropriate diets for pet loris (they are mostly given fruit and rice) will often kill the animals after one or two weeks.

Southern White-cheeked Gibbon, *Nomascus siki*

Despite considerable effort, only four gibbon groups were recorded during the field survey and none of these was record for more than one time. Details of gibbon records are presented in Annex 5e and summarized in Table 17 below:

Table 17 Summary of records of observations of gibbons, *Nomascus siki* in surveyed areas

Group no.	Group composition				Co-ordinates	Record type	Locality
	Adult	Adult	Young	Total			
G 01	1	1		02	0614600 E 1940100 N	H	Khe Cha Khe area. Thuong Trach forest, PN-KB NP
G 02	1	2		03	0620150 E 1944750 N	H	Khe Nhom area. Thuong Trach forest, PN-KB NP
G 03	1	1	1	03	0620600 E 1945850 N	H	Khe Nhom area. Thuong Trach forest, PN-KB NP
G 04	1	1		02	0594300 E 1955700 N	H	Ma Xang area. Hoa Son forest, PN-KB NP
Total	4	5	1	10			

Notes: Co-ordinates give are the estimate the central of group's home range, using WGS 84 Map Datum.

Interviews conducted with local hunters/woodcutters and villager also confirmed that there are few group of gibbon in the surveyed area.

Because of the low number of records and the low frequency of calling by the gibbon groups that were located, it was not possible to use rigorous techniques to estimate the size of the gibbon population. However, the density is clearly quite low (see below).

The teams also observed one gibbon skin in On Village, Thuong Hoa commune, which reportedly was hunted in the Da Lat area, near the Lao border. This confirms that hunting is still a threat to the species, despite its protected status.

Hatinh langur, *Trachypithecus hatinhensis*

Hatinh langur (*Trachypithecus hatinhensis*) were observed on day-time transects in Xuan Trach, Thuong Hoa and Hoa Son, with at least 4, 3 and 5 groups members respectively, confirming its presence in the extension area of the Park. Separately, the Gibbon Survey Team observed groups estimated to be composed of 12-15 individuals (at least 9 adults), seen southeast of Khe Chu Ngat. Two groups estimated to be of 10-15 individuals (at least 8 and 4 adults, respectively) were seen in the Hung Cau forest area, and at least 5 individuals were seen in Ma Xang forest area.

Pygathrix nemaeus

(*Pygathrix nemaeus*) were observed in Hoa Son, confirming the presence of both of these species in the extension area. One dead Red-shanked Douc together with one dead Hatinh Langur were observed being transferred out of the forest from Ma Rinh. Groups estimated to be of 30-35 individuals (at least 18 adults, southeast of Khe Chu Ngat), 13-20 individuals (at least 10 adults, Hung Ngon forest area) and 11-15 individuals (at least 9 adults, Ma Xang forest area) were seen separately by the Gibbon Survey Team (Annex 5f).

Bear Macaque, *Macaca arctoides*

A total of 8 individuals were photographed by camera traps in 3 images, including a group of 5 belonging to one group. Bear Macaque are not restricted to limestone areas and often scout the ground for food, hence they were captured by the camera often. Because of its less restricted habitat and travel behaviour the Bear Macaque, and also the Rhesus Macaque, often are captured in the local hunters' snare traps. They may be one of the most threatened primates in the park as the result of snaring.

Assam Macaque, *Macaca assamensis*

In addition to camera trap records of Bear Macaque, a group of six Bear Macaque (*Macaca arctoides*) and a group of twelve Assam Macaque (*Macaca assamensis*) were observed at the same time on transect surveys in Hoa Son, thus confirming the presence of these species in the extension area.

Allied arboreal species

Sunda Colugo, *Galeopterus variegatus*

Colugo or flying lemurs are now considered to be closely allied with primates, so this species is considered here. Only one record was obtained during the surveys. A pair of Sunda Colugo (*Galeopterus variegatus*) were observed and photographed in Ma Rinh Moi survey area, Hoa Son Commune in the extension area.

Northern Treeshrew, *Tupaia belangeri*

While not closely related to primates, neither is the treeshrew a shrew or a true insectivore, so they are considered here. A specimen of Northern Treeshrew (*Tupaia belangeri*) was collected by the Insectivore and Rodent Survey team in the Hang En survey area in the extension area. Single animals were also photographed by camera traps in Da Lat, Thuong Hoa Commune and in Ca Con-Hung Tri, Xuan Trach Commune. No evidence has yet been found for the occurrence of the Northern Smooth-tailed Treeshrew *Dendrogale murina* although it has been confirmed as present in the adjacent karst forest area of Hin Namno in Lao PDR.

(NB: CONFIDENTIAL SECTION, not for publication or general distribution without permission from the National Park Management Board)

6.1 General threats to and management concerns for nonvolant mammals in the PNKB National Park and region

Phong Nha ó Ke Bang National Park is considered to be one of the areas that experiences very high human impact. Hunting and logging reportedly were the most serious threats to wildlife in the park in the past (Do Tuoc and Truong Van La, 1999, Haus et al., 2009, Le Khac Quyet et al., 2002, Le Trong Dat et al., 2009, Le Xuan Canh et al., 1997, Meijboom and Ho Thi Ngoc Lanh, 2002, Nguyen Ngoc Chinh et al., 1998, Nguyen Manh Ha, 2006) and are still now the major threat to wildlife. During our survey, loggers, agarwood collectors, and hunters were commonly observed in every forest sectors of the park.

Based on the information collected during the surveys, the survey teams assessed the relative levels of different threats in the surveys areas.

6.1.1 Hunting

Hunting is the most serious threat to large and small nonvolant mammals, and is and will be the key reason for the decline of many large and small mammals and other terrestrial species in Vietnam (Robertson, 2004, Nguyen Manh Ha, 2009, Brunner, 2012).

The common occurrence of hunting in PNKB has already been reported in previous biodiversity surveys (Nguyen Manh Ha and Do Tuoc, 2011, Nguyen Xuan Dang and Nguyen Xuan Nghia, 2012). The three teams working on the current survey also independently confirmed this finding. The evidence indicates very high hunting pressure in the park, and reports indicate that hunting actually has been happening for several years. Old and new snare trapping lines were also observed in the survey areas. Moreover, hunters with rifle and hunting dogs were also observed in the Ca Con area. Large numbers of local people were observed entering the forest to hunt or to collect precious forest products for commercial purpose. Snaring trap lines were also observed commonly in the survey area. This activity may be a key factor in how low the animal populations in the park are currently.

During our survey, evidence of hunting such as spent cartridges (from military rifle and hunting gun) and snare traps were found in almost every sector of the survey areas. More importantly, much of the evidence was from active hunting camps, hunting with guns, or newly-built snare trap lines. At least 13 men and woman and one hunting dog were captured by camera traps, suspected to have entered the forest to do snare trapping and hunting. At least 500 snare traps, 7 spent cartridges, and 8 active hunting camps were found across the three survey areas. In addition, 1 hunted Hatinh Langur (*Trachypithecus hatinhensis*), 1 Red-shanked Douc (*Pygathrix nemaeus*), 6 Small-toothed ferret badgers, 1 Large-toothed ferret badger, 3 Common Palm Civets, and 1 Javan mongoose were observed in hunter camps in all three areas. Several other wildlife species such as macaques, civets, turtles, serow (parts of animals) were also observed in 3 local restaurants (2 in Hoa Son and 1 in Cha Lo), ready to be prepared and served.

most permanently) by local hunters, and evidence of a number (bones and skins) were found in the cave. 13 suspected hunters or as in the three areas. Most of the people seemed quite curious about the camera without destroying it and some of them were actually carrying hunted animals (jungle rat) in front of the camera.

A group of four children were captured on camera at night while they entered deep in the forest using torchlights. They probably were in search of frog or fish. The appearance of the children in such a remote area has raised an issue on how common people are in the forest of PNKB.

One hunting dog was also captured on camera. Using dogs to hunt can have a serious impact on slow moving animals such as turtles and pangolin. As a result these animals are now become extremely rare in Vietnam. During our survey, no track or feeding sign of pangolin was observed even though Phong Nha is a place where pangolin have been recorded.

Three cameras were lost and destroyed in the forest. It is suspected that some hunters were aware of the cameras and destroyed them to avoid any trouble from illegally entering the park.

Snaring activity seems to have reached a very specialized level in terms of hunter skill and trapping protocol. For instance, local hunters often take a rapid survey in an area to identify tracks and sightings of animals, before applying an appropriate snaring method. Traps are only set where tracks of animals are found, and local hunters informed us that this additional step means there are better cost-benefits, and it also saves time in comparison to employing a long trap line. Cables for snares (bicycle brake cables) can be purchased quite easily in the local commune. A few hundred of them could be purchased without any difficulty. The price for a cable is VND 4,000 (about \$0.20 USD).

Using a gun for hunting also seems quite common in both Hoa Son and Thuong Hoa commune. About 4 shots were heard and 3 hunters using guns were observed in the forest in Ma Rinh, and 3 other shots were heard in Ma Ma Valley (Thuong Hoa Commune). All the shooting happened at night. At least 5 spent cartridges (AK 47 -7.62mm x 39mm, and specialized small calibre hunting gun .177 calibre) were collected in a hunting camp. In addition, at least 2 dead monkeys (1 Hatinh Langur, 1 Red-shanked Douc) were observed being transferred out of the forest from Ma Rinh. The hunter informed us that a military rifle was used to hunt the two animals, and that hunting still continues in the forest. We were told that bullets could be purchased in local villages for VND 12,000 each for .177caliber bullets (about \$0.57 USD), and VND 30-40,000 each for larger bullets.

Interviews with local people and a quick assessment of the wildlife trade and consumption of wildlife in Hoa Son, Thuong Trach, and Xuan Son revealed that an undercover network of restaurants and wildlife retailers is still active in all three communes. These purchase all dead or live animals hunted from the forest to supply local restaurants and other restaurants in Quy Dat Twon and Dong Hoi City of Quang Binh Province. It was not hard to find a bushmeat restaurant in all three communes, and some are very well-known to local people. Parts of several other wildlife species, including macaques, turtles and serow were also observed in 3 local restaurants adjacent to the Park (2 in Hoa Son and 1 in Cha Lo), ready to be prepared and served.

The information collected in this survey indicates a very high level of threat created by hunting, trade and consumption of wildlife in PNKB. This trade has formed a very streamlined market chain, with highly motivated and specialized hunters. Hunting has become generally seen as a normal activity in local villages, with almost no interference from local authorities or rangers. For instance, local retailers could purchase and transfer hunted animals out of the commune without difficulty. Hunting camps have been set-up permanently in the forest, allowing hunters to start hunting again immediately after finishing agricultural cropping. The camps saw almost no intervention by the local authority or the park.

and buying of illegal hunted animals is not banned in these life will certainly increase the number of people involved in pe out many species of wildlife in the area.

6.1.2 Logging

Illegal logging occurs commonly in all survey areas, similar to what has been previously reported in Quang Binh Province (Robertson, 2004). The search for valuable wood not only damages the forest but also create a large disturbance to the park. Hunters use explosives and tools to move rock and earth to find roots and tree trunks in the forest.

More than 30 loggers/porters were observed in one single day in Hoa Son commune (9 August 2011) all in the act of carrying illegal timber out of the forest. Evidence of logging, such as felled trees, unloaded timber, and old camps were observed commonly in all three areas. For instance in Hoa Son and Thuong Hoa, many big trees (>80cm in diameter) were cut down in the forest, and local villagers informed us that the trees are cut before they are cut by other loggers. Timber was observed commonly in all local villages and its origin is rarely checked by the local forest ranger. Sales of chain-saws were quite common in all three areas. It seemed to be quite easy to purchase and repair any brand of chain-saw in local villages.

Several species of tree are harvested from the Park (Table 18). The Tonkin rose-wood (Hue, *Dalbergia tonkinensis*) and ebony wood (Mun, *Diospyros* sp.) have attracted the most intense logging activity in PNKB for the last 15 years. The area is known to be one of the last strongholds of the species. However, these two species are under serious threat in Phong Nha-Ke Bang, and it is possible that almost all of the mature trees have already been wiped out in the park.

The demand for *Dalbergia tonkinensis* has been so great that the price has climbed steadily from VND 8,000 per kg in 1999 to VND 20,000,000 per kg (about \$1,000 USD) for the same piece of wood in 2011 (Nguyen Manh Ha per.com. 1999:2011). The collection of *Dalbergia tonkinensis* has become so intensive that loggers often come back to the same logging sites to collect roots and branches of the tree, which have also become valuable items nowadays. The high price of the wood has driven a significant number of local people to get involved in the collecting any remaining part, chip or branch of the wood. Collector now are scouting every corner of the park to look for remaining trees or dead tree trunk so that they could collect the wood chips or root for sale. Gangs of collectors searching for rose wood were observed commonly in the Cha Noi, Ca Con, Hung Tri areas. The Camera Trapping team met at least 3 groups (20-25 members each group) on the camera setting trip and 2 other groups in the camera collecting trip in the same area. On August 8, 2011, at least 8 loggers were observed in Thuong Hoaø forest while they travelled to an old logging camp to collect the roots of *Dalbergia tonkinensis*. Another 4 people were observed in the Khe Gat area while transferring a load of *Dalbergia tonkinensis* roots (approximate 20kg) out of the forest (16/9/2011). Root is purchased at the lowest price, but the load would probably cost VND 30-35,000,000 according to a local retailer. Local people informed us that because of the high price of the wood, most of the young men from Xuan Trach Commune are involved in *Dalbergia tonkinensis* extraction. People are organized into groups of 4-8 people, and each trip takes 7-10 days. They usually go to the forest once a month for this purpose.

The extraction of *Diospyros* sp. is less intensive. However it is one of the most expensive woods at present, second only to Aloewood and *Dalbergia tonkinensis*. Currently, the price of ebony wood is VND 50-70,000 per kg (about \$2.50-3.50 USD per kg).

Logging for construction timber was observed in many places in the park, but especially in Hoa Son and Thuong Hoa commune.

most harvested at the time of the survey

		Purpose	Type of product	Price (VND)
1	Hue (<i>Dalbergia tonkinensis</i>)	Boutique furniture and incense	All parts of the tree	2 ó 30 million per kg (depends on quality)
2	Mun (<i>Diospyros</i> sp.)	Luxury furniture	Timber and branches	20,000 to 80,000 per kg (depends on quality)
3	Lat (<i>Chukrasia tabularis</i>)	Luxury furniture	Timber	14-15 million per m ³
4	Vù h ng (<i>Cinnamomum balansae</i>)	Furniture and oil distillery	Timber and root for oil distillery	8-10 million per m ³
6	Vàng tâm (<i>Manglietia fordiana</i>)	Furniture	Timber	8-10 million per m ³
7	Gi (<i>Talauma gioi</i>)	Furniture	Timber	7-10 million per m ³
8	B p (sp.)	Furniture	Timber	5-7 million per m ³

6.1.3 Other activities

Hunting and logging are the top threats to biodiversity in the Park, but there are a number of other activities that directly and indirectly create threats to mammals and other biodiversity in the survey area (although their impact is less than in these other two areas).

Honey collection: the collection of honey from the forest provides a relatively large benefit for local people. Annually, a honey collector could harvest approximately 10 liters, earning VND 2 to 2.4 million at approximately VND 200,000 to 250,000 per liter. According to the former commune leader of the Hoa Son commune (Mr. Giao), annually the people of Hoa Son collect between 2 and 5 tonnes of honey from the forest, providing a good cash income for the local community. The collection of honey does not seem to create much impact on the forest, however it does disturb the natural habitat as local people travel in the forest quite often during the honey season. In addition, these people may also collect other forest resources such as orchids or turtles while searching for honey.

Medicinal plants: The survey interviews indicate that the collection of medicinal plants seems to have decreased in intensity over the last five years in Phong Nha Ke Bang. However, the collection of orchids, specifically *Anoectochilus* spp., as medicinal plants is still going on in the Park. Local retailers purchase the *Anoectochilus* for VND 50-80,000 per kg, which has attracted many local people to the harvesting and selling of the plant. The plant is now only rarely seen in the wild as the result of over exploitation.

Orchids: Orchid collection for the flower trade was quite common two years before our survey. During the survey, at least 13 large fallen trees (>60 cm in diameter) were observed in Thuong Hoa and Hoa Son, felled by orchid collectors. Local people informed us that over the last two years the Minh Hoa State Forest Enterprise and local retailers started purchasing a large amount of orchids which attracted many local people in the Minh Hoa district to get involved in collection. Many trees with orchid colonies were cut down for that reason. This action probably created a serious impact on the orchids as well as the forest in the area.

“Swallow” hunting: There was only one cave in the survey area (Hang En) that was intensively used by birds. It is not clear as of this writing whether these are swallows (*HIRUNDINIDAE*), swifts (*APODIDAE*) or Ashy Woodswallows (*Artamus fuscus*). The colony seems to have had a good population of birds for many years, and the cave is well-known to the local community. Bird hunting seems quite common in the area during the nesting season (January to April). Local people visit the

birds at the time when the birds need to travel in and out of a permanent hunting camp was built by local people at the evidence of bird netting, such as old fishing nets, dead birds and cooking gear. According to local people, hunting of birds is less intense from May to December because at this time the birds travel to and from the cave only 2 times per day. Interviews with local people and the evidence seen in the camps shows how intensive hunting is in the area. There seems to be very little intervention by local authorities and rangers.

Fishing: Fishing is not a very common activity in the forest as most of the survey sites have no important water system, with the exception of the Ma Ma Lake. Local people informed us that fishing does take place in all three areas; however, over-fishing and the use of electric shock devices has made a big impact on the fish populations in most of the streams in the region. Lack of fish has led to fewer people being involved in this activity. The Ma Ma Lake seem to be an important fishing site for people in Thuong Hoa commune, and fishing evidence seems quite common around the lake such as old fishing nets and fishing camps. At least 2 local fishermen were observed at the lake with approximately 200m of net. Frequent fishing in the lake would have a big impact on the fish population, as well as on other animals that prey on fish and crabs, such as otters and Crag-eating mongoose. In addition, the Ma Ma Lake is an important water resource in the area (the only permanent water hole), and the frequent appearance of local people may disturb the lake and disturb animals accessing the lake for water.

Cattle grazing: Free-ranging cattle grazing appeared to be quite common in all three areas. Valleys and flat land which are close to local villages are most commonly used for cattle grazing, especially in Thuong Hoa where most of the villagers have domestic cattle. Domestic cattle could be strong competitors to wildlife in terms of food and feeding areas. Moreover, disease exchange could be another issue when wildlife and domestic animals are in frequent contact. Allowing cattle to roam freely also sets the stage for human-wildlife conflict if large predators switch to preying on cattle instead of scarce wild prey.

Cinnamon oil distillery: at least two distillery sites were observed in Hoa Son. The distilleries often destroy large numbers of the *Cinnamomum balansae* trees to use their root for distillery processes. A large quantities of other trees are also consumed as firewood for the process. The sites are often quite visible at a long distance as most of the trees are cut with mechanized equipment. One old camp and one freshly removed camp were observed in the forest of Hoa Son, about 1km from the Park boundary. If this activity is not controlled the process will soon move to the forest of Phong Nha Ke Bang National Park.

6.1.4 Threats specific to small carnivores

All small carnivores in PNKB NP are now under serious threat from human activities, especially hunting, snare trapping and the illegal wildlife trade. There is no species of small carnivore that has a large population, and some species such as the palm civets (PARADOXURINAE) that were considered common in the park in the last 10 years (Nguyen Xuan Dang et al., 1998) have now become rare. Moreover, some species have become extremely rare such as the Binturong. Otters can be considered as locally extinct in many of their former habitats in Hoa Son and Thuong Hoa communes.

Direct interviews with hunters in their snaring camp during the survey revealed that civets are among the most sought-after species in the area, third only to the Three-striped Box Turtle (*Cuora trifasciata*), and the pangolin (*Manis* spp.). The price for a live Common Palm Civet reaches VND 1,200,000 per kg (about \$60) in the local village and VND 2-2.4 million per kg at local restaurants (about \$100-120). One live captured Common Palm Civet (average 2 kg) would bring VND 4-5 million, enough to purchase food for half a month. As a result of this demand and the high prices, snaring efforts have reached professional level and quality: at least 3 specialized palm civet snare sites

Each a set of 7-10 snare traps were set-up in a complete fenced area and other fruit were laid out to attract palm civets. Once a civet was transferred alive immediately to a local retailer to reduce the mortality rate. More importantly, before the trap lines are set, hunters often scout the area for palm civet sightings, leading to a high intensity of civet snaring. If this pressure is not reduced, the Common Palm Civet could soon become a threatened species in the park.

Local hunters reported that the Masked Palm Civet is one of the most sought after animals in PNKB because their price is second only to the Common Palm Civet VND 600,000 ó 800,000 (\$30-40). The demand for Masked Palm Civet from local retailers and restaurants is also high, as its meat could be served as Common Palm Civet for a higher price in the restaurant. Local hunters informed us that live Smalltoothed Palm Civets are purchased at the same price as Masked Palm Civets; however, they are much rarer and often sold dead, so the price drops to VND 200,000 per kg. Hunting and intense logging in the earth hill area of Hoa Son may soon put the Smalltoothed Palm Civet under threat if it continues. Binturong is also purchased by local wildlife traders at a high price, due to the very good taste of the meat and also their large size (in comparison with other viverrids). The hunters also informed us that, due to its size and tracks marked in trees, the animal was quite easy to locate and hunt or trap. This pressure from hunting and trade indicates that the civets in this group may soon be critically threatened in this area.

6.1.5 Threats specific to insectivores and rodents

Status of Insectivores in Vietnam, in general, and in PNKB NP, in particular, is very poorly known. The species are not threatened by hunting, but forest degradation may change their population status. However, this question needs further study.

Rodents are threatened in Vietnam by hunting/snaring and habitat loss. Almost all squirrel species are hunting targets of local people for food and ornamental purposes. Rats and mice are also hunted for food in several areas of Vietnam. Habitat loss, especially forest destruction is one of the main threats to rodent species in Vietnam. As a result, 8 rodent species of Vietnam were listed in Red Data Book of Vietnam (2007) for urgent conservation actions (Table 19).

Rodent fauna in PNKB is threatened by hunting/snaring and forest degradation due to selected timber removal and NTFP collecting. Signs of these threats were found in all 3 survey sites, including trapping/snaring, hunter camps, encroachment, timber cutting, honey and NTFP collecting, agricultural fields and domestic cattle raising (Annex 3).

Six rodent species of high conservation concern were found during the surveys, including 5 species listed in the Red Data Book of Vietnam and 2 species listed in the IUCN Red List (2011) as globally threatened or near threatened species (Table 19). All these species are facing intensive threats in PNKN NP

Table 19 A list of threatened Rodent species in Vietnam

No.	Common name	Scientific name	VRDB (2007)	IUCN RL (2011)
1.	Black Giant Squirrel	<i>Ratufa bicolor</i>	VU	NT
2.	Hairy-Footed Flying Squirrel	<i>Belomys pearsonii</i>	CR	
3.	Particoloured Flying Squirrel	<i>Hylopetes alboniger</i>	VU	
4.	Lesser Giant Flying Squirrel	<i>Petaurista elegans</i>	EN	
5.	Red Giant Flying Squirrel	<i>Petaurista philippensis</i>	VU	
6.	Laotian Rock Rat	<i>Laonastes aenigmamus</i>		EN

ok (2007), IUCN RL ó IUCN Redlist (2012). CR ó Critical
ulnerable, LR ó Low risk, NT ó Near threatened, DD ó Data

Black Giant Squirrel *Ratufa bicolor* is threatened mainly by hunting. The large size, diurnal behavior and good taste of its meat make this squirrel a regular hunting target of local hunters.

Flying squirrels (*Belomys pearsonii*, *Hylopetes alboniger*, *Petaurista elegans*, *Petaurista philippensis*) are not direct hunting targets. Their nocturnal activity and use of dense forest canopy make them more difficult to hunt. However, as strict-forest species that need tall trees for nesting and foraging, so these species are very sensitive to forest degradation by timber removal.

Laotian Rock Rat is seriously threatened by snaring activities of local residents. This species was confirmed in Thuong Hoa Commune and reported to exist also in Hoa Son Commune. However, both these communes have a strong tradition of trapping rats for food. Laotian Rock Rat is easy to trap due to its ground surface residence and slow moving behavior. The tame behavior of this species also means the animals do not try to escape from areas disturbed by humans and are more prone to snaring.

6.2 Ranking and identification of areas of high threat

Based on the evidence found in the Small Carnivore Survey as well as on the priority list of conservation issues and their level for each commune, Hoa Son and Thuong Hoa seem to be the sites where the most evidence of threats to wildlife has been found. Both of these areas are in the newly extended areas and located far from the Parkø headquarter with fewer ranger stations. Hence the hunting and logging are possible without much intervention from law enforcement activities.

Hunting, the wildlife trade, and logging were all common in Hoa Son and Thuong Hoa communes. Local loggers could be seen daily while they travelled in and out of the forest with chain-saws and a variety of timber species. Hunters, snaring lines, and active hunting camps were also commonly observed in the two communes. Logging using buffalo was also observed in Hoa Son forest, with at least 16 very large timber pieces (1.2 m x 15cm x 3m) counted in the forest while they were transferred by 3 buffalos. Cut trees and unloaded timber were found frequently in the forest of both Hoa Son and Thuong Hoa, and itø likely that the illegal activities do not experience much intervention from relevant law enforcement forces.

Thuong Hoa commune also had high levels of activities such as fishing, bird hunting and cattle grazing. Local people reported that the trapped animals and birds are often sold to local markets, especially in Quy Dat town. The wildlife trade and hunting seem very common in the commune, and in the forest many snare trapping lines and old hunting camps in both Thuong Hoa and Xuan Trach were said to belong to hunters in Thuong Hoa. In addition, trapping of rats and small animals for food seemed very common in the commune.

In the forest of Xuan Trach commune (Hung Dang, Ca Tot, Cha Noi), only 2 hunters and one camp were observed, with very few sightings of logging in the forest. Nevertheless, logging seems quite common along the Ho Chi Minh highway where in the afternoon we could see local people using motorcycles to transfer their timber to the village. In addition, the commune is very famous for their dedicated and skillful *Dalbergia tonkinensis* collection. During our survey, all of the *Dalbergia tonkinensis* collectors we met in the forest and on the Ho Chi Minh highway were from Xuan Trach commune.

Table 20 Impact to forest and wildlife in Phong Nha – Ke Bang

Rank	Type of impact	Extension area		World Heritage Site
		Hoa Son	Thuong Trach	Xuan Trach

		Very high	Very high	High
		High	High	Average
		High	High	High
4	Habitat fragmentation	Low	Low	Average
5	Honey collection	High	High	Low
6	Orchid collection and medicinal plants	High	Average	Low
7	Bird netting	No	High	No
8	Fishing	Average	Average	Low
9	Cattle grazing	High	Average	Average
10	Cinnamon oil distillery	High	No evidence	No evidence

The Insectivore and Rodent survey team independently carried out an assessment of threats in their three surveys sites. All threat signs recorded during the insectivore and rodent survey are shown in Annex 7b and summarized in Table 21. A map of hunting/snaring threat signs were shown in Annex 8c.

Table 21 Summary of threat record statistics in 3 survey sites

Threat	Extension Area		World Heritage Site
	Ma Rinh in Hao Son	Hang En in Thuong Hoa	Hung Dang in Xuan Trach
1. Snaring & camps (<i>localities</i>)	12	9	9
2. Hunters (<i>persons</i>)	2	8	5
3. NTFP collecting (<i>localities</i>)	1	2	3
4. NTFP Collectors (<i>persons</i>)	0	11	0
5. Timber removal (<i>localities</i>)	20	4	0
6. Timber removers (<i>persons</i>)	28	0	0
7. Agricultural field (<i>localities</i>)	0	1	1
8. Cattle raising (<i>localities</i>)	0	0	Many

There were 8 threats recorded in the survey areas, with different levels for each survey sites. Table 22 shows the results of threat assessment using the scoring method of Salafsky et al. (1999). Maximal score for each threat criteria is 5, and minimal score is 0 (when the threat does not occur).

Table 22 Threat assessment and comparison between survey sites

Threats	Extension area								World Heritage Site			
	Ma Rinh in Hoa Son Commune				Hang En in Thuong Hoa Commune				Hung Dang in Xuan Trach Commune			
	Sca.	Int.	Urg.	Total	Sca.	Int.	Urg.	Total	Sca.	Int.	Urg.	Total
Hunting/snaring	5	5	5	15	5	5	5	15	5	5	5	15
NTFP collecting	2	1	1	4	3	4	4	11	4	3	3	10
Timber removal	3	4	4	11	2	2	2	6	0	0	0	0
Agricultural field	0	0	0	0	1	1	1	3	1	2	2	5
Cattle raising	0	0	0	0	0	0	0	0	3	4	4	11
Total:				30				35				41

Note: Sca ó scale, Int ó Intensity, Urg ó Urgency. NTFP ó Non-Timber Forest Products

The assessment shows that:

- Hunting presents the most serious threat in all 3 survey sites. This threat includes hunting with guns and snares (mostly wire cable snares). Snaring was quite popular in all survey areas. The

ly from snares. Rodents were hunted mainly for local use, carnivores were hunted mainly for trade.

serious threat in the Ma Rinh area, the third in the Hang En area and does not occur in the Hung Dang area. Local people extract economically valuable timber trees for some local use and mainly for trade. Some traders from other regions pay for local residents to cut timber trees, then gather and transport them to cities for sale.

- NTFP collecting is the second most serious threat in the Hang En area, the third in the Hung Dang area and in the Ma Rinh area. In Ma Rinh there are only 3 threats and NTFP collecting is the least serious, and this threat is also lowest in Ma Rinh area in comparison with other 2 survey sites. NTFPs harvested included firewood, bamboo and bee honey.
- Agricultural fields occurred only in Hang En and Hung Dang areas and not very serious threat in these areas. Only one farm was found in the Hang En area and 2 farms in the Hung Dang area. (Note that, in the Hung Dang area, fields are far away from trapping sites).
- Cattle raising was found only in the Hung Dang area and was quite serious, representing the second most serious threat in this area after hunting/snaring.

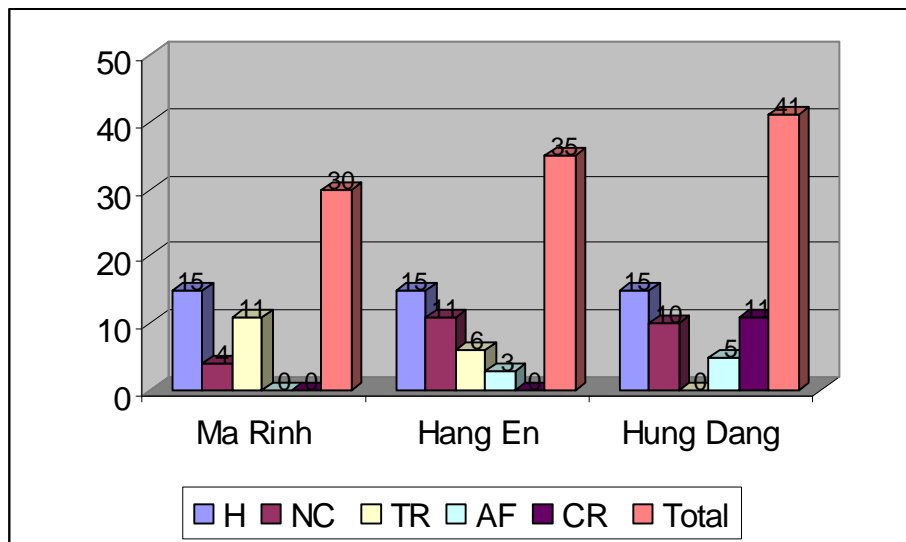


Figure 10. Comparison of threat level between 3 survey sites

H ó Hunting/snaring, NC ó NTFP collecting, TR - Timber removal
AF ó agricultural field, CR ó Cattle raising

Note: Ma Rinh is in Hoa Son Commune, Hang En is in Thuong Hoa Commune, both in the extension area of the National Park. Hung Dang is in Xuan Trach Commune and inside the World Heritage Site property boundaries as currently demarcated.

Comparison of threat number and threat scoring among the 3 survey areas (Figure 10) shows that:

- Hung Dang area, inside the World Heritage property, had the highest threat level: there were 4 threats with a total score of 41. This area is not very far from villages and there were large former logging trails of 2-3m wide running through the forest. Forests have been much degraded, converted into mixed bamboo forests. Hunting and cattle raising were the most serious threats in this area.
- Hang En area had the second highest threat level: there are 4 threats with total of 35 scores. This area is not very far from On Village. Tall forests remain but valuable trees have been removed and hunting was quite intensive.
- Ma Rinh area had the lowest threat level of threat, probably due to being very far away from villages. Three (3) threats occurred there with a total score of 30. Forest in this area is old growth

removal and hunting pressure were very high. During our survey, the area for timber cutting and log transport every day.

Logging was mostly focused on rose wood collection, however construction wood is also a target. The team recorded one chainsaw near Ca Con area, and several down trees from which timber was removed out of the forest.

6.3 Current conservation management in the survey areas

Based on the observations made by the survey teams, law enforcement seems to be a key issue for PNKB National Park. During the surveys, few sightings of active patrol were recorded. The team once made contact with a group of rangers in Ma Ma valley (Thuong Hoa commune). While they did carry out a patrol in the area, very few snare traps were removed.

Some conservation education activities have been carried out for local people by the National Park. These have not been frequent enough in the villages near the survey areas. Local people seem unaware of the critical issue of biodiversity protection in PNKB NP, as well as of the consequences of illegal actions such as hunting and logging. No relevant notices or posters were seen in the local villages and communes. Moreover, hunters do not seem to be aware of the risk of trial and prosecution.

6.4 Use of mammals as indicators of change

The presence and composition of mammal communities is often proposed as a monitoring indicator for levels of disturbance, particularly hunting. The presence of high value, easily hunted species (pangolin, deer, etc.) would suggest that hunting levels are low or sustainable. Their absence, as in this study, suggests that hunting levels are high and unsustainable for these species. As the National Park comes under better protection, we would expect to see a rise in the abundance of all hunted species over time, as reflected in trapping success and encounter rates on transects. The current study provides a baseline for future comparisons. Future surveys should make every effort to repeat the surveys exactly as done (same location, same methods, same season, same times) in order to insure comparability in the results over time.

Rodents can be used as good indicators of habitat change; their abundance indicates level of forest destruction (Sokolov et al. 1992, 1993, 1998, Shilova 1993, Shilova et al. 1996, Shipanov et al. 1996, Kuznetsov et al. 1997, Kuznetsov 2006). In primary intact forests, rodent species numbers are low and the rodent community includes strict forest dependent and endemic species. Moderate levels of anthropogenic damage to primary forests leads to increase of species number and abundance of rodent community due to the appearance of new ecological niches for not strict-forest species. When anthropogenic damage reaches a threshold, the rodent species diversity will be reduced due to elimination of strict-forest species. Our survey found 12 strict-forest species and one endemic species indicating low anthropogenic damage to primary forest in PNKB NP.

Within the strict-forest-dependent rodent species, the Indomalayan *Maxomys* *Maxomys surifer* is considered the best indicator of ecological changes in forest ecosystems (Sokolov et al. 1992, 1993, Shilova et al. 1993, 1996, Shipanova et al. 1996, Kuznetsov et al. 1998, Kuznetsov 2006). Studies in central and southern Vietnam have shown that in an intact primary tropical forests, specimens of *M. surifer* accounts for 15.0% of total rodent specimens trapped. In contrast, in heavily disturbed forests, they reach 30.52% in Buon Luoi forest of Gia Lai Province and even 61.8% or 77.6% in Ma Da forests of Dong Nai Province (Kuznetsov et al. 1998, Kuznetsov 2006). Studies by Kuznetsov in Buon Luoi forest (Gia Lai Province) shows that change in abundance of *M. surifer* is clearly relates to level of the forest destruction:

	than 10% damage:	1.29
-	Primary tropical forest with 15-20% damage:	2.08
-	Primary tropical forest with 40-50% damage:	8.57
-	Primary tropical forest with 100% damage:	0.77
		2.00

(All figures are individuals per 100 trap.nights)

Results of our study in PNKB support this hypothesis well (Table 23): The Hung Dang area with highest threat level (a score of 41) had the highest percentage (20.8%) and abundance (0.53) of *M. surifer*; the Hang En area with the second highest threat level (35) had the second highest percentage (16.1%) and abundance (0.50) of *M. surifer* and Ma Rinh with the lowest threat level (30) had the lowest percentage (9.5%) and abundance (0.24) of *M. surifer*. More studies should be conducted to further explore this phenomenon, but it strongly suggests that rodent surveys could be used as an indicator for monitoring change in forest condition.

Table 23 Percentage and abundance of *M. surifer* in 3 survey sites

Survey site	Threat score	% of total specimen number in current site	Abundance/ trap success (ind./100 trap.night.)
Ma Rinh	30	9.5	0.24
Hang En	35	16.1	0.50
Hung Dang	41	20.8	0.53

d Recommendations

7.1 The status of nonvolant mammal biodiversity in the PNKB National Park

All the survey sites were selected because of their good forest condition and the relatively abundant animal populations, which were described both by local hunters and by the National Park staff. The surveys confirmed the high diversity of the mammal fauna of Phong Nha- Ke Bang. Nevertheless records were relatively scarce and there was little sign of large mammals were encountered. This result indicates an alarming conservation issue in Phong Nha Ke Bang, as those forests still look to be in good condition from satellite images and from the vegetation map, however the forests may contain very few animal. The common occurrence of intensive hunting and snaring activity was probably the major factor that has led to the decline of animal populations in the park.

7.1.1 Status of small-carnivores and loris

The presence of a total of 19 species of small carnivore and 2 species of loris were confirmed in Phong-Nha Ke Bang National Park. Several species in the park are listed as being under threat at different levels in the IUCN Red List, the Red Data Book of Vietnam, and are protected by the Decree of the Government of Vietnam (see Table 2 and Table 10). The survey results have again confirmed PNKB NP as an important conservation area for small carnivores in Vietnam, as the park supports a large area and a variety of habitats that are suitable for most species of small carnivore.

The survey results indicated a low density of small carnivore in PNKB NP. Not many tracks and animals were observed and collected in the field, despite the intense survey effort. It seems likely that high levels of human activity in the survey areas (hunting, logging, and non-timber forest product collection) have reduced both the abundance and the observability of the small carnivores and loris in PNKB NP.

As a result of these surveys, the status of loris is now more clear in the Park, although very few loris were actually recorded in the field. Loris have not suffered from hunting as much as small carnivores, and there is no evidence of commercial hunting for loris. However, their population seems very low in the park. Previous primate surveys also recorded very little evidence of these species, and this was mostly from interview information (Haus et al., 2009, Le Khac Quyet et al., 2002, Le Trong Dat et al., 2009, Nguyen Xuan Dang et al., 1998). It is possible that the karst terrain and forest in PNKB NP is not suitable for these species. This question could be answered by a specific loris study in the park.

7.1.2 Status of insectivores and rodents

Insectivores and rodents play a very important role in tropical forest ecosystems as important actors for pollination, seed dispersal, food chains, transformation of botanical materials and soil environment improvement. They serve as important food resources for many predators (mammalian carnivores, rat-snakes, birds of prey, etc.) including endangered species. Forest ecosystems cannot maintain a healthy status without insectivores and rodents species. The composition of the rodent community also can be used as a good indicators of forest status. Some rodent species may be harmful, destroying vegetation and transferring diseases, but these species represent only a small percentage of the rodent community and damage to intact forest ecosystems occurs only in some extraordinary situations when their numbers become over-abundant. Overhunting and forest destruction have caused many rodent species, especially strict-forest species, to decline dramatically in number and distribution range, such

extinction. Eight (8) of 70 rodent species (11.4%) known in the Red Data Book for urgent conservation action.

In spite of their important ecological role and population decline, conservation of rodents has been poorly addressed in Vietnam, because people often neglect their important ecological role while over-emphasizing the harmful features of some species. Conservation of Insectivores and rodents must be strengthened to save healthy forest ecosystems and support conservation of other endangered species. The rodent fauna in PNKB NP is quite rich and diverse. To date, 35 rodent species of 20 genera and 5 families have been recorded in PNKB NP. These account for 50% of total species number, 69 % of total genera number and 100% of total family number of Vietnam's rodent fauna. This still does not exhaust the list of rodent species in PNKB NP; more species will surely be added to the list in future surveys.

Rodent fauna is poorly investigated in most of Vietnam's protected areas. Figure 4 compares rodent species number recorded in some limestone protected areas which have been the subject of relatively complete biodiversity investigation. The diagrams shows the highest recorded species number in PNKB NP, but this likely indicates the still poor investigation of rodent fauna in other protected areas.

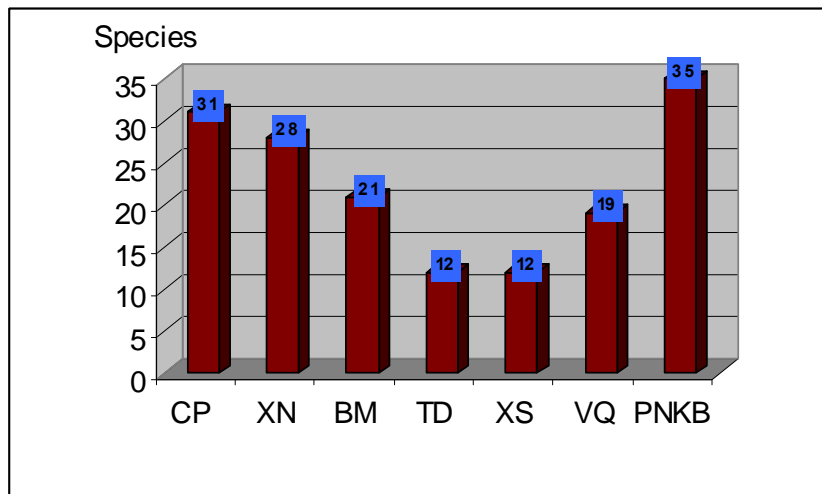


Figure 4. Number of rodent species recorded in some protected areas

(**CP** - Cuc Phuong NP (Ninh Binh Province), **XN** - Xuan Nha NR (Son La P), **BM** - Bach Ma NP (Thua Thien Hue), **TD** - Tam Dao NP (Vinh Phuc), **VQ** ó Vu Quang NP (Ha Tinh), **BB** ó Ba Be NP (Bac Kan), **PNKB** ó PNKB NP (Quang Binh). **CP**: after Le Trong Dat 2007, **XN**: Nguyen Xuan Dang et al. 2011, **BM**: Le Vu Khoi et al. 2005, **TD**: Nguyen Xuan Dang et al. 2006, **XS**: Nguyen Xuan Dang et al. 2006, **VQ**: Korzun et al. 2001, **BB**: Le Trong Trai et al.2004, **PNKB**: this study)

Insectivore fauna in Vietnam is very poorly studied. This study recorded only 5 species of Insectivores in PNKB NP. It is very likely that future surveys will add more species to the list of insectivore species of PNKB NP.

Six (6) rodent species of high conservation concern were recorded in PNKB NP (Table 1 and Table 11). They are nationally endangered (listed in the Vietnam Red Data Book) and 2 of them (*Ratufa bicolor*, *Laonastes aenigmamus*) are also globally threatened or near threatened (listed in the IUCN Red List; IUCN, 2012). Fortunately, three (3) of them (*Ratufa bicolor*, *Belomys pearsonii*, *Petaurista philippensis*) were relatively common in the survey sites. Two (2) other species (*Petaurista elegans* and *Hylopetes alboniger*) were very rare in these survey sites and also in most of the protected areas of Vietnam. All these information highlight the utmost importance of PNKB NP in conservation of rodent endangered species, not only for the nation, but also for the global community.

us) is a very special case. This is mystery species is endemic its protection conserves an ancient mammalian family, the en found only in a few localities in Khammoune Province of Lao PDR and now, with this study, in the Thuong Hoa commune of PNKB NP. The population size and also ecological requirements are still poorly known, but all their known populations (both in Lao and Vietnam) are facing very high hunting pressure (Aplin et al. 2008, Vu Ngoc Thanh 2011).

7.1.3 Status of large mammals and primates

The camera trap survey effort in three area of Hoa Son, Thuong Hoa and Xuan Trach commune photographed 176 pictures that confirm the presence of at least 17 species of mammal in PNKB National Park. Among the mammal species recorded, three species have high conservation importance, being listed in both IUCN's and Vietnam's red data book; Annamite Striped Rabbit, Bear Macaque and Giant Black Squirrel. No important ungulate such as Saola, Muntjac, deer, cats, bears, or pangolins were recorded by the cameras. The result indicated a low density of large mammals in PNKB national park, with a limited number of individuals of all species in all survey areas. The prevalence of hunters and snaring suggests an obvious explanation for why densities should be so low. However, the scarcity of water sources during the dry season in these karstic habitats may also be a factor. In fact, the two factors may have a compounding effect, as hunting may be made easier in the dry season by the concentration of animals near remaining water sources.

Gibbon densities were also demonstrated to be very low in the surveyed area. At the very most, a total of 66 km² was sampled at the 21 listening posts, Only four (4) groups were detected. The area sampled is certainly lower than this estimate, and some groups and individuals may not have called during the short survey period, however, the results taken together indicate that the density of gibbon groups in the area sampled cannot be less than 6 groups in 100 km². Assuming an average group size of 2.5, this would imply a minimum density of 15 individuals in 100 km².

This estimate is an absolute minimum number of the gibbons in the sample area. The actual number may be an order of magnitude greater than this. However, even so, the densities would be very much lower than previous densities detected in PNKB NP in the earth hills area around U Bo (Le Trong Dat et al., 2009). That previous census covered 7.7 km² and recorded approximately 41 gibbon family groups with at least 113 individuals in all, of which 37 groups with at least 101 individuals were recorded inside the PNKB NP and another 5 groups with at least 12 individuals were recorded in the bufferzone of the Park. These numbers can be considered the absolute minimum number of individuals in the U Bo area.

Clearly, the density of gibbons in the sample area is very much lower than in the U Bo area of the Park. Two possible hypotheses could explain why this is the case. First, the habitat in the area sampled in this survey is largely karst forest, and this habitat may be suboptimal for gibbons. The high densities of *Nomascus siki* gibbons previously documented in Ubo were living in forest on earth hills, not karst. Secondly, the large numbers of hunters in the area suggests that gibbons densities may have been lowered by past or current hunting. While most hunting observed involved the use of snares, which do not pose a threat to strictly arboreal species such as gibbons, hunting with guns also still occurs in the Park. Hunting would also explain the very low rate of calling by gibbons, as gibbons are known to decrease calling rates in areas subject to hunting⁴. The observation of a gibbon skin trophy reportedly obtained from an area inside the Park, confirms that hunting has been a threat to the gibbons, despite their protected status in Vietnam.

⁴ c.f. Nijman, V. (2001) The effect of behavioural changes due to habitat disturbance on density estimation of rain forest vertebrates, as illustrated by gibbons (Primates: Hylobatidae). In *The Balance between Biodiversity Conservation and Sustainable Use of Tropical Rain Forests* pp. 217-224.

Nonvagrant mammal fauna in PNKB is threatened by hunting/snaring and forest degradation. Signs of these threats were found in all 3 survey sites, including trapping/snaring, hunter camps, hunters in the area, timber cutting, honey and NTFP collecting, agricultural fields and domestic cattle grazing.

Hunting, and especially snare trapping, is putting all terrestrial species in PNKB in a critical conservation situation. Evidence of intensive hunting was recorded in all three survey areas. Hunting/snaring represents the most serious threat in all survey sites. Snare trapping and hunting seems to have reached a professional level - the hunting continues year-round, and trapped and hunted animals were continuously transferred to villages and retailers where they would be purchased and forwarded on. In addition, hunting bullets and snare trapping supplies are very accessible in the local villages, which indicates how common hunting may be and how open the activity is in the area. Wild meat was also sold relatively openly in some local restaurants, including protected species: douc langur, macaque, serow and civets were observed and were advertised to the team in Hoa Son. Hunting intensity seems to increase as the animals become more scarce, because the price of hunted animals increases as a result of scarcity. We found that hunters generally have very little fear of interventions or arrest from any law enforcement agencies. A key species of great concern, the Laotian Rock Rat is seriously threatened by the snaring activities of local residents, both in Thuong Hoa Commune and Hoa Son Commune, due to a strong local tradition of trapping rats for food in these areas.

Illegal logging is the second most serious threat to mammal biodiversity in the Park. Evidence for logging, such as felled trees, lumber piles, and loggers were observed commonly in all three areas. *Dalbergia tonkinensis* collection was also very common as the wood's price has reached extraordinary levels, and it attracts a many local people searching and harvesting this species. The logging seems quite easy in these areas: logged lumber is stored in the forest and on trails near local villages openly without any intervention from rangers. Chain-saws were sold openly in most of the villages, showing the scale of mechanized logging.

Cattle grazing also appears to be common in areas of forest close to villages or in flat valleys. Within the Park, cattle grazing was found only in the Hung Dang area but was quite serious there. The grazing is a violation of park regulations. Domestic animals could be strong competitors for wildlife in terms of food and grazing areas, as well as being a source of disease.

By one assessment, the Hung Dang area had the highest threat level. Although there is no sign of logging, forests have been much degraded, converting them into mixed bamboo forests. Hunting and cattle raising are the most serious threats in this area. The Hang En area had the second highest threat level. Tall forests remain there but valuable trees have been removed and hunting is quite intensive. The Ma Rinh area has the lowest threat level. Forest is primary or little affected, however, timber removal and hunting pressure are very high now.

7.3 Recommendations

Based on the results of the survey and the conservation issues raised, the survey teams offer the following recommendations for Phong Nha Ke Bang National Park and the authorities in the Bufferzone communities around the Park to improve conservation management:

Active law enforcement patrols: An active patrol routine will be vital to reduce the snaring and logging in the park. If patrols are done more regularly in key hotspot areas, hunting and logging could be dramatically reduced. This should be the first priority activity in PNKB NP. Rangers should regularly patrol the forest in groups of four or five, particularly focusing on hotspot areas to find and remove traps and destroy hunting and logging camps. If this activity is well organized and maintained,

ing and other negative impacts for the wildlife in the area. A is strongly recommended. The activity should be planned for g and monitoring mechanism.

Increasing management of the wildlife trade: Local retailers and restaurants should be checked and fined for violations. Serious cases should be brought to trial, which will have a strong effect on others involved in this illegal activity. Effective wildlife trade control will make a big contribution to wildlife protection in the park. When the demand and trade is reduced, hunting will be reduced accordingly. This will require coordination with law enforcement authorities outside the Park.

Managing sale of logging and hunting supplies in the local villages: Sales of cables used for snaring, of bullets and of chain-saws needs to be strictly controlled in the local market (at the commune level). Shop owners need to be registered with local authorities and ranger stations. The supply of cables should be strictly controlled and monitored, such that people should not be allowed to purchase more than 3 bicycle brake cables at a time. Selling bullets is strictly prohibited in Vietnam, therefore stores and hunters in the Bufferzone who violate this regulations should be strictly punished. This will require coordination with law enforcement authorities outside the Park. An undercover survey on hunting, trade in wildlife, and supply of hunting and logging equipment is strongly recommended in order to provide reliable information for better control of the wildlife trade and sale of hunting supplies.

Better involvement of local authorities and communities: Local authorities at the village and commune level keep a distance from forest and wildlife management. For example sales of hunting and snaring supplies are carried out openly in local villages. Greater cooperation between the National Park and local authorities is vital to reduce these threats to the forest. Joint patrols and management of the wildlife trade is strongly recommended in order to improve involvement of local authorities and for better monitoring of illegal activities.

Provide alternative livelihoods: The agricultural land in the area appears to be quite small, and most areas are located on hills and slopes which do not provide a high yield. Forest work therefore seems to be a major alternative for most of the communes. Local people informed us that after finishing the agricultural harvest, most local people join the logging activity in different ways (logger, porter, cook, etc.) and they experience little intervention from local authorities. The logging problem will only be effectively solved if unemployment and agriculture promotion in the area receive appropriate attention and investment.

Awareness building: Some conservation education activities have been carried out for local people, however these have not been frequent enough in these survey areas. Local people seem unaware of the critical issues of biodiversity conservation in PNKB NP, as well as of the consequences of illegal actions such as hunting and logging. In addition, hunters do not seem to be aware of the risk of trial and prosecution. An education focus is strongly recommended, and a specific education campaign should be designed to raise people's understanding about the Park's conservation value and about the impact of hunting on the Park and on Vietnam's wildlife heritage, and to make them aware of the laws and the penalties for violating them.

Training of rangers and park staff: Although several training sessions were organized for the park's personnel in the last few years (by FFI, the Vietnam-German PNKB Conservation Project, WWF, Cologne Zoo, CRES, and by the Park itself), the attitudes and performance of the people involved in this survey still showed much room for improvement. Poor training and low motivation is a major concern with regard to the scientific staff and rangers of the Park. Few have appropriate skills on using topographic maps, compass and GPS, and many have poor orientation while working in the forest. Perhaps these weaknesses are the reason that rangers avoid patrols, particularly in deep areas of forest. Regular training on use of field equipment and forest field craft is strongly recommended. These skills together with improved species identification training and well-designed patrol routines will certainly improve the impact of ranger patrols.

...sity monitoring and patrol database should be designed and create datasheets and instructions for rangers and park staff to collect information on their patrols. This monitoring information will be vital to compare and analyze threat levels, identify hotspots, and assess the performance of staff. This in turn is vital for the affective conservation management of PNKB NP.

Continue camera trapping for monitoring and research: Camera trapping is a recommended method for monitoring. In the area which was surveyed, mammals are under great pressure and are very rare. Continuous monitoring activity will help to verify rare species in the park and also help to track trends in their populations and the threats they face. With their newly acquired equipment and skills, the staff of PNKB should be able to actively continue the camera trapping survey activity.

Focus on threatened mammal species: In addition to enforcement activities to control hunting, a monitoring programme should be initiated to monitor status and trends of the populations of mammals and the threats to their survival. Camera trapping should continue, focusing on large cats and bear, which are rarely recorded now in the park. Other ungulates such as muntjac, saola, serow and small carnivores should also be priority species for additional surveys and ongoing monitoring. Special conservation effort should be made to protect six endangered rodent species (*Laonastes aenigmamus*, *Belomys pearsonii*, *Hylopetes alboniger*, *Petaurista elegans*, *Petaurista philippensis* and *Ratufa bicolor*).

Further study on new species: The remarkable discovery of *Laonastes aenigmamus* calls for further study to understand its distribution, ecology (microhabitat, food, activity behaviour, reproduction, etc.) and population size, and also to estimate snaring pressure (animal offtake) by local people. An awareness campaign should be initiated for residents of Hoa Son and Thuong Hoa Commune to raise their understanding of the importance of conservation of this species. To stop trapping of this species, support should be provided to local people to help them raise domestic animals for meat as an alternative to trapping rats and other wildlife for food.

Use the composition of rodent communities as monitoring indicator of forest condition: Rodent species composition and abundance indexes (encounter rate, trap success), and especially, those of *M. surifer*, should be monitored as an indicator of the condition of the forests of PNKB NP.

Further study on less understood and endangered taxa: Less understood and endangered species should be given priority for future research and monitoring. For example, further surveys should be conducted to fully characterize the species diversity and ecology of Insectivore fauna in PNKN NP.

1. ABRAMOV A.V., JENKINS, P. D., ROZHNOV, V.V. AND KALININ, AL. A. 2008. Description of a new species of *Crociodura* (Soricomorpha: Soricidae) from the island of Phu Quoc, Vietnam. *Mammalia* 72 (2008): 2696272
2. ANON 2007. B Khoa h c và Công ngh , Vi n Khoa h c và Công ngh Vi t Nam. Sách Vi t Nam. Ph n I. ng v t. Nxb. Khoa h c t nhiên và Công ngh , Hà N i. [Vietnam's Red Data Book. Animals. Science and Technology Publishing House, Hanoi] (in Vietnamese)
3. ANON. 1992. Investment plan for Phong Nha Nature Reserve (in Vietnamese). Dong Hoi: Quang Binh Provincial People's Committee.
4. APLIN, K. & LUNDE, D. 2008. *Laonastes aenigmamus*. In: IUCN 2011. 2011 IUCN Red List of Threatened Species. <www.iucnredlist.org>.
5. APLIN, K.P., BROWN, P.T., JACOB, J., KREBS, C.J., AND SINGLETON, G.R. 2003. Field methods for rodent studies in Asia and the Indo-pacific. Aust. Centre for Intern. Agricultural Research, Canberra, Australia
6. AVERIANOV, A.O., ABRAMOV, A.V., AND TIKHONOV, A.N. 2000. A new species of *Nesolagus* (Lagomorpha, Leporidae) from Vietnam with osteological description. Contributions from the Zool. Inst., Russ. Acad. Sci., St. Petersburg 3: 1-22.
7. BALAKIREV 2009. Nghiên c us a đ ng sinh h c c a các loài chu t mi n Nam Vi t nam trên ph ng di n chu n oán và phân lo i h c. Báo cáo khoa h c H i ngh khoa h c toàn qu c v sinh thái và tài nguyên sinh v t l n th ba. Nxb. Nông nghi p, Hà N i, 445-453 [Study of Niviventer and Rattus rats in Southern Vietnam] (in Vietnamese).
8. BIRISSENKO, A. V., IVANOVA, N. V. & POLET, G. 2004. First recent record of the Small-toothed Palm Civet *Arctogalidia trivirgata* from Vietnam *Small Carnivore Conservation*, 30 5-6.
9. BOONRATANA, R. 2004. A photograph of a remarkable *Viverra* from Vietnam *Small Carnivore Conservation*, 31.
10. BRUNER, J. 2012 Biodiversity conservation in Vietnam: A perfect storm. <cmsdata.iucn.org/downloads/iucn_nbsap_workshop_march_2012_paper_final.pdf> Downloaded December 29 2012
11. BUI HUU MANH 2001. Results of Rhino Survey August ó December 2001. Unpublished report to Asian Rhino and Elephant Action Strategy ó Vietnam.
12. CAO V N SUNG, NG HUY HU NH & BÙI KÍNH, 1980. Nh ng loài g m nh m Vi t Nam. Nxb. Khoa h c và K thu t, 201 trang. [Rodents of Vietnam] (in Vietnamese).
13. CITES. (2011). Convention on International Trade in Endangered Species of Wild Fauna and Flora. Electronic database available at <http://www.cites.org>.
14. CORBET, G. B. & J.E. HILL 1992. *The Mammals of the Indomalayan Region: A Systematic Review*, Natural History Museum Publications, Oxford University Press.
15. NG HUY HU NH, CAO V N SUNG, LÊ XUÂN C NH, PH M TR NG NH, NGUY N XUÂN NG, HOÀNG MINH KHIÊN & NGUY N MINH TÂM, 2008. ng v t chí Vi t Nam. T p 25. L p Thú ó Mammalia. Nxb. Khoa h c và K thu t, Hà N i, 362 tr. [Fauna of Vietnam, Vol. 25: Mammalia] (in Vietnamese).
16. NG HUY HU NH, ÀO V N TI N, CAO V N SUNG, PH M TR NG NH & HOÀNG MINH KHIÊN 1994. *Danh lục các loài thú (Mammalia) Việt Nam (Checklist of Mammals in Vietnam)*, Hà N i, Nhà xu t b n Khoa h c và K thu t.
17. NG HUY HU NH, HOÀNG MINH KHIÊN, LÊ XUÂN C NH, NGUY N XUÂN NG, V ÌNH TH NG & NG HUY PH NG, 2007. Thú r ng Mammalia Vi t Nam: hình thái và sinh h c sinh thái m t s loài. Nxb. Khoa h c t nhiên và Công ngh qu c gia. T p I, 232 tr. [Forest mammals of Vietnam: Morphology and Ecology of some species] (in Vietnamese).
18. NG NG C C N, HIDEKI ENDO & NGUY N TR NG S N VÀ CS., 2008. Danh l c các loài thú hoang dã Vi t Nam. Shoukadoh Book Sellers, Japan, 440 tr. [A checklist of wild mammal species of Vietnam] (In Vietnamese).

- , LI, C., BEARD, C. & METAIS, G. 2006. *Laonastes* and *Malacothrix* in Vietnam. *Mammals, Science*, 311:145661458, 2006.
1999. Chuyên ngành v t r ng vùng m Phong Nha-K Bàng, t nh Qu ng Bình. D án b o t n liên qu c gia Hin N m Nô-Phong Nha-K Bàng/WWF.
21. DUCKWORTH, J. W. & LE, X. C. 1998. The Smooth-coated Otter *Lutrogale perspicillata* in Vietnam. *IUCN Otter Specialist Group Bulletin* 15, 38-42.
22. DUCKWORTH, J. W. & ROBICHAUD, W. G. 2005. Yellow-bellied Weasel *Mustela kathiah* sightings in Phongsaly province, Laos, with notes on the species range in South-East Asia, and recent records of other small carnivores in the province. *Small Carnivore Conservation*, 33, 17-20.
23. DUCKWORTH, J. W. 1998. The difficulty of estimating population densities of nocturnal forest mammals from transect counts of animals. *J. Zool., Lond*, 246, 466-468
24. EAMES, J.C., LAMBERT, F.R., NGUYEN CU, 1994. A survey in Annamese Lowlands, Vietnam and its implications for the conservation of Vietnamese and Imperial Pheasants *Lophura hatinhensis* and *L. Imperialis*. *Bird Conservation International* 4(4): 343-382.
25. FRANCIS CH., 2008. A guide to mammals of Southeast Asia. Princeton Univ. Press, UK, 392 pp.
26. GEISSMANN, T., NGUYEN XUAN DANG., LORMEE, N & MOMBERG, F. (2000). Vietnam Primate Conservation Status Review 2000. Part 1: Gibbons. *Fauna & Flora International Indochina Programme*, Hanoi.
27. GFA CONSULTING GROUP 2006. Nature Conservation and Sustainable Management of Natural Resources in the Phong Nha ó Ke Bang National Park Region. Feasibility study
28. HAUS, T., VOGT, M., FORSTER, B., VU NGOC THANH & ZEIGLER, T. 2009. Distribution and population densities of diurnal primates in the karst forests of Phong Nha-Ke Bang National Park, Quang Binh province, central Vietnam. *International Journal of Primatology*, 30, 301-312.
29. IUCN, 2012. *The IUCN Red List of Threatened Species. Version 2012.2*. <<http://www.iucnredlist.org>>. Downloaded on 20 December 2012.
30. JENKINS, P. D., KILPATRICK, C. W., ROBINSON M.F., & TIMMINS, R. J. 2005. Morphological and molecular investigations of a new family, genus and species of rodent (Mammalia: Rodentia: Hystricognatha) from Lao PDR. *Systematics and Biodiversity* 2 (4): 419-454
31. KARANTH, K. U. 1995, Estimating tiger *Panthera tigris* populations from camera-trap data using capture-recapture models. *Biol. Conserv.*, 71, 333-338.
32. KAWADA S., 2005. The historical notes and taxonomic problems of East Asia moles Euorscaptor, Parascaptor and Scaptochirus, of continental Asia (Insectivora talpidae). *Mammal Study* 30: S5-S11.
33. KOUZNETSOV, A. N., PHAN LUONG, DEVYATKIN, A. L., KALYAKIN, M. V., KROUSKOP, S. V., KOUZNETSOV, G. V., VASSILYEV, B. D., VU VAN LIEN & PHAM HONG PHUONG 1999. Results of the complex zoological-botanical expedition to the Ke Bang area. Hanoi: Vietnam-Russia Tropical Centre.
34. KUZNETSOV G.V., BORISENKO, A.B., RHOZNOV, V.V. 2001. Composition of mammal fauna in Vu Quang NP. In "Reports of zoo-botanic studies in Vu Quang NP (Ha Tinh Province, Vietnam. Moscow, Hanoi, Tropical Centre, 161-189. (In Russian)
35. KUZNETSOV, G. V., 2006. *Mammal of Vietnam*. Moscow: KMK Scientific Press Ltd., 420pp (in Russian)
36. KUZNETSOV, G.V., PUZACHENKO, U.G., PHAN LUONG, LOZINOV, G.L., 1998. S phân b theo sinh c nh c a ng v t g m nh m s ng trên m t t trong r ng nhi t i m gió mùa vùng núi B c Vi t Nam. Tuy n t p báo cáo khoa h c. Quy n 1. Sinh thái nhi t i và Y h c nhi t i. Trung tâm Nhi t i Vi t-Nga, Hà N i, 43-57 [Distribution of terrestrial rodents by habitats in moist tropical forest] (in Vietnamese).
37. LE KHAC QUYET, DINH HAI DUONG, BUI NGOC THANH & LE VAN LONG 2002. Results of Surveys on Primates in Vuc Tro and Hung Dang Areas, Phong Nha-Ke Bang National Park, Quang Binh Province, Vietnam (in Vietnamese). Hanoi; Fauna and Flora International - Vietnam Programme.

ÊN VÀ INH HOÀNG TU N 2010. i u tra thành ph n và
r (Phasianidae) VQG Phong Nha ó K Bàng. Trung tâm
n Qu c gia PNKB.

39. LE TRONG DAT AND LE THIEN DUC (2006). Report on a Biodiversity survey for Vertebrate Fauna in Truong Son State Forest Enterprise, Quang Ninh district, Quang Binh province. Tropical Forest Trust-Indochina Programme, Hanoi.
40. LE TRONG DAT, DO TUOC, DINH HUY TRI, LE THUC DINH & DANG NGOC KIEN 2009. Census of southern white-cheeked crested gibbons in U Bo and adjacent bufferzone forests, Phong Nha-Ke Bang National Park, Bo Trach District, Quang Binh Province, Vietnam. Hanoi: Fauna & Flora International Vietnam Programme.
41. LE XUAN CANH, TRUONG VAN LA, DANG THI DAP, HO THU CUC, NGO ANH DAO, NGUYEN NGOC CHINH, NGUYEN QUOC DUNG, PHAM NHAT, NGUYEN THAI TU, NGUYEN QUOC THANG & TRAN MINH HIEN 1997. A report on field surveys on biodiversity in Phong Nha - Ke Bang Forest, Quang Binh Province, Central Vietnam. Hanoi; UNDP & WWF - Indochina Report.
42. LEKAGUL, B. & MCNEELEY, J. A. 1988. Mammals of Thailand. Association for the Conservation of Wildlife, Sahakambhat Co., Bangkok, Thailand.
43. LONG, B. & MINH HOANG 2006. Recent records of and notes on the conservation of small carnivores in Quang Nam province, central Vietnam. *Small Carnivore Conservation* 34&35, 39-46.
44. LUNDE, D. P. & SON, N. T. 2001. An Identification Guide to the Rodent of Vietnam. American Museum of Natural History, New York, 80pp.
45. LUNDE, D. P., MUSSER, G. G. & SON, N. T. 2003. A survey of small mammals from Mt. Tay Con Linh II, Vietnam, with the description of a new species of *Chodsigoa* (Insectivora: Soricidae). *Mammal Study*, 28: 31-46.
46. LUNDE, D.P., MUSSER, G. G. & ZIEGLER, T. 2004. Description of new species of *Crocidura* (Soricomorpha: Soricidae, Crocidurinae) from Ke Go Nature Reserve, Vietnam. *Mammal Study* 29: 27-36.
47. LUU MINH THANH 2009. The cooperation process between Phong Nha ó Ke Bang NP and Cologne Zoo. In " Phong Nha ó Ke Bang NP & Cologne Zoo: 10 years of cooperation (1999-2009)". Dong Hoi City, 72-77.
48. MEIJBOM M. & H TH NG C LANH (biên t p), 2002. H ng-th c v t Phong Nha - K Bàng và Hin N m Nô. D án LINC-WWF, Qu ng Bình, Vi t Nam. (Flora and fauna of Phong Nha-Ke Bang and Hin Namno - A compilation Report. WWF LINC Project: Linking Hin Namno and Phong Nha-Ke Bang through parallel conservation/WWF. In Vietnamese and English)
49. MONRE (B Tài nguyên và Môi tr ng) 2005. Báo cáo hi n tr ng môi tr ng qu c gia. Chuyên a d ng sinh h c. Hà N i, 95 tr. [National Environmental Report on Biodiversity] (in Vietnamese).
50. MOTOKAWA M., 2004. Phylogenetic relationship within the family Talpidae (Mammalia: Insectivora). *J. Zool. Soc. Lond.* 263: 147-157.
51. MOTOKAWA M., YU, H., & HARADA, M. 2005. Diversification of the White-toothed Shrews of genus *Crocidura* (Insectivora: Soricidae) in East and Southeast Asia. *Mammal Study* 30:S53-S64.
52. MUSSER, G.G., SMITH, A.L., ROBINSON, M.F., & LUNDE, D.P. 2005. Description of a New Genus and Species of Rodent (Murinae, Muridae, Rodentia) from the Khammouan Limestone National Biodiversity Conservation Area in Lao PDR. *American Museum Novitates*, 3497: 31pp.
53. NGUYÊN M NH HÀ 2004. T nh hình buôn bán b t h p pháp m t s loài thú Vi t Nam. *Tạp chí Nông nghiệp và Phát triển Nông thôn*, 8, 1148-1149.
54. NGUYEN MANH HA 2006. Some Observations on the Hatinh langur, *Trachypithecus laotum hatinhensis* (Dao, 1970), in North Central Vietnam. *Primate Conservation*, 21.
55. NGUYEN MANH HA 2009. International wildlife trade in Vietnam: an overview and management recommendations. In: SATO, J. (ed.) *Transboundary Resources and Environment in Mainland Southeast Asia*. Kyoto: Shoukadoh.
56. NGUYEN MANH HA AND DO TUOC 2011. Biodiversity survey of small carnivores (Mustelidae, Viverridae, Herpestidae) and loris (*Nycticebus*) in and around the Phong Nha- Ke

Vietnam. FFI Vietnam/ A report for the Nature Conservation
Management in Phong Nha ó Ke Bang National Park Region

57. NGUYEN MANH HA, VU VAN DUNG, NGUYEN VAN SONG, HOANG VAN THANG, NGUYEN HUU DUNG, PHAM NGOC TUAN, HOA, T. T. & CANH, D. 2007. Report on the review of Vietnam's wildlife trade policy. Hanoi and Geneva CRES/FPD/UNEP/CITES/IUED.
58. NGUYEN MANH HA. 2002. *The Illegal Animal Trade Crossing the Border from Vietnam to China: a review of the present state of this activity and recommendations on how to stop it*. Master thesis, International University of Andalusia.
59. NGUYEN NGOC CHINH, NGUYEN QUOC DUNG & BUI DAC TUYEN 1998. Investment plan for Phong Nha-Ke Bang National Park, Quang Binh province (In Vietnamese). Hanoi: Forest Inventory and Planning Institute.
60. NGUYEN NGOC TUAN 2012. Report of pheasant survey in Quang Binh and Quang Tri provinces. Unpublished report to CEPF/Birdlife International, Vietnam.
61. NGUYEN XUÂN NG & LÊ XUÂN C NH, 2009. Phân lo i h c l p thú (Mammalia) và c i m khu h thú hoang dã Vi t Nam. Nxb Khoa h c t nhiên và Công ngh , Hà N i, 150 tr. [Taxonomy of Mammals and characteristics of Vietnam mammal fauna] (in Vietnamese).
62. NGUYEN XUAN DANG AND NGUYEN XUAN NGHIA, 2011. Biodiversity survey of rodents and insectivores in and around the Phong Nha- Ke Bang national park, Quang binh, Vietnam. FFI Vietnam/ A report for the Nature Conservation and Sustainable Natural Resource Management in Phong Nha ó Ke Bang National Park Region Project, Quang Binh
63. NGUYEN XUÂN NG, NGUYEN XUÂN NGH A, NGUYEN M NH HÀ, LÊ C MINH2, NGUYEN DUY L NG, INH HUY TRÍ, 2012. PHÁT HI N LOÀI G M NH M "HÓA TH CH S NG" (*Laonestes aenigmanus*) PHONG NHA - K BÀNG, VI T NAM. T P CHÍ SINH H C, 2012, 34(1): 40-47
64. NGUYEN XUÂN NG, 2011. Ti m n ng và c h i trong nghiên c u b o t n và phát tri n tài nguyên ng v t t i VQG Phong Nha - K Bàng. Báo cáo t i H i th o 10 n m thành l p VQG Phong Nha - K Bàng. (ang in). [Perspective and opportunity of research on conservation and development of zoological resource in Phong Nha Ke Bang NP](In Vietnamese).
65. NGUYEN XUAN DANG, PHAM NHAT, PHAM TRONG ANH & HENDRICHSEN, D. 1998. Result of survey for Mammal fauna in Phong Nha-Ke bang (in Vietnamese). Hanoi: Flora & Flora International - Vietnam programme
66. NGUYEN XUÂN NG, PH M NH T, PH M TR NG NH, HENDRICHSEN, D.K. 1998. K t qu i u tra nghiên c u khu h thú Phong Nha - K Bàng, Qu ng Bình (1/7-25/9/1998). Fauna & Flora International Indochina, Hà N i, Vi t Nam.
67. NOWAK, R. M. 2005. *Walker's Carnivores of the World*, Baltimore, John Hopkins University Press.
68. OSHIDA T., YASUDA, M., ENDO, H., HUSSEIN, N.A. & MASUDA, R. 2001. Molecular phylogeny of five squirrel species of genus *Callosciurus* (Mammalia, Rodentia) inferred from Cytochrome b Gene sequence. *Mammalia* 65(4):473-482.
69. OSHIDA, T. & MASUDA, R. 2000. Phylogeny and Zoogeography of six squirrel species of the genus *Sciurus* (Mammalia, Rodentia), Inferred from Cytochrome b Gene sequence. *Zoological Science* 17: 405-409.
70. PAN QH, WANG YX, YAN K, 2007. A Field guide to the mammals of China. China Forest Publishing House, (in Chinese).
71. PARR, J. W. K. & HOANG XUAN THUY 2008. *Field Guide to the Large Mammals of Vietnam* Hanoi, pannature.
72. PHAM MONG GIAO, DO TUOC, VU VAN DUNG, WIKRAMANAYAKE, E.D., ARCTANDER, A. G. & MACKINNON, P.J.R (1998). Description of *Muntiacus truongsonensis*, a new species of Muntijac (Artiodactyla: Muntiacidae) from Central Vietnam, and implications for conservation. *Animal Conservation*. Zool. Soc. London 1: 61-68.
73. PHAM NHAT & NGUYEN XUAN DANG 2000. *Field guide to the key mammal species of Phong Nha-Ke Bang*, Hanoi, Lao Dong Publishing House.
74. PHAM NHAT (2002) *Primates of Vietnam* (Thú Linh tr ng Vi t Nam), Agriculture Publishing House, Ha Noi; 111pp (in Vietnamese).

- PHAM HONG NGUYEN (2000). Report on research result monitoring survey of the red shanked douc langur (*P.nemaus*) forest area. Forestry University of Vietnam and World Wide Fund for Nature (WWF), Hanoi.
76. PHONG NHA-KE BANG NATIONAL PARK, (2008). 2008 Checklist of Reptile and Amphibian of Phong Nha-Ke Bang National Park. Centre for Science Research and Wildlife Rescue, Phong Nha-Ke Bang National Park, Bo Trach, Quang Binh.
 77. RATAJAZCZAK, R. & COX, R. 1991. Back-striped weasel in Vietnam. *Small Carnivore Conservation*, 4, 17.
 78. ROBERTON, S. 2004. An Assessment of the Threats to the Biodiversity of Phong Nha-Ke Bang National Park, Quang Binh province, Vietnam - Report No. 1: Intelligence-led Investigations into the Illegal Trade in Wildlife. Dong Hoi: Fauna and Flora International
 79. ROBERTON, S. I. 2007. *The Status and Conservation of Small Carnivores in Vietnam*. Phd thesis, University of East Anglia.
 80. ROBERTON, S., TIMMINS, R. J., LONG, B., YING-XIANG, W. & TRAN QUANG PHUONG 2008. *Chrotogale owstoni*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1.. Downloaded on 27 October 2011.
 81. ROOS, C., VU NGOC THANH, WALTER, L. AND NADLER, T. (2007): Molecular Systematics of Indochinese Primates. *Vietnam Journal of Primatology* 1: 41-53p.
 82. ROZHNOV, V. V. & PHAM TRONG ANH 1999. A note on the Tainguen civet - a new species of viverrid from Vietnam (*Viverra tainguensis* Sokolov, Rozhnov & Pham Trong Anh, 1997) *Small Carnivore Conservation* 20, 11-27.
 83. ROZHNOV, V. V., KUZNETZOV, G. V. & PHAM TRONG ANH 1992. New distributional information on Owston's palm civet. *Small Carnivore Conservation*, 6, 7.
 84. ROZHNOV, V. V., KUZNETZOV, G. V. & PHAM TRONG ANH 1993. New data on the distribution of small carnivores in Vietnam. *Lutreola* 2, 14-15.
 85. SALAFSKY, N. & MARGOLUIS, R. 1999. Threat reduction assessment: a practical and cost effective approach to evaluating conservation and development projects. *Conservation Biology* 13:1830-841.
 86. SANCHEZ-VILLAGRA M.R., HOROVITZ, I. & MOTOKAWA, M. 2006. A comprehensive morphological analysis of talpid moles (Mammalia) phylogenetic relationships. *Cladistics* 22(2006): 59-88.
 87. SCHALLER, G.B., NGUYEN XUAN DANG, LE DINH THUY AND VO THANH SON 1990. Javan Rhinoceros in Vietnam. In *Oryx*, 24, No. 2, 77-80.
 88. SCHREIBER, A., WIRTH, R., RIFFEL, M. & VAN ROMPAEY, H. 1989. *Weasels, civets, mongooses and their relatives: an action plan for the conservation of mustelids and viverrids*, IUCN, Gland, Switzerland.
 89. SEYDACK, A. H. W. 1984, Application of a photo-recording device in the census of larger rain-forest mammals. *South Afr. J. Wildlife Res.*, 14, 10614.
 90. SFNC, 2000. Pumat: A biodiversity survey of a Vietnamese protected area. Vinh, Vietnam; SFNC, Ngh An.
 91. SHILOVA, S.A., 1993. Population ecology as tool for abundance control of small mammals. Nauka Publ. House, Moscow. (In Russian).
 92. SHIPANOV, N.A., SHEKAROVA, O.N. & PHAM VAN THAN, 1996. Specific characters of population structure of small mammals in damage ecosystems based on example of *M. Surifer*. In" Long-term biological effects of war in Southern Vietnam. Moscow, 1929-1964. (In Russian).
 93. SHIRAS, G. 1906. Photographing wildlife with flashlight and camera. *Natl. Geogr.*, 17, 3676423.
 94. SMITH, A.T., XIE Y (eds,) 2008. A Guide to the Mammals of China. Princeton Univ. Press, UK.
 95. SOKOLOV, V. E., ROZHNOV, V. V. & PHAM, T. A. 1997. New species of viverrid of the genus *Viverra* (Mammalia, Carnivora) from Vietnam. *Zoologicheskoye Zhurnal [Russian]* 76, 585-589.
 96. SOKOLOV, V.E., KUZNETSOV, G.V., TIKHONOV, I.T. & TIKHONOVA, G.N. 1998. Nghiên cứu cấu trúc quần thể động vật có vú nhỏ ở khu vực bảo tồn sinh quyển Phong Nha - Kẻ Bàng, Việt Nam. Tuyển tập báo cáo khoa học. Quyển 1. Sinh thái nhiệt đới và Y học nhiệt đới. Trung

97. [Impact of anthropogenic landscape deformation to small (se)].
98. GROMOV, V.S., SHEKAROVA, O.N. & SHIPANOV, N.A. 1993. Some aspects of ecology and behaviour of *M. Surifer Miller*, 1990. *J. Ecology* (3): 46-53
98. SOKOLOV, V.E., SHIPANOV, N.A. & SHILOVA, S.A., 1992. Perspectives of using population approach in analysis of anthropogenic dynamics of tropical ecosystems. In " Achievements of modern biology. V.112 (1): 130-138. (In Russian).
99. STREICHER, U. 2009. Diet and feeding behaviour of pygmy lorises (*Nycticebus pygmaeus*) in Vietnam. *Vietnamese Journal of Primatology* 3, 37-44.
100. SURRIDGE, A. K., TIMMINS, R.J., HEWITT, G.M. AND BELL, D.J. 1999. Striped rabbits in Southeast Asia. *Nature*, 400, 726.
101. HAUS. T., VOGT. M. FORSTER, B. NGOC THANH VU & ZIEGLER, T. (2008) Distribution and population densities of diurnal primates in the karst forests of Phong Nha ó Ke Bang National Park, Quang Binh Province, Central Vietnam. *Int J Primatol* DOI 10.1007/s10764-009-9343-4
102. TIMMINS R.J., EVANS, T.D., KHAMKHOUN KHOUNBOLINE AND CHAINOL SISOMPJONE 1998. Status and conservation of the giant muntjac *Megamuntiacus vuquangensis* and notes on other muntjac species in Laos. *Oryx* 32(1): 59-67.
103. TIMMINS, R. J., DO TUOC, TRINH VIET CUONG & HENDRICHSEN, D.K. 1999. A Preliminary Assessment of the Conservation Importance and Conservation Priorities of the Phong Nha-Ke Bang Proposed National Park, Quang Binh Province, Vietnam. Hanoi: Fauna & Flora International - Indochina Programme
104. TORDOFF, A. W. 2002. *Directory of important bird areas in Vietnam: key sites for conservation*, Hanoi, birdlife International in Indochina and the Institute of Ecology and Biological Resources.
105. TORDOFF, A. W., TRAN, Q. B., NGUYEN, D. T. & LE, M. H. 2004. *Sourcebook of Existing and Proposed Protected Areas in Vietnam*, Hanoi, MARD/Birdlife International.
106. VAN NGOC THINH & ROOS, C. (2008). Phylogeny, Taxonomy and Distribution of Crested Gibbons (Genus *Nomascus*) German Primate Center (Presentation in Conservation of Primates in Indochina International Symposium, Cuc Phuong National Park, 27th-30th November, 2008)
107. VAN NGOC THINH (2008). Preliminary report on a Rapid Survey for White-cheeked Crested Gibbon in Phong Nha-Ke Bang National Park. Unpublished report (in Vietnamese).
108. VIETNAM GOVERNMENT (CHÍNH PH VI T NAM) 2004. Chi n l c hành ng qu c gia v t ng c ng ki m soát buôn bán ng v t, th c v t hoang dã n n m 2010. Hà N i, 37tr. [National Action plan to strengthen control of trade in wild fauna and flora to 2010] (in Vietnamese).
109. VRTC-WWF, 1999. Results of the complex zoological ó botanical expedition to the Ke Bang area. Final Report. WWF Indochina - VRTC. Hanoi, Vietnam.
110. VU NGOC THANH 2011. Loài thú tuy t ch ng 11 tri u n m tr c b bán y r y ch . [Living mammal species of 11 million years ago fossil is commonly selling in Market]. Interview report in website "Tin Tuc Quang Binh" 14 September 2011. (In Vietnamese).
111. V TI N TH NH AND RAWSON, B. M. 2011. Package for calculating gibbon population density from auditory surveys. Ph n m m tính m t V n t s li u i u tra qua ti ng hót. Conservation International / Fauna & Flora International, Hanoi, Vietnam.
112. VU VAN DUNG, PHAM MONG GIAO, NGUYEN NGOC CHINH, DO TUOC, & ARCTANDER, P. 1993. A new species of living bovid from Vietnam. *Nature* 363:443-444.
113. WALSTON, J. & VERON, G. 2001. Questionable status of the óTaynguyen Civetö, *Viverra zibethoides* Sokolov, Taznov and Pham Trong Anh, 1997 (Mammalia: Carnivora: Viverridae). *Mamm.Biol.*, 66, 181-184.
114. WILSON, D. E. & REEDER, D. M. (eds.) 2005. *Mammal species of the world: a taxonomic and geographic reference*. 3rd edition, Vol. 1 & 2, Baltimore: Johns Hopkins University Press. 2141 pp.
115. ZIEGLER, T. & VU NGOC THANH 2009. Ten years of herprtodiversity research in Phong Nha-Ke Bang National Park, Central Vietnam. In " Phong Nha ó Ke Bang NP & Cologne Zoo: 10 years of cooperation (1999-2009)". Dong Hoi City, 103-124.

THE TRAINING FOR PARK STAFF AND

Introduction

Phong Nha Ke Bang is one of the most well-known National Parks of Vietnam. The park is one of the largest as well as most magnificent karst landscapes and with the highest biodiversity richness in Asia. However, the park is also one of the more newly established protected areas in the country and has many young and inexperienced staff. Some necessary skills such as field craft, biodiversity survey and monitoring, species identification, field equipment use, survey design, and report preparation still need to be improved. Under The Nature Conservation and Sustainable Natural Resource Management in Phong Nha ó Ke Bang National Park Region Project, Quang Binh, a series of biodiversity surveys have been implement in PNKB. As a prelude to the surveys, short-classroom trainings were undertaken for selected PNKB staffs, especially those involved in the biodiversity surveys. Following the classroom training, field practice was integrated in the biodiversity surveys, which allowed trainees to join and learn necessary survey and field work skills.

Annex 1a. Training for Small Carnivore and Loris Surveys

In the case of the small carnivore and loris group, one day training was implemented in PNKB headquarter for 15 trainees, and two selected trainee (one ranger and one technical staff) attended a 30 day field practice.

Training objective

- To review and understand information and status of small carnivore and loris in Vietnam, especially species that occur in PNKB;
- To train rangers and technical staff on species identification techniques such as track and sign identification and other skills needed for field identification of the small carnivore and loris species;
- To introduce and train rangers and technical staff in survey methods, datasheets, equipment and questionnaires that will be used for the survey;

Training method

Classroom training

A one day training course was implemented for 15 trainees from Phong Nha Ke Bang National Park. The course provided some general information on small carnivores and loris, focusing on species that occur in PNKB that were targeted in the survey.

A great deal of time were spent introducing methods used for small carnivore and loris surveys, including the datasheets and information that will be collected during the survey. The trainees was also learned the use of some essential field equipment for small carnivore diurnal and nocturnal surveys.

Trainers also provided reading materials, such as books, field guides and other related reports on small carnivore and loris in Vietnam and Phong Nha Ke Bang.

urs to discuss the difficulty of the terrain and natural sary preparation for the survey.

Field practice

Two trainees were selected to participate in the field survey:

1. Tran The My - ranger of PNBK - 38 years old - undergraduate degree
2. Tran Mung - technical staff - 28 years old - undergraduate degree

During the survey, two trainees were supervised by the Team Leader and Assistant of the small carnivore and lorisø to implement diurnal and nocturnal transect survey, specimen and track identification techniques. The trainees were also requested to independently perform transect surveys and datasheet recording with close supervision by trainers.

Use of field equipment use and topographic, orienteering and data recording were one of the major field skills that the trainee studied, and they were requested to practice daily in the field.

Participant review

Both trainees had good attitudes toward the task that they were assigned and followed all necessary instruction as supervised by the team. This good attitude created a very cooperative environment during the survey and other team work.

Trainees have excellent health and fitness. This critical advantage has allowed the team to complete the survey successfully, getting to the remote survey areas and working in the difficult terrain of PNKB without difficulty.

The learning ability and responsibility of the trainees was also good. They both showed quite impressive performance abilities in species identification, information collection and transect design during the survey. Both trainees had good field work skill while working in the forest. Their scientific understanding of forest and animal ecology was satisfactory. Their understanding on conservation issue was still weak, and they often confused conservation with law enforcement. Mapping and GPS skills need to be improved. The trainees could not work independently in the forest without a local guide.

In summary, the trainee generally had a good attitude and took responsibility for the assigned tasks, and more importantly, had willingness to learn. The assessment is summarized in Table 1-1.

Table 1-1. Review of trainees

Name	Fitness	Responsibility	Motivation	Learning ability	Task compliment
Tran The My	Excellent	Excellent	Good	Good	Very good
Tran Mung	Excellent	Good	Good	Good	Good

Annex 1b. Training for Insectivore and Rodent Surveys

Training Park staff on methodology of Insectivore and Rodent surveys was conducted on 25 August 2011, just before the main field survey. Ten (10) staff of PNKB NP attended this training. The list of participants is shown in Table 1-2. Schedule of training is shown in Table 1-3. Training materials

ed "Methods of biodiversity survey on small mammals
ed to each participant prior to the beginning of the training
ing room in PNKB NP headquarter. Training materials were
presented in the form of power presentations. The following training topics were delivered to trainees
by Assoc. Prof. Dr. Nguyen Xuan Dang:

1. Why should study Insectivore and Rodent Biodiversity?
2. Overview of Rodent fauna in Vietnam (taxonomy, general features of morphology and ecology)
3. Overview of Insectivore fauna in Vietnam (taxonomy, general features of morphology and ecology)
4. Identification guidance and brief ecology of key rodent and Insectivore species
5. Trapping methods: Trap use, trap arrangement, handling and treatment of specimens, making animal description notes and taking baseline measurements, taking DNA samples, specimen preparation, recording in datasheets, etc.)
6. Transect survey methods: transect making, tracking transects, direct animal observation, indirect observation of animal signs (tracks, droppings, vocalization, etc.), taking notes of habitat and animal observations, recording in datasheets.
7. Spotlight survey: tracking transect, direct animal observation, taking notes of habitat and animal observations, recording in datasheets.
8. Using field equipment: map, GPS, compass, binocular, digital camera
9. Method of data analysis: species diversity, encounter rates, trap success, mapping species records, etc.
10. Brief theory of threat assessment for conservation
11. Threat records and assessment methods (scoring for threat ranking)
12. Explanation of field survey workplan and responsibility assignments

**Table 1-2. List of participants of training course
"Methods of biodiversity survey on Insectivores and Rodents"**

No	Name	Division
1.	Dang Ngoc Kien	Centre for Science Research and Rescue, PNKB NP
2.	Nguyen Thanh Binh	Centre for Science Research and Rescue, PNKB NP
3.	Nguyen Tri Phuong	Centre for Science Research and Rescue, PNKB NP
4.	inh Hong Tran	Centre for Science Research and Rescue, PNKB NP
5.	Le Thuan Kien	Centre for Science Research and Rescue, PNKB NP
6.	Le Vinh Le	Centre for Science Research and Rescue, PNKB NP
7.	Pham Kim Vuong	Centre for Science Research and Rescue, PNKB NP
8.	Nguyen Van Dai	Centre for Science Research and Rescue, PNKB NP
9.	Tran Mung	Centre for Science Research and Rescue, PNKB NP
10.	Nguyen Thanh Huyen	Forest Protection Devison, PNKB NP

**Table 1-3. Schedule of training
"Methods of biodiversity survey on Insectivores and Rodents"**

Time	Activities
8:00	- Opening speech by Mr. Dinh Huy Tri ó Director of Centre for Science Research and Rescue, PNKB NP
8:05 -9:00	- Why should we study Insectivore and Rodent Biodiversity? - Overview of Rodent fauna in Vietnam (taxonomy, general features of morphology and ecology) - Overview of Insectivore fauna in Vietnam (taxonomy, general features of morphology and ecology)
9:00 - 9:30	- Identification features and brief ecology of key rodent and Insectivore species

		Transect survey methods: Trap use, trap arrangement, handle and treatment of specimens, making animal description notes and taking baseline measurements, taking DNA samples, specimen preparation, recording in datasheets, etc.)
11:00 ó 12:00	-	Using field equipment: map, GPS, compass, binocular, digital camera
12:00 -13:30		Lunch
13:30-14:30	-	Identification guidance and brief ecology of key Rodent and Insectivore species (slide show)
14:30 -15:00	-	Transect survey methods: transect making, tracking transect, direct animals observation, indirect observation of animal signs (tracks, droppings, vocalization, etc.), taking notes of habitat and animal observations, recording in datasheets. - Spotlight survey: tracking transect, direct animals observation, taking notes of habitat and animal observations, recording in datasheets.
15:00-15:20		Coffee break
15:20 ó 16:00	-	Method of data analysis: species diversity, encounter rates, trap success, mapping species records etc.
16:00-16:30	-	Brief theory of threat assessment ó based conservation - Threat records and assessment methods (scoring for threat ranking)
16:30-17:00	-	Explanation of field survey workplan and responsibility assignments - Questions & Answers

Evaluation: All trainees were highly interested in the training materials. Preparation of the training room and teaching facility was good. One day was too short for trainees to obtain relevant survey skill, however, it helped them to get some general knowledge about Insectivore and rodent fauna, the importance of their study and conservation and some acquaintance with survey methodology.

After training, Mr. Nguyen Thanh Binh from the Centre for Science Research and Rescue and Mr. Nguyen Thanh Huyen from Forest Protection Division joined the main survey for further training in the field. During the survey, they showed high responsibility and were actively involved in survey activities. Mr. Binh was a careful and skillful person. He learned survey techniques fast and could independently carry out some activities such as finding the best place to set traps, properly handling captured animals and helping in specimen preparation. During transect survey he learned how to search for animals and collect necessary information/data. As ranger, Mr. Huyen show more interest and better skill in detection and recording signs of threat.

Recommendation: The trainees need more training to conduct any survey and monitoring activities. Taxonomic identification of rodents and insectivores is very difficult for trainees. They need much more training, good identification manuals and more field practice in the future.

Annex 1c. Training for Gibbon Surveys and Monitoring

In accordance with the project requirements a one day training course was conducted with the following contents:

1. Introductory information on the Gibbon
2. Basic map and compass skills
3. Geographical Position System (GPS) receiver unit use
4. Survey planning (logistical considerations, timing, duration, etc.)
5. Gibbon survey methods - i) preliminary interviews; ii) field survey techniques (listening and observation methods)

... of campsites, reducing environmental impact, together with health and safety guidelines were also provided during the field portion of the course.

In general, except some person who were graduated from university and have participated the last gibbon survey before others course the trainee knowledge regarding conservation, biology, biodiversity and monitoring surveys; natural history about the gibbon was very limited. Understanding of even the basic elements relevant to biological surveying and monitoring, such as use of field equipment, navigation, survey planning, etc., was particularly limited.

After the training course the trainees had an improved understanding of: monitoring and survey method, the importance of gibbon conservation and the necessity of monitoring for conservation and management. By the end of the course, trainees had knowledge of, and were able to apply, gibbon survey techniques such as: preliminary interviews, listening and observation methods, recording data and plan surveys (including logistical considerations, timing, duration, etc.). Additionally, trainees also improved their general field skills (including camping skills, equipment care, and behaviours of field surveyors, health and safety in the field).

Furthermore for the traineesøinstruction in note taking; report writing and field interview techniques were also given. Significantly, the trainees also gained experiences in organizing fieldtrips for research purposes. After the course the trainees had improved knowledge of how to organize field trips and to select appropriate materials and equipment. Table 1-4 provides a summary evaluation of each trainee.

Table 1-4 List of trainees for gibbon survey and evaluation

No	Name	Position	Evaluation
11.	Tran Ngoc Anh	Centre for Science Research and Rescue, PNKB NP	Good
12.	Nguyen Thanh Binh	Centre for Science Research and Rescue, PNKB NP	Good
13.	Nguyen Viet Doai	Centre for Science Research and Rescue, PNKB NP	Good
14.	Dang Ngoc Kien	Centre for Science Research and Rescue, PNKB NP	Excellent
15.	Le Thuan Kien	Centre for Science Research and Rescue, PNKB NP	Good
16.	Le Vinh Le	Centre for Science Research and Rescue, PNKB NP	Excellent
17.	Tran Mung	Centre for Science Research and Rescue, PNKB NP	Excellent
18.	Nguyen Tri Phuong	Centre for Science Research and Rescue, PNKB NP	Excellent
19.	Pham Van Sau	Forest Protection Devision, PNKB NP	Good
20.	Pham Kim Vuong	Centre for Science Research and Rescue, PNKB NP	Good

Annex 1d. Recommendations for future training

More training is recommended for all staff of PNKB. Not only academic theory but also practical training are needed and "on the job training" would be the best way to achieve these goals. Necessary skills such as working with local people, interview surveys, use of field



PDF Complete

*Your complimentary use period has ended.
Thank you for using PDF Complete.*

[Click Here to upgrade to Unlimited Pages and Expanded Features](#)

be some very urgent skills that should be improved. The biodiversity survey, data analysis, and reporting. If the will certainly improve the performance of the PNKBø staff as well as conservation results in the area.

D SCHEDULE OF MAMMAL SURVEYS

Annex 2a. Survey area and schedule for small carnivores and loris and location of main camps

Location	Coordinates (UTM)	Survey period
<i>Hoa Son commune</i>		<i>10 days</i>
Camp 1 - HS	0591468/1956467	10 to 14 th August 2011
Camp 2 - HS	0591519/1956371	15 to 19 August 2011
<i>Thuong Hoa commune</i>		<i>10 days</i>
Camp 1 - TH	0605055/1949026	25 to 29 August 2011
Camp 2 - TH	0603887/1951160	20 august to 2 nd September 2011
<i>Xuan Trach commune</i>		<i>10 days</i>
Camp 1 - XT	0612925/1949640	10 to 14 September 2011
Camp 2 - XT	0612776/1948413	15 to 19 September 2011

Annex 2b. Location of insectivore and rodent survey sites

Name of Camp	Survey site	UTM, WGS 84		Altitude (m)
		X	Y	
Ma Rinh Camp	Ma Rinh (Hoa Son Com.)	0591326	1958490	650
Hang En Camp	Hang En (Thuong Hoa Com.)	0605048	1949015	270
Hung Dang Camp	Hung Dang (Thuong Trach Com.)	0614259	1951077	340

fort of insectivore and rodent survey

Survey Site	Coordinates (UTM/WGS84)	Altitude (m)	Habitat	Number of traps	Number of night	Trap effort (trap.night)	No. of species & specimens trapped
Ma Rinh							
Trapline 1	0592167; 1957985	530	Primary evergreen forest	60	5	300	<i>Insectivores: 2 species, 2 specimens</i> <i>Rodents: 14 species, 23 specimens</i>
Trapline 2	0590372; 1958778	620	Lowland forest & Karst forest	40	5	200	
Trapline 3	0591708; 1958695	512	Primary evergreen forest	50	5	250	
Trapline 4	0591107; 1956825	1200	Primary karst forest	50	4	200	
Total 1				200		950	16 species, 26 specimens
Hang En							
Trapline 1	0605206; 1958798	270	Primary evergreen forest with selected timber removal	65	5	325	<i>Insectivores: 1 species, 1 specimens</i> <i>Rodents: 13 species, 33 specimens</i>
Trapline 2	0606034; 1947586	310	Primary evergreen forest with selected timber removal	65	5	325	
Trapline 3	0604238; 1948129	410	Primary evergreen forest	70	5	350	
Total 2				200		1,000	14 species, 35 specimens
Hung Dang							
Trapline 1	0613343; 1959885	380	Secondary evergreen forest	50	5	250	<i>Insectivores: 1 species, 1 specimens</i> <i>Rodents: 10 species, 26 specimens</i>
Trapline 2	0614345; 1950718	350	Secondary evergreen forest mixed with bamboos	46	5	230	
Trapline 3	0614638; 1950217	510	Primary evergreen forest & karst forest	54	5	270	
Trapline 4	0613541; 1949856	518	Primary evergreen forest & karst forest	50	4	200	
Total 3				200		950	11 species, 27 specimens
Grand total						3,900	24 species, 88 specimens

Note: **Ma Rinh** area in Hoa Son Commune (NP extension part), **Hang En** area in Thuong Hoa Commune (NP extension part), **Hung Dang** are in Thuong Trach Commune (NP core zone)

survey and effort of transect survey

Transect name	(UTM/WGS 84)		Length (km)	Habitat	Transect length covered (km)	
	Starting point	Ending point			By daytime survey	By night time survey
Ma Rinh						
MR 1	0590988 1958273	0590166 1956477	3.4	Primary karst forest	3.4 x 2 times = 6.8	
MR 2	0591207 1958586	0589526 1958398	3.2	Primary karst forest	3.2 x 2 times = 6.4	
MR 3	0591469 1958720	0590173 1959463	4.3	Valley tall forest	4.3 x 2 times = 8.6	2.7 x 4 times = 10.8
MR 4	0591635 1958460	0593180 1958189	3.8	Valley tall forest	3.8 x 2 times = 7.6	2.5 x 4 times = 10.0
				Total:	29.4	20.8
Hang En						
HE 1	0606828 1946740	0603904 1950499	3.7	Valley tall forest with selected timber cutting, agricultural field	3.7 x 4 times = 14.8	2.3 x 4 times = 9.2
HE 2	0605240 1948306	0603479 1947295	3.1	Valley tall forest with selected timber cutting and karst forest	3.1 x 2 time = 6.2	
HE 3	0605658 1948411	0607124 1946424	3.6	Valley tall forest and karst forest	3.6 x 2 time = 7.2	2.5 x 4 times = 10.0
				Total:	28.2	19.2
Hung Dang						
HD 1	0614209 1950483	0613228 1949961	3.3	Valley tall forest & Karst forest	3.3 x 4 times = 13.2	2.7 x 2 times = 5.4
HD 2	0613924 1950701	0612163 195052	3.8	Valley tall forest & Karst forest	3.8 x 2 times = 7.6	2.4 x 2 times = 4.8
HD 3	0614209 1950483	0615304 1950737	4.4	Secondary tall forest mixed with bamboos	4.4 x 2 times = 8.8	
				Total:	29.6	10.2
				Grand total:	87.2	50.2

rodent surveys

	Activities
25 Aug 2011	<ul style="list-style-type: none"> • Training staff members of PNKB NP on techniques of Insectivore and Rodent survey
26 Aug, 2011	<ul style="list-style-type: none"> • Logistic preparation for field work • Travel to Dang Hoa village (Hoa Son Commune) and hiring local labor assistants
27 Aug, 2011	<ul style="list-style-type: none"> • Travel from Dang Hoa village to Survey site I (Ma RinH area)
28 Aug to 2 Sept 2011	É Fieldwork in Ma RinH area
2 Sept, 2011	<ul style="list-style-type: none"> • (Afternoon) Travel from Ma RinH area to Son Trach Commune
3 Sept, 2011	É Specimen care and logistical preparation
4 Sept, 2011	<ul style="list-style-type: none"> • Travel from Son Trach Commune to Ban On Village (Thuong Hoa Commune) and hiring local labor assistants
5 Sept, 2011	<ul style="list-style-type: none"> • Travel from Ban On village to Survey site 2 (Hang En area)
6 ó 11 Sept.	É Field work at Hang En area
11 Sept, 2011	<ul style="list-style-type: none"> • Travel from Hang En area to Son Trach Commune
12 Sept, 2011	É Specimen care and logistical preparation
13 Sept, 2011	<ul style="list-style-type: none"> • Travel from Son Trach Commune to Thon 4 Village (Thuong Trach Commune) and hiring local labor assistants
14 Sept, 2011	<ul style="list-style-type: none"> • Travel from Thon 4 to Survey site 3 (Hung Dang area)
15 ó 20 Sept.	<ul style="list-style-type: none"> • Field works at Hung Dang area
20 Sept, 2011	<ul style="list-style-type: none"> • Travel from Hung Dang area to Son Trach Commune
21 Sept, 2011	<ul style="list-style-type: none"> • Specimen care & Preparation of preliminary survey report
22 Sept, 2011	<ul style="list-style-type: none"> • Reporting PNKB NP managers on preliminary survey results • Travel from Son Trach commune to Dong Hoi City
23 Sept.	<ul style="list-style-type: none"> • Reporting to PMU of PNKB Project on preliminary survey results • Dr. Dang and Mr. Nghia traveled to Hanoi

Survey in Ma Rin, Hoa Son commune

CC	Date set	Location	Coordinates	Elevation	Bearing/ height	Habitat	Terrain	Evidence of mammal	Evidence of human	Set by	Date collected	Days of trapping	Images captured	Battery condition	Camera status when collect	Collected by
M1	6/13/2012	Ma Rin	0591285 1958357	618	180/60cm	Primary forest , earth hill and stream	Flat narrow alley with year round stream	Track of civet and macaque	Track of selecting logging for more than 5 years	Nguyen Ng c Tuan	7/12/ 2012	30	30	Good	Intact	Ph m Minh Hùng
M2	6/13/2012	Ma Rin	0591584 1958249	608	310/50cm	Primary forest , next to limestone	Narrow and flat valley, earth hill	Likely leopard track	Track of selecting logging for more than 5 years	Nguyen Ng c Tuan	7/12/ 2012	30	12	Good	Intact	Ph m Minh Hùng
M3	6/13/2012	Ma Rin	0591803 1958095	632	315/50cm	Primary forest	Narrow and flat valley, earth hill	Track of animal path	No evidence of human impact	Nguyen Ng c Tuan	7/12/ 2012	30	LC D dea d	Battery dead with water	Intact, water got in the case	Ph m Minh Hùng
M4	6/13/2012	Ma Rin	0592072 1958001	623	40/60cm	Primary forest	Narrow and flat valley, earth hill	No track or sign	No evidence of human impact	Nguyen Ng c Tuan	7/12/ 2012	30	LC D dea d	Battery dead	Intact, battery was shaken	Ph m Minh Hùng
M5	6/13/2012	Ma Rin	0591727 1958388	637	310/60cm	Primary forest	Ridge between two mountains	No track or sign	Selected log and old trap	Nguyen Ng c Tuan	7/12/ 2012	30	12	Good	Intact	Ph m Minh Hùng

M6	6/13/ 2012	Ma Rin	0591406 1958500	630	330/60cm	Secondary forest after logging	Narrow and flat valley, earth hill	No track or sign	Selected log and old trap	Nguyen Ng c Tuan	7/10/ 2012	28	168	Good	Intact	inh Hoàng Tu n
M7	6/13/ 2012	Ma Rin	0484969 1958844	622	155/60cm	Primary forest and wood land	Narrow and flat valley, earth hill	No track or sign	Some light impact from human	Nguyen Ng c Tuan	7/11/ 2012	29	30	Good	Intact	inh Hoàng Tu n
M8	6/13/ 2012	Ma Rin	0484762 1958996	682	350/60cm	Primary forest and wood land	Narrow and flat valley, earth hill	No track or sign	No evidence of human impact	Nguyen Ng c Tuan	7/11/ 2012	29	30	Good	Intact	inh Hoàng Tu n
M9	6/13/ 2012	Ma Rin	0484425 1959046	661	170/60cm	Primary forest and wood land	Narrow and flat valley, earth hill	No track or sign	Some light impact from human	Nguyen Ng c Tuan	7/11/ 2012	29	LC D dea d	Battery dead	Intact	inh Hoàng Tu n
M10	6/13/ 2012	Ma Rin	0484244 1959104	647	180/60cm	Primary forest and wood land	Fairly flat area	No track or sign	No evidence of human impact	Nguyen Ng c Tuan	7/11/ 2012	29	76	Good	Intact, on/off button doesnot work	inh Hoàng Tu n
M11	6/14/ 2012	Ma Rin	0589996 1958850	620	215/60cm	Primary forest and wood land	Narrow and flat valley, earth hill	Animal path to water	No evidence of human impact	Nguyen Ng c Tuan	7/11/ 2012	29	LC D dea d	Battery dead	Intact	inh Hoàng Tu n
M12	6/14/ 2012	Ma Rin	0589816 1958983	617	180/60cm	Primary forest and wood land	Narrow and flat valley, earth hill	Animal path to water	No evidence of human impact	Nguyen Ng c Tuan	7/11/ 2012	29	24	Good	Intact	inh Hoàng Tu n

M13	6/14/ 2012	Ma Rin	0589551 1959173	634	0/60cm	Primary forest and wood land	Narrow and flat valley, earth hill	No track or sign	No evidence of human impact	Nguyen Ng c Tuan	7/12/ 2012	30	72	Good	Intact	inh Hoàng Tu n
M14	6/14/ 2012	Ma Rin	0589440 1959333	578	220/60cm	Primary forest and wood land	Flat area, in narrow mountain with stream	Animal path to water	Old trap line (2-3 years)	Nguyen Ng c Tuan	7/12/ 2012	30	Lost	Lost	Lost and destroyed by human	inh Hoàng Tu n
M15	6/14/ 2012	Ma Rin	0589561 1959308	598	0/60cm	Primary forest and wood land	Flat area, in narrow mountain with stream	No track or sign	No evidence of human impact	Nguyen Ng c Tuan	7/12/ 2012	30	LC D dea d	Battery dead	Intact	inh Hoàng Tu n
M16	6/14/ 2012	Ma Rin	0589653 1959434	635	170/60cm	Primary forest and woodland	ridge on earth hill	No track or sign	Old logging sign (5-7 years)	Nguyen Ng c Tuan	7/12/ 2012	30	Lost	Lost	Lost and destroyed by human	inh Hoàng Tu n
M17	6/14/ 2012	Ma Rin	0589800 1959144	630	40/50 cm	Primary forest and woodland	Narrow valley	No track or sign	No evidence of human impact	Nguyen Ng c Tuan	7/12/ 2012	30	56	Low battery	Intact	inh Hoàng Tu n
M18	6/14/ 2012	Ma Rin	0590002 1959134	657	340/60cm	Primary forest and woodland	Ridge between two mountains, and slope side	Animal path	No evidence of human impact	Nguyen Ng c Tuan Do Tuoc	7/12/ 2012	30	LC D dea d	Battery dead	Intact	inh Hoàng Tu n
M19	6/13/ 2012	Lu ng, Hóa S n	0591503 1958257	681	120/60cm	Primary forest and woodland	Ridge two mountains	No track or sign	New logging tracks	Do Tuoc	7/11/ 2012	29	42	Good	Intact	Ph m Minh Hùng

M20	6/14/ 2012	Hang lu ng, Hóa S n	0591268 1958707	681	160/50cm	Primary forest	Old snare trap line on earth hill, stream in both side.	Animal path	New logging tracks	Do Tuoc	7/10/ 2012	28	LC D dea d	Battery dead	Intact	Ph m Minh Hùng
M21	6/14/ 2012	Đông núi hang lu ng, Hóa S n	0591021 1958928	670	40/60 cm	Primary forest on earth hill	Slope side on earth hill, stream in both side	Animal path	No evidence of human impact	Do Tuoc	7/11/ 2012	29	54	Good	Intact	Ph m Minh Hùng
M22	6/14/ 2012	Đông núi hang lu ng, Hóa S n	0590878 1959086	718	180/60cm	Primary forest on earth hill	Slope side on earth hill	No track or sign	New logging tracks	Do Tuoc	7/11/ 2012	18	54	Good	Intact	Ph m Minh Hùng
M23	6/14/ 2012	Hang luông, Hóa S n	0590828 1959721	740	40/40cm	Primary forest	Low mountain with stream	No track or sign	Old logging tracks	Do Tuoc	7/11/ 2012	29	LC D dea d	Battery dead	Intact	Ph m Minh Hùng
M24	6/14/ 2012	Đông núi hang lu ng, Hóa S n	0590191 1959269	748	310/50cm	Primary forest	Low mountain with stream	No track or sign	New logging tracks	Do Tuoc	7/11/ 2012	29	LC D dea d	Good	Intact, battery was shaken.	Ph m Minh Hùng
M25	6/14/ 2012	u Khe c p cãng, Hóa s n	0590569 1959038	731	5 /60cm	Primary forest	Slope side on the mountain to water.	No track or sign	New logging tracks	Do Tuoc	7/11/ 2012	29	36	Good	Intact	Ph m Minh Hùng

M26	6/14/ 2012	Hóa s n minh hóa	0590670 1958850	696	160/50cm	Primary forest	ridge, fairly flat area	No track or sign	New logging tracks	Do Tuoc	7/11/ 2012	29	18	Good	Intact	Ph m Minh Hùng
M27	6/14/ 2012	Đông núi hang lu ng, Hóa S n	0591446 1958276	680	45/40cm	Primary forest	Ridge between two streams	No track or sign	New logging tracks and old trap line	Do Tuoc	7/11/ 2012	29	LC D dea d	Battery dead	Intact	Ph m Minh Hùng
	6/14/ 2012	Ranh gi i VQG và Ma rinh m i	0591925 1958461	651	180/60cm	Primary forest	Fairly flat area , with stream	No track or sign	Old logging track and evidence of rattan collection	Do Tuoc	7/10/ 2012	28	36	Good	Intact	Ph m Minh Hùng
M29	6/14/ 2012	Ma Rinh	0590240 1958994	651	40/60 cm	Primary forest on earth hill	Fairly flat area in narrow valley	No track or sign	No evidence of human impact	Do Tuoc	7/12/ 2012	30	LC D dea d	Battery dead	Intact	Ph m Minh Hùng
M30	6/14/ 2012	Ma Rinh	0590490 1958864	665	50/50cm	Primary forest on earth hill	Fairly flat area	No track or sign	No evidence of human impact	Do Tuoc	7/12/ 2012	30	LC D dea d	Battery dead	Intact	inh Hoàng Tu n

Notes:

CC = Camera code number

date of setting

Location = name of setting area

Bearing = compass bearing/and height of camera above ground

Evidence of mammal = track or evidence of mammal in the area

Evidence of human = track or evidence of human impact

Camera status = status of camera when collected (intact, affected by human or animal, destroyed, lost)

Annex 2g. Detail information on camera trap survey in Da Lat, Thuong Hoa commune

CC	Date set	Location	Coordinates	Elevation	Bearing/ height	Habitat	Terrain	Evidence of mammal	Evidence of human	Set by	Date collected	Days of trapping	Images captured	Battery status	Camera status	Collected by
M 1	18/7/2012	Thung Bà Ròng	0597965; 1950163	538 m	40/40cm	Evergreen forest on earth hill	Flat valley	track of wild boar	light impact from human	Le Vang Dung	8/10/2012	22	78	Battery dead	Intact	Tr n Th M , Nguy n tri Ph ng
M 2	18/7/2012	Thung Bà Ròng	0598052; 1950109	554 m	230/30cm	Evergreen forest on earth hill	Flat valley	track of wild boar	light impact from human	Le Vang Dung	8/10/2012	22	13	Battery dead	Intact	My & Phuong
M 3	19/7/2012	Thung Bìm bìm	0597427; 1953062	332m	05/40cm	Evergreen forest on earth hill	Flat valley	Unidentified mammal track	Often be impacted by human	Le Vang Dung	8/11/2012	22	18	Battery dead	Intact	My & Phuong
M 4	18/7/2012	Thung a ch t	0597767; 1950342	524m	290/30cm	Evergreen forest on earth hill	Slope of earth hill	track of wild boar	old snare trap lines	Le Vang Dung	8/10/2012	22	454	Battery dead	Intact	My & Phuong
M 5	19/7/2012	Thung Bìm bìm	0597033; 1952714	338m	160/30cm	Evergreen forest on earth hill	Close to limestone mountain	Unidentified mammal track	Often be impacted by human	Le Vang Dung					Lost	My & Phuong
M 6	19/7/2012	Thung à l t 2	0597219; 1952527	417m	190/40cm	Evergreen forest on earth hill	Close to limestone mountain	Unidentified mammal track	light impact from human	Le Vang Dung	8/11/2012	22	228	Battery dead	Intact	My & Phuong

M 7	19/7/ 2012	Thung à l t 2	0597162; 1952318	436m	230/80cm	Evergreen forest on earth hill	Slope of earth hill	Unidentified mammal track	Often be impacted by human	Le Vang Dung	8/11/2012	22	146	Good	Intact	My & Phuong
M 8	18/7/ 2012	Thung a ch t	0596909; 195072?	515m	330/60cm	Primary forest	Next to dry stream	track of wild boar	light impact from human	Nguyen Ngoc Tuan	8/10/2012	22	68	Good	Intact	My & Phuong
M 9	18/7/ 2012	Thung à l t 3	0597036; 1950450	498m	180/50cm	Primary forest	Next to dry stream	track of wild boar	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	22	42	Battery dead	Intact	My & Phuong
M 10	18/7/ 2012	Thung a ch t	0596710; 1950670	531m	165/50cm	Primary forest	Close to limestone mountain	track of wild boar	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	22	24	Battery dead	Intact	My & Phuong
M 11	18/7/ 2012	Thung a ch t	0597044; 1950892	554m	270/20cm	Evergreen forest on earth hill	Slope of earth hill	Track of small carnivore	light impact from human	Nguyen Ngoc Tuan	8/10/2012	22	114	Good	Intact	My & Phuong
M 12	18/7/ 2012	Thung a ch t	0597724; 1950088	525m	160/50cm	Evergreen forest on earth hill	Next to dry stream	track of wild boar	old snare trap lines	Nguyen Ngoc Tuan	8/10/2012	22	12	Good	Intact	My & Phuong
M 13	18/7/ 2012	Thung à l t 3	0597017; 1950094	530m	530/50cm	Primary forest	Next to dry stream	track of wild boar and ungulate	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	22	24	Battery dead	Intact	My & Phuong
M 16	18/7/ 2012	Thung à l t 3	0596939; 1950369	?	172/?	Primary forest	Next to dry stream	track of wild boar and likely pangolin track	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	22	24	Battery dead	Intact	My & Phuong
M 17	18/7/ 2012	Thung à l t 3	0596805; 1950512	557m	183/50cm	Primary forest	Old snare trap line	track of wild boar and civet	no evidence of human impact	Nguyen Ngoc Tuan	10/8/2012	22	12	Battery dead	Intact	My & Phuong
M 18	18/7/ 1012	à l t 2	0596885; 1951406	501m	0/40cm	Primary forest	Ridge	track of wild boar and civet	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	22	24	Battery dead	Intact	My & Phuong

M 19	18// 2012	à l t 2	0596932; 1951548	483m	150/50cm	Primary forest	Close to limestone mountain	Track of civet	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	22	90	Good	Intact	My & Phuong
M 20	18/7/ 2012	Thung a ch t	0597696; 1950310	511m	280/30cm	Evergreen forest on earth hill	Slope of earth hill	track of wild boar	old snare trap lines	Nguyen Ngoc Tuan	8/10/2012	22	18	Good	Intact	My & Phuong
M 21	18/7/ 2012	thung Bà Roòng	0598034; 1949959	585m	110/40cm	Evergreen forest on earth hill	Slope of earth hill	track of wild boar	old snare trap lines	Nguyen Ngoc Tuan	8/10/2012	22	60	Good	Intact	My & Phuong
M 22	18/7/ 2012	thung Bà Roòng	0597966; 1950252	537m	130/50cm	Evergreen forest on earth hill	Slope of earth hill	Unidentified mammal track	light impact from human	Nguyen Ngoc Tuan	8/10/2012	22	18	Battery dead	Intact	My & Phuong
M 23	18/7/ 2012	thung Bà Roòng	0598127; 1950146	553m	280/50cm	Evergreen forest on earth hill	Next to dry stream	track of wild boar	light impact from human	Le Van Dung	8/10/2012	22	20	Battery dead	Intact	My & Phuong
M 24	19/7/ 2012	à l t 2	0597285; 1952144	419m	200/30cm	Evergreen forest on earth hill	Slope of earth hill	Unidentified mammal track	Agarwood collection track	Le Van Dung	8/10/2012	21	12	Battery dead	Intact	My & Phuong
M 25	19/7/ 2012	Hung á Cát	0596919; 1952074	477m	40/60cm	Primary forest	Next to dry stream	track of wild boar and civet	no evidence of human impact	Le Van Dung	8/10/2012	21		Battery dead	Intact	My & Phuong
M 26	19/7/ 2012	Hung á Cát	0596675; 1951800	500m	15/60cm	Primary forest	Close to limestone mountain	track of wild ungulate	no evidence of human impact	Le Van Dung	8/10/2012	21	18	Battery dead	Intact	My & Phuong
M 28	19/7/ 2012	Hung á Cát	0596611; 1952007	505m	162/50cm	Primary forest	Close to limestone mountain	Track of mammal	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	21	78	Good	Intact	My & Phuong
M 29	19/7/ 2012	Hung á Cát	0596948; 1951819	482m	320/50cm	Primary forest	Close to limestone mountain	track of wild boar and civet	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	21	12	Good	Intact	My & Phuong



Your complimentary
use period has ended.
Thank you for using
PDF Complete.

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

M 30	19/72 012	Hung á Cát	0596620; 1951503	487m	135/60cm	Primary forest	Old snare trap line	track of wild ungulate	no evidence of human impact	Nguyen Ngoc Tuan	8/10/2012	21	54	Good	Intact	My & Phuong
---------	--------------	---------------	---------------------	------	----------	-------------------	------------------------	------------------------------	--------------------------------------	------------------------	-----------	----	----	------	--------	----------------

Survey in Ca Con-Hung Tri, Xuan Trach commune

CC	Date set	Location	Coordinates	Elevation	Bearing/ height	Habitat	Terrain	Evidence of mammal track	Evidence of human impact	Set by	Date collected	Days of trapping	Images captured	Battery condition	Camera status when collect	Collected by
M2	19/8/2012	Cá Cản	0622877; 1947913	409	150/ 70cm	Evergreen forest on earth mixed limestone hill	Slope side	unidentified mammal track	Light impact from human	Le V. Dung	9/17/2012	28	24	Battery dead	Intact	Nguyen N. Tuan
M3	19/8/2012	Cá Cản	0623063 ;1947837	404	10/ 70cm	Evergreen forest on earth mixed limestone hill	ridge	unidentified mammal track	Old camp and trail	Le V. Dung	9/16/2012	27	38	Good	Intact	Nguyen N. Tuan
M5	20/8/2012	Cá Cản	0624021 ;1948247	339	20/ 50cm	Evergreen forest on earth mixed limestone hill	next to limestone mountain	unidentified mammal track	Old trap line	Le V. Dung	9/15/2012	26	12	Battery dead	Intact	Nguyen N. Tuan
M6	19/8/2012	Cá Cản	0623095; 1947546	418	340/ 60cm	Evergreen forest on earth mixed limestone hill	slope side	unidentified mammal track	Old camp and trail	Le V. Dung	9/16/2012	27	34	Low battery	Intact	Nguyen N. Tuan
M8	19/8/2012	Cá Cản	0623611; 1946986	452	60/ 80cm	Evergreen forest on limestone hill	ridge between two valley	unidentified mammal track	Old camp and trail	Le V. Dung	9/16/2012	27	60	Battery dead	Intact	Nguyen N. Tuan

M9	19/8/2012	Cá Càn	0623486; 1947144	392	300/ 50cm	Evergreen forest on earth mixed limestone hill	slope side	Wild boar track	Old camp and trail	Le V. Dung	9/16/2012	27	18	Battery dead	Intact	Nguyen N. Tuan
M10	19/8/2012	Cá Càn	0623329; 1947645	369	0/ 90cm	Evergreen forest on earth mixed limestone hill	Ridge	unidentified mammal track	Old snare trap line	Le V. Dung	9/16/2012	27	48	Good	Intact	Nguyen N. Tuan
M11	19/8/2012	Cá Càn	0623389; 1947353	385	40/ 60cm	Evergreen forest on earth mixed limestone hill	ridge	unidentified mammal track	Old snare trap line	Le V. Dung	9/16/2012	27	12	Battery dead	Intact	Nguyen N. Tuan
M12	19/8/2012	Cá Càn	0623567; 1947777	353	260/ 80cm	Evergreen forest on earth mixed limestone hill	slope side	unidentified mammal track	Old camp and trail	Le V. Dung	9/16/2012	27	48	Low battery	Intact	Nguyen N. Tuan
M14	19/8/2012	Cá Càn	0623745; 198005	357	190/ 40cm	Primary forest	Flat valley	unidentified mammal track	Old snare trap line	Nguyen N. Tuan	9/17/2012	28	4	Battery dead	Intact	Nguyen N. Tuan
M15	19/8/2012	Cá Càn	0624151; 1947440	348	300/ cm	Primary forest	Valley, next to stream	Track of civets and hog badger	Met two hunter with AK-47 and hunting dog	Nguyen N. Tuan	9/16/2012	27		Battery dead	Lock broken, Intact	Nguyen N. Tuan
M17	19/8/2012	Thung khe Ch c	0624513; 1946612	428	340/ 50cm	Primary forest	ridge	unidentified mammal track	No evidence of hunting and logging, but often has human occurrence	Nguyen N. Tuan	9/16/2012	27	32	Good	Intact	Nguyen N. Tuan

M18	19/8/ 2012	Cá Càn	0623916; 1947830	365	125/ 60cm	Primary forest	ridge	Track of civets	No evidence of hunting and logging, but often has human occurrence	Nguyen N. Tuan	9/16/2012	27	32	Good	Intact	Nguyen N. Tuan
M19	19/8/ 2012	Thung khe Ch c	0624661; 1946471	460	180/ 40cm	Primary forest	ridge	unidentified mammal track	Some paths in the area	Nguyen N. Tuan	9/16/2012	27	33 31	Battery dead	Intact	Nguyen N. Tuan
M20	19/8/ 2012	Cá Càn	0623914; 1948116	343	220/ 40cm	Primary forest	next to limestone mountain	Track of civets and hog badger	No evidence of hunting and logging, but often has human occurrence	Nguyen N. Tuan	9/16/2012	27	18	Battery dead	Intact	Nguyen N. Tuan
M22	19/8/ 2012	Cá Càn	0623835; 1947547	375	120/ 50cm	Woodland and primary forest	Small hill in the valley	Track of civets	Old logging track	Nguyen N. Tuan	9/16/2012	27	18	Battery dead	Intact	Nguyen N. Tuan
M23	19/8/ 2012	Thung khe Ch c	0624372; 1947212	370	120/ 50cm	Woodland and primary forest	Slope side	Track of civets	No evidence of hunting and logging, but often has human occurrence	Nguyen N. Tuan	9/16/2012	27	18	Battery dead	Intact	Nguyen N. Tuan
M26	19/8/ 2012	Thung khe Ch c	0624485; 1946921	318	60/ 60cm	Woodland and primary forest	Ridge	unidentified mammal track	Heard one hunting gun shoot	Nguyen N. Tuan	9/16/2012	27	18	Battery dead	Intact	Nguyen N. Tuan

Notes: As above.

Annex 21. Gibbon Listening Posts set up during the field survey

Listening Post (LP)		Co-ordinates (Use WGS 84 Map Datum)	Elevation (m)	Locality name	Note (Date of survey day)
LP No	LP name				
1.	LP 01	0614644 E 1950235 N	694	Hung Ngoai	24-25/8/2011
2.	LP 02	0612569 E 1948004 N	394	Hung Ha Ca Tot	26-27/8/2011
3.	LP 03	0611677 E 1945581 N	281	Hung Khe San	27-28/8/2011
4.	LP 04	0607622 E 1944658 N	629	Hung Nuoc Mat	28-29/8/2011
5.	LP 05	0605773 E 1947174 N	534	Hung Ha Gai	29-30/8/2011
6.	LP 06a	0605521 E 1951908 N	282	Ha Cong Vien	30-31/8/2011
7.	LP 07	0608462 E 1953483 N	454	Dinh Thang	1-2/9/2011
8.	LP 06b	0608462 E 1953083 N	554	Khe Nuoc Lan	31/8-2/9/2011
9.	LP 06	0615442 E 1944332 N	658	Khe Nac	22-23/9/2011
10.	LP 07a	0613384 E 1940135 N	623	Khe Cha Khe	24-25/9/2011
11.	LP 07b	0618885 E 1941198 N	680	Khe Vinh	25-26/9/2011
12.	LP 08	0619363 E 1945751 N	690	Khe Nhom	27-28/9/2011
13.	LP 09	0621637 E 1948422 N	429	Khe Cung	28-29/9/2011
14.	LP 10	0626234 E 1950187 N	420	Doc Khan	29-30/9/2011
15.	LP 11	0585310 E 1959309 N	820	Ruc Ma Rinh	26-27/9/2011

		1956553 E		Ma Xanh	21/22/9/2011
17.	LP 12a	0591778 E 1958081 N	810	Da Luong	22-23/9/2011
18.	LP 12b	0590991 E 1955435 N	832	Ma Rinh Moi	23-24/9/2011
19.	LP 13	0594902 E 1956653 N	550	Ma Xang	21 & 30/9/2011
20.	LP 14	0597343 E 1954092 N	360		25-26/9/2011
21.	LP 15	0598123 E 1951301 N	694	Da Lat 1	28-29/9/2011

ANNEX 4. LISTS OF NONVOLANT MAMMALS RECORDED IN THE PNKB REGION BEFORE 2010

Annex 4a. List of small carnivores recorded in Phong Nha-Ke Bang before 2010

No.	Scientific name	Common name	Related documents
	PRIMATE	Primate	
	Loridae	Loris	
1	<i>Nycticebus bengalensis</i>	Slow loris	(Nguyen Xuan Dang et al., 1998, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999)
2	<i>Nycticebus pygmaeus</i>	Pygmy loris	(Nguyen Xuan Dang et al., 1998, Pham Nhat and Nguyen Xuan Dang, 2000, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999)
	CARNIVORA	Carnivore	
	Mustelidae	Weasels and Martens	
3	<i>Martes flavigula</i>	Yellow-throated Marten	(Nguyen Xuan Dang et al., 1998, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009)
4	<i>Arctonyx collaris</i>	Hog-badger	(Nguyen Xuan Dang et al., 1998, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Le Khac Quyet et al., 2002)
	<i>Melogale personata</i>	Large-tooth ferret-badger	(Le Trong Dat et al., 2009, Le Khac Quyet et al., 2002)
5	<i>Melogale moschata</i>	Small-tooth Ferret-badger	(Nguyen Xuan Dang et al., 1998, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009, Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999)
6	<i>Lutra lutra</i>	Eurasian Otter	(Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000)

		Common name	Related documents
7	<i>Lutrogale perspicillata</i>	Smooth-coated Otter	(Nguyen Xuan Dang et al., 1998)
8	<i>Aonyx cinerea</i>	Oriental Small-clawed Otter	(Nguyen Xuan Dang et al., 1998, Kouznetsov et al., 1999)
	Viverridae	Civets	
9	<i>Viverra zibetha</i>	Large Indian Civet	(Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Le Xuan Canh et al., 1997)
10	<i>Viverra megaspila</i>	Large-spotted Civet	(Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999)
11	<i>Viverricula indica</i>	Small Indian Civet	(Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Le Trong Dat et al., 2009, Le Khac Quyet et al., 2002)
12	<i>Prionodon pardicolor</i>	Spotted Linsang	(Kouznetsov et al., 1999, Le Khac Quyet et al., 2002)
13	<i>Paradoxurus hermaphroditus</i>	Common Palm Civet	(Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009)
14	<i>Paguma larvata</i>	Masked Palm Civet	(Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000, Le Trong Dat et al., 2009)
15	<i>Arctictis binturong</i>	Binturong	(Le Xuan Canh et al., 1997, Nguyen Xuan Dang et al., 1998, Do Tuoc and Truong Van La, 1999, Kouznetsov et al., 1999, Timmins et al., 1999, Pham Nhat and Nguyen Xuan Dang, 2000)
16	<i>Arctogalidia trivirgata</i>	Small-toothed Palm Civet	(Nguyen Xuan Dang et al., 1998)
17	<i>Chrotogale owstoni</i>	Owston's Banded Civet	(Kouznetsov et al., 1999, Timmins et al., 1999)
	Herpestidae	Mongoose	
18	<i>Herpestes javanicus</i>	Small Asian Mongoose	(Le Xuan Canh et al., 1997, Do Tuoc and Truong Van La, 1999, Le Trong Dat et al., 2009)



Your complimentary
use period has ended.
Thank you for using
PDF Complete.

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

		Common name	Related documents
19	<i>Herpestes urva</i>	Crab-eating Mongoose	(Nguyen Xuan Dang et al., 1998)

Annex 4b. List of insectivores and rodents recorded before 2010

No.	Scientific name	Vietnamese name	Birdlife (1994)	WWF (1997)	WWF (1999)	FFI (1998)	FFI (1999)	VRTC (1999)
	ERINACEOMORPHA	Bộ Chuột voi						
	Erinaceidae	1. Họ Chuột voi						
1.	<i>Hylomys suillus</i>	Chu t voi i						x
	SORICOMORPHA	Bộ Chuột chù						
	Soricidae	1. Họ Chuột chù						
2.	<i>Crocidura sp.</i>	Chu t chù						x
3.	<i>Suncus murinus</i>	Chu t chù nhà			x			
	Talpidae	2. Họ Chuột chũi						
	RODENTIA	Bộ Gặm nhấm						
	Sciuridae	1. Họ Sóc						
4.	<i>Hylopetes alboniger</i>	Sóc bay en tr ng		x		x		
5.	<i>Petaurista philippensis</i>	Sóc bay trâu		x	x	x		x
6.	<i>Ratufa bicolor</i>	Sóc en	x		x	x	x	x
7.	<i>Callosciurus erythraeus hendei</i>	Sóc b ng chân en	x	x		x	x	x
	<i>C. e. flavimanus</i>	Sóc chân vàng		x	x	x		x
8.	<i>Callosciurus inornatus</i>	Sóc b ng xám			x	x	x	
9.	<i>Menetes berdmorei</i>	Sóc v n l ng				x		
10.	<i>Dremomys rufigenis</i>	Sóc mõm hung	x	x	x	x	x	x
11.	<i>Tamiops maritimus</i>	Sóc chu t h i nam	x				x	
12.	<i>Tamiops rodolphii</i>	Sóc chu t l a		x	x		x	
	Spalacidae	2. Họ Dúi						
13.	<i>Rhizomys pruinosus</i>	Dúi m c l n		x				x
14.	<i>Rhizomys sumatrensis</i>	Dúi má vàng						x
	Muridae	3. Họ Chuột						
15.	<i>Bandicota indica</i>	Chu t t l n		x	x			
16.	<i>Bandicota savilei</i>	Chu t t bé		x				
17.	<i>Berylmys bowersi</i>	Chu t m c l n						x
18.	<i>Leopoldamys sabanus</i>	Chu t núi uôi dài		x	x			x

	Latin name	Vietnamese name	Birdlife (1994)	WWF (1997)	WWF (1999)	FFI (1998)	FFI (1999)	VRTC (1999)
19.	<i>Maxomys moi</i>	Chu t xu-ri lông m m						x
20.	<i>Maxomys surifer</i>	Chu t xu-ri		x				x
21.	<i>Mus caroli</i>	Chu t nh t ng						x
22.	<i>Mus cervicolor</i>	Chu t nh t ho ng						x
23.	<i>Mus musculus</i>	Chu t nh t nhà		x	x			x
24.	<i>Mus pahari</i>	Chu t nh t n ng						
25.	<i>Niviventer fulvescens</i>	Chu t h u bé						x
26.	<i>Niviventer tenaster</i>	Chu t núi ông d ng						x
27.	<i>Rattus argentiventer</i>	Chu t b ng b c		x	x			
28.	<i>Rattus nitidus</i>	Chu t bóng						
29.	<i>Rattus rattus/ tenazumi</i>	Chu t nhà						x
30.	<i>Rattus remotus/andamanensis</i>	Chu t r ng		x	x			x
	Hystricidae	4. Họ Nhím						
31.	<i>Atherurus macrourus</i>	on			x	x	x	x
32.	<i>Hystrix brachyura</i>	Nhím uôi ng n		x	x	x		
	Total (species)		4	15	14	10	7	20

Note: Birdlife (1994) - Eames et al., 1994. WWF (1997) – Le Xuan Canh et al., 1997. WWF (1999) – Do Tuoc & Truong Van La, 1999. FFI (1998): Nguyen Xuan Dang et al., 1998. FFI (1999) – Timmins, R.J., et al., 1999. VRTC (1999) – VRTC-WWF, 1999.

FROM THESE SURVEYS (2011)

Annex 5a. Location of individual small carnivore and loris records

Transect	UTM Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
Th ng Húa- day time transect												
2 (On village)	0603532/1952081	0604128/1950380	NM Ha, D. Tuoc	cloudy and light wind	26-Aug	Golden Cat	9:10	1	foot print	0604107/1950382	shrub and active free grazing cattle	freshly foot print
						Javan Mongoose	9:00	1	killed animal	0604033/1950936		freshly killed
6	0603731/1950395	0604256/1949861	NM Ha, TT My	cloudy and light wind	26-Aug	civet	14:07	1	fecal	0603759/1950405	beneath a cliff of rock	3-4 day olds fecal
						Binturong	14:17	1	foot print	0603901/1950443	limestone hill	5 weeks old food print
9	0603604/1950319	0603201/1949965	D. Tuoc, T Mung	sunny and light wind	27-Aug	Hatinh Langur	9:14	4	observation	0603327/1950064	forest on limestone	close to a limestone cliff
16	0605464/1948655	0605963/1947829	NM Ha, TT My	sunny and light wind	28-Aug							
13	0603680/1950352	0605477/1948701	NM Ha và D. Tuoc	sunny and light wind	28-Aug	Common Palm Civet	9:24	1	foot print	0604598/1950470	valley	freshly foot print
15	0605437/1948657	0605117/1949423	D. Tuoc, T Mung	sunny and light wind	28-Aug							
20	lán ng	0605553/1947949	NM Ha và D. Tuoc	sunny and light wind	29-Aug	Clouded Leopard	13:17	1	foot print	0605515/1948183	forest on slope side	foot print close to a water hole
22	0605167/1949386	0605066/1950481	D. Tuoc, T Mung	cloudy and light wind	30-Aug							
23	0605008/1949664	0606073/1949687	NM Ha, TT My	sunny and light wind	30-Aug							

Transect	Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
26	0604591/ 1950589	0604820/1 949649	D. Tuoc, T Mung	sunny and light wind	31- Aug							
28	0604595/ 1950586	0605342/1 951377	NM Ha, TT My	sunny and light wind	31- Aug							
Xuân Tr ch- day light transect												
2 (chà nòi)	0613356/ 1949318		D. Tuoc, TT My	rainy	12- Sep							
1	0612943/ 1949645	0613248/1 949796	NM Ha, T Mung	cloudy and light wind	12- Sep	Common Palm Civet	9:31	1	fecal	0613030/1 949394	valley forest	
4	0611929/ 1947849	0612915/1 948687	NM Ha, T Mung	rainy and cloudy	13- Sep							
3	0612925/ 1949640	0612915/1 948687	NM Ha, T Mung	sunny	14- Sep	Hatinh Langur	14:25	3	observation	0612777/1 949269	limestone cliff	
						ferret badger	15:10	1	observation	0612780/1 949041	captured by local people	picture taken
22	0613351/ 1949309	0613447/1 949443	D. Tuoc	cloudy and rain	14- Sep	Black Giant Squirrel	7:15	1	sound	0613270/1 949443		30 m away
20	0613586/ 1949927	0614581/1 950244	T Mung, D. Tuoc	rainy	15- Sep	civet	11:15		fecal	0613854/1 949884	slope side	
Xuân Tr ch- nocturnal transect												
1 (chà nòi)	0612925/ 1949604		D. Tuoc, TT My,	rainy	11- Sep	small flying squirrel	21:05	1	observation	0613561/1 949458	forest on limestone	10m above canopy
2	0612925/ 1949640		NM Ha, T Mung	foggy	11- Sep							
3	0613351/ 1949304	0613793/1 949527	D. Tuoc, TT My	cloudy and light wind	12- Sep							

Transect	Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
4	0612930/ 1949538		NM Ha, T Mung	mist and light wind	12- Sep	muntjac	21:17	1	observation	0613317/1 949723		
6	0611929/ 1947849	0612915/1 948687	NM Ha, T Mung	rainy	13- Sep							
21	0613701/ 1949374	0613311/1 949176	D. Tuoc,	mist and light wind	14- Sep	Common Palm Civet	20:30	1	observation	0613380/1 949212	forest on limestone	clearly observed
5	0612925/ 1949640	0612915/1 948687	NM Ha, T Mung	full moon	14- Sep	Masked Palm Civet	21:10		fecal	0612785/1 949275	valley	fresh fecal in a rock cave
Th ng Hóa ó nocturnal transect												
1 (yên h p)	0597395/ 1955141	0596158/1 955557	NM Ha, TT My	light wind	25- Aug	mongoose	22:44	2	observation	0596337/1 955518	forest on limestone	one young and adult animal
8	0603695/ 1950350	0604274/1 950100	D. Tuoc, T Mung	light wind	26- Aug	snake	8:30	1	observation	0604137/1 950334		picture taken
7(ón)	0603731/ 1950395	0604256/1 949861	NM Ha, TT My	light wind	26- Aug	giant flying squirrel	19:50	1	observation		fruit tree	picture taken
						giant flying squirrel	22:30	1	observation			picture taken
11	0603697/ 1950347	0603201/1 949965	D. Tuoc, T Mung	rainy	27- Aug	giant flying squirrel	19:58	2	observation	0603592/1 950432	secondary forest	
						civet	20:51	1	fecal	0603331/1 9500085	secondary forest	
12			NM Ha, TT My	mist and light wind	27- Aug	giant flying squirrel	21:01	2	observation	0604018/1 949618	Dracontomelum tree	picture taken
14	0605437/ 1948657	0605139/1 949085	D. Tuoc, T Mung	light wind	28- Aug	Slow Loris	22:04	1	observation	0605358/1 949101	disturbed forest	
17	0605464/ 1948656	0605963/1 947829	NM Ha, TT My	light wind	28- Aug							

Transect	Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
21	lán 2	nhà	NM Ha, TT My	mist and light wind	29-Aug	giant flying squirrel	20:40	2	observation		valley forest	picture taken
						Large-toothed Ferret Badger		1	specimen	b n 3 nhà		
						Small-toothed Ferret Badger		1	specimen	b n 3 nhà		
18	0605531/1948823	0606081/1947921	D. Tuoc, T Mung	light wind	29-Aug	giant flying squirrel	20:48	2	observation	0605982/1948285	valley forest	
						Common Palm Civet	21:06	1	observation	0606007/1948228	valley forest	
						giant flying squirrel	22:13	1	observation	0605920/1948362	forest on limestone	
25	0605008/1949666	0606073/1949687	NM Ha, TT My	light wind								
24	0605167/1949386	0605090/1950410	D. Tuoc, T Mung	light wind	30-Aug	Pygmy Loris	19:56	1	observation	0605251/1949539	valley forest	
27	0604591/1950589	0604820/1949649	D. Tuoc, T Mung	light wind	31-Aug	giant flying squirrel	20:25	1	observation	0604631/1950551		
						giant flying squirrel	21:13	1	observation	0604653/1949649		
Hoa S n -night transect												
2			D. Tuoc	rainy and light wind	11-Aug	Red-shanked Douc	18:30	6	observation	0594363/1956433	valley forest	30 m away
4	0592434/1955357		NM Ha	light wind	11-Aug							

Transect	Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
7	0591751/ 1955647	Lán 1 Hs	NM Ha		12- Aug	giant flying squirrel	19:00	2	observation	tr c lán		
						Sunda Colugos	20:05	2	observation	0591941/1 956047	forest on limestone	
9	0591846/ 1950151		D. Tuoc	sunny and light wind	12- Aug	giant flying squirrel	7:00	2	sound	0591704/1 956625		20m away
						civet	8:02	1				run away quickly, unidentified
14	Lán 2		NM Ha	sunny and light wind	14- Aug							
16			NM Ha	sunny and light wind	15- Aug	Small-toothed Palm Civet	22:21	2	observation	0591856/1 956109		
Hoa S n ó day light transect												
3	Lán 1 Hs	0592434/1 955357	NM Ha	rainy and light wind	11- Aug							
5	Lán 1 Hs	0590918/1 956526	NM Ha	mist and light wind	12- Aug	Hatinh Langur	8:05	5	observation	0590918/1 956526		200 away in a cliff
6			NM Ha	sunny and light wind	12- Aug	Bear Macaque	17:19	6	observation	0591751/1 955647	forest on limestone	2 male, 3 females and one infant
						Bear Macaque	17:19	12	observation	0591751/1 955647	forest on limestone	4 males, 2 juveniles
11			NM Ha, D. Tuoc	sunny and light wind	13- Aug	Small-toothed Ferret Badger				0592513/1 955495		specimen collected
						Small-toothed Ferret Badger		1	foot print	0591683/1 956742		

Transect	Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
						Yellow-bellied Weasel		1	observation	0591752/1 957454		
						Binturong		1	observation	0591694/1 957871		on a tree
12	Lán 2	0590828/1 958322	NM Ha, TT My	sunny and light wind	14- Aug	King Cobra		1		0591069/1 958255	freshly dead animal	
						Small toothed Ferret Badger			cave	0591004/1 958255		
13		0592347/1 957792	D. Tuoc, T Mung	sunny and light wind	14- Aug	Black Giant Squirrel		1	observation	0591853/1 957987		
						Black Giant Squirrel		1	observation	0592071/1 958026		
						Crab-eating Mongoose		1	fecal	0592113/1 958023		
						Owston's Civet				0592285/1 957881		
15		0591691/1 958482	D. Tuoc, T Mung	sunny and light wind	15- Aug	Small Indian Civet			foot print	0591786/1 958380		freshly foot print
16			NM Ha, D. Tuoc	sunny and light wind	15- Aug	Small- toothed Ferret Badger			foot print	0592155/1 957852		
						Black Giant Squirrel'			skeleton			dead
						civet			skull	0592289/1 958047		
21	lán 1	0590375/1 958561	NM Ha	sunny and light wind	16- Aug	Black Giant Squirrel						
						Hatinh			sound			

Transect	Start	UTM End	Surveyor	Weather	Date	Species	Time	No. of ind.	Evidence	UTM	Observed Habitat	Remark
						Langur						
						Small-toothed Ferret Badger			foot print	0590479/1 958479		
						Javan Mongoose			fecal	0590479/1 958479		
						Binturong			foot print	0590479/1 958479		
						Clouded Leopard			???	0590428/1 958477		
						Golden Cat			???	0590428/1 958477		

and rodent records

Scientific name	Vietnamese name	English name	Survey site	UTM, WGS 84	
				X	Y
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0593270	1958573
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0590949	1958770
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0590997	1958918
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0591234	1958318
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0591497	1958535
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0591219	1957780
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Ma Rinh	0590970	1956765
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hang En	0605118	1948717
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hang En	0605305	1948028
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hang En	0603578	1947585
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hang En	0603834	1949831
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hang En	0606105	1947466
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hang En	0604523	1947985
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hung Dang	0614179	1950835
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hung Dang	0612571	1950716
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hung Dang	0613626	1950027
<i>Ratufa bicolor</i>	Sóc en	Black Giant Squirrel	Hung Dang	0613311	1949857
<i>Belomys pearsonii</i>	Sóc bay lông chân	Hairy-Footed Flying Squirrel	Ma Rinh	0591191	1958705
<i>Belomys pearsonii</i>	Sóc bay lông chân	Hairy-Footed Flying Squirrel	Ma Rinh	0590770	1959113
<i>Belomys pearsonii</i>	Sóc bay lông chân	Hairy-Footed Flying Squirrel	Ma Rinh	0591825	1958182
<i>Belomys pearsonii</i>	Sóc bay lông chân	Hairy-Footed Flying Squirrel	Hang En	0604691	1949537
<i>Belomys pearsonii</i>	Sóc bay lông chân	Hairy-Footed Flying Squirrel	Hung Dang	0613399	1950742
<i>Hylopetes alboniger</i>	Sóc bay en tr ng	Particoloured Flying Squirrel	Hang En	0606092	1949537
<i>Petaurista philippensis</i>	Sóc bay râu	Red Giant Flying Squirrel	Ma Rinh	0591213	1958785
<i>Petaurista philippensis</i>	Sóc bay râu	Red Giant Flying Squirrel	Ma Rinh	0592597	1958022
<i>Petaurista philippensis</i>	Sóc bay râu	Red Giant Flying Squirrel	Hang En	0605197	1948543
<i>Petaurista</i>	Sóc bay râu	Red Giant Flying Squirrel	Hung Dang	0614205	1950556

<i>Petaurista elegans</i>	Sóc bay sao	Lesser Giant Flying Squirrel	Ma Rinh	0590408	1959190
---------------------------	-------------	------------------------------	---------	---------	---------

Annex 5c. Insectivore and rodent specimens trapped during surveys

(All specimens are stored at Zool. Collection of Institute of Ecology and Biological Resource -IEBR)

No.	Scientific name	Vietnamese name	MR	HE	HD	7.3.1.1.1	7.3.1.1.2	Voucher code in IEBR
	SORICOMORPHA1	BỘ ĂN SÂU BỘ						
1.	<i>Hylomys suillus</i>	Chu t voi i	1			1		
2.	<i>Crocidura attenuata</i>	Chu t chù uôi en	1	1		2		
3.	<i>Crocidura fuliginosa</i>	Chu t chù uôi tr ng			1	1		
4.	<i>Euroscaptor longirostris</i>	Chu t ch i m i dài	1	1		2		
	RODENTIA	BỘ Gặm nhấm						
5.	<i>Belomys pearsonii</i>	Sóc bay lông chân	1			1		PNKB-13
6.	<i>Callosciurus erythraeus</i>	Sóc b ng	1	1		2		
7.	<i>Menetes berdmorei</i>	Sóc v n l ng		1		1		
8.	<i>Dremomys rufigenis</i>	Sóc mõm hung	1			1		PNKB-12
9.	<i>Tamiops maritimus</i>	Sóc chu t h i nam	1	1		2		
10.	<i>Tamiops rodolphii</i>	Sóc chu t l a			1	1		
11.	<i>Berylmys bowersi</i>	Chu t m c l n	5	1	3	9		PNKB-54, PNKB-61
12.	<i>Chiropodomys gliroides</i>	Chu t nh t cây	2	1	2	4		PNKB-14, PNKB-56
13.	<i>Leopoldamys edwardsi</i>	Chu t h u l n	1		1	2		PNKB-51
14.	<i>Leopoldamys sabanus</i>	Chu t núi uôi dài	2	4	6	12		PNKB-4, PNKB-39, PNKB-28
15.	<i>Maxomys moi</i>	Chu t xu-ri lông m m		1		1		
16.	<i>Maxomys surifer</i>	Chu t xu-ri	2	5	5	12		PNKB-7, PNKB-17, PNKB-36, PNKB-57
17.	<i>Niviventer fulvescens</i>	Chu t h u bé	2	6	3	15		PNKB-2, PNKB-16, PNKB-42
18.	<i>Niviventer langbianis</i>	Chu t lang bi an	1	1		2		PNKB-44
19.	<i>Niviventer tenaster</i>	Chu t núi ông d ng	2	3	1	6		PNKN-22, PNKB-24, PNKB-59
20.	<i>Mus cervicolor</i>	Chu t nh t h o ng		3	1	3		

	Species name	MR	HE	HD	7.3.1.1.1	7.3.1.1.2	Voucher code in IEBR
21.	<i>Mus pahari</i>		2		2		
22.	<i>Rattus nitidus</i>	1			1		
23.	<i>Rattus andamanensis</i>		1	3	4		PNKB-27
24.	<i>Laonastes aenigmamus</i> *		4		4		PNKB-19, PNKB-20, PNKB-21
	Total specimens	25	37	27	89		
	Total species	16	14	11	24		

Note: MR ó Ma RinH area (Hoa Son Commune), HE ó Hang En area (Thuong Hoa Commune), HD ó Hung Dang area (Thuong Trach Commune). (*) - Specimens of *Laonastes aenigmamus* were captured by residents of Ban On Village (Thuong Hoa Commune).

Annex 5d. Detail camera trap survey records by area

Cam. No.	Common name	Latin name	No. of Individ.	Date Taken	Time taken	Coordinate (UTM)
Survey area 1 -Ma RinH, Hoa Son commune						
M1	Jungle rat	<i>Leopoldamys</i> ? sp.	1	7.7	1:39	(0591285; 1958357)
	Masked Palm Civet	<i>Paguma larvata</i>	1	26.6	2:04	
	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	1	27.6	0:01	
M6	Jungle rat	<i>Leopoldamys</i> ? sp.	1	2.7	4:20	(0591406; 1958500)
	Jungle rat	<i>Leopoldamys</i> ? sp.	1	24.6	20:54	
	Jungle rat	<i>Leopoldamys</i> ? sp.	1	5.7	20:22	
	Jungle rat	<i>Leopoldamys</i> ? sp.	1	20.6	21:49	
	Yellow-throated Marten	<i>Martes flavigula</i>	2	1.7	4:13	

Cam. No.	Common name	Latin name	No. of Individ.	Date Taken	Time taken	Coordinate (UTM)
	Mustelid	MUSTELIDAE sp.	1	27.6	3:44	
	Annamite striped rodent	<i>Nesolagus timminsi</i>	1	30.6	2:36	
M8	Crab eating mongoose	<i>Hepestes urva</i>	1	5.7	9:34	(0484762; 1958996)
M10	Jungle rat	<i>Leopoldamys ? sp.</i>	1	18.6	4:32	(0484244; 1959104)
	Jungle rat	<i>Leopoldamys ? sp.</i>	1	20.6	23:17	
	Mustelid	MUSTELIDAE sp.	1	26.6	2:48	
	Mustelid	MUSTELIDAE sp.	1	26.6	23:49	
	Annamite striped rabbit	<i>Nesolagus timminsi</i>	1	22.6	1:32	
M11	Annamite striped rabbit	<i>Nesolagus timminsi</i>	1	20.6	20:44	(0589996; 1958850)
	Wild boar	<i>Sus scrofa</i>	1	3.7	19:28	(0589816; 1958983)
M12	Ferret badger	<i>Melogale sp.</i>	1	22.6	3:50	
	Jungle rat	<i>Leopoldamys ? sp.</i>	1	16.6	22:46	
	Jungle rat	<i>Leopoldamys ? sp.</i>	1	15.6	23:15	(0589551; 1959173)
M13	Ferret badger	<i>Melogale sp.</i>	1	25.6	3:14	
	Jungle rat	<i>Leopoldamys ? sp.</i>	1	20.6	23:39	
	Jungle rat	<i>Leopoldamys ? sp.</i>	1	26.6	1:28	
	Ferret badger	<i>Melogale sp.</i>	1	23.6	0:05	(0590002; 1959134)
M18	Ferret badger	<i>Melogale sp.</i>	1	29.6	4:11	
	Civet	VIVERRIDAE sp.	1	8.7	5:37	(0591503; 1958257)
M19	Jungle rat	<i>Leopoldamys ? sp.</i>	1	26.6	23:47	
	Whistling thrush	<i>Myiophoneus</i>	1	5.7	7:13	(0591268; 1958707)
M20	Jungle rat	<i>Leopoldamys ? sp.</i>	1	22.6	21:33	

Cam. No.	Common name	Latin name	No. of Individ.	Date Taken	Time taken	Coordinate (UTM)
M21	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	1	28.6	4:15	(0591021; 1958928)
M22	Whistling thrush	<i>Myiophoneus</i> sp.	1	17.6	22:49	(0590878; 1959086)
M23	Jungle rat	<i>Leopoldamys</i> ? sp.	1	26.6	0:49	(0590828; 1959721)
M24	Ferret badger	<i>Melogale</i> sp.	1	16.6	20:48	(0590191; 1959269)
M25	Jungle rat	<i>Leopoldamys</i> ? sp.	1	27.6	2:24	(0590569; 1959038)
M27	Civet	VIVERRIDAE sp.	1	18.6	20:20	(0591446; 1958276)
	Jungle rat	<i>Leopoldamys</i> ? sp.	1	18.6	19:55	
M30	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	1	9.7	23:13	(0590490; 1958864)
	Jungle rat	<i>Leopoldamys</i> ? sp.	1	29.6	3:58	
Survey area 2 - Da Lat, Thuong Hoa Commune						
M6	Jungle rat	<i>Leopoldamys</i> ? sp.	1	30.7	19.45	(0597299; 1952527)
	Ferret badger	<i>Melogale</i> sp.	1	24.7	0.1875	
	Northern Treeshrew	<i>Tupaia belangeri</i>	1	28.7	14.43	
M7	Jungle rat	<i>Leopoldamys</i> ? sp.	1	24.7	3.17	(0597162; 1952318)
M8	Ferret badger	<i>Melogale</i> sp.	3	25.7	21.45	(0596909; 1950720)
M9	Masked Palm Civet	<i>Paguma larvata</i>	1	20.7	20.2	(0597036; 1950450)
M10	Jungle rat	<i>Leopoldamys</i> ? sp.	1	19.7	20.59	(0596710; 1950670)
M11	Jungle rat	<i>Leopoldamys</i> ? sp.	1	30.7	3.52	(0597044; 1950892)

Cam. No.	Common name	Latin name	No. of Individ.	Date Taken	Time taken	Coordinate (UTM)
M19	Ferret badger	<i>Melogale</i> sp.	1	22.7	3.07	(0596932; 1951548)
	Wild Boar	<i>Sus scrofa</i>	1	9.8	18.36	
M21	Bear Macaque	<i>Macaca arctoides</i>	5	20.7	11.09	(0598031; 1949959)
M22	Bear Macaque	<i>Macaca arctoides</i>	1	24.7	11.27	(0597966; 1950252)
M30	Wild Boar	<i>Sus scrofa</i>	1	1.8	11.35	(0596620; 1951503)
Survey area 3 - Ca Con-Hung Tri, Xuan Trach Commune						
M3	Jungle rat	<i>Leopoldamys</i> ? sp.	1	19.8	22:51	(0623063; 1947837)
	Bear Macaque	<i>Macaca arctoides</i>	2	12.9	16:10	
M8	Black Giant Squirrel	<i>Ratufa bicolor</i>	1	26.8	17:27	(0623611; 1946986)
M12	Northern Treeshrew	<i>Tupaia belangeri</i>	1	15.9	11:00	(0623576; 1947777)
	Jungle rat	<i>Leopoldamys</i> ? sp.	1	15.9	1:06	

Annex 3c. Gibbons recorded during the surveys

Group. no.	Group composition				Co-ordinates (Estimate the central of group's home range. Use WGS 84 Map Datum)	Record type	Locality	Distance heard (km)	Time and date of record
	Adult	Adult	Young	Total					
G 01	1	1		02	0614600 E 1940100 N	H	Khe Cha Khe area. Thuong Trach forest, PN-KB NP	1.8	8.45-8.51 am. 25/9/2011; recorded from LP7a
G 02	1	2		03	0620150 E 1944750 N	H	Khe Nhom area. Thuong Trach forest, PN-KB NP	1.3	6.15-6.22 am. 28/9/2011; recorded from LP08
G 03	1	1	1	03	0620600 E 1945850 N	H	Khe Nhom area. Thuong Trach forest, PN-KB NP	1.0	7.46-7.51 am. 28/9/2011; recorded from LP08
G 04	1	1		02	0594300 E 1955700 N	H	Ma Xang area. Hoa Son frest, PN-KB NP	2.0	6.03-6.06 am. 21/9/2011
Total: 4 groups with at least 10 individuals	4	5	1	10					

ANNEX 31. RECORDS OF HAIRY LANGUR IN SURVEYED AREAS OF PHONG NHA-KE BANG NATIONAL PARK

Group no.	Group composition (Minimum sighted individual numbers)		Total (Range of group size estimation, based on heard calling or seen branches shaking)	Co-ordinates (Co-ordinates of observation site. Use User UTM WGS 84 Map Datum)	Field record		Locality
	Adult	Young			Type of record	Date of record	
I	9	3 Juv.	12-15	0614500 E 1950100 N	O	25/8/2011	Southeast of Khe Chu Ngat. PN-KB NP
II	8	2	10-15	0610882 E 1946276 N	O	26/8/2011	Hung Cau forest area. PN-KB NP
III	Unknown.	Unknown.	Unknown.	0611677 E 1945581 N	H	27 & 28/8/2011	Hung Khe San area. PN-KB NP
IV	4	2 Inf.	10 -15	0606183 E 1946896 N	O	29/8/2011	Hung Cau forest area. PN-KB NP
V	Unknown.	Unknown.	Unknown.	0608462 E 1953083 N	H	1 & 2/9/2011	Dinh Thang forest area. PN-KB NP
VI	5	Unknown.	Unknown (> 5)	0594902 E 1956653 N	O	21/9/2011	Ma Xang forest area, PN-KB NP
Total: 5 groups	> 26	> 7	> 37-50				

Notes:

Group composition - number of adult male and female or young (sub-adult/infant) heard or seen; **Young** ó Sub. = sub-adult, Inf. = infant, Juv. =Juvenile;

Total - minimum number of individuals heard or seen

Locality - local name of the forest area

Co-ordinates ó estimates centre of group's home range (using WGS 84 Map Datum)

Record type ó H =heard singing; O = observed by sight

Annex 3g. Records of Red-shanked Douc Langur field in surveyed areas of Phong Nha-Ke Bang National Park

Group no.	Group composition (Minimum sighted individual numbers)		Total (Range of group size estimation, based on heard calling or seen braches shaking)	Co-ordinates (Co-ordinates of observation site. Use User UTM WGS 84 Map Datum)	Field record		Locality
	Adult	Young			Type of record	Date of record	
I	18	6 Juv.	30-35	0614550 E 1950150 N	O	25/8/2011	Southeast of Khe Chu Ngat. PN-KB NP
II	10	2 Juv.; 1 Inf.	13-20	0614429 E 1942464 N	O	23/9/2011	Hung Ngon forest area. PN-KB NP
III	9	2 Juv.	11-15	0594962 E 1956713 N	O	21/9/2011	Ma Xang forest area. PN-KB NP
Total: 3 groups	37	11	54-70				

Notes:

Group composition - number of adult male and female or young (sub-adult/infant) heard or seen; **Young** ó Sub. = sub-adult, Inf. = infant, Juv. =Juvenile;

Total - minimum number of individuals heard or seen

Locality - local name of the forest area

Co-ordinates ó estimates centre of group's home range (using WGS 84 Map Datum)

Record type ó H =heard singing; O = observed by sight

ANNEX 6. RELATIVE ABUNDANCE AND TRAP SUCCESS OF RODENTS

No.	Scientific name	MR			HE			HD			7.3.1.1.3 MR+HE+HD		
		S	%	E	S	%	E	S	%	E	S	%	E
1.	<i>Callosciurus erythraeus</i>	1	4.76	0.105	1	3.23	0.100	0	0	0	2	2.63	0.051
2.	<i>Menetes berdmorei</i>	0	0	0.105	1	3.23	0	0	0	0	1	1.32	0.026
3.	<i>Dremomys rufigenis</i>	1	4.76	0.105	0	0	0	0	0	0	1	1.32	0.026
4.	<i>Tamiops maritimus</i>	1	4.76	0.105	1	3.23	0.100	0	0	0	2	2.63	0.051
5.	<i>Tamiops rodolphii</i>	0	0	0	0	0	0	1	4.17	0.105	1	1.32	0.026
6.	<i>Berylmys bowersi</i>	5	23.80	0.526	1	0	0	3	12.50	0.316	9	11.84	0.205
7.	<i>Chiropodomys gliroides</i>	2	9.52	0.211	1	3.23	0.100	2	8.33	0.211	4	5.26	0.103
8.	<i>Leopoldamys edwardsi</i>	1	4.76	0.105	0	0	0	1	4.17	0.105	2	2.63	0.051
9.	<i>Leopoldamys sabanus</i>	2	9.52	0.211	4	12.90	0.400	6	25.00	0.632	12	15.79	0.308
10.	<i>Maxomys moi</i>	0	0	0	1	3.23	0.100	0	0	0	1	1.32	0.026
11.	<i>Maxomys surifer</i>	2	9.52	0.211	5	16.13	0.500	5	20.83	0.526	12	15.79	0.308
12.	<i>Niviventer fulvescens</i>	2	9.52	0.211	6	19.35	0.600	3	12.50	0.316	10	13.16	0.256
13.	<i>Niviventer langbianis</i>	1	4.76	0.105	1	3.23	0.100	0	0	0	2	2.63	0.051
14.	<i>Niviventer tenaster</i>	2	9.52	0.211	3	9.68	0.300	1	4.17	0.105	6	7.89	0.154
15.	<i>Mus cervicolor</i>	0	0	0	3	9.68	0.300	1	4.17	0.105	3	3.95	0.077
16.	<i>Mus pahari</i>	0	0	0	2	6.45	0.200	0	0	0	2	2.63	0.051
17.	<i>Rattus nitidus</i>	1	4.76	0.105	0	0	0	0	0	0	1	1.32	0.026
18.	<i>Rattus andamanensis</i>	0	0	0	1	3.23	0.100	3	12.50	0.316	4	5.26	0.103
	Total	21	100%	2.211	31	100	3.10	24	100%	2.526	76	100%	1.949

Note: **MR** ó Ma RinH area (Hoa Son Commune), **HE** ó Hang En area (Thuong Hoa Commune), **HD** ó Hung Dang area (Thuong Trach Commune). **MR**: Trapping effort (Te) = 950 trap.night, **HE**: Te = 1000 trap.night, **HD**: Te = 950 trap.night, Total Te = 3,900 trap.night. **S** ó number of trapped specimens, % - specimen percentage of each species per total specimen number, **E** ó trap success (specimen per 100 trap-nights)

D IN AND AROUND THE PARK

Annex 7a. Threats recorded by the Small Carnivore and Loris survey team

Transect	UTM Start	UTM End	Surveyor	Type of impact	Date	Time	Coordinate	Number	Level of impact	Remark
Thượng Hóa Commune										
2 (Thôn Ôn)	0603532/ 1952080	0604128/ 1950379	NM Ha, D Tuoc	logger	26/8	8:00	0603223/ 1952752	1	unspecified	Start entering the forest
				Fishing		9:00	06043223/ 1950436	2	fishing and hunting animal	use more 200m of fishing net
				logger		9:05	06043223/ 1950437	2	searching for valuable wood	Start entering the forest
4 (Thôn Ôn)	0603689/ 1950340	0604270/ 1950231	D Tuoc, T Mung	buffalo grazing	26/8	14:50	0604233/ 1950389	6	free grazing	
				Fishing		14:35	0604128/ 1950399			
6	0603731/ 19500395	0604256/ 1949861	NM Ha, TT My	logger and timber	26/8	14:38	0604138/ 1950484			for timber, 2 years old
				logger and timber		14:48	0604192/ 1950520			freshly cut, unload
				hunting camp		15:35	0604429/ 1950082			new camp for more than 3 hunter,
				snaring line		15:35	0604429/ 1950082		20 snares	
9	0603604/ 1950319	0603201/ 1949965	D Tuoc, T Mung	timber	27/8	8:50	0603421/ 1950293			old timber, loaded

Transect	Start	End	Surveyor	Type of impact	Date	Time	Coordinate	Number	Level of impact	Remark
				snaring line		8:53	0603374/ 1950227	3 cái		small mammal snaring line
				buffalo grazing		8:53				free grazing
				hunter		10:05	0603534/ 1905076	2	un-specified	2 people is setting the snares
10	0603606/ 1950332	0604160/ 1949486		logger camp	27/8	9:16	0604148/ 1949522		un-specified	freshly cut, 1 week
16	0605464/ 1948655	0605963/ 1947829	NM Ha và TT My	civet specialized snaring line	28/8	14:28	0605467/ 1948616		fresh	use ripped banana to attract civet
				logger camp		14:28	0605570/ 1948590			2 month old camp for more than 3 hunter
				timber		15:41	0605885/ 1948266			timber, unload
				logger camp		15:46	0605923/ 1948188	3		
				snaring line		16:07	0605970/ 1947907		fresh	20 freshly set snare
				snaring line		16:12	0605974/ 1948054		fresh	10 freshly set snare
				snaring line		16:25	0605819/ 1948359		fresh	more than 50 snare
13	0603680/ 1950352	0605477/ 1948701	NM Ha và D Tuoc	logger camp	28/8	10:10	0605264/ 1949241			3 weeks old for 5 logger
				timber		10:23	0605449/ 1948993			cut and hanging to dry in the forest

Transect	Start	End	Surveyor	Type of impact	Date	Time	Coordinate	Number	Level of impact	Remark
15	0605437/ 1948657	0605117/ 1949423	D Tuoc, T Mung	timber	28/8	14:35	0605355/ 1948600		3 months old	many cut and loaded timber and fallen trees
				snaring line		14:47	0605256/ 1948487		1 year old	400m snaring line
				snaring line		15:02	0605009/ 1948741		fresh	200m snaring line
				gun hunting		21:10	0605013/ 1948780			2 hunting gun shoots within 10 minutes
20	lán ng	0605553/ 1947949	NM Ha và D Tuoc	snaring line	29/8	10:02	0605558/ 1947949			specialized civet hunting method and tactic
				bird hunting camp			0605558/ 1947949			3-4 hunter visit the camp per month
22	0605167/ 1949386	0605066/ 1950481	D Tuoc, T Mung	logging area	30/8	11:17	0605182/ 1950306		old	
				local people in the forest		9:22	0605237/ 1949232			Dalbergia tonkinensis collectors
23	0605008/ 1949664	0606073/ 1949687	NM Ha, TT My	snaring line	30/8	10:14	0605770/ 1949533		fresh	more than 30 snare
				snaring line		10:43	0606008/ 1949698		old	abandoned snaring line (more than 30 snares)
26	0604591/ 1950589	0604820/ 1949649	D Tuoc, T Mung	logging area	31/8	9:50	0604684/ 1950153		old	
				local people in the forest		9:54	0604678/ 1950084		honey collector	
28	0604595/ 1950586	0605342/ 1951377	NM Ha, TT My	snaring line	31/8	9:45	0604676/ 1951060		fresh	abandoned snaring line (more than 20 snares)
Xuân Trạch Commune										

Transect	Start	End	Surveyor	Type of impact	Date	Time	Coordinate	Number	Level of impact	Remark
2 (chà nòi)	0613356/ 1949318		D Tuoc, TT My	hunting camp	12-Sep	9:00	0613270/ 1949258		fresh	met 2 hunters with 1 small-tooth ferret badger and forced to release the animal by ranger
				snaring line		9:30			fresh	
1	0612943/ 1949645	0613248/ 1949796	NM Ha, T Mung	high explosive noise	12-Sep	10:20				1km away, southern of Thung Dang
				snaring line		9:48	0613111/ 1949385		fresh	300m of snaring line from valley to ridge
				hunting camp					fresh	3 old hunting camp
4	0611929/ 1947849	0612915/ 1948687	NM Ha, T Mung	hunting camp	13-Sep	10:00	0612915/ 1948687		fresh	observed 4 camps: 2 freshly built, one hunter and one snaring line
3	0612925/ 1949640	0612915/ 1948687	NM Ha, T Mung	snaring line	14-Sep		0612756/ 194374		fresh	Active
Hóa Sơn Commune										
11			NM Ha, D Tuoc	The Ruc cave		13- Aug		4	fresh	100 un-set snare line, many remains (bone, skin, skull) of animal, civet, badgers, mongoose
13		0592347/ 1957792	D Tuoc, T Mung	logging		14/8	0592119/ 1957844			
12	lán 2	0590828/ 1958322	NM Ha, TT My	hunting camp		14/8	0591695/ 1958286	4		regularly active hunting camp, especially during the rainy season
				logging			0591338/ 19588187			

ore and Rodent Survey team

Threat evidence	Status	Description	UTM (WGS84)		Forest type
			X	Y	
Ma Rinh in Hoa Son Commune					
<i>1. Hunting/snaring</i>					
Traps	O	Trapline of about 50 wire snares	0591014	1958918	1
Traps	O	Trapline of about 50 wire snares	0590831	1958777	1
Traps	N	Trapline of about 40 wire snares	0591142	1958669	1
Traps	O	Trapline of about 40 wire snares	0590486	1958805	1
Traps	O	Trapline of about 40 wire snares	0590161	1958933	1
Traps	O	Trapline of about 30 wire snares	0590537	1959027	1
Traps	O	Trapline of about 40 wire snares	0591654	1958361	1
Traps	O	Trapline of about 20 wire snares	0592721	1958097	1
Traps	N	Trapline of about 12 wire snares	0591125	1957056	3
Traps	O	Trapline of about 20 wire snares	0591339	1957722	3
Hunters		2 hunters with 5 burned Melogale civet, 1 Treeshrew, 1 Asian Red-cheeked Squirrel and 2 rats	0591161	1958178	3
Hunter camp	U	A camp for 5-6 persons, strings for snare making, explosive for bee removal, cooking sets	0591283	1958586	1
Hunter camp	O	A camp for 5-6 persons, strings for snare making, mammal furs	0590338	1958709	1
<i>2. NTFPs collecting</i>					
Honey collecting	O	Signs of tree climbing and fire for honey collecting	0519247	1958330	1
<i>3. Timber removal</i>					
Timber cutting	O	A cut timber of 65 cm diameter, some sawwood remained	0590863	1958914	1
Timber cutting	N	A cut timber of 50 cm diameter, some sawwood remained	0590849	1958990	1
Timber cutting	O	A cut timbers of 50 cm and 75 cm diameter, some sawwood remained	0590802	1958836	1
Timber cutting	O	A cut timber of 80 cm diameter, some sawwood remained	0591207	1958586	1
Timber cutting	O	A cut timber of 70 cm diameter, some sawwood remained	0590596	1958754	1
Timber cutting	N	A cut timber of 64 cm diameter, some sawwood remained	0590298	1958882	1
Timber cutting	O	A cut timber of 74 cm diameter, some sawwood remained	0590221	1959343	1
Timber cutting	O	A cut timber of 67 cm diameter, some sawwood remained	0591160	1958848	1

		74 cm diameter, some sawwood remained	0590460	1959087	1
Timber cutting	O	A cut timber of 80 cm diameter, some sawwood remained	0591160	1958481	1
Timber cutting	N	A cut timber of 65 cm diameter, some sawwood remained	0591569	1958293	1
Timber cutting	N	A cut timber of 60 cm diameter, some sawwood remained	0591671	1958216	1
Timber cutting	O	A cut timber of 75 cm diameter, some sawwood remained	0592030	1958003	1
Timber cutting	O	A cut timber of 70 cm diameter, some sawwood remained	0592235	1957986	1
Timber cutting	O	A cut timber of 82 cm diameter, some sawwood remained	0592047	1958123	1
Timber cutting	O	A cut timber of 67 cm diameter, some sawwood remained	0591637	1958660	1
Timber cutting	N	A cut timber of 67 cm diameter, some sawwood remained	0591407	1958481	1
Timber cutting	O	A cut timber of 75 cm diameter, some sawwood remained	0592951	1958080	1
Timber cutting	O	A cut timber of 84 cm diameter, some sawwood remained	0591032	1958694	1
Timber cutting	O	A cut timber of 68 cm diameter, some sawwood remained	0592567	1958046	1
Timber collectors		2 persons carrying timber woods	0591345	1958531	1
Timber collectors		26 persons			
4. Forest clearance		Not seen			
5. Cattle raising		Not seen			
Hang En in Thuong Hoa Commune					
1. Hunting/snaring					
Traps	N	Trapline of about 20 wire snares	0604372	1949464	2
Traps	N	Trapline of about 30 wire snares	0604894	1949294	2
Traps	N	Trap enclosure for trapping monkeys	0605031	1948937	2
Traps	O	Trapline of about 30 wire snares	0605678	1947854	2
Traps	N	Trapline of about 30 wire snares	0605790	1948589	2
Traps	N	Trapline of about 30 wire snares	0604555	1948695	2
Traps	N	Trapline of about 30 wire snares	0605207	1948834	2
Traps	N	Trapline of about 50 wire snares	0603834	1948900	1
Traps	N	Trapline of about 50 wire snares	0603834	1947675	1
Hunters		A hunter returning from checking snares with large Bower's rats	0605719	1948021	2
Hunters		7 hunters in Ban On Village	0602477	1954262	
Hunting camp	U	In gate of Hang En cave, nets for bird catching	0605158	1948265	3
Hunting camp		A camp with wire snares, remains of hunted ferret-badger	0606481	1947251	1
2. NTFPs					

Honey collecting	O	Tree climbing string, fire remains	0605159	1948364	2
Fruit tree cutting	N	6 trees cut down for fruit collecting	0604759	1949699	2
Hue wood collectors		A team of 7 persons with bags of 20-30 kg Hue wood (<i>Dalbergia sp.</i>)	0605303	1948920	2
Hue wood collectors		2 men on way to forest for Hue Wood collecting	0605694	1948104	2
Hue wood collectors		2 men with about 20-30 kg of Hue wood each	0605694	1948104	2
<i>3. Timber removal</i>					
Timber cutting	O	A timber of 0.65m diameter	0604963	1949370	2
Timber cutting	O	A timber of 0.7m diameter	0605031	1948937	2
Timber cutting	N	A timber of 0.6m diameter	0603977	1947708	1
Timber cutting	N	A timber of 0.62m diameter	0606555	1947004	
<i>4. Forest clearance</i>					
Agricultural field	U	A farm of cassava, bananas, etc.	0604558	1950008	2
<i>5. Cattle raising</i>					
Not seen					
Hung Dang in Thuong Trach Commune					
<i>1. Hunting/snaring</i>					
Traps	N	Trapline of about 20 wire snares	0614845	1950715	1
Traps	N	Trapline of about 30 wire snares	0614765	1950465	1
Traps	N	Trapline of about 50 wire snares	0614598	1950813	2
Traps	O	Trapline of about 30 wire snares	0613635	1951008	2
Traps	N	Trapline of about 30 wire snares	0613853	1950504	1
Traps	N	Trapline of about 50 wire snares	0613520	1950011	1
Traps	N	Trapline of about 30 wire snares	0612626	1950538	3
Hunters		2 hunters catching salamanders	0614259	1951088	2
Hunters		3 hunters going to stream for water	0613807	1951089	2
Hunting camp	U	A camp with wire snares and cooking asset	0613655	1951257	2
Hunting camp	U	A camp with wire snares and cooking asset	0613704	1950022	1
<i>2. NTFPs collecting</i>					

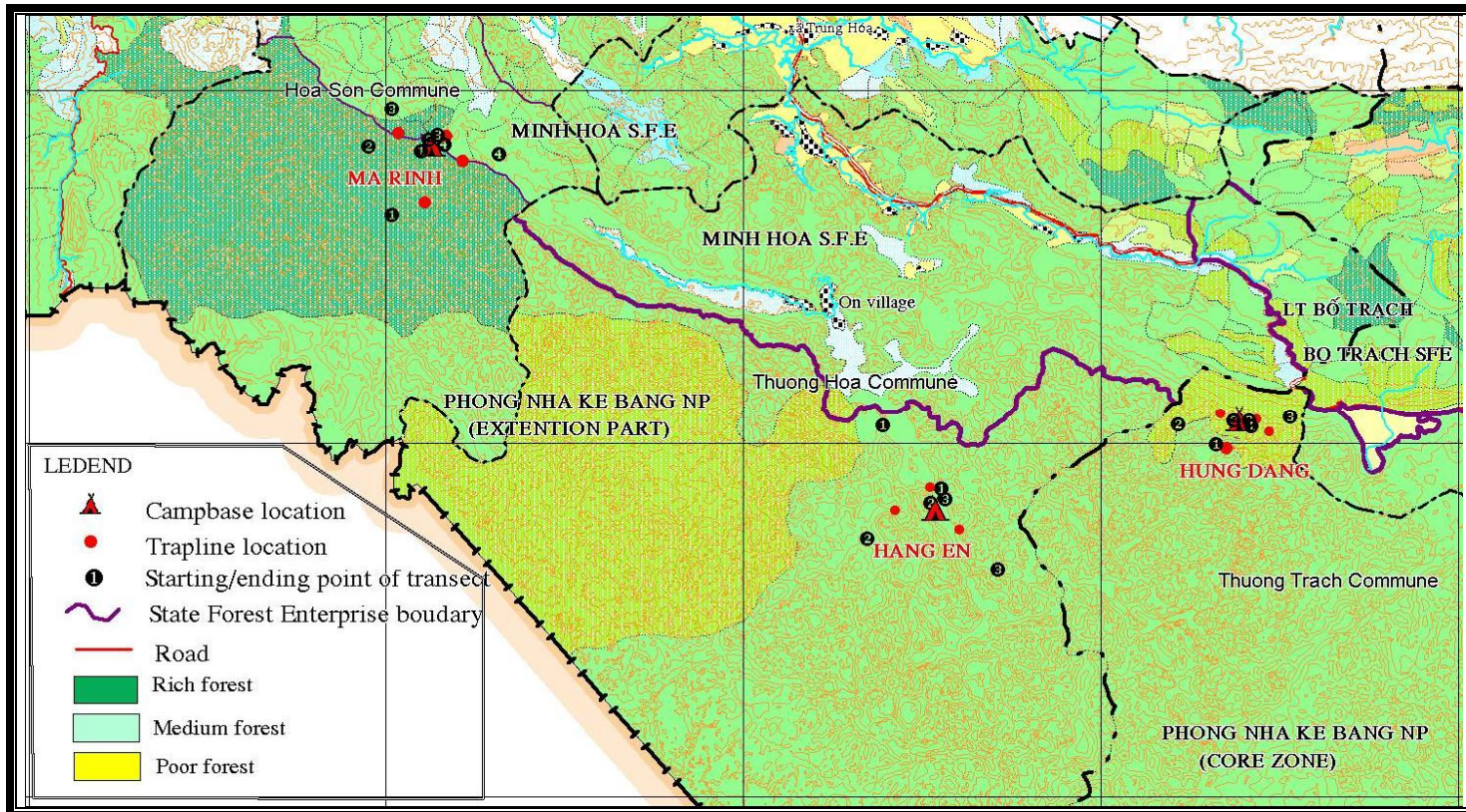
	Food collecting		0616852	1950639	2
Bamboo cutting		Bamboo cutting for local use	0616118	1950487	2
Firewood		signs of firewood collecting	0616844	1950615	2
3. Timber removal		Not seen			
4. Forest clearance		Agricultural field	0616991	1950634	
5. Cattle raising		Tracks were found throughout valley with lowland forest outside Hung Dang mountain range but not found inside it.	0613250	1951100 to 1950100	2

Note: Status: N ó new (less than 30 days), O ó old (more than 30 days), U ó in use. **Forest type:** 1 ó Primary or little-affected lowland forest; 2 ó Selected logged lowland forest, 3 ó Karst forest

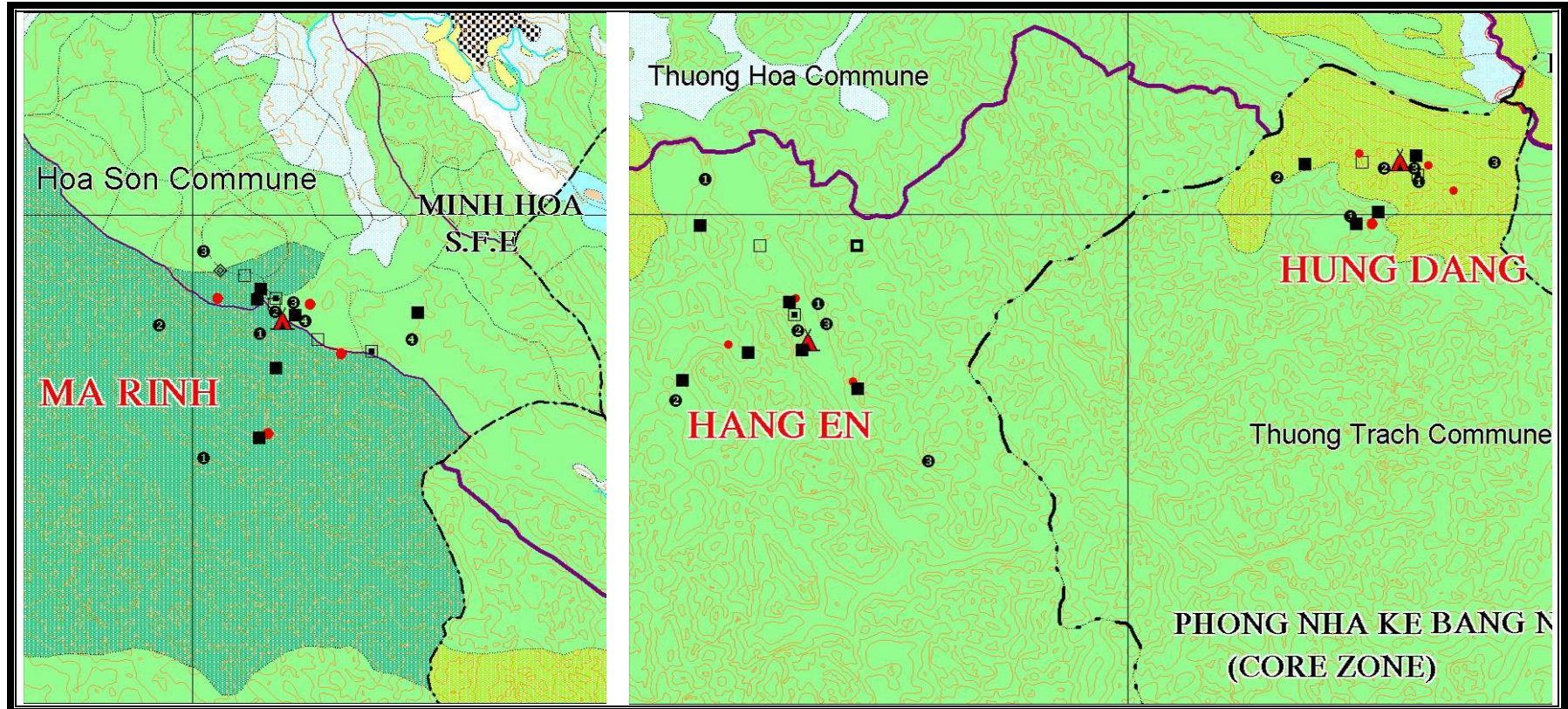
Annex 7c. Record of humans and their impacts by camera trapping team

Camera No.	Human record	No. of Individuals	Date	Time	Coordinate
Ma Rinh, Hoa Son commune					
M2	Children	4	7.7		0591584; 1958249
Da Lat, Thuong Hoa commune					
M27	Hunters	3	1.8	12.56	0597162; 1952318
Ca Con- Hung Tri, Xuan Trach commune					
M9	Honey hunters	2	20.7	12.57	0597036; 1950450
	Loggers	3	28.7	18.59	
M13	Loggers	1	21.7	6.23	0597017; 1950094
M15	Hunting dog	1	19.8	11:07	0624151; 1947440

Map 1. Location of Insectivore and Rodent Survey Sites

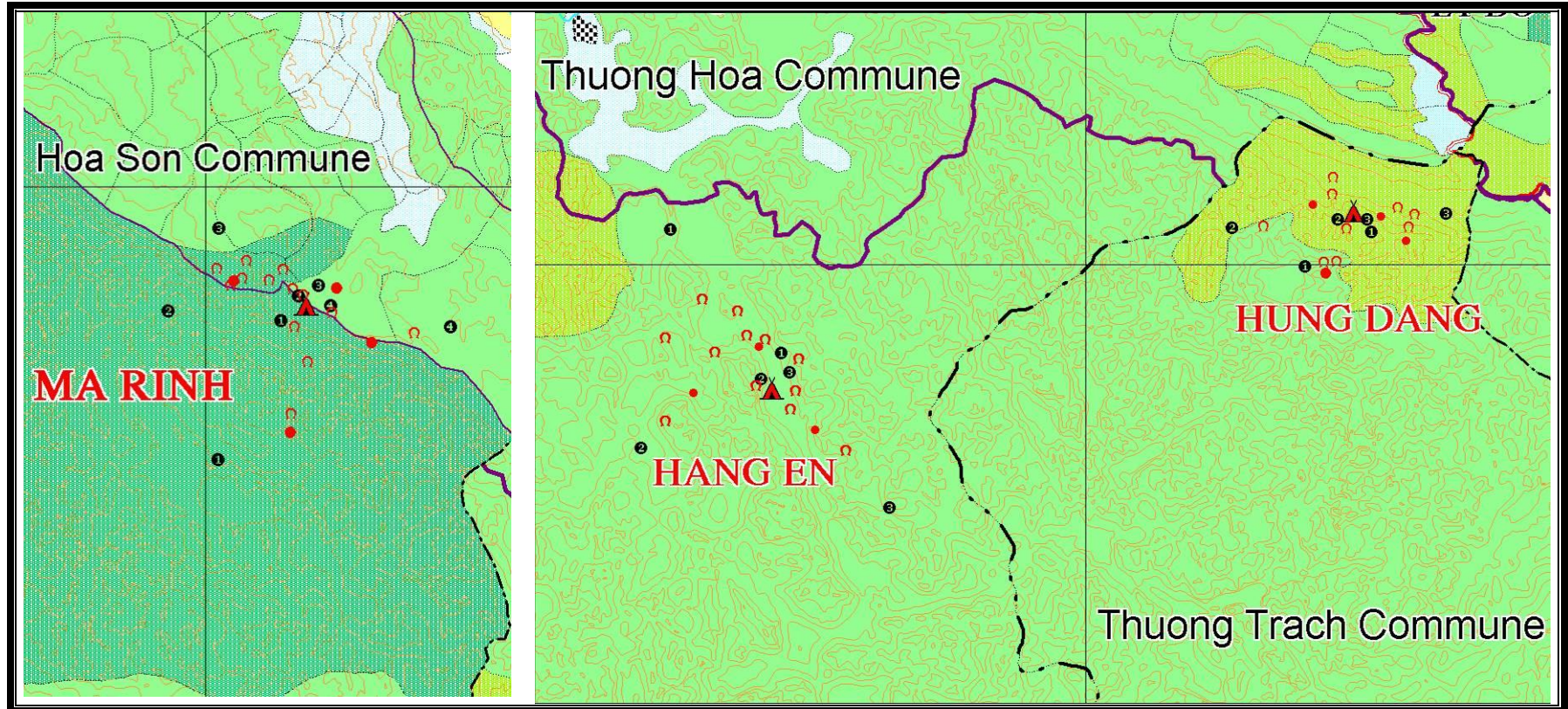


rodent species



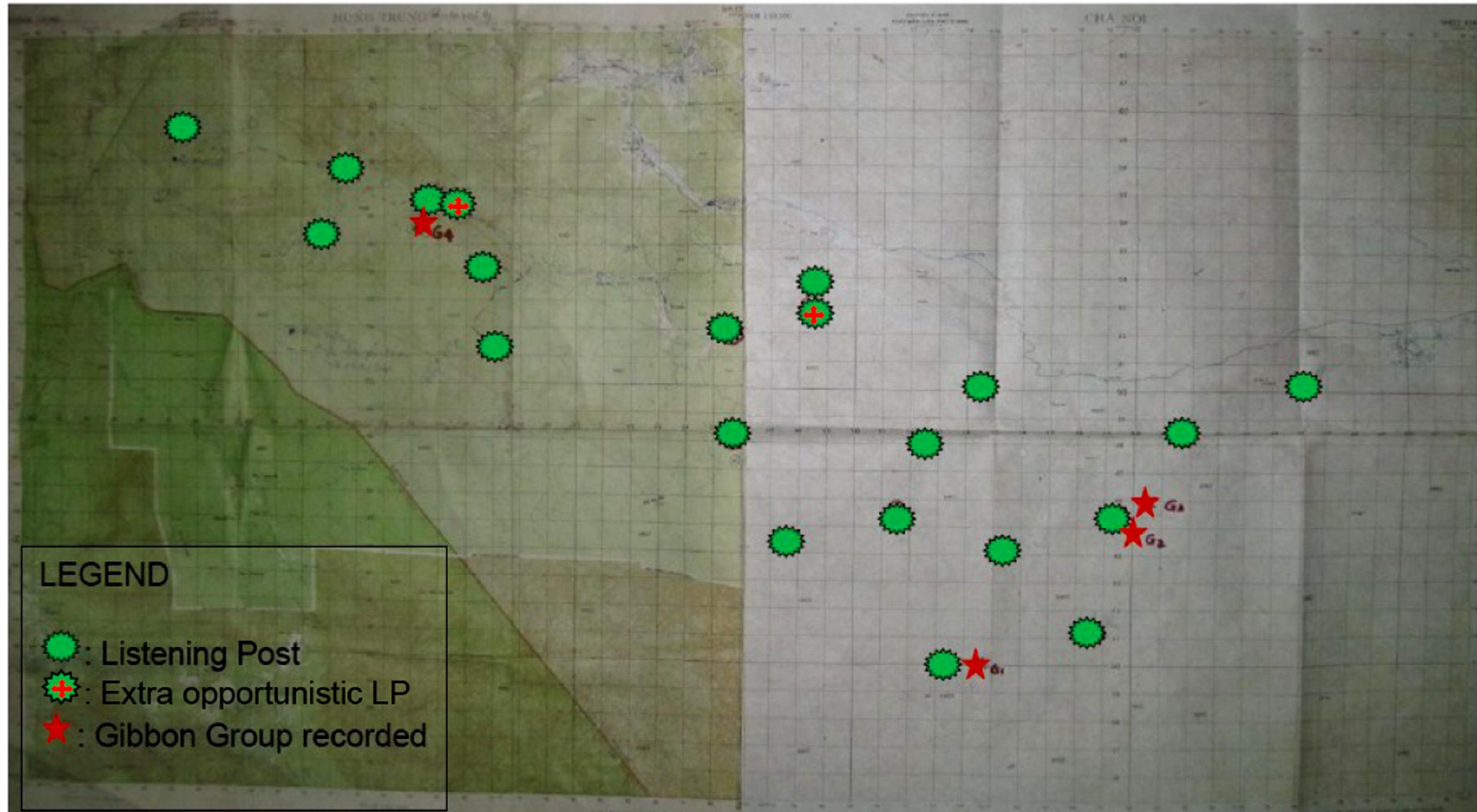
- | | | | |
|---------------------------|----------------------------|---------------------|-----------------|
| ■ Ratufa bicolor | ◆ Petaurisa elegans | ▲ Campbase location | ■ Rich forest |
| □ Belomys pearsonii | ⊕ Hunting signs | — Road | ■ Medium forest |
| ■ Hylopetes alboniger | ● Trapline location | ~ SFE boundary | ■ Poor forest |
| ■ Petaurista philippensis | ① Start/end transect point | | |

s recorded during survey period

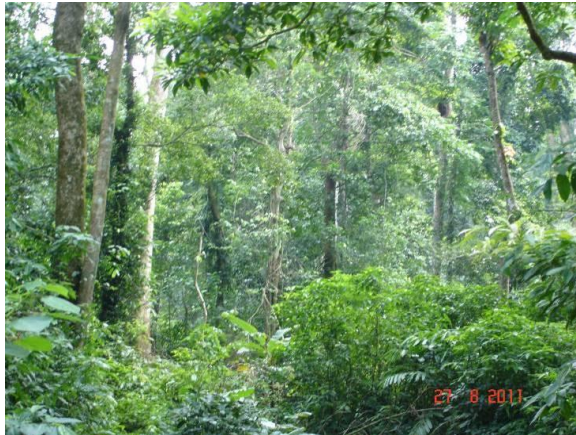


- | | | | |
|---------------------------|----------------------------|---------------------|-----------------|
| ■ Ratufa bicolor | ◆ Petaurisa elegans | ▲ Campbase location | ■ Rich forest |
| □ Belomys pearsonii | ⊖ Hunting signs | — Road | ■ Medium forest |
| ■ Hylopetes alboniger | ● Trapline location | ~ SFE boundary | ■ Poor forest |
| ■ Petaurista philippensis | ① Start/end transect point | | |

and gibbon records



PLANTS AND ANIMALS RECORDED DURING THE SURVEYS



1. Evergreen forest in Ma Rinh (Hoa Son Commune)
Photo: Nguyen Xuan Dang



2. Karst forest in Ma Rinh (Hoa Son commune)
Photo: Nguyen Xuan Dang



3. Disturbed evergreen forest in Hang En (Thuong Hoa Com.)
Photo: Nguyen Xuan Nghia



4. Karst forest in Hang En (Thuong Hoa Com.)
Photo: Nguyen Xuan Nghia



5. Heavily disturbed forest in Hung Dang (Thuong Trach)
Photo: Nguyen Xuan Dang



7. Karst forest in Hung Dang (Thuong Trach Com)
Photo: Nguyen Xuan Dang



6. Lightly disturbed evergreen forest remains on hills
Photo: Nguyen Xuan Nghia



8. Evergreen forest on hill slope in Hung Dang (Thuong Trach Com)
Photo: Nguyen Xuan Nghia



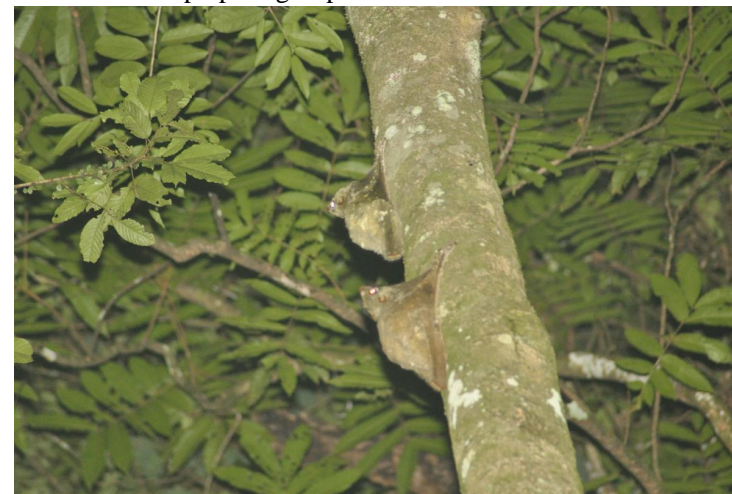
9. Track of an unidentified small carnivore.



10. Survey team in Hang En Camp. Mr. Nghia
is preparing a specimen



11. Small-toothed Ferret Badger *Melogale moschata*.



12. A pair of Sunda Colugo *Galeopterus variegatus* seen
during a night transect.



13. A Hairy-footed Flying Squirrel *Belomys pearsonii* photographed in Ma Rin, a new record for the Park. Photo: Nguyen Xuan Nghia



14. A Particolored Flying Squirrel *Hylopetes alboniger* photographed in Thuong Hoa. Photo: Nguyen Manh Ha



15. A Large Brown Flying Squirrel *Petaurista philippensis* photographed during a night transect.



16. Lang Bian White-bellied Rat *Niviventer langbianis* photographed in Hang En (PNKB-44). Photo: Nguyen Xuan Nghia



17. Edwards's Long-tailed Giant Rat *Leopoldamys edwardsi* from Hang En. Photo: Nguyen Manh Ha



18. A Northern Treeshrew, *Tupaia belangeri* From Hang En (PNKB-29)
Photo: Nguyen Xuan Nghia



19. *Leopoldamys edwardsi* from Hung Dang (PNKB-51)
Photo: Nguyen Xuan Nghia



20. *Chiropodomys gliroides* from Ma Rinh (PNKB-2)
Photo: Nguyen Xuan Nghia



21. *Chiropodomys gliroides* from Hung Dang (PNKB-56)
Photo: Nguyen Xuan Nghia



22. *Maxomys surifer* from Hung Dang (PNKB-49)
Photo: Nguyen Xuan Nghia



23. *Leopoldamys sabanus* from Hang En (PNKB-41)
Photo: Nguyen Xuan Nghia



24. *Laonastes aenigmamus* from Hang En (PNKB-21), a new record for Vietnam. Photo: Nguyen Xuan Nghia



25. *Laonastes aenigmamus* from Hang En (PNKB-21) Photo: Nguyen Xuan Nghia



26. *Niviventer tenaster* from Hang En (PNKB-25) Photo: Nguyen Xuan Nghia



27. *Rattus remotus/andamanensis* from Hang En (PNKB-27) Photo: Nguyen Xuan Nghia



28. *Niviventer fulvescens* from Ma Rinh (PNKB-2)
Photo: Nguyen Xuan Nghia



29. *Berymys bowersi* from Ma Rinh (PNKB-10)
Photo: Nguyen Xuan Nghia



30. Three living Brush-tailed Porcupines *Atherurus macrourus* in a hunter's back basket in Cha Khe forest, Thuong Trach Commune. Photo: Le Trong Dat



31. The horns of a Saola *Pseudoryx nghetinhensis*, a Large-antlered Muntjac *Muntiacus vuquangensis* and other muntjac species found in a local house in Hoa Son Commune.



32. A sack of bones in a hunters' camp including the skull of serow, *Capricornis milneedwardsii*. Photo: Le Trong Dat



33. Hunters' camp in Ma Rin. Photo: Nguyen Xuan Dang



34. Traps and snares in the hunting camp. Photo: Nguyen Xuan Dang



35. Timber cutting in Ma Rin. Photo: Nguyen Xuan Dang



36. Transportation of logs in Ma Rin. Photo: Nguyen Xuan Dang



37. Traps enclosure in Hang En. Photo: Nguyen Xuan Dang



38. Sign of bee honey collecting in Hang En area



39. Hunted animals from hunters in Ma Rin. Photo: Nguyen Xuan Dang



40. Bones and skins of small mammals at a hunters' camp

CIPANTS AND CONTRIBUTORS

Employment		Address
Small carnivore and loris team		
Nguyen Manh Ha	Centre for Natural Resources and Environmental Studies (CRES)	Vietnam National University Hanoi
Do Tuoc	Forest Inventory and Planning Institute	Hanoi
Insectivore and rodent team		
Nguyen Xuan Dang	Institute of ecology and Biological Resource	18 Hoang Quoc Viet Road, Cau Giay, Hanoi Phone: 0437562810. Mobile: 0913312431 E-mail: dangnx@fpt.vn
Nguyen Xuan Nghia	Institute of ecology and Biological Resource	18 Hoang Quoc Viet Road, Cau Giay, Hanoi Phone: 0437562810. Mobile: 0914083100 E-mail: nghiaiebr@gmail.com
Nguyen Thanh Binh	Centre for Science Research and Rescue, PNKB NP	Son Trach commune, Bo Trach District, Quang Binh Provinces Phone: 0523677021. Mobile: 01694166755
Nguyen Thanh Huyen	Forest Protection Division, PNKB NP	Son Trach commune, Bo Trach District, Quang Binh Provinces Phone: 0523677021. Mobile: 0905510270
Camera trap team		
Nguyen Manh Ha	Centre for Natural Resources and Environmental Studies (CRES)	Vietnam National University Hanoi
Nguyen Ngoc Tuan	XXX	
Le Van Dung	XXX	
Do Tuoc	Forest Inventory and Planning Institute	Hanoi
Gibbon survey team		
Le Trong Dat	Gibbon surveyor, Team Leader 1	901 Thien Son, Thien Ton, Hoa Lu, Ninh Binh
Do Tuoc	Gibbon surveyor, Team Leader 2, Institute of Forest Inventory and Planning	, Hanoi
Nguyen Tri Phuong	Technician, Centre for Science Research and Rescue, PNKB NP	Phong Nha-Ke Bang National Park
Nguyen Viet Doai	Technician, Centre for Science Research and Rescue, PNKB NP	Phong Nha-Ke Bang National Park
Pham Van Sau	Ranger, Forest Protection Division, PNKB NP	Phong Nha-Ke Bang National Park
Tran The My	Ranger, Forest Protection Division, PNKB NP	Phong Nha-Ke Bang National Park
Nguyen Duy Luong	Manager of FFI Phong Nha -	Office tel: +84.4.7194117/8; Fax:

		ation	+84.4.7194119 Add: 340 Nghi Tam, Tay Ho, Ha Noi - Vietnam
Do Thang Long	Guide/Porter		Son Trach commune, Bo Trach District, Quang Binh Provinces
Do Anh Son	Guide/Porter		Son Trach commune, Bo Trach District, Quang Binh Provinces
Nguyen Ngoc Linh	Guide/Porter		Son Trach commune, Bo Trach District, Quang Binh Provinces
Nguyen Quoc Loi	Guide/Porter		Son Trach commune, Bo Trach District, Quang Binh Provinces
Nguyen Van Hoang	Guide/Porter		Son Trach commune, Bo Trach District, Quang Binh Provinces
Cao Van Son	Guide/Porter		Ban On, Hoa Son commune, Minh Hoa District, Quang Binh Provinces
Cao Van Hoa	Guide/Porter		Ban On, Hoa Son commune, Minh Hoa District, Quang Binh Provinces
Cao Van Nhan	Guide/Porter		Ban On, Hoa Son commune, Minh Hoa District, Quang Binh Provinces
Ho Van Man	Guide/Porter		Ban On, Hoa Son commune, Minh Hoa District, Quang Binh Provinces
Coordination and editing			
Nguyen Duy Luong	Manager of FFI Phong Nha - Ke Bang Conservation Programme		Office tel: +84.4.7194117/8; Fax: +84.4.7194119 Add: 340 Nghi Tam, Tay Ho, Ha Noi - Vietnam
William Bleisch, Ph.D.	Consultant to FFI		CERS, B2707 SouthMark, Wong Chuk Hang, Hong Kong E-mail: wbleisch@gmail.com

BIODIVERSITY SURVEY OF BATS IN AND AROUND THE PHONG NHA – KE BANG NATIONAL PARK, QUANG BINH, VIETNAM

by

VU DINH THONG^{1,*}, Pham Duc Tien¹, Nguyen Truong Son¹, Tran Thi Lua², Vu Thi Thuy², Nguyen Thi Thiep³, Pham Kim Vuong⁴, Dinh Hoang Tuan⁴, Le Thuc Dinh⁴

¹Institute of Ecology and Biological Resources

²Vietnam National University, Hanoi

³Hanoi National University of Education

⁴Phong Nha-Ke Bang National Park

*E-mail: thong@iebr.ac.vn

28 February 2012

A report for the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region Project, Quang Binh



Vietnam-Germany Development Cooperation (BMZ 2004 65 989)

REPORT STRUCTURE/LAY-OUT:

Acronyms and Abbreviations
Executive Summary/Abstract
Acknowledgements

1 Introduction

- 1.1 Overview of the report
- 1.2 Phong Nha - Ke Bang National Park and the PNKB Regional Project
- 1.3 Brief history of the Phong Nha - Ke Bang National Park relevant to bat survey
- 1.4 PNKB physical structure and climate
- 1.5 Previous biodiversity survey work on bats in and around the PNKB National Park

2 Objectives of the survey

- 2.1 Aims and objectives of the biodiversity survey on bats
- 2.2 Scope of the survey on bats

3 Bat survey

- 3.1 Overview
- 3.2 Methodology, sampling scheme, and survey locations
- 3.3 Results
 - 3.3.1 Bats in the PNKB National Park and the extension area
 - 3.3.2 Threats to and management concerns of bats in the PNKB National Park and the extension area
- 3.4 Analysis and discussion of the results, observation, and data

4 Conclusions and Recommendations

- 4.1 The status of bat diversity at the PNKB National Park
- 4.2 Threat assessments
- 4.3 Recommended actions
- 4.4 Recommendations for the NP Management Plan

5 References

- Annex 1 GPS reading`s for species recorded in and around the park
- Annex 2 Report on the training for park and survey staff
- Annex 3 Bat taxa recorded from PNKBNP
- Annex 4 Selected photographs of bat species captured during the survey.

Acronyms and Abbreviations

PNKB: Phong Nha-Ke Bang National Park

PNKBNP: Phong Nha-Ke Bang National Park and extension areas.

IUCN2011. IUCN Red List of Threatened Species. Version 2011.2

RDBVN2007: Red Data Book of Vietnam. Version 2007.

IEBR: Institute of Ecology and Biological Resources

Executive Summary/Abstract

This report describes a bat survey of Phong Nha – Ke Bang National Park and extension section, Quang Binh Province, Vietnam, conducted as part of the Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang National Park Region Project, from July 2011 to February 2012.

PNKBNP covers a total of 341,824 ha in Quang Binh Province, North Central Vietnam. The park contains the greatest cave systems of the country with over 300 caves and grottoes discovered. Particularly, PNKBNP is home to the world's longest and largest caves, and is the oldest major karst area in Asia. The findings of this survey indicate that PNKBNP is host to a remarkably high diversity bat fauna. At least, 41 bat species have been recorded over the present and previous surveys, including a new species to science, 5 species listed in the 2007 Red Data Book of Vietnam, and 1 species listed in the 2011 IUCN Red List of Threatened Species as "Vulnerable". In fact, the number of bat species recorded from the park had been rapidly increased over the surveys, and bat surveys were just carried in very narrow area in comparison with the total area of PNKBNP. These imply that PNKBNP would be an important site for both academic and conservation of bats in Vietnam and Asia. Further investigations into the bat fauna of PNKBNP are clearly required for a proper assessment of its diversity and conservation values.

Acknowledgements

This study was commissioned by the PNKBNP Region Project with funding from the Vietnam-Germany Development Cooperation. We are grateful to the managerial boards of IEBR, Phong Nha – Ke Bang National Park and other colleagues for administrative assistance. Particular thanks are extended to Mr Nguyen Trung Thuc, Mr Le Duc Duong, Mr Bas van Helvoort, Ms Vu Thi Binh Minh, Ms Nguyen Thi Ngoc Lan, Mr Luu Minh Thanh, and Mr Dinh Huy Tri for their kind help in administrative works and field surveys. We are greatly indebted to Prof. Hans-Ulrich Schnitzler, Dr. Annette Densinger, Dr Christian Dietz and other staff and students of the University of Tuebingen, Germany for their various supports; Dr Paul J.J. Bates, Dr. David Harrison, Dr. Nikky Thomas, of the Harrison Institute, UK; Dr Tigga Kingston of the Texas Tech University, USA; Prof. Paul A. Racey and Dr. Neil M. Furey of the Aberdeen University, UK for their help with valuable advice and encouragement.

1. Introduction

1.1. Overview of the report

To date, bat research in Vietnam is at an early stage. Although Vietnamese bats has received attention from scientist in recent times, currently still very little is known regarding the status and distribution of the majority of species occurring within the country. Despite large gaps remaining in terms of survey coverage, however, recent studies have clearly demonstrated that Vietnam contains very high levels of species richness. In particular, limestone karst formations, such as those which characterise much of the landscape of Phong Nha-Ke Bang National Park, are highly significant areas for bat diversity due to their typically extensive cave networks which provide ideal roosting sites. Moreover, sites of forested limestone karst provide critical habitat for several globally threatened and near-threatened bat species occurring in Vietnam.

The purpose of the present survey was to conduct a bat survey within the strictly protected core areas and extension section of Phong Nha-Ke Bang National Park, with a special emphasis on caves, and to assess their importance for biodiversity conservation in Phong Nha-Ke Bang National Park as a whole.

1.2. Phong Nha - Ke Bang National Park and the PNKB Regional Project

PNKBNP is a UNESCO World's Natural Heritage Site. It is situated in the Bo Trach and Minh Hoa districts of Quang Binh province, north-central Vietnam. The park was created to protect one of the world's two largest karst regions with over 300 caves and grottoes, to protect the ecosystem of limestone forest of the Annamite Range region in north central of Vietnam. The cave systems of the park contain many fascinating rock formations and various forest types. Particularly, it is located in a plateau, which is evaluated as one of the finest and most distinctive examples of a karst landform complex in Southeast Asia.

The PNKB Regional Project area covers the core zone of PNKBNP with an area of 116,824 ha (including extension area of 31,070 ha) and a buffer zone of 225,000 ha, consisting of parts of 13 adjacent communes in three districts: Bo Trach, Minh Hoa, and Quang Ninh of Quang Binh Province, Vietnam. The total population of these 13 communes comprising 146 villages is 12,828 households, 61,256 people of which about 11,000 are ethnic minorities of Van Kieu and Chut and the rest belong to the majority ethnic group of Kinh.

The Nature Conservation & Sustainable Natural Resource Management in Phong Nha - Ke Bang Region, Vietnam aims to improve the management of Phong Nha – Ke Bang National Park and reduce the pressure on its natural resources.

In the context of management formulation and improvement, the project organizes biodiversity baseline surveys. These surveys have the following functions:

To inform the management plan and management implementation.

To form the basis of long term biodiversity monitoring, and/or to assess the impact of improved management.

To provide a basis to apply for World Heritage status on biodiversity grounds for the extended PNKB NP.

The subjects and topics of biodiversity baseline surveys need to be chosen and guided carefully to balance between the need to increase relevant knowledge, park management, monitoring needs, management planning, and available time. The surveys need to be scientifically adequate, relevant, and results comprehensively processed to optimize the value and benefit to PNKB NP. The specialists to undertake the various surveys need to be chosen carefully, as many surveys need specialized knowledge and skills.

1.3. Brief history of the Phong Nha - Ke Bang National Park relevant to bat survey

In 1986, Phong Nha-Ke Bang region was first considered for protection of the extensive cave system within an area of 5,000 ha. Subsequently, it was established as a nature reserve by the Quang Binh Provincial People's Committee in 1993. Subsequently, the Forest Inventory and Planning Institute (FIPI) prepared a revised investment plan for establishment of Phong Nha-Ke Bang National Park region as a national park. In 2001, the Prime Minister approved the revised plan by FIPI, but did not include an approximately 60,000 ha of the Ke Bang limestone section in Minh Hoa district, which was proposed for inclusion within the national park in the plan. Remarkably, Phong Nha-Ke Bang has been recognized as a UNESCO World Heritage Site since 1998. It contains over 300 grottoes and caves, including the largest and longest caves of the world. It is clear that, the outstanding cave systems and various vegetations covering large karst area are home to a highly diverse bat fauna, which would include precious species.

1.4. PNKB physical structure and climate

PNKBNP is one of the two largest limestone regions in the world. In addition, since its karsts can be traced back to Palaeozoic era, 400 million years ago, PNKBNP appears as the oldest major karst in Asia. It contains around two dozens of mountain peaks with over 1,000 metres in height. Noteworthy peaks are the Peak Co Rilata with a height of 1,128 m and the Peak Co Preu with a height of 1,213 m.

Besides the grotto and cave systems, PNKBNP has the world's longest underground river. The Son and Chay are the main rivers in this national park. Most of caves here have been shaped by these two rivers. These cave ecosystems together with surrounding forests provide ideal homes to bats and other animals.

Similar to other areas within North-central Vietnam, climate in PNKBNP is tropically hot and humid. The annual mean temperature is 23 to 25 °C, with a maximum of 41 °C in the summer and a minimum of 6 °C in the winter. The hottest months in this region fall from June to August, with an average temperature of 28 °C,

and the coldest months from December to February with an average temperature of 18 °C. Annual rainfall is 2,000 mm to 2,500 mm, and 88% of the rainfall is from July to December. With more than 160 rainy days per year, raining appears in every month of the year. On the other hand, the annual relative humidity averages 84%.

1.5. Previous biodiversity survey work on bats in and around the PNKBNP

Prior to the survey, very few studies incorporating bats were conducted within PNKBNP. A brief chronology of these is given below.

Nguyen Xuan Dang et al. (1998; 1999; 2000) provided reports on mammal surveys at PNKBNP, which included records of bat species

Timmins et al. (1999) produced an assessment of conservation importance and conservation priorities of the Phong Nha-Ke Bang, which included records of bat species.

Nguyen Truong Son et al. (2000) provided a list of bat species recorded from a rapid survey in PNKBNP.

Hendrichsen et al. (2001) produced a review of bat research in Vietnam, including records of bat species from PNKBNP. This is the most comprehensive document regarding previous bats of PNKBNP. It summarized all previous records of bats from the park by 2001 and truthfully referred its records to either primary materials or literatures. Therefore, only data from this document is cited in the report for discussion on bat diversity of PNKBNP.

2. Objectives of the survey

2.1. Aims and objectives of the biodiversity survey on bats

The aim of the field surveys were to evaluate the biodiversity value, and make conservation recommendations for PNKBNP.

Specific objectives of the field survey were to:

- Collect data on the bat fauna of the study areas;
- Identify important bat roosts and caves within the study area;
- Assess the conservation value of the sites surveyed; and
- Formulate recommendations for appropriate conservation management of the study area.

2.2. Scope of the survey on bats

The survey was conducted in selected sites, which represent typical habitats and are suitable for bat roosts, in the core zone and extension section of Phong Nha-Ke Bang National Park. To pursue the above aims and objectives, the survey was focused mostly on assessment of bat diversity and conservation status within the study areas.

3. Bat survey

3.1. Overview

The survey comprised two phases of fieldwork in PNKBNP. The first phase of fieldwork was carried out in the extension section between July and August 2011. The second phase of fieldwork was carried out in the core zone in February 2012. A list of survey sites and survey effort is given overleaf in Annex 1.

3.2. Methodology, sampling scheme, and survey locations

Site selection

The survey was emphasized on caves and forests, where bats had not been previously studied to determine the species composition of cave and non-cave roosts within core and extended zones of Phong Nha-Ke Bang National Park. Apart from the caves, the surveys were conducted along the courses of rivers, streams, and flight corridors under forest canopies.

In the extended zones, bat capture was conducted at four caves (DBP, Mo O, On 1, On 2), and six trapping sites under forest canopies. In the core zone, the fieldwork was also carried out at four caves and five sites under forest canopies. Selection of trapping sites was largely based on information from local guides and field observations.

Mist netting and Harp trapping

A total of ten mist nets with various sizes (6-12m [length] x 3m [height]) and five harp trap (4 bank design, Francis 1999) were employed during the field surveys. Nets were attended constantly while in active use. Harp traps were generally more effective for capturing insectivorous bats while mist nets were often more effective in wider flight corridors and for capturing fruit bats. Since harp traps were obviously helpful for capturing large numbers of bats, they were always placed at cave doors, where large aggregations of bats would fly together.

Specimen collection

Whenever possible, representative specimens were collected for each species, preferably one of each sex. For several species not easily diagnosed, additional specimens were collected encompassing the range of variation within the captured material (based on biometrics, external morphology, pelage and gender). All specimens were humanely killed using diethyl ether and subsequently soaked in 70% ethanol solution. The large specimens were injected with 10% formalin, prior to storage in 70% ethanol. Pregnant and lactating bats were released at the capture point after taking important external measurements, weight, and photos. Voucher specimens collected during the surveys are retained at the Institute of Ecology and Biological Resources (IEBR), Hanoi, in the collection of Vu Dinh Thong, and at the Phong Nha – Ke Bang National Park.

Identification

Preliminary identifications were made in the field using Lekagul & McNeely (1977), Corbet & Hill (1992), Bates & Harrison (1997), Borissenko and Kruskop (2003), Francis (2008), and Vu Dinh Thong (2011). Further examination of specimens was carried out in Hanoi using information from a variety of published literature. All specimens were determined by the first author (Vu Dinh Thong).

Data collected

All bats captured were measured for forearm length, identified, sexed and the time of capture recorded. For study specimens, additional measurements including head and body (HB), tibia (TB), ear height (EH), lengths of the third, fourth and fifth finger were also recorded to the nearest 0.1mm using two digital calipers. Weight of all live bats and study specimens were taken within one hour from capture time using a digital balance with accuracy to the nearest 0.1g. Details of pelage colors and important external characteristics were also recorded before soaking in ethanol.

Training for park and survey staff

Basic bat survey technique was given to selected staff of PNKBNP during field survey. Additionally, a short training workshop was also conducted at the headquarter of the park with involvement of many other staff of PNKBNP and students from universities in Hanoi. These activity efforts are illustrated in the Annex 2, 3.

3.3. Results

3.3.1. Bats in the PNKB National Park and the extension area

Over the two phases of the survey, a total 179 individuals belonging to 23 species, 13 genera, 6 families were captured. Of which, 24 individuals were kept as voucher specimens for taxonomic examination at IEBR. Provisionally named specimens will require further taxonomic examination to confirm identifications. A full list of species recorded during the survey period is given in Annex 3.

Results from the field survey provide 10 species new to PNKBNP (*Megaerops ecaudatus*, *Sphaerias blanfordi*, *Taphozous melanopogon*, *Rhinolophus macrotis*, *Hipposideros scutinaries*, *Hipposideros cineraceus*, *Murina cyclotis*, *Murina eleryi*, *Murina tiensa*, *Murina cineracea*), and one horseshoe bat species (*Rhinolophus* sp.) new to science. Collating the results from the present with previous surveys conducted in PNKBNP, a total of 41 species belonging to 23 genera, 7 families are now known from the study area. A list of these species is given in Annexes 3, 4.

Of the 12 sites surveyed during the present study, four are identified as important for bat conservation because of presence of either rare or threatened species, comprising *R. paradoxolophus*, *Hipposideros scutinaries*, *Rhinolophus* sp. [nov.], *Murina cineracea*, *Murina tiensa*, *Macroglobosus sobrinus*, and *Megaerops ecaudatus*.

Survey site accounts

The survey efforts are given below. Number of captured individuals, which partially indicates a relative abundance of each species within the trap site, is given in either the text or square brackets.

1. Trap Site #1 - Cave 11:

(17°32'.24"N; 106°16'.59"E), Cave 11 is one of the large caves of the cave system. It is located in the core zone of PNKB, covered and surrounded by less disturbed forests. A large number of bats were observed at this cave. However, estimated number is much decreased in comparison with data recorded in 2009. Remains of sticks and batteries indicate clearly that bats inhabiting this cave were illegally hunted by local people. Two mist nets and a harp trap were placed at the cave door. Seven species were recorded at this cave: *Aselliscus stoliczkanus* [1], *Hipposideros armiger* [1], *H. larvatus* [2], *H. pomona* [2], *Rhinolophus thomasi* [2], *R. pearsonii* [2], and *Myotis calicraniatus* [1].

2. Trap Site #2 - Cha Noi Cave:

(17°38'.18.1"N; 106°06'.12.3"E), Cha Noi Cave is one of the most well known caves of PNKB. It is located near the Cha Noi Forestry Protection Station and a valley, and surrounded by good forests. A large stream seasonally runs beside this cave. Five mist nets and two harp traps were placed at the cave door and across the stream. Ten species were captured from this study site: *Cynopterus sphinx* [1], *Megaderma lyra* [3], *Aselliscus stoliczkanus* [1], *Hipposideros armiger* [1], *H. larvatus* [1], *H. pomona* [1], *H. scutinaries* [1], *Rhinolophus thomasi* [1], *R. paradoxolophus* [1], *R. pearsonii* [1], and *la io* [3]. Particularly, an individual of unnamed horseshoe

bat species, which is describing by the first author and here provisionally identified as *Rhinolophus* sp. characteristics of this individual are identical to those of a series of individuals previously collected from other nature reserves and national parks in Northern Vietnam. They are clearly distinct from all known horseshoe bats et species levels, and currently classified as a new species to science. Their detailed descriptions are given in our manuscript, which was submitted to a peer-reviewed journal.

3. Trap Site #3 - Bay Tang Cave:

(17°31'33.3"N; 106°16'31.2"E), Bay Tang Cave is a very large cave located within the core zone of PNKB. Since it is a historical site, many tourists visit this cave annually. This cave is surrounded by almost primary forests, and has two adjacent doors. Three mist nets were placed at the cave doors and across a flight corridor inside the cave. Additionally, four other mist nets and two harp traps were also placed across a long footpath connecting the cave and the Legendary Road 20. In order to sample a variation of species composition in a good forest area with cave, bat captures were carried out in February and July, these months belong to the typical rainy and dry seasons, respectively. Four species were captured within this cave area: *Taphozous melanopogon* [5], *Aselliscus stoliczkanus* [1], *Rhinolophus thomasi* [1], and *Pipistrellus javanicus* [1]. Remarkably, a large number of bats were observed and captured inside the cave during the trapping nights in July, but none was seen in February. Further ecological studies within this cave area are required to determine this variation. Of the four captured species, *Taphozous melanopogon* is the most abundant while *Pipistrellus javanicus* appears very rare with only one individual captured.

4. Trap Site #4 – an unnamed forest site:

(17°40'39.8"N; 105°55'48.4"E), the trapping site contains a small tributary and various vegetation types: remaining timber trees, shrubs, banana, and bamboo. Three mist nets and two harp traps were placed at this study site. However, only a single individual of *Megaderma lyra* [1] was captured during two trapping nights at this study site.

5. Trap Site #5 – an unnamed forest site:

(17°40'32.0"N; 105°56'38.7"E), the trap site is located beside a farm with various fruit trees. The farm is surrounded by degraded forests with a small stream running across. Two mist nets were placed along an edge of the farm, and a harp trap was placed across the stream. Four species were captured during three trapping at this site, comprising *Rhinolophus pusillus* [1], *Hipposideros larvatus* [2], *Murina cyclotis* [2], and *Murina cineracea* [2].

6. Trap Site #6 - Sot Cave

(17°32'02.3"N; 106°15'18.9"E), Sot Cave is located within the core zone of PNKB. Two mist nets and two harp traps were employed to capture bats within this site. Three species were collected over two trapping nights: *Rhinolophus pusillus* [1], *R. thomasi* [6], and *Pipistrellus javanicus* [2].

7. Trap Site #7 – an unnamed forest site:
(17o40.26.4"N; 105o56.26.4"E), the trap site contains various vegetation types ranging from old farms to secondary forests. Six mist nets and three harp traps were employed during three nights. Only two common species, *Hipposideros larvatus* [6] and *Rhinolophus thomasi* [1], were captured at this site.

8. Trap Site #8 – Da Lat Forest
(17o40'33.7"N; 105o56'05.4"E), Da Lat is a primary forests located in Hoa Son Commune, Minh Hoa District. Four mist nets and two harp traps were employed over three nights. Six species were captured from this site: *Hipposideros armiger* [4], *H. larvatus* [2], *Rhinolophus thomasi* [2], *R. pearsonii* [2], *Murina cineracea* [1], and *M. tiensa* [2].

9. Trap Site #9 – an unnamed forest site:
(17o40'39.8"N; 105o55'48.4"E), this site contains a range of habitats, including streams, small caves and secondary forests. Six mist nets and four harp traps were employed during seven nights. Twelve species were captured over four trapping nights: *Rhinolophus macrotis* [1], *R. thomasi* [8], *R. pearsonii* [1], *R. pusillus* [17], *Aselliscus stoliczkanus* [4], *Hipposideros cineraceus* [4], *H. larvatus* [1], *H. pomona* [2], *Macroglobosus sobrinus* [1], *Megaerops ecaudatus* [1], *Murina cyclotis* [1], and *Myotis caldicraniatus* [1]. Of these, *Megaerops ecaudatus* and *Macroglobosus sobrinus* are rarely documented throughout its distribution range.

10. Trapping Site #10 – DBP585 Cave:
(17o40'44.4"N; 105o55'46.6"E), this is a small cave situated beside a large farm and near an army station. Prior to the present study, it had not been named and received no zoological survey. We here name it after the well known army station 585 (= "Don Bien Phong 585" in Vietnamese). Only one species, *Hipposideros armiger* [11], was captured from this cave over one night using two mist nets and a harp trap.

11. Trap Site #11 – Mo O Cave:
(17o40'05.3"N; 105o56'23.8"E), Mo O Cave has a small mouth opening towards an old farm. It is surrounded and covered by good forests. Prior to this study, the cave was not named and had received no zoological survey. Nine species were captured from this cave over four trapping nights: *Aselliscus stoliczkanus* [15], *Hipposideros armiger* [6], *H. larvatus* [8], *H. pomona* [6], *H. cineraceus* [3], *Rhinolophus macrotis* [2], *R. thomasi* [11], *R. pearsonii* [3], and *R. pusillus* [7].

12. Trap Site #12 – Mo O village
(17o40'38.8"N; 105o56'33.8"E), the trap site comprises various vegetation types: shrubs, banana, small timber trees, and secondary forest. Four species were captured from this site over three trapping nights: *Sphaerias blanfordi* [1], *Aselliscus stoliczkanus* [1], *Rhinolophus macrotis* [1], *Myotis caldicraniatus* [1], *Murina cineracea* [1], and *M. tiensa* [2].

3.3.2. Threats to and management concerns of Bats in the PNKBNP and the extension area

Similar to several karst areas of the country, threats to bat populations in PNKBNP stem from three principal sources: habitat loss and degradation, incidental disturbance of bat roosts, over-harvesting of caves for tourism development.

To date, very little is known regarding the ecology, roosting and habitat requirements of bats in PNKB and other areas of Vietnam. However, it is clear that habitat loss and degradation can pose a serious threat to bat populations. An example study in Lao P.D.R. showed dramatic differences between sites possessing good vegetation cover compared to those with secondary cover, with much higher bat abundance and diversity recorded in the former (Hutson *et al.* 2001; Furey and Son, 2002). Without doubt, bat species are directly affected by habitat degradation. Cutting timber and large trees definitely leads to loss of roosting sites of bats. Particularly, cave visiting has been well developed in PNKB. As consequence, cave roosts of bats are seriously threatened. Results from interviews and evidence remained inside several caves indicate that bats of PNKB are hunted for local consumption. It is clear that hunting would be one of the most serious threats to cave roosts within PNKB.

Given the low reproductive potential of bats (usually one to two young per year), this activity poses a serious concern as colonies require considerable lengths of time to recover from population declines. Furthermore, given that cave roosts are inherently vulnerable sites which account for the largest proportion of bat populations in karst areas at certain times of the year, clearly these activities have the potential to cause dramatic declines in bat populations in localised areas.

3.4. Analysis and discussion of the results, observation, and data

Collating the results of previous and present researches, a total of at least 41 species are now known from PNKB, representing nearly half of the known bat fauna of Vietnam and approximate 4.0% of the world's bat species (Vu Dinh Thong, unpublished data; Simmons, 2005; Vu Dinh Thong, 2011). These figures alone demonstrate a highly important area for bat conservation in South-east Asia. A full species list is given in Annex 3. It should be noted that this list is clearly incomplete as it is based upon the results of specimen collections, which in some cases have been published prior to their examination by a professional taxonomist.

In terms of individual areas, the present data indicates that the 4 most important sites for bat conservation within PNKB are Da Lat Forest, Cha Noi Cave, Mo O Cave, and Cave 11. In fact, numbers of bat species recorded from PNKBNP had been rapidly increased over the surveys. Therefore, there are good reasons to expect that further survey works will reveal additional bat species at this area. The present survey recorded 10 new species to PNKBNP and a new species to science in just 25 days of fieldwork covering a relatively small proportion of the area. Given

that large areas of forested karst in PNKB remain essentially uninvestigated in terms of their bat fauna, particularly within both core and extended zones.

Unfortunately however, bat populations within PNKB are presently threatened by several factors. Despite the limited coverage and relatively short duration of the present survey, it is evident that incidental disturbance of cave roosts is widespread within the area and presents a serious concern. Although not conclusive, the available evidence also strongly suggests that direct persecution of bats for local consumption could also present a serious concern in localised areas. Further research to determine the scale of these activities within PNKB and identify a representative network of key sites for bat conservation should be considered a priority. Moreover, immediate measures to address these threats and to ensure adequate protection for key cave roosts identified in this study are required.

4. Conclusions and Recommendations

4.1. The status of bat diversity at PNKB National Park

- * The currently known bat fauna of PNKBNP is highly diverse.
- * A number of nationally and globally rare bat species are living in PNKBNP.
- * The numbers of bat species recorded from PNKB have been rapidly increased over the recent surveys. This result suggests a great potentiality of bat diversity of PNKB.

4.2. Threat assessments

Within PNKB, over harvesting of caves for tourism development appears as one of the most threats to bats of the area, particularly to the cave dwelling species. On the other hand, evidence of hunting for local consumption is also a critical threat to bats within PNKB.

4.3. Recommended actions

- ◆ Additional surveys, combining all mist nets, harp traps, mobile nets with support of echolocation detector systems are required to fill current gaps in survey coverage and identify other important bat roosts in PNKBNP. These should attempt to identify a representative network of key sites for bat conservation within PNKBNP and provide a better understanding of seasonal patterns in activity and movement. Insofar as is possible, roost assessments

in caves should be conducted between December to March, the peak season for cave roosting.

- ◆ Monitoring studies of roosts at caves such as Mo O cave, should be undertaken to ascertain the safe limits of manure harvesting and least damaging means of collection, and, if deemed appropriate, a system of quotas should be introduced to maintain collection within these limits.
- ◆ In tandem with the above research, further information regarding the scale and severity of other factors threatening cave bat populations within PNKB is required to provide a basis for prioritisation of targeted conservation actions. Research is also required to determine whether current levels of tourism at PNKBNP are negatively affecting bat roosts, and to what extent there may be a need to restrict levels of access at different times of the year.
- ◆ PNKBNP represents an ideal area for more detailed studies investigating the roosting and habitat requirements and behavioural ecology of several poorly known species of special conservation concern. Opportunities to realise this potential should be sought with relevant universities and research institutes.
- ◆ A review of specimen collections made at sites within PNKBNP is required to resolve existing uncertainties concerning the species composition of these areas.
- ◆ Training courses with involvement of the managers of PNKBNP, local authorities, school teachers, and selected key people should be taken to raise public awareness of bat's importance in ecosystems. The efforts of the courses would provide fruitful results in monitoring and conservation of bats and environments within PNKBNP and surroundings.

4.4. Recommendations for the NP Management Plan

- Effective protection of the two key cave roosts, Cha Noi and Mo O, identified in this study is required to safeguard their conservation value. All these sites should be incorporated into patrol routes and visited on a regular basis, particularly during times of peak usage (December to March). Existing site patrols should also be expanded to include the Phong Nha, Thien Duong, and Son Doong caves to ensure these sites are not subjected to further unnecessary disturbance.
- In terms of forest areas, regular patrols and other appropriate measures should be taken to prevent the possible occurrence of habitat loss and

degradation in the On and Mo O forest areas, in particular, as these represent especially significant sites for bat conservation.

- A conservation management strategy specifically for bats should be formulated for PNKB.
- Awareness-raising activities should be undertaken to promote understanding among local communities of the ecological importance e.g. beneficial roles in insect pest control, pollination and seed dispersal etc, conservation significance and fragility of bat populations to incidental and deliberate disturbance. In particular, training should be provided to relevant FPD staff so they can assume a key role in carrying out these and other monitoring activities e.g. roost assessments. Appropriate awareness-raising activities could include educational discussions held in relevant villages, distribution of educational materials e.g. posters., talks given in local schools and supervised visits to selected caves to witness the emergence of bat roosts.
- Specific cave management plans should be formulated to safeguard the archaeological and biological value of all caves which currently serve as tourist attractions. Relevant interpretative and educational materials should be also created to promote understanding and appropriate behaviour on the part of visitors to the site. This could include displaying codes of conduct and/or 'thoughtful tourism' style notices in appropriate locations.
- Development proposals for tourism related infrastructure involving alterations to the interior environment of caves e.g. pathway creation, cementing of floors, installation of lights etc. should be properly evaluated prior to the onset of construction, and, if necessary, revised, to eliminate negative impacts upon the biodiversity and archaeological value of these sites.
- A database should be created for all data regarding bat biodiversity within PNKB to facilitate future research and conservation management and provide accessible baseline information for future monitoring efforts.

5. References

- Anon. 2007. Red Data Book of Vietnam. Vol. 1. Animals. Scientific and Technique Publishing House.
- Bates PJJ, Harrison DL (1997) *Bats of the Indian Subcontinent*. Harrison Zoological Museum Publications, Kent, UK.
- Borissenko AV, Kruskop SV (2003) *Bats of Vietnam and Adjacent Territories: an Identification Manual*. Hanoi, Vietnam and Moscow, Russia.
- Corbet GB, Hill JE (1992) *The Mammals of the Indomalayan Region*. Oxford University Press, Oxford, UK.
- Francis C (2008) *A Guide to the Mammals of South-east Asia*. Princeton University Press. Princeton, New Jersey, and Oxford, United Kingdom. 392 pp.

- Francis CM (1989) A comparison of mist nets and two types of harp traps for capturing bats. *Journal of Mammalogy* 70:865–870.
- Hendrichsen DK, Bates PJJ, Hayes BD, Walson JL (2001) Recent records of bats (Mammalia: Chiroptera) from Vietnam with six species new to the country. *Myotis* 39: 35–199.
- IUCN (2011) IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on **28 February 2012**.
- Lekagul B, McNeely JA (1977) *Mammals of Thailand*. Sahakarnbhat Co. Bangkok, Thailand.
- Nguyen Truong Son, Nguyen Xuan Dang and Hendrichsen D (2000) Preliminary results of surveys of bats (Chiroptera) in Phong Nha-Ke Bang (Quang Binh province) and Huu Lien (Lang Son province). *Tap Chi Sinh Hoc [Journal of Biology]* 22(15) CD: 145-150. In Vietnamese.
- Nguyen Xuan Dang and Truong Van La (2000) Diversity of vertebrates in Phong Nha-Ke Bang-Hinamno area. *Tap Chi Sinh Hoc [Journal of Biology]* 22(15) CD: 122-124. In Vietnamese.
- Nguyen Xuan Dang, Nguyen Truong Son, Nguyen Manh Ha (1999) Preliminary results of surveys of bats (Chiroptera) in Phong Nha-Ke Bang (Quang Binh province) and Huu Lien (Lang Son province). Pp 50-56 in: Le Sau ed. [Protection and sustainable development of forest and biodiversity in limestone areas of Vietnam] Hanoi: Forest Inventory and Planning Institute. In Vietnamese.
- Nguyen Xuan Dang, Pham Nhat, Pham Trong Anh, Hendrichsen DK (1998) [Results of survey on mammal fauna in Phong Nha-Ke Bang area, Quang Binh, Vietnam]. Hanoi: Fauna and Flora International-Indochina Programme and the Institute of Ecology and Biological Resources. In Vietnamese.
- Simmons NB (2005) Order Chiroptera. Pp. 312–529 in *Mammal species of the world: a taxonomic and geographic reference* (D.E. Wilson and D. M. Reeder, eds.). 3rd ed. The Johns Hopkins University Press, Baltimore, Maryland.
- Timmins RJ, Do Tuoc, Trinh Viet Cuong, Hendrichsen DK (1999) A preliminary assessment of the conservation importance and conservation priorities of the Phong Nha-Ke Bang proposed national park, Quang Binh province, Vietnam. Hanoi: Fauna and Flora International-Indochina Programme.
- Vu Dinh Thong (2011) Systematics and echolocation of rhinolophoid bats (Mammalia: Chiroptera) in Vietnam. PhD Thesis, University of Tuebingen, Tuebingen, Germany.

Annex 1. GPS reading`s for species recorded in and around the park

Survey site	Location	Habitat	Species recorded
The core zone			
Cave 11	17o32'.24.3"N 106o16'.59.2"E	Cave	<i>Aselliscus stoliczkanus</i> , <i>Hipposideros armiger</i> , <i>H. larvatus</i> , <i>H. pomona</i> , <i>Rhinolophus thomasi</i> , <i>R. pearsonii</i> , and <i>Myotis caltocraniatus</i> .
Cha Noi Cave	17o38'.18.1"N 106o06.12.3"E	Cave Tream	<i>Cynopterus sphinx</i> , <i>Megaderma lyra</i> , <i>Aselliscus stoliczkanus</i> , <i>Hipposideros armiger</i> , <i>H. larvatus</i> , <i>H. pomona</i> , <i>H. scutinares</i> , <i>Rhinolophus thomasi</i> , <i>R. paradoxolophus</i> , <i>R. pearsonii</i> , and <i>la io</i> .
Bay Tang Cave	17o31'33.3"N 106o16'31.2"E	Forest Cave	<i>Taphozous melanopogon</i> , <i>Aselliscus stoliczkanus</i> , <i>Rhinolophus thomasi</i> , and <i>Pipistrellus javanicus</i> .
Sot Cave	17o32'02.3"N 106o15'18.9"E	Cave	<i>Rhinolophus pusillus</i> , <i>R. thomasi</i> , and <i>Pipistrellus javanicus</i>
The extension section			
Trap Site #4	17o40'39.8"N 105o55'48.4E	Forest	<i>Megaderma lyra</i>
Trap Site #5	17o40'32.0"N 105o56'38.7"E	Forest Stream	<i>Rhinolophus pusillus</i> , <i>Hipposideros larvatus</i> , <i>Murina cyclotis</i> , and <i>Murina cineracea</i> .
Trap Site #7	17o40.26.4"N 105o56.26.4"E	Forest	<i>Hipposideros larvatus</i> and <i>Rhinolophus thomasi</i>
Trap Site #8	17o40'33.7"N 105o56'05.4"E	Forest	<i>Hipposideros armiger</i> , <i>H. larvatus</i> , <i>Rhinolophus thomasi</i> , <i>R. pearsonii</i> , <i>Murina cineracea</i> , and <i>M. tiensa</i> .
Trap Site #9	17o40'39.8"N 105o55'48.4E	Forest Cave Streams	<i>Rhinolophus macrotis</i> , <i>R. thomasi</i> , <i>R. pearsonii</i> , <i>R. pusillus</i> , <i>Aselliscus stoliczkanus</i> , <i>Hipposideros cineraceus</i> , <i>H. larvatus</i> , <i>H. pomona</i> , <i>Macroglobosus sobrinus</i> , <i>Megaerops ecaudatus</i> , <i>Murina cyclotis</i> , and <i>Myotis caltocraniatus</i> .
Trapping Site #10	17o40'44.4"N 105o55'46.6"E	Cave	<i>Hipposideros armiger</i>
Trap Site #11	17o40'05.3"N 105o56'23.8"E	Cave	<i>Aselliscus stoliczkanus</i> , <i>Hipposideros armiger</i> , <i>H. larvatus</i> , <i>H. pomona</i> , <i>H. cineraceus</i> , <i>Rhinolophus macrotis</i> , <i>R. thomasi</i> , <i>R. pearsonii</i> , and <i>R. pusillus</i> .
Trap Site #12	17o40'38.8"N 105o56'33.8"E	Forest	<i>Sphaerias blanfordi</i> , <i>Aselliscus stoliczkanus</i> , <i>Rhinolophus macrotis</i> , <i>Myotis caltocraniatus</i> , <i>Murina cineracea</i> , and <i>M. tiensa</i> .

Annex 2. Report on the training for park and survey staff

Trainee	Position	Subjects	Training schedule	Methodology	Conclusions
Mr Pham Kim Vuong	Scientific staff of PNKBNP.	Bat survey techniques.	- During field surveys. - Workshop.	- Presentation & discussion over the workshop. - Practical activities during field surveys.	The trainee has learnt and applied basic techniques during the courses.
Mr Dinh Hoang Tuan	Scientific staff of PNKBNP.	Bat survey techniques.	- During field surveys. - Workshop.	- Presentation & discussion over the workshop. - Practical activities during field surveys.	The trainee has learnt and applied basic techniques during the courses.
Ms Vu Thi Thuy	Student of Hanoi National University.	Bat survey techniques.	- During field surveys. - Workshop.	- Presentation & discussion over the workshop. - Practical activities during field surveys.	The trainee has learnt and applied basic techniques during the courses.
Ms Tran Thi Lua	Student of Hanoi National University.	Bat survey techniques.	- During field surveys. - Workshop.	- Presentation & discussion over the workshop. - Practical activities during field surveys.	The trainee has learnt and applied basic techniques during the courses.
Ms Nguyen Thi Thiep	Student of Hanoi National University.	Bat survey techniques.	- During field surveys. - Workshop.	- Presentation & discussion over the workshop. - Practical activities during field surveys.	The trainee has learnt and applied basic techniques during the courses.
Five other staff of PNKBNP	Staff of the Scientific unit of PNKBNP.	Bat survey techniques.	-Workshop	- Presentation & discussion over the workshop.	The trainee gain basic knowledge on bats of PNKBNP.

Annex 2. Report on the training for park and survey staff (continued)

Photos taken during the field and indoor workshops



Annex 3. Bat taxa recorded from PNKBNP

No.	Taxa		Data sources	Conservation status	
	Family	Species		VNRDB2007	IUCN2011
1	Pteropodidae	<i>Rousettus leschenaulti</i>	II		LC
2		<i>Cynopterus sphinx</i>	I, II		LC
3		<i>Eonycteris spelaea</i>	II		LC
4		<i>Megaerops ecaudatus</i>	I		LC
5		<i>Megaerops niphanae</i>	II		LC
6		<i>Macroglobosus sobrinus</i>	I, II		N/A
7		<i>Sphaerias blanfordi</i>	I		LC
8	Emballonuridae	<i>Taphozous melanopogon</i>	I		LC
9	Megadermatidae	<i>Megaderma lyra</i>	I, II		LC
10		<i>Megaderma spasma</i>	I, II		LC
11	Rhinolophidae	<i>Rhinolophus thomasi</i>	I, II	VU	LC
12		<i>Rhinolophus affinis</i>	II		LC
13		<i>Rhinolophus luctus</i>	II		LC
14		<i>Rhinolophus paradoxolophus</i>	I, II	VU	LC
15		<i>Rhinolophus macrotis</i>	I		LC
16		<i>Rhinolophus pearsoni</i>	I, II		LC
17		<i>Rhinolophus pusillus</i>	I, II		LC
18		<i>Rhinolophus sp.</i>	I		N/A
19	Hipposideridae	<i>Aselliscus stoliczkanus</i>	I, II, III		LC
20		<i>Hipposideros armiger</i>	I, II		LC
21		<i>Hipposideros scutinares</i>	I		VU2
22		<i>Hipposideros cineraceus</i>	I		LC
23		<i>Hipposideros larvatus</i>	I, II, III		LC
24		<i>Hipposideros pomona</i>	I, II		LC
25	Vespertilionidae	<i>Hypsugo pulveratus</i>	I		LC
26		<i>Ia io</i>	I, II	VU	LC
27		<i>Murina cyclotis</i>	I, II		LC
28		<i>Murina eleryi</i>	I		N/A
29		<i>Murina tiensa</i>	I		N/A
30		<i>Murina cineracea</i>	I		N/A
31		<i>Murina sp.</i>	I		
32		<i>Harpiocephalus harpia</i>	II	VU	LC
33		<i>Harpiocephalus mordax</i>	II		DD
34		<i>Myotis ater</i>	II		LC
35		<i>Myotis chinensis</i>	II		LC
36		<i>Myotis horsfieldii</i>	II		LC
37		<i>Myotis ricketti</i>	II	LR	N/A
38		<i>Myotis calicraniatus</i>	I, II		N/A
39		<i>Scotomanes ornatus</i>	II		LC
40		<i>Pipistrellus javanicus</i>	II		LC
41	Miniopteridae	<i>Miniopterus magnater</i>	II		LC

Note: I = The present study result; II = Hendrichsen et al. (2001); III = Vu Dinh Thong (2011).

VNRDB2007 = Red Data Book of Vietnam; IUCN2011 = IUCN Red List of Threatened Species. Version 2011.2

VU, LR = categories defined in VNRDB2007; VU2; LC, DD = categories defined in IUCN2011. N/A = not available.

Annex 4. Selected photographs of bat species captured during the survey.

Pteropodidae



Cynopterus sphinx



Megaerops ecaudatus



Macroglossus sobrinus



Sphaeris blandfordi

Emballonuridae



Taphozous melanopogon



Megaderma lyra



M. spasma

Megadermatidae

Rhinolophidae



Rhinolophus thomasi



R. paradoxolophus



R. macrotis



R. pearsonii



R. pusillus



Rhinolophus sp. [nov.]

Hipposideridae



Aselliscus stoliczkanus



Hipposideros armiger



H. cineraceus



H. cineraceus



H. larvatus



H. pomona

Vespertilionidae



Hypsugo pulveratus



Ia io



Murina cyclotis



M. eleryi



M. tiensa



M. cineracea

FINAL REPORT

BIODIVERSITY SURVEY OF MACAQUE, LANGUR AND DOUC MONKEY IN AND AROUND THE PHONG NHA – KE BANG NATIONAL PARK, QUANG BINH, VIETNAM



Figure 1: Karst landscape in Phong Nha – Ke Bang National Park. *Photo: Bui Van Tuan*

by
Frankfurt Zoological Society in Vietnam
Danang, 31/12/2011

**A report for the Nature Conservation and Sustainable Natural Resource Management
in Phong Nha – Ke Bang National Park Region Project, Quang Binh**



Vietnam-Germany Development Cooperation (BMZ 2004 65 989)



Acronyms and Abbreviations	3
Executive Summary	4
Acknowledgements	5
1. Introduction	6
1.1. <i>Overview of the report</i>	6
1.2. <i>Phong Nha - Ke Bang National Park and the PNKB Regional Project</i>	6
1.3. <i>PN-KB physical structure and climate</i>	6
1.4. <i>Previous biodiversity survey work on macaque, langur and douc monkeys in and around the PN-KB National Park</i>	6
2. Objectives of the survey	7
2.1. <i>Aims</i>	7
2.2. <i>Objectives of the biodiversity survey</i>	7
2.3. <i>Scope of the survey</i>	7
3. Survey	8
3.1. <i>Overview</i>	8
3.2. <i>Methodology, sampling scheme, and survey locations</i>	8
3.2.1. <i>Interview</i>	8
3.2.2. <i>Presence and absence method</i>	9
3.2.3. <i>Transect survey</i>	9
3.2.4. <i>Data analysis</i>	10
3.3. <i>Results</i>	11
3.3.1. <i>Record of Macaque, Langur and Douc monkey in the PNKB NP</i>	11
3.3.2. <i>Threats to primate fauna and management concerns in the PNKB National Park</i>	17
3.4. <i>Analysis and discussion results</i>	18
3.4.1. <i>Primate fauna (Macaques, Langurs and Douc monkey) in PN-KB NP</i>	18
3.4.2. <i>Population abundance</i>	19
3.4.3. <i>Threats to the primates fauna in Phong Nha- Ke Bang and the extended area</i>	19
4. Conclusions and Recommendations	20
4.1. <i>The status of macaques, langurs and douc monkeys biodiversity at the PN-KB NP</i>	20
4.2. <i>Threats to the primate fauna in the Phong Nha- Ke Bang National Park</i>	20
4.3. <i>Recommendations for primates conservation in the Phong Nha- Ke Bang NP</i>	20
4.4. <i>Recommendations for management plan of the Phong Nha- Ke Bang NP</i>	21
5. References	21
6. Annex	22

<i>Annex 1: Report on the training for park and survey staff</i>	22
<i>Annex 2: List of animals observed in PN-KB during the field survey</i>	24
<i>Annex 3: GPS of locations where primates were observed</i>	24
<i>Annex 4: Distribution map of primates observed in PN-KB National Park</i>	27
<i>Annex 5: Photographs and picture of specimens</i>	27
<i>Annex 6: Digital data that can be used for managing plan of the Phong Nha-Ke Bang NP</i>	32
<i>Annex 7: List of surveyors and people who contributed for the field survey</i>	32

Acronyms and Abbreviations

Phong Nha-Ke Bang NP	:PN-KB NP
Birdlife International	:Birdlife
World Conservation Monitoring Centre	:WCMC
International Union for Conservation of Nature	:IUCN
Frankfurt Zoological Society	:FZS

Executive Summary

Survey on primate fauna with a focus on macaques, langur and douc monkeys in Phong Nha-Ke Bang National Park was conducted in the framework of biodiversity survey, sponsored by Vietnam-Germany Development Cooperation. The field work was taken place from 11th of July to 7th of August 2011. Line-transect method was used to investigate occurrence of primates, and population abundance was estimated using the encounter rate. 40 transects were set up and each transect was 2.93 km in length. In total, there 117 km of transect had been surveyed. As result, 7 primate species were recorded in the PN-KB NP. Among these primates, 5 of them were observed in the field and 2 of them were reported by local people. Abundance of primate fauna in PN-KB NP was quite high with the encounter rate about 0.43 group per 1 km of surveyed transect. Level of abundance of primate fauna inside the park was higher than that of in the extended area 0.57group/km and 0.31group/km, respectively. The Hatinh langur's population was the most abundance in the park. They occupied about 48% of total observed groups during the survey. Cha Noi area was the hotspot for primates in the park. The human disturbances, which are most danger to the primate fauna in the park, were illegal logging, hunting and trapping. The disturbance in the extended area was more extensive than in the park. Recommendations for managing the park and protecting primate fauna were also discussed in the report.

Acknowledgements

We would like to send many thanks to officials of the Centre for Rescuing and Scientific of the Phong Nha- Ke Bang National Park for their good support and cooperation. We also would like to thank rangers in Tro Mong, Hoa Son, Thuong Hoa and Cha Noi station for their support. Thanks to local people who have been worked together with us during survey time for their hard working and friendship. We would like to thank staffs of the Primate Reintroduction Programme (PRP) for their cooperation. We would like to send a special thank to Mr Dirk G. Euler and Sladzana Miskovic, Mr Nguyễn Thanh Hải, Mr Lê Lưu Dũng for their help and friendship. Finally, we are grateful for the support from Miss Vu Thi Binh Minh from AHT office and Mr Le Duc Duong from PN-KB region project. This study was commissioned by the PNKB NP Region Project with funding from the Vietnam-Germany Development Cooperation.

1. Introduction

1.1. Overview of the report

This report provides the most update information about the biodiversity in the Phong Nha-Ke Bang NP with a focus on primate fauna (macaque, langur and douc monkeys). Base on the data collected in the field, the distribution status, population abundance and threats to primate fauna in the park were analyzed. Recommendations for managing and conserving primate fauna in the park were also provided.

1.2. Phong Nha - Ke Bang National Park and the PNKB Regional Project

Phong Nha-Ke Bang National Park located in the west of the Bo Trach District, on the border to Laos. It belongs to a large limestone mountain range lie between the North of Truong son range and the South of Truong Son range. It is close to Hin Namno National Protected forest in Laos. The park was established in 2001 with an area of 85,754 ha. 96.2% of the park was forest-covered, 92.2% in primary forest. The park was recognized as a World Heritage Site in 2003. From 2009, the park was extended to the north with an area 31,000 ha (Birdlife, 2004).

The project “Nature conservation and sustainable managing nature resource in Phong Nha-Ke Bang region” acts in both area of PN-KB NP with 116,824 ha and its buffer zone with 25,000 ha. The project aims to enhance the managing and conserving nature resource of the heritage site PN-KB NP, and to mitigate the pressure on nature resource of the park.

1.3. PN-KB physical structure and climate

Phong Nha-Ke Bang National Park in the Central Annamite Mountains and its bordering lowlands is in one of the largest and most distinctive tracts of karst topography in the world. With the neighboring Ke Bang Conservation Area and karsts it comprises a wide deeply dissected plateau of some 200,000 ha extending into Hin Namno, a similar area in Laos. Its geological history is traced back to the late Ordovician-early Silurian period around 460-400 million years ago. The limestone is discontinuous, being interbedded with shales and sandstones and capped by schists and granites, rising to a number of unexplored peaks over 1,000m high. There were three main rivers in the region including Chay River, Son River, and Trooc River (Birdlife, 2004; WCMC, 2010).

The climate is tropical, hot and humid. The annual mean temperature ranges between 23⁰C and 25⁰C, with a summer maximum of 41⁰C and a winter minimum of 6⁰C. The hottest months are from June to August, with a mean of 28⁰C; the coldest months are from December to February with a mean of 18⁰C. The high annual rainfall averages 2,000-2,500mm, 88% falling between July and December, though there is rain in every month and on more than 160 days a year. The mean annual relative humidity is 84% (WCMC, 2010).

1.4. Previous biodiversity survey work on macaque, langur and douc monkeys in and around the PN-KB National Park

Before 2000, studying primate fauna in Phong Nha – Ke Bang national park was conducted by several researchers such as Pham Nhat (2000), Le Xuan Canh and others (1997) and Timmin and others (1999). According to Pham Nhat and Nguyen Xuan Dang, the primate fauna in Phong Nha – Ke Bang was quite diverse. There were 9 species in the park, including red-shanked douc monkey (*Pygathrix nemaeus*), Ha Tinh langur (*Trachypithecus hatinhensis*), Southern white-cheeked gibbon (*Nomascus siki*) Rhesus macaque (*Macaca mulatta*), Stump-tailed macaque (*Macaca arctoides*), Pig-tailed macaque (*Macaca nemestrina*), Long-tailed macaque (*Macaca fascicularis*), Pigmy loris (*Nycticebus pymaeus*), and slow loris (*Nycticebus begalensis*) (Pham Nhat and Nguyen Xuan Dang, 2000). However, there was very few study on population density of primates in the park due to restrict of financial and difficulty of terrain access. Recently, Haus and colleagues (2009) conducted survey on primate fauna in the park to estimate population density. As a result, Haus confirmed five primate taxa in the park including the red-shanked douc monkey (*Pygathrix nemaeus*), Hatinh langur (*Trachypithecus hatinhensis*), Southern white-cheeked gibbon (*Nomascus siki*), Stump-tailed macaque (*Macaca arctoides*), Assamensis macaque (*Macaca assamensis*). The population density of Hatinh langurs was about 2,143 (\pm 467) individuals and that population of Hatinh langur actually larger than previous estimate. Haus also estimated about 1,316 (\pm 871) individuals of red-shanked doucs, 930 (\pm 489) stump-tailed macaques (*Macaca arctoides*), 986 (\pm 883) eastern Assamese macaques (*M. assamensis*). A survey on the southern white-cheeked gibbon conducted by Le Trong Dat in 2009. The authors estimated about 41 groups of the gibbon with about 113 individuals in the park.

The two studies on population density of primate were taken place inside the National Park with about 85,000 ha. There was no study on population status of primates in the extended area of the national park (~31,000 ha).

2. Objectives of the survey

2.1. Aims

The survey study biodiversity in the Phong Nha – Ke Bang National Park and the extended area with a focus on macaques, langurs and douc monkeys.

2.2. Objectives of the biodiversity survey

- To produce a list of primate species in the extended area of the park.
- To reconfirm the primate species in the core zone area of the park
- To build a distribution map of primate species in the surveyed area.
- To give an estimate on relative density of primate species in the surveyed area.
- To identify the threats to the primate species in surveyed area.
- To recommend the authority conservation action to protect primates species in the park.

2.3. Scope of the survey

The survey was conducted in the extended area (31,000 ha) in Thuong Hoa Village and Hoa Son Village. Inside the core-zone of the Phong Nha –Ke Bang, survey was conducted in Tro Mong, Cha Noi and U Bo area.

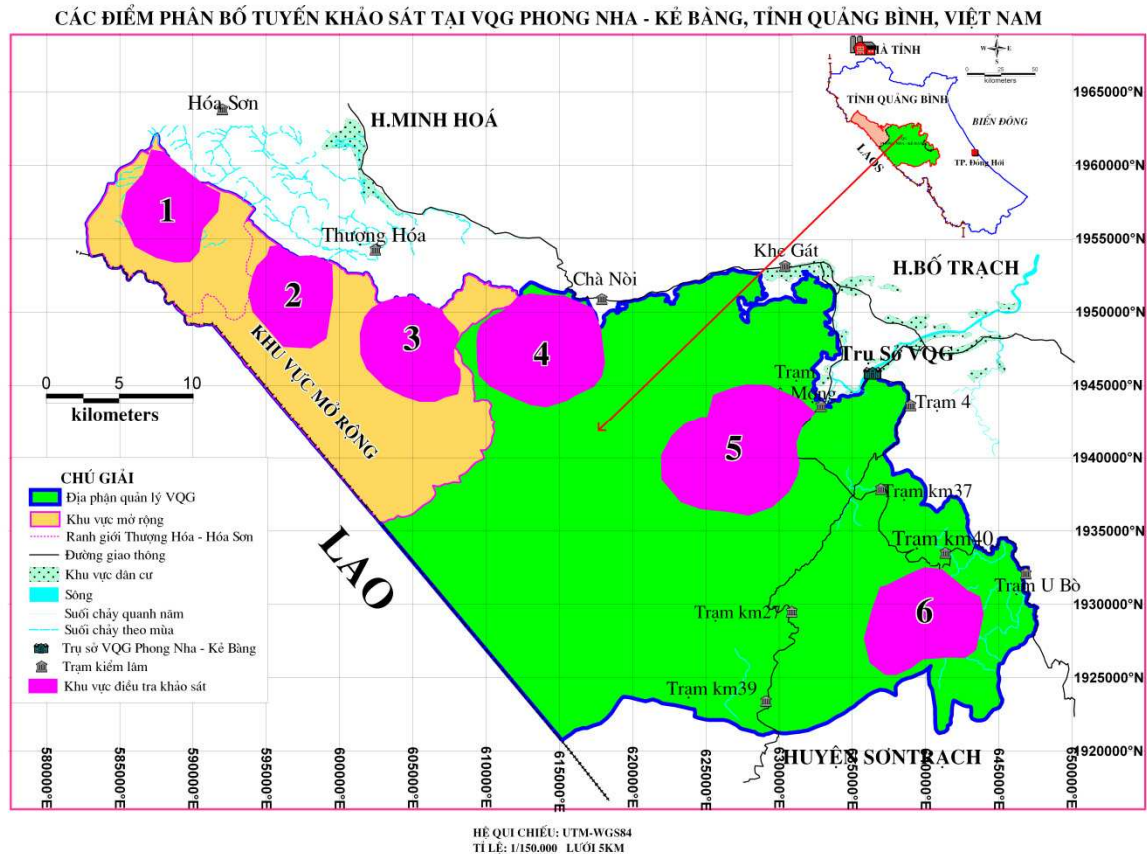


Figure 2: Locations of surveying in PN-KB National Park

3. Survey

3.1. Overview

The survey was conducted from 11/07/2011 to 07/08/2011. Survey team was comprised of expert from Frankfurt Zoological Society and trained staff of Centre for Wildlife Rescuing and Science Research, PN-KB NP. Survey was begun in Thuong Hoa and Hoa Son area and then was carried out in the park.

3.2. Methodology, sampling scheme, and survey locations

3.2.1. Interview

First of all, interviews were carried out with staffs from the National Park. Questions mostly concerned the distribution and recent sightings of primates as well as threats to them in the region. Questions were concerned with the occurrence of primates in the areas, forest condition and forest type. In the villages, the interviews were focus on hunters, forest product collectors, wildlife traders and local people who farm inside the forest. The questions used in this survey included open-ended questions. Open-ended questions are used to gather general information of the animal, hunting and forest condition in the region. The use of these questions allows respondents to answer in their own way, without influence from the interviewer. The questionnaire followed guidelines in Peterson (2000).

For the purpose of identifying species, questions were designed based on the different external characteristics of four the distinctive groups of Vietnamese primates: gibbons,

langurs, macaques and lorises, as described in “Primates of Vietnam” (Pham Nhat, 2002). Characteristics of each species were distinguished using the “Vietnamese Primate Field Guide” (Nguyen Vu Khoi and Shaw, 2005). The questions were collected and grouped based on our experience from previous surveys of primates.

3.2.2. Presence and absence method

We applied the presence and absence method to gather information of geographic range and habitat requirements of primate species in the study site. This data then was used to accomplish a species list (Singh *et al.*, 1999; McGraw, 1998). In the field, we collected data on presence of living primates or signs of occurrence of primates such as faeces, call, feeding site along line transects. We also recorded information of the captive or killed primates in the village, market at the study site. We investigated origin of these captured primates. Beside, report of recent sightings of primates was also recorded and we checked the accuracy of identification and location of sighting.

3.2.3. Transect survey

The 40 transects were established in 5 main locations (Hoa Son: 1, Thuong Hoa: 2 and 3, Cha Noi: 4, Tro Mong: 5, Son Doong: 6), see Figure 2. There including 23 transects in the extended area (~31,000 ha) and 17 transects inside the Phong Nha – Ke Bang National Park. These transects vary from 2 km to 4.5 km. On average, the length of transect in the extended area and the park were 2.8 km and 3.0 km, respectively.

Each transect was surveyed by one team for one day from 6h00 to 18h00. Five teams carried out the survey. Each team has 3 members including expert from Frankfurt Zoological Society, field assistants (park’s rangers) and local guides. If the primates are seen on transects, the location was recorded using GPS device. The group size and forest condition were recorded. Researcher also collected data on indirect occurrence of primates in the field including feeding site, food remains, and faeces. The species was identified. Picture of animal was taken for classification.

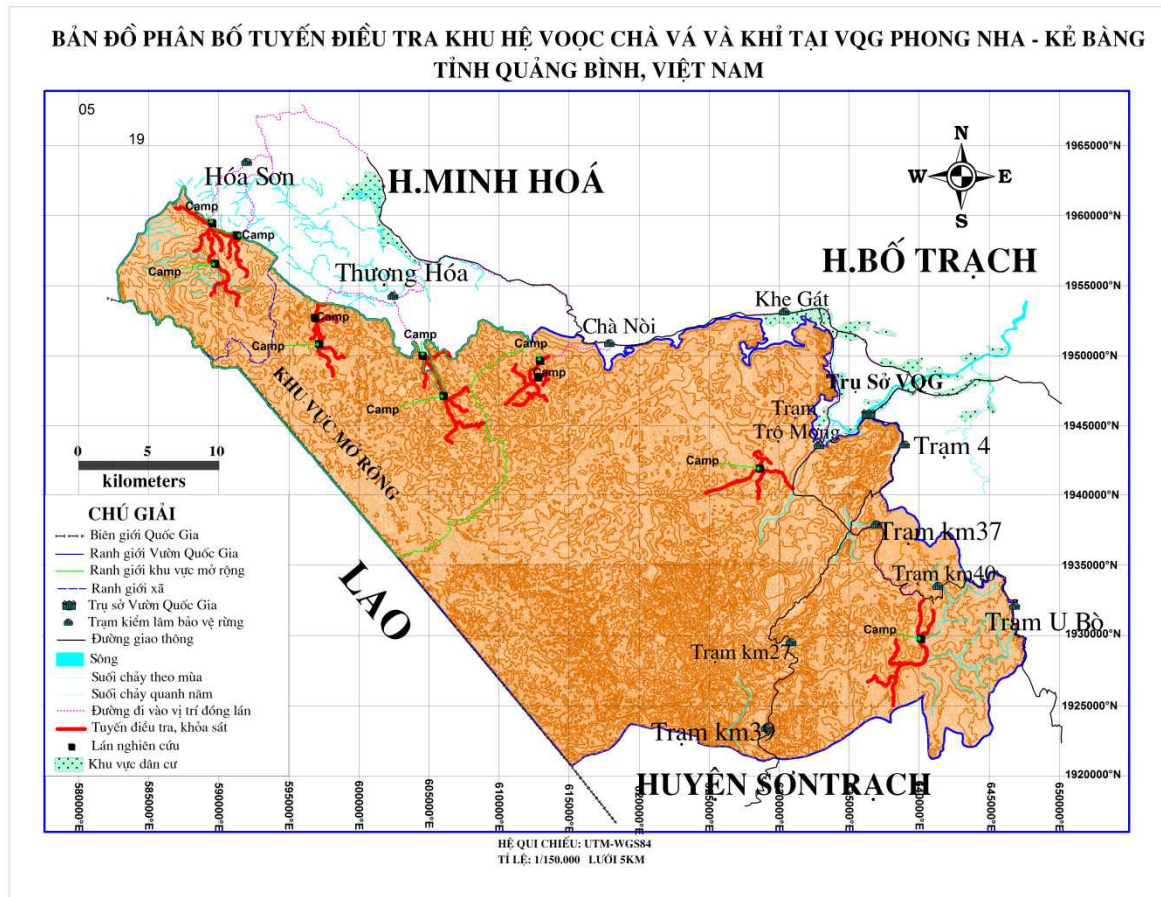


Figure 3: Distribution of transects in the park and the extended area

3.2.4. Data analysis

3.2.4.1. Identify species list

First of all, the information collected from interview was analysed to determine occurrence of primate fauna in the study site. The species identification characters will follow the “Primates field guide” written by Nguyen Vu Khoi and Shaw, 2005. Secondly, direct observation of primates in the field was used to make a list of exist species in the area. The conservation status of each species was referred in the Vietnamese Red Data Book 2007 and IUCN Red List 2012.

3.2.4.2. Distribution map of primates in the study area

The coordinate of the location, where the primates were recorded in the field, was put in the software Map Inform version 10.5. Based in this data, a map of the distribution of primates was produced.

3.2.4.3. Estimate population abundance

Encounter rate (ER) index was used to estimate relative abundance of primate population in the study area (Rovero *et al*, 2006). Encounter rate was analysed for all species found in the study site as well as for each species. The encounter rate presents number of observed group per one kilometre of surveyed transects. Data on group of primate species observed in the

field as well as length of transects was put in the software Excel 2007. The encounter rate was calculated using the formulation below:

$$ER = n_i/l$$

n_i : number of group of species i

l : total length of transect been surveyed

3.3. Results

3.3.1. Record of Macaque, Langur and Douc monkey in the PNKB NP

3.3.1.1. Interview result

In total, 7 officials of the park and 23 hunters and non-timber product collectors were interviewed during the survey period. Among 23 hunters, it was comprised of 17 hunters in the extended area and 6 hunters in the park area. The result showed that most interviewee could describe and recognize pictures of primates in their living area. They reported the occurrence of ten different species in the survey area (the Phong Nha – Ke Bang National Park and the extended area). Among 10 species Hatinh langurs, Red-shanked douc monkeys, Assamese macaques, Stump-tailed macaques and white-cheeked gibbons were often described. The black langur had the least information regarding distribution and population. In fact, there only one hunter reported sighting of the black langur near Laos border. There was no information of the long-tailed macaques (*Macaca fascicularis*) in both the extended area and the national park. Following is the list of primate species described by the interviewees:

Table 1: List of primate species described by local hunters

Group	No	Vietnamese name	Common name	Scientific name	Local name
Douc	1	Chà vá chân nâu	Red-shanked douc monkeys	<i>Pygathrix nemaeus</i>	Muồm, khi bầy màu, khi chú lính
Langur	2	Voọc Hà Tĩnh	Hatinh langur	<i>Trachypithecus laotum hatinhensis</i>	Khi đen, Cụng
	3	Voọc đen tuyền	Black langur	<i>Trachypithecus laotum laotum</i>	Khi đen
Macaque	4	Khi mặt đỏ	Stump-tailed macaque	<i>Macaca arctoides</i>	Giút, khi đất, Cà Xác
	5	Khi vàng	Rhesus macaque	<i>Macaca mulatta</i>	Nước, con Lúp
	6	Khi mốc	Assamese	<i>Macaca</i>	Quảng, Cà mà

			macaque	<i>assamensis</i>	
	7	Khỉ đuôi lợn	Northern pig-tailed macaque	<i>Macaca leonina</i>	Khỉ Sư tử, khỉ đầu chó
Loris	8	Culi lớn	Slow loris	<i>Nycticebus bengalensis</i>	Khỉ gió lớn
	9	Culi nhỏ	Pigmy loris	<i>Nycticebus pigmaeus</i>	Khỉ gió nhỏ
Gibbon	10	Vượn đen má trắng Siki	Southern white-cheeked gibbon	<i>Nomascus leucogenys siki</i>	Khỉ đen

During the survey time, surveyor recorded 8 individuals of macaques were kept by the local people in Hoa Luong, Tan Hoa and Thuan Hoa hamlet, Hoa Son village. That included 4 Rhesus macaques, 3 Stump-tailed macaques, and 1 Assamese macaque. According to the owners, all the macaques were captured in the extended area. Here is the list of species:

Table 2: List of species and location of primate kept illegally by local people

No	Location	Species	Number	Sex/Condition
1	Tân Hóa, Hóa Sơn	<i>Macaca mulatta</i>	1	Male, sub-adult, healthy
2	Tân Hóa, Hóa Sơn	<i>Macaca arctoides</i>	1	Infant, healthy
3	Thuận Hóa, Hóa Sơn	<i>Macaca mulatta</i>	2	1 male adult, injured leg 1 female sub-adult, healthy
4	Hóa Lương, Hóa Sơn	<i>Macaca mulatta</i>	1	Female adult, healthy
5	Hóa Lương, Hóa Sơn	<i>Macaca assamensis</i>	1	Female adult, injured
6	Hóa Lương, Hóa Sơn	<i>Macaca arctoides</i>	2	1 male adult, healthy 1 female adult, healthy
	Total		8	

3.3.1.2. Primate fauna (douc monkeys, langurs and macaques) in PN-KB

Based on the result of interview and observation, a list of primate species recorded in the extended area and the Phong Nha – Ke Bang National Park was described in the Table 3.

In this survey, 7 primate species recorded in the park and the extended area. Five species were definitely confirmed by surveyors in the field including Red-shanked douc monkey, Hatinh langur, Rhesus macaque, Assamese macaque, Stump-tailed macaques. Two species including Northern pig-tailed macaque and Black langur were only provisional information reported by the local people. The long-tailed macaque (*Macaca fascicularis*) was neither observed in the field nor reported by local people. Therefore, the species is absence in the surveyed area.

Table 3: List of douc monkeys, langurs and macaques recorded in this survey

Group	No	Common name	Scientific name	Location	Source of data
Douc	1	Red-shanked douc monkeys	<i>Pygathrix nemaeus</i>	Thuong Hoa, Hoa Son, Cha Noi, Tro Mong, Son Doong	<ul style="list-style-type: none"> • Observed • Interview
Langurs	2	Hatinh langur	<i>Trachypithecus laotum hatinhensis</i>	Thuong Hoa, Hoa Son, Cha Noi, Tro Mong, Son Doong	<ul style="list-style-type: none"> • Observed • Interview
	3	Black langur	<i>Trachypithecus laotum laotum</i>	Hoa Son, Thuong Hoa	<ul style="list-style-type: none"> • Interview
Macaques	4	Stump-tailed macaque	<i>Macaca arctoides</i>	Hoa Son	<ul style="list-style-type: none"> • Observed • Interview
	5	Rhesus macaque	<i>Macaca mulatta</i>	Tro Mong, Son Doong, Cha Noi	<ul style="list-style-type: none"> • Observed
	6	Assamese macaque	<i>Macaca assamensis</i>	Thuong Hoa, Hoa Son, Tro Mong, Son Doong, Cha Noi	<ul style="list-style-type: none"> • Observed • Interview
	7	Northern pig-tailed macaque	<i>Macaca leonina</i>	Hoa Son	<ul style="list-style-type: none"> • Interview

3.3.1.3. Distribution status

Distribution status of primates in surveyed locations (Hoa Son, Thuong Hoa, Cha Noi, Tro Mong, and Son Doong) was presented in the Figure 4. Number of group observed in the surveyed locations was presented in the Table 4. Difference in distribution status in the extended area and the park was presented in Figure 5.

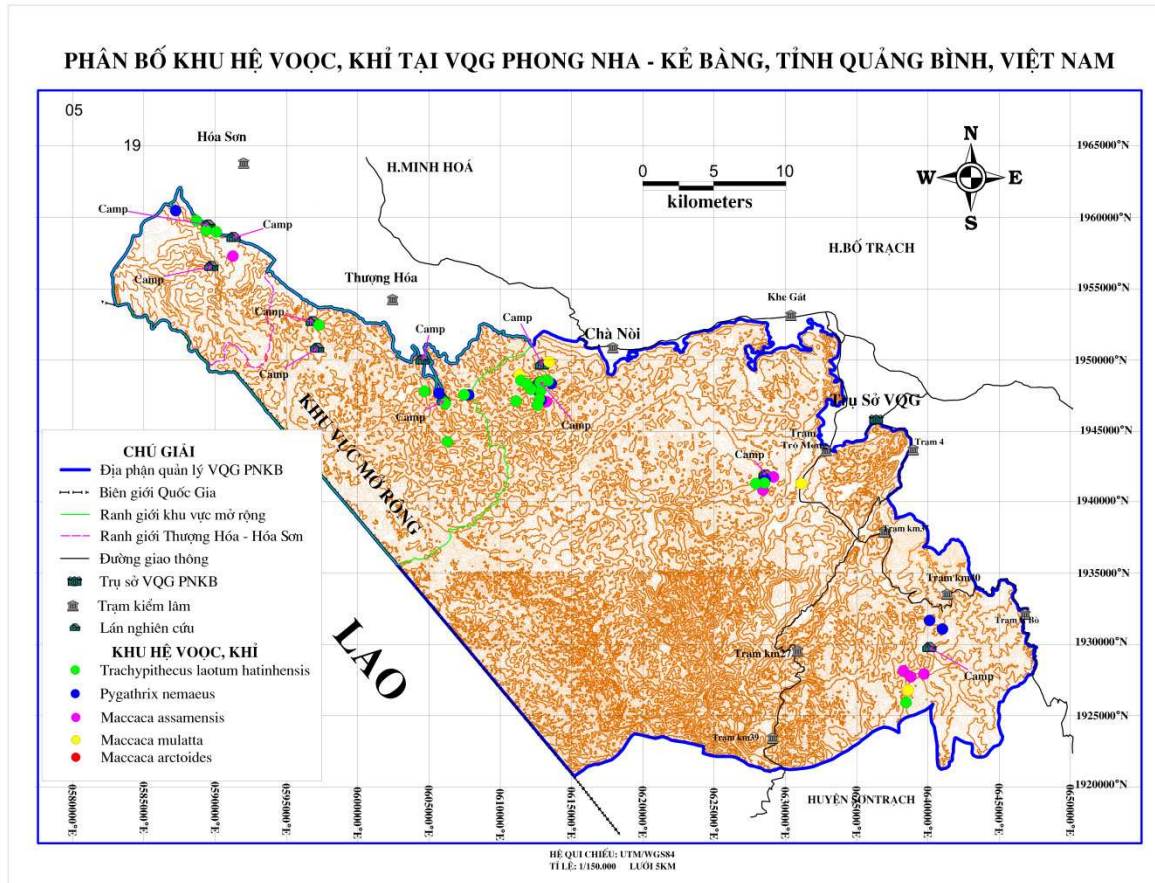


Figure 4: Distribution status of Douc monkeys, Langurs and Macaques in PN-KB NP

The distribution status in the extended area and the park was different. 30 groups of primates were recorded in the park in comparison to 20 groups recorded in the extended area, although total length of surveyed transect in the park was less than that of in the extended area, 52 km and 65.2 km. This indicates that the population of primates in the park was more abundance than that of in the extended area.

For each species, number of group observed in the park was higher than that of in the extended area. For example, 14 groups of the Hatinh langur found in the park while there were 10 groups of Hatinh langur found the extended area. 6 groups of Red-shanked douc found in the park while there 4 groups of the species found in the extended area.

In the five surveyed areas, 17 groups (occupied 34%) were observed in Cha Noi area. Hatinh langurs were the most abundance with 11 groups. And, there were four taxa of primates (Hatinh langurs, Red-shanked doucs, Assamese macaques, and Rhesus macaques) recorded in Cha Noi area. This indicates that Cha Noi area is important distribution area for primates in the park.

The Hatinh langur was the most popular in the surveyed area with 24 groups (48% of all observed groups). It is followed by Assamese macaques (11 groups ~ 22%), red-shanked douc monkeys (10 groups ~ 20%), and Rhesus macaques (4 groups ~ 8%). Only one group of Stump-tailed macaques was recorded. No observation of black langurs, long-tailed macaques and pig-tailed macaques was made in this survey.

Table 4: Total groups of each species observed in 5 locations

	<i>Trachypithecus laotum hatinhensis</i>	<i>Pygathrix nemaeus</i>	<i>Macaca assamensis</i>	<i>Macaca mulatta</i>	<i>Macaca arctoides</i>	Total (groups)	Percentage
Thuong Hoa	7	3	4	0	0	14	28
Hoa Son	3	1	1	0	1	6	12
Tro Mong	2	1	2	1	0	6	12
Son Doong	1	2	3	1	0	7	14
Cha Noi	11	3	1	2	0	17	34
Total (groups)	24	10	11	4	1	50	
Percent	48	20	22	8	0	0	100

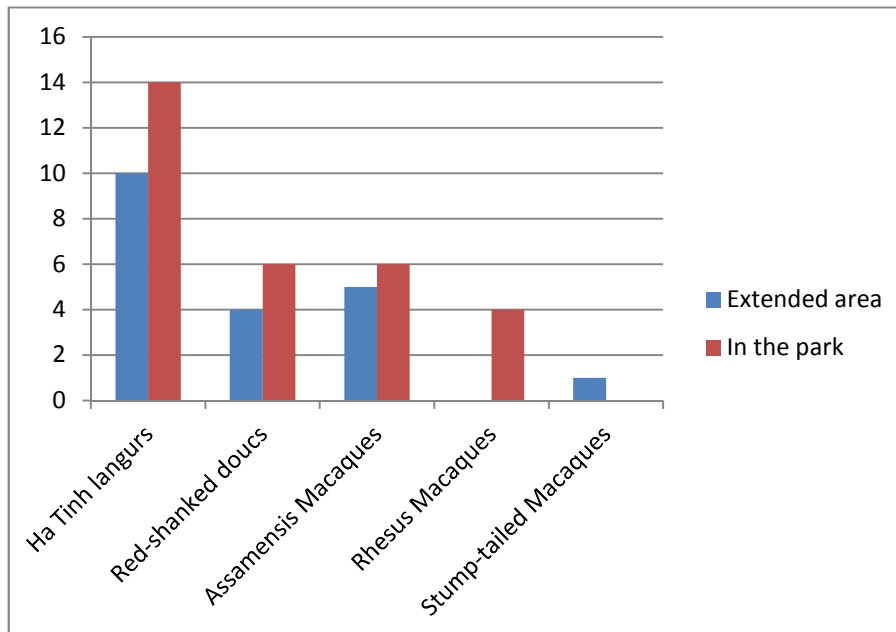


Figure 5: Difference in group of primates observed in the park and the extended area

3.3.1.4. Population abundance

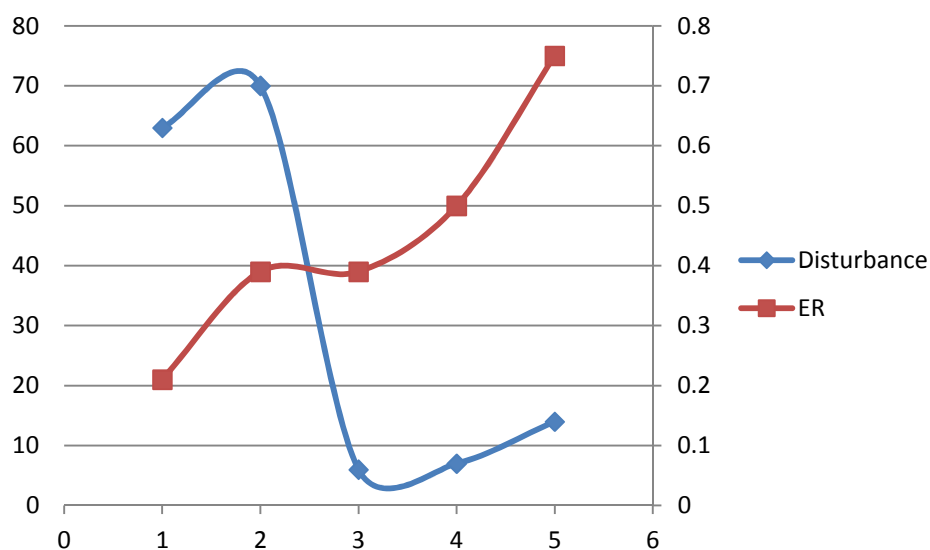
Population abundance of primates in PN-KB NP was estimated using encounter rate index (ER). For the whole survey, the encounter rate was 0.43 groups per one kilometer transect. The encounter rate of primates in the park was higher than that of in the extended area. There were 0.57 groups/km and 0.31 groups/km, respectively.

Among five surveyed locations, the encounter rate of primates in Cha Noi area was the greatest (0.75 groups/km). It is followed by the Son Doong area (0.5 groups/km) and Tro Mong (0.39 groups/km) and Thuong Hoa (0.39 groups/km). The encounter rate of primates in Hoa Son area was the lowest (0.21 groups/km).

The encounter rate (ER) of primates has negative relationship with the human disturbance in the five surveyed locations. The human disturbance was very intensive in Thuong Hoa and Hoa Son area resulted in the lower encounter rate. Oppositely, fewer disturbances in Tro Mong, Son Doong and Cha Noi led to the higher encounter rate (Figure 6).

Table 5: Encounter rate of each primate species in different locations

	<i>Trachypithecus laotum hatinhensis</i>	<i>Pygathrix nemaeus</i>	<i>Macaca assamensis</i>	<i>Macaca mulatta</i>	<i>Macaca arctoides</i>	Total
Thuong Hoa	0.19	0.08	0.11	0.00	0.00	0.39
Hoa Son	0.10	0.03	0.03	0.00	0.03	0.21
Tro Mong	0.13	0.07	0.13	0.07	0.00	0.39
Son Doong	0.07	0.14	0.21	0.07	0.00	0.50
Cha Noi	0.48	0.13	0.04	0.09	0.00	0.75



Locations: (1) Hoa Son, (2) Thuong Hoa, (3) Tro Mong, (4) Son Doong, (5) Cha Noi

Figure 6: The relationship between human disturbance and encounter rate (ER) of primates

3.3.2. Threats to primate fauna and management concerns in the PNKB National Park

The human disturbance in five surveyed location was presented in the Table 6. The difference in level of human disturbance recorded in the extended area and in the park was presented in Figure 7.

Among 8 types of human disturbance that we collected data in the field, three types of disturbances which are most danger to primate fauna and their habitat were:

- The hunting camp (including old camp and recently used camp) was recorded mostly in the surveyed areas with 59 sightings. According to local guides, the camp is normally used for long-time stay in forest. They were built for loggers, hunters and forest product collectors. Camps were found in both the extended area and the park. This indicates that human disturbance was presence in the both place. The camps were found more intensive in the extended area than in the park with 41 and 18 sightings, respectively.
- Traps (mostly string traps) were the second type which also popular in the surveyed area with 57 sightings. Traps were found less in the park (7 sightings) than that of in the extended area (50 sightings). People, who we met in transects, was also a type of disturbance since they went to the forest with purpose of collecting non-timber forest product such as honey, medical plan. They were found more in the extended area with 21 people in comparison to 1 people in the park. There was one sighting of a hunter caught one turtle.
- Logging also was found in the surveyed area with 19 sightings. All the sighting of logging was made in the extended area.

Among five locations, where survey was conducted, the sighting of human disturbance was found mostly in Thuong Hoa area with 70 sightings, followed by Hoa Son area with 63 sightings, Cha Noi area with 14 sightings, Son Doong area with 7 sightings. Tro Mong area has least sighting of human disturbance with only 6 sightings.

Table 6: Human disturbance recorded in the transects during the survey time

Location	Hunting	Camp	Logging	Cutting tree	Traps	Trapped Animal	Human in forest	Slash and burn field	Total
Hoa Son	0	25	8	0	30	0	0	0	63
Thuong Hoa	1	16	11	1	20	0	21	0	70
Tro Mong	0	5	0	0	1	0	0	0	6
Son	0	5	0	0	1	0	1	0	7

Doong									
Cha Noi	0	8	0	1	5	0	0	0	14
Total	1	59	19	2	57	0	22	0	160

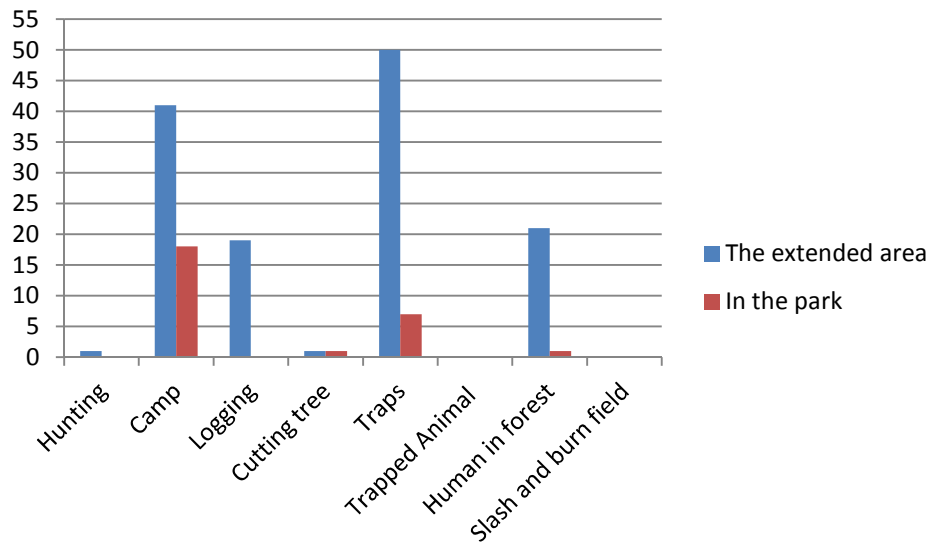


Figure 7: Human disturbance recorded in the extended area and inside the park

3.4. Analysis and discussion results

3.4.1. Primate fauna (Macaques, Langurs and Douc monkey) in PN-KB NP

Previous studies on primate fauna in the Phong Nha – Ke Bang national park conducted by Pham Nhat and Nguyen Xuan Dang suggested that 9 species of primates (including gibbon and loris) existed in the park. Long-tailed macaques and Black langurs were also on the list (Pham Nhat and Nguyen Xuan Dang, 2000). In this survey, 7 species of primates (excluding gibbon and loris) were recorded in the surveyed area. 5 species were observed in the field including Hatinh langurs, Red-shanked douc monkeys, Assamese macaques, Rhesus macaques, and Stump-tailed macaques. Two species, Pig-tailed macaques and Black langur were not confirmed, although the occurrence of these species was reported by local hunters.

This result was quite similar to the study result of Haus and colleagues. They also confirm existence of 5 primate taxa in the 127 surveyed transects, and the Long-tailed macaque was not observed in the field (Haus *et al.* 2009). Hence, Pham Nhat and Nguyen Xuan Dang did not give a detail on occurrence of the Long-tailed macaque in the Park. Therefore, the existence of long-tailed macaques in the park was questionable since the zoogeography distribution of this species is limited to the south of the latitude number 12 (Fooden, 1996). We suggested that if there was a report of Long-tailed macaques in the park, these individuals could be wrongly released to the site rather than origin in the park. In the future, Long-tailed macaques should not be released into PN-KB NP.

3.4.2. Population abundance

In this survey, we found that the encounter rate (ER) for the whole study is 0.43 groups/km. There was a significant difference in encounter rate of primates in the extended area (0.31 groups/km) and the park (0.57 groups/km). There was an evidence of the influence of human disturbance on the encounter rate. The more intensive of human disturbance the lower encounter rate of primate in transect.

The Hatinh langur was the most abundance with 24 groups observed in the field. The encounter rate of the species was 0.97 groups/km. Then, it is followed by the Assamese macaques (11 groups), Red-shanked doucs (10 groups) and Rhesus macaques (4 groups). This finding is agreed with the result of Haus' study in 2009. The authors used the distance sampling method to estimate absolute abundance of primate population in Phong Nha – Ke Bang national park. They found that Hatinh langurs were the most abundance with about 2,143 (± 467) individuals. The red-shanked doucs were estimated about 1,316 (± 871) individuals (Haus *et al.* 2009). Interestingly, the result from this study was also quite similar to the finding from Mwanihana Forest, Udzungwa Mountains, Tanzania. Using the same method, Rovero and others (2006) found that encounter rate of *Procolobus gorbonorum* was 0.59 groups/km, followed by *Colobus angolensis* (0.43 groups/km), and *Cercopithecus mitis* (0.35 groups/km) (Rovero *et al.* 2006).

Among five surveyed locations, encounter rate of primates was greatest in Cha Noi area (0.75 groups/km) and lowest in Hoa Son area (0.21 groups/km). The encounter rate between Cha Noi area and Hoa Son area can be explained as follows. The Cha Noi area belongs to the park since a long time with the terrain very difficult to access and rangers make regular patrols in the site, therefore, the human disturbance is very low. This led to the safe habitat for the primate fauna. In the opposite site, Hoa Son area in the extended area where the authority of the park have not yet controlled the human impacts such as hunting, logging and wildlife trade. This led to the human disturbance to the habitat of the primates very intensive.

3.4.3. Threats to the primates fauna in Phong Nha- Ke Bang and the extended area

The data collected in this study showed that the main threats to primate in the region are: hunting (using trap and gun), illegal logging, non-timber forest product collecting and wildlife trading. Great number of camp used for hunter and logger been observed in the field suggested that there were a large number of local people enter the national park and the extended area and try to take some things home. Sighting of cartridge in the camp suggested that hunter use gun in the forest. And this is a real threat to the primate fauna here.

Logging activity is happened very intensive in the extended area. Local people are using buffalo to carry log from the forest to village. This activity bring quite a big cash to villagers who live in adjacent the border of extended area. The authorities of village seem cannot control this activity. Large trees normally provide fruit food and the main support for primates to travel between mountains. Therefore, uncontrolled logging in the extended area is real threat to primate fauna in the region.

The surveyor found quite a number of macaques kept illegally by local people in the Hoa Son area. The owners were very keen to sale those macaques for a primate between 1 and million VND to for one individual. They also claimed that all the macaques were trapped in the park and that they can supply more if the buyer request. There was no sign of law enforcement in

these villages, therefore, macaques were kept freely in the cage in bad condition. And the owners do not care of confiscation. If there is no action to prevent a “free market” of wildlife in the area, this will lead to the big trouble to the population in the forest of the national park.

4. Conclusions and Recommendations

4.1. The status of macaques, langurs and douc monkeys biodiversity at the PN-KB NP

- The primate fauna (Macaques, Langurs, and Douc monkeys) in PN-KB NP is quite diverse with 7 species: Stump-tailed macaque, Assamse macaque, Rhesus macaque, Pig-tailed macaque, Hatinh langur, Black langur and Red-shanked douc monkey.
- The Long-tailed macaque does not exist in PN-KB NP. The release of this species in the future to the park should be forbidden.
- The population abundance of primate fauna (Macaques, Langurs, and Douc monkeys) is quite high in the park with the encounter rate 0.43 groups/km. Hatinh langur was the most abundant with encounter rate 0.97groups/km.
- The population abundance of primate fauna in the extended area was lower than that of in the protected forest of the park. Cha Noi area is the hotspot for primate fauna of the park with encounter rate 0.75 groups/km. Hoa Son area has lowest population abundance of the primate fauna with encounter rate 0.23 groups/km.

4.2. Threats to the primate fauna in the Phong Nha- Ke Bang National Park

- This study confirmed that threats such as: hunting, wildlife trading (including primate species), illegal logging and forest production collecting were quite serious to the primate fauna in the area, especially the extended area.
- There was evidence that the distribution status and population abundance of primates is highly affected by the disturbance of human in the Park.

4.3. Recommendations for primates conservation in the Phong Nha- Ke Bang NP

- The park authority and provincial authority need to act quickly to proof the extended area to become park’s land, and the clear boundary land mark of the extended area need to be clarified for local authority and local people. This is very important to prevent intensive logging activity in the extended area.
- Wildlife trade including macaques should be immediately stopped in the Hoa Son, Thuong Hoa Village, and Quy Dat Town. Strong law enforcement should be applied in these areas to prevent hunting and trapping of primates in the park’s forest.
- Raising awareness programme for location people in the value of the park, sustainable using nature resource should be carried out as soon as possible in the extended area.
- Development project from the government should be priority to Hoa Son and Thuong Hoa area to improve the living condition of local people. For example, reforestation project should be allocated to local people in those villages in order to help local less depend on the forest product.

4.4. Recommendations for management plan of the Phong Nha- Ke Bang NP

- Park's rangers should organise the patrol more frequently (every week instead of every month) inside the park and the extended area. The patrolling should focus in the border of Thuong Hoa and Hoa Son areas. A ranger station should be established in Ban On, Thuong Hoa.
- Park's rangers should work with frontier army force and local police to confiscate captured monkeys kept illegal in Thuong Hoa and Hoa Son areas. They should also work with district's authority to investigate the wildlife trade in the restaurants surrounding the park, and commitment letter should be issued to the restaurants in which clarified that wildlife trade is prohibited.
- The park should have a joining patrol programme with local police and frontier army force every month to control illegal logging inside the park.
- The park's authority should cooperate with mass media companies in the Quang Binh Province to forecast regularly about wildlife in Phong Nha- Ke Bang NP, sustainable use of nature resource as well as the Law of Protection and Development of forest.
- Scientific department of the park should make plan for wildlife monitoring in the park. Primates species such as Hatinh langurs, Red-shanked douc monkeys, White-cheeked gibbons should be included in the monitoring list.

5. References

- BirdLife International (2010). *Important Bird Areas factsheet: Phong Nha*. BirdLife International, Cambridge, U.K.
- Brockelman, W.Y., and Ali, R. (1987). *Methods of surveying and sampling forest primate populations*. In Marsh, C. W., and Mittermeier, R. A (eds.), *Primate conservation in the tropical rain forest*. Alan R. Liss, New York, pp. 23-62.
- Fooden, J. (1996). Zoogeography of Vietnamese Primates. *International Journal of Primatology* 17. 845-899.
- IUCN (2012). *2012 IUCN Red List of Threatened Species*. <www.iucnredlist.org>. Download 11 March 2012.
- Le Trong Dat, Do Tuoc, Dinh Huy Tri, Le Thuc Dinh and Dang Ngoc Kien (2009). *Census of southern white-cheeked crested gibbons in U Bo and adjacent buffer-zone forests, Phong Nha-Ke Bang National Park, Bo Trach District, Quang Binh Province, Viet Nam*. Fauna and Flora International- Indochina Program, Hanoi.
- Le Xuan Canh, Truong Van La, Dang Thi Dap, Ho Thu Cuc, Ngo Anh Dao, Nguyen Ngoc Chinh, Nguyen Quoc Dung (1997). *A Report on Field Surveys on Biodiversity in Phong Nha-Ke Bang Forest (Quang Binh Province) Central Vietnam*. WWF and UNDP, Hanoi.
- Nguyen Vu Khoi and Shaw, J. C. (2005). *Vietnamese Primate Field Guide*. Agriculture Publishing House.
- Pham Nhat, & Nguyen Xuan Dang. (2000). *Field guide to the key mammal species of Phong Nha-Ke Bang*. Fauna and Flora International-Indochina Programme, Hanoi.
- Pham Nhat, Do Quang Huy, Pham Hong Nguyen (2000). *Report on research result on distribution, ecology and monitoring survey of the red-shanked douc langur (P.nemaesus nemaesus) in Phong Nha-Ke Bang forest area*. Forestry University of Vietnam and World Wide Fund for Nature (WWF), Hanoi.

- Pham Nhat, (2002). *Primates of Vietnam* (Thú Linh trưởng Việt Nam), Agriculture Publishing House, Ha Noi (in Vietnamese).
- T. Haus, M. Vogt, B. Forster, Ngoc Thanh Vu and Thomas Ziegler. (2008). *Distribution and Population Densities of Diurnal Primates in the Karst Forests of Phong Nha – Ke Bang National Park, Quang Binh Province, Central Vietnam*. *International Journal of Primatology*. 30. 301-312.
- Timmins, R. J., Do Tuoc, Trinh Viet Cuong, & Hendrichsen, D. K. (1999). *A preliminary assessment of the conservation importance and conservation priorities of the Phong Nha–Ke Bang proposed National Park, Quang Binh Province, Vietnam*. Fauna and Flora International – Indochina Programme, Hanoi.
- Rovero. F, Struhsaker. T.T, Marshall. A.R, Rinne. T.A, Perderson. U.B, Butynski. T.M, Ehardt. C.L, Mtui. A.S (2006). *Abundance of Diurnal Primates in Mwanihana Forest, Udzungwa Mountains, Tanzania: A Multi-Observer Comparison of Line-Transect Data*. *International Journal of Primatology*. 27 (3). 675-697.
- WCMC (2012). Phong Nha-Ke Bang National Park - Vietnam, World Heritage Site. <http://www.unep_wcmc.org/medialibrary/2011/06/14/7333dfe5/Phong%20Nha%20Ke%20Bang.pdf>. Download 2 March 2012.

6. Annex

Annex 1: Report on the training for park and survey staff

1. Goal and Objectives

- Improve capacity of the park’s staff in order to conduct successful survey on primates in Phong Nha – Ke Bang NP.
- Provide knowledge of diversity of primates of the world and Vietnam and guiding the park’s staff to identify primates fauna in Phong Nha – Ke Bang.
- Strengthen the skill of using field equipments such as GPS, Map and compass to the park’s staff.

2. Training Program

2.1 Time schedule

Date	Content	Trainer
5 th July 2011	Diversity of primates in the world and Vietnam	Dr. Ha Thang Long
	Distribution of primates in Vietnam	
6 th July 2011	Field work skill 1: Identify key primates in the wild of Phong Nha – Ke Bang National Park	Dr. Ha Thang Long
	Field work skill 2: Using GPS, Map and compass	Mr. Bui Van Tuan
	Post-training assessment test	

2.2 List of attendee

STT	Name	Working field	Contact
1	Nguyễn Tri Phương	Centre for Scientific Research and Wildlife Rescuing (TTNCKH-CH)	0974 079 175
2	Trần Mừng	TTNCKH-CH	0985 800 199
3	Đình Hoàng Tuấn	TTNCKH-CH	01662 790 067
4	Nguyễn Việt Đoàn	TTNCKH-CH	0523 506 975
5	Nguyễn Thanh Bình	TTNCKH-CH	01694 166 755
6	Nguyễn Quang Vĩnh	TTNCKH-CH	01682 567 953
7	Hoàng Hữu Hà	Kiểm lâm	0942 071 394
8	Nguyễn Thanh Hải	Kiểm lâm	0988 227 229

3. Results

Eights staffs of the Phong Nha – Ke Bang National Park had attended the training course. Two of them are rangers and six of them are official of the Centre for scientific and Wildlife Rescue. Two trainees could not attend the training course until the end due to working task of the park.

According to the result from the post- training assessment valuation, most of trainees have improved their understanding of primate diversity, distribution of Vietnamese primates as well as their conservation status. Overall, trainees have answered correctly 82% of questions in the test. One trainee has got 100% of questions been answered correctly. Most of trainees have answered correctly about the diversity of primate fauna in Vietnam and the Phong Nha-Ke Bang National Park.

Regarding the skill of identifying the primate fauna in Phong Nha – Ke Bang National, all trainees have improved their ability to distinguish the difference between slow lorries and pigmy lorries as well as they can describe exactly the key characters of Ha Tinh langurs and the red-shanked douc monkeys. Although, there is still a bit confuse on identify the difference between the Rhesus macaques and Assamese macaques.

Regarding the skill of using field equipments, 100% of trainees have successfully used the GPS device to record a location and save the GPS point in the device. 83% of trainees can use the map and compass to identify and design transect for primate survey.

Two trainees who have attended the training course were selected to join in the field work in the Phong Nha – Ke Bang National Park and the extended area.

4. Conclusion and Recommendation

The training course has achieved the goal. Eight trainees participated the training section. Almost of rangers and official of the park have improved their knowledge on diversity of primates in the Vietnam the park. They also improved their skill on identify primates and using orientation equipments for field work.

2. Annex 2: List of animals observed in PN-KB during the field survey

STT	Tên Việt Nam	Tên khoa học	Cites-Vietnam	IUCN Redlist (2012)
	Bộ linh trưởng			
1	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	Appendix II	Endangered
2	Vọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	Appendix II	Endangered
3	Vọc đen tuyền	<i>Trachypithecus laotum laotum</i>	Appendix II	Vulnerable
4	Khỉ mặt đỏ	<i>Macaca arctoides</i>	Appendix II	Vulnerable
5	Khỉ vàng	<i>Macaca mulatta</i>	Appendix II	Least concern
6	Khỉ xám	<i>Macaca assamensis</i>	Appendix II	Near threaten
7	Khỉ đuôi lợn	<i>Macaca nemestrina</i>	Appendix II	Vulnerable
	Lớp Bò sát			
8	Rắn lục mép trắng	<i>Trimeresurus albolabris</i>		Least concern
9	Rắn lục sừng	<i>Trimeresurus cornutus</i>		Data deficient
10	Rùa sa nhân	<i>Cuora mouhotii</i>	Appendix II	Endangered
	Lớp Chim			
11	Phường chèo đò đuôi dài	<i>Pericrocotus ethologus</i>		Least concern
12	Hồng hoàng	<i>Buceros bicornis</i>	Appendix II	Near Threaten

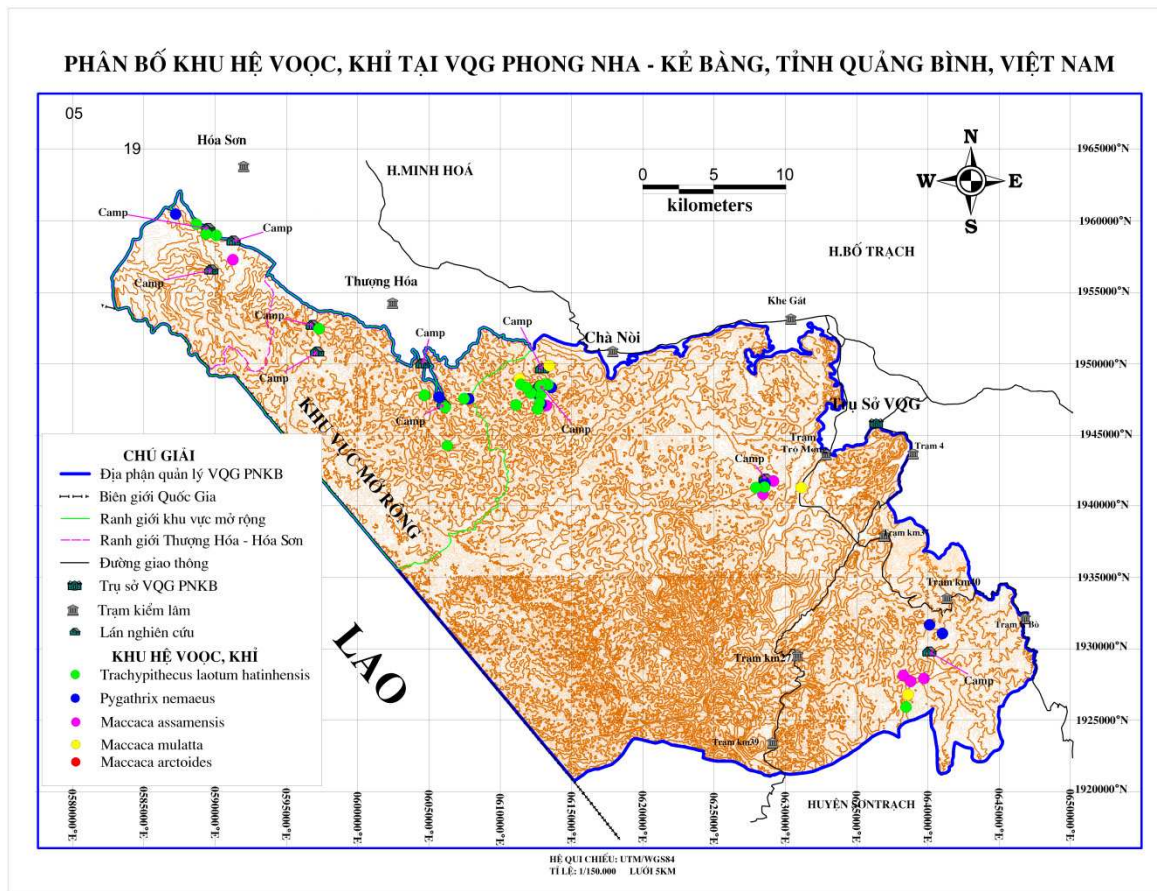
3. Annex 3: GPS of locations where primates were observed

No Group	Date	Species		n	Coordination		Altitude
		Vietnamese name	Latin name		X	Y	
1	11/07/2011	Khỉ Mốc	<i>Macaca assamensis</i>	18	604079	1954588	258
2	11/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	1	604099	1954455	250
3	14/07/2011	Vọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	4	588668	1959784	587
4	14/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	6	587223	1960476	866
5	14/07/2011	Khỉ Mốc	<i>Macaca assamensis</i>	4			
6	14/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	4			
7	14/07/2011	Vọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	6	607459	1947570	664
8	14/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	1	607775	1947554	728
9	15/07/2011	Vọc Hà Tĩnh	<i>Trachypithecus laotum</i>	6			

			<i>hatinhensis</i>				
10	15/07/2011	Khi Mốc	<i>Macaca assamensis</i>	3			
11	15/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	4	605971	1947381	244
12	15/07/2011	Khi Mốc	<i>Macaca assamensis</i>	6	606122	1947233	245
13	16/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	2	589359	1959096	693
14	16/07/2011	Khi mặt đỏ	<i>Macaca arctoides</i>	2	589357	1959100	696
15	16/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	4			
16	16/07/2011	Khi Mốc	<i>Macaca assamensis</i>	9			
17	16/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	7	606281	1944244	494
18	16/07/2011	Khi Mốc	<i>Macaca assamensis</i>	3	591234	1957284	624
19	16/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	4	590129	1957811	561
20	17/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	6	604684	1947817	303
21	21/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	2	597284	1952454	490
22	21/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	10	590758	1933349	
23	29/07/2011	Khi Vàng	<i>Macaca mulatta</i>	20	631116	1941275	37
24	29/07/2011	Khi Mốc	<i>Macaca assamensis</i>	2	629161	1941727	402
25	30/07/2011	Khi Mốc	<i>Macaca assamensis</i>	8	628430	1940819	580
26	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	11	628533	1941315	492
27	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	8	627933	1941272	512
28	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	6	612808	1948459	284
29	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	6	612808	1948459	285
30	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	3	612155	1947947	364
31	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum</i>	3	612614	1946842	428

			<i>hatinhensis</i>				
32	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	2	611106	1947126	385
33	31/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	10	612630	1947881	381
34	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	2	612832	1947853	437
35	31/07/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	1	612744	1947279	496
36	31/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	4	612861	1947187	461
37	31/07/2011	Khi mốc	<i>Macaca assamensis</i>	7	613240	1947095	446
38	31/07/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	6	628572	1941578	419
39	01/08/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	1	613342	1948539	440
40	01/08/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	16	613583	1948349	423
41	01/08/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	2	613134	1948581	442
42	02/08/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	15	640112	1931670	482
43	03/08/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	2	611449	1948569	492
44	03/08/2011	Khi vàng	<i>Macaca mulatta</i>	6	611349	1948954	693
45	03/08/2011	Voọc Hà Tĩnh	<i>Trachypithecus laotum hatinhensis</i>	7	611833	1948352	378
46	03/08/2011	Khi Mốc	<i>Macaca assamensis</i>	15	639717	1927920	193
47	03/08/2011	Chà vá chân nâu	<i>Pygathrix nemaeus</i>	2	641017	1931073	496
48	04/08/2011	Khi vàng	<i>Macaca mulatta</i>	3	613426	1949874	293
49	04/08/2011	Khi Mốc	<i>Macaca assamensis</i>	3	638282	1928132	339
50	04/08/2011	Khi Vàng	<i>Macaca mulatta</i>	7	638608	1926792	329

4. Annex 4: Distribution map of primates observed in PN-KB National Park



5. Annex 5: Photographs and picture of specimens

a. Pictures of field researchers



Plate 1: Researchers in the Thuong Hoa ranger station. *Photo: Nguyen Ai Tam*



Plate 2: Researchers on the way to the field study site. *Photo: Bui Van Tuan*

b. Observations of douc monkeys, langurs and macaques in the surveyed area



Plate 3: Assamese Macaques (*Macaca assamensis*). *Photo: Nguyen Ai Tam*



Plate 4: Rhesus macaques (*Macaca mulatta*). *Photo: Nguyen Ai Tam*



Plate 5: Red-shanked douc monkeys (*Pygathrix nemaeus*). Photo: Tran Van Bang



Plate 6: Hatinh langurs (*Trachypithecus hatinhensis*). Photo: Ha Thang Long

c. Human disturbance in the surveyed area



Plate 7: Logging in Thuong Hoa area. Photo: Nguyen Ai Tam



Plate 8: Logging in Ban On area. Photo: Nguyen Ai Tam



Plate 9: Cutting tree inside the extended area. Photo: Ha Thang Long



Plate 10: Traps found in the Thuong Hoa area. Photo: Nguyen Ai Tam



Plate 11: Hunter camp in Thuong Hoa.
Photo: Nguyen Ai Tam



Plate 12: Traps collected in Thuong Hoa area.
Photo: Nguyen Ai Tam



Plate 13: Oil extraction from trees. Photo:
Tran Huu Vy



Plate 14: cartridge for hunting found in Hoa Son.
Photo: Bui Van Tuan



Plate 15: Logging in Hoa Son area. Photo:
Tran Huu Vy



Plate 16: Hunter camp in Hoa Son. Photo:
Bui Van Tuan







Plate 17: Rhesus macaques kept in Hoa Luong Village. Photo: Bui Van Tuan



Plate 18: Stump-tailed macaques kept in Hoa Luong Village. Photo: Bui Van Tuan

d. Animals observed during the survey period (*All photo of this section made by Nguyen Ai Tam*)

<p>Rùa sa nhân (<i>Cuora mouhotii</i>)</p>	<p>Rắn lục sừng (<i>Trimeresurus cornutus</i>)</p>

	
	
<p>Rắn lục sp (<i>Viperridae</i> sp)</p>	<p>Phường chèo đỏ đuôi dài (<i>Pericrocotus ethologus</i>)</p>

Annex 6: Digital data that can be used for managing plan of the Phong Nha-Ke Bang NP

Annex 7: List of surveyors and people who contributed for the field survey

Stt	Tên và chức danh	Đơn vị	Nhiệm vụ	Địa chỉ liên lạc
1.	TS. Hà Thăng Long	Hội động vật học Frankfurt, Chương trình bảo tồn linh trưởng miền Trung (FZS, Miền Trung)	Tư vấn chính	thg_long@yahoo.com
2.	CN. Trần Hữu Vỹ	FZS, Miền Trung	Trưởng nhóm điều tra thực địa	tranhuuvy@gmail.com
3.	CN. Bùi Văn Tuấn	FZS, Miền Trung	Thành viên nhóm nghiên cứu thực địa	Vantuan_sh@gmail.com
4.	ThS. Trần Ngọc Sơn	FZS, Miền Trung	Thành viên nhóm nghiên cứu	

			cứu thực địa	
5.	CN. Trần Văn Bằng	FZS, Miền Trung	Thành viên nhóm nghiên cứu thực địa	
6.	CN. Nguyễn Ái Tâm	FZS, Miền Trung	Thành viên nghiên cứu thực địa	
7.	ThS. Dirk Gerrit Euler	FZS, PRP	Điều phối Nhóm nghiên cứu thực địa	
8.	CN. Trần Văn Mừng	Trung tâm nghiên cứu và cứu hộ, VQG Phong Nha – Kẻ Bàng	Thành viên nhóm nghiên cứu	Vườn quốc gia Phong Nha – Kẻ Bàng
9.	CN. Trần Văn Đoài	Trung tâm nghiên cứu và cứu hộ, VQG Phong Nha – Kẻ Bàng	Thành viên nhóm nghiên cứu	Vườn quốc gia Phong Nha – Kẻ Bàng
10.	Ông Cao Thanh Viên	Người địa phương	Dẫn đường	Xã Thượng Hóa, Minh Hóa, Quảng Bình
11.	Ông Nguyễn Văn Hoàn	Người địa phương	Dẫn đường	Khe Gát, Minh Hóa, Quảng Bình
12.	Ông Trần Văn Hoàng	Người địa phương	Dẫn đường	Xã Sơn Trạch, Bố Trạch, Quảng Bình
13.	Ông Phong	Người địa phương	Dẫn đường	Xã Sơn Trạch, Bố Trạch, Quảng Bình
14.	Ông Cao Chuẩn	ã gười địa phương	Dẫn đường	Xã Hóa Sơn, Minh Hóa, Quảng Bình
15.	Ông Cao Sơn	ã gười địa phương	Dẫn đường	Xã Hóa Sơn, Minh Hóa, Quảng Bình
16.	Ông ả guyễn Mạnh	ã gười địa phương	Thành viên nhóm nghiên cứu	

Final Report

BIODIVERSITY SURVEY OF AVIFAUNA IN AND AROUND THE PHONG NHA – KE BANG NATIONAL PARK, QUANG BINH PROVINCE, VIETNAM

by

BirdLife International Vietnam Programme

A report for the Nature Conservation and Sustainable Natural Resource
Management in Phong Nha-Ke Bang National Park Region Project,
Quang Binh Province, Vietnam.



Vietnam-Germany Development Cooperation (BMZ 2004 65 989)



Hanoi, December 2011

Final Report

BIODIVERSITY SURVEY OF AVIFAUNA IN AND AROUND THE PHONG NHA – KE BANG NATIONAL PARK, QUANG BINH PROVINCE, VIETNAM

by

BirdLife International Vietnam Programme

A report for the Nature Conservation and Sustainable Natural Resource
Management in Phong Nha-Ke Bang National Park Region Project,
Quang Binh Province, Vietnam

PNKB PROJECT
MANAGEMENT UNIT

CHIEF OF TECHNICAL ADVISOR

FOR AND ON BEHALF OF
BIRDLIFE INTERNATIONAL,
ASIA DIVISION

Nguyen Trung Thuc
Director

Bas Van Helvoort

Cristi Marie Nozawa
Director

Hanoi, December 2011

**Report on Avifauna Baseline Surveys in the extension area of Phong
Nha-Ke Bang National Park, Quang Binh, Vietnam**

by

Le Trong Trai and Pham Tuan Anh

With contributions from

Nguyen Cu, Ngo Xuan Tuong and Phan Van Truong

Hanoi, December 2011

Director of PPMU: Mr. Nguyen Trung Thuc

Chief of Technical Adviser
KfW Component: Mr. Bas Van Helvoort

Field Survey Team: Le Trong Trai (BirdLife International Vietnam Programme)
Phan Van Truong (BirdLife International Vietnam Programme)
Nguyen Cu (Independent Consultant)
Ngo Xuan Tuong (Institute of Ecology and Biological Resources)
Pham Kim Vuong (Phong Nha-Ke Bang National Park)
Nguyen Chi Phuong (Phong Nha-Ke Bang National Park)

Report written by: Le Trong Trai (BirdLife International Vietnam Programme) and
Pham Tuan Anh (BirdLife International Vietnam Programme), with
contributions of Nguyen Cu, Ngo Xuan Tuong and Phan Van
Truong.

Maps: Le Trong Trai (BirdLife International Vietnam Programme)

Project Funding: *Kredit Anstalt für Wiederaufbau*-German Development Bank
(KfW)

Citation: BirdLife International Vietnam Programme (2011) *Report on
Avifauna Baseline Surveys in the extension area of Phong Nha-Ke
Bang National Park, Quang Binh, Vietnam*. BirdLife International
Vietnam Programme, Hanoi, Vietnam: PNKB Project, KfW
Component.

Copies available from: PNKB Project, KfW Component.
Phong Nha-Ke Bang National Park
Quang Binh Province, Vietnam

Tel.: +84 52 3858587
Fax: +84 52 3844413

Table of contents

Conventions Used.....	vii
Acknowledgements.....	1
Executive summary.....	2
1. Introduction and background.....	5
1.1. Overview of this report.....	5
1.2 Phong Nha-Ke Bang National Park and the KfW project.....	5
1.3 The history of Phong Nha-Ke Bang National Park.....	6
1.4 Phong Nha-Ke Bang physical structure and climate.....	7
1.5 Previous ornithological surveys at Phong Nha-Ke Bang.....	8
1.6 Aims and objectives of this bird survey.....	9
1.7 Study areas and survey effort.....	9
2. Birds.....	11
2.3 Results.....	12
2.3.1 Diversity and composition (resident forest avifauna).....	12
2.3.2 Species lists.....	13
2.3.3 Mist netting.....	14
2.3.4 Species of conservation concern.....	14
2.3.5 Species of conservation concern with unconfirmed records during this survey.....	17
3. Discussion.....	18
3.1 Biological Evaluation.....	18
3.1.1 Species Richness and Diversity.....	18
3.1.2 Globally and Nationally Threatened Species and Restricted Range Species.....	18
3.1.3 Similarity.....	19
3.1.4 Important Bird Area Criteria.....	19
3.1.5 Importance of the Avifauna of Phong Nha-Ke Bang National Park including the extension area.....	20
3.2 Threats to the forests and biodiversity in the survey sites.....	22
3.2.1 Timber extraction.....	22
3.2.2 Timber transportation and trading.....	23
3.2.3 Hunting.....	23
3.2.4 <i>Cinnamomum</i> oil extraction.....	24
3.2.5 Honey collection.....	24
3.2.6 Agricultural cultivation.....	24
4. Conservation recommendations.....	25
4.1 Management issues.....	25
4.2 Hunting and Logging.....	25
4.3 Conservation Research and Monitoring.....	26
5. Other species of conservation interest recorded during the survey.....	28
References.....	29
Appendix 1: Birds recorded for Phong Nha-Ke Bang National Park.....	31
and Extension Area in Thuong Hoa and Hoa Son Comunes.....	31
Appendix 2: Bird Species caught by mist net during the survey in Thuong Hoa and Hoa Son...	38
Appendix 3: GPS readings for key sightings and camp sites during the survey.....	39
Appendix 4: GPS readings for key sightings and camp sites during the survey (UTM VN2000-METER).....	40
Appendix 5: Maps.....	41
Appendix 6: Selected photographs taken in Thuong Hoa and Hoa Son Areas.....	43

Appendix 7: Report on the training on birds survey techniques for Phong Nha – Ke Bang National Park. 47

Conventions Used

The taxonomy of Bird names (common and scientific), sequence and species limits follow BirdLife International (2011) in Appendix 1.

Abbreviations and Acronyms Used

EBA	-	Endemic Bird Area
GIZ	-	<i>Deutsche Gesellschaft fuer Internationale Zusammenarbeit</i> (GIZ)-GmbH-German Technical Cooperation
IBA	-	Important Bird Area
IUCN	-	The World Conservation Union
KfW	-	<i>Kredit Anstalt für Wiederaufbau</i> -German Development Bank
PNKBNP	-	Phong Nha-Ke Bang National Park
PPMU	-	Provincial Project Management Unit
RRS	-	Restricted Range Species
MIST	-	Management Information System (Software)

Acknowledgements

This report is an output of the project entitled “*Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang Region, Vietnam*” which is managed by the Quang Binh Provincial People’s Committee (PPC). The project has two components: the KfW component focusing on the core zone of Phong Nha-Ke Bang National Park (PNKBNP), and the GIZ component largely focusing on buffer zone development and tourism planning. This report was produced by BirdLife International Vietnam Programme, which was sub-contracted by the KfW component to carry out avifauna baseline surveys, assess threats to biodiversity and provide recommendations for threat mitigation in the extension area of the Park.

The authors of the report would like to take this opportunity to sincerely thank the staff of the Project Management Unit (PMU) in Quang Binh Province for their support regarding administrative and logistic arrangements for our field surveys. In particular, thanks are due to Mr Nguyen Trung Thuc, Director of PMU, for his valuable contributions to the work; to Mr Bas Van Helvoort, the Chief Technical Adviser, KfW component, for his valuable technical inputs; to Mr Le Duc Duong, Head of Planning-Personnel Management and General Affairs for his effective facilitation throughout our assignment.

In Phong Nha-Ke Bang NP Management Board, the authors would like to thank Mr. Dinh Huy Tri and Le Thuc Dinh from the Scientific Research and Wildlife Rescue Centre of PNKBNP, for their support in providing staff and arranging necessary logistics for the survey. Thanks are also due to Mr. Pham Kim Vuong and Nguyen Chi Phuong, technical staff of PNKBNP, for their dedicated participation in the field survey and training exercise.

Finally, the authors would like to thank Jonathan Charles Eames O.B.E., Programme Manager of BirdLife International in *Indochina*, for his technical advices, review and endorsement of this report.

Executive summary

During July 2011, as part of the project entitled “the *Nature Conservation & Sustainable Natural Resource Management in Phong Nha – Ke Bang Region, Vietnam*” at Phong Nha-Ke Bang National Park, scientists from BirdLife International Vietnam Programme conducted biodiversity baselines surveys on birds in the extension area of the PNKBNP (Thuong Hoa and Hoa Son Communes of Minh Hoa District, Quang Binh Province). The aim of the survey was to establish baselines on birds in the extension area of the PNKBNP to inform the future management plan of the Park and its implementation, form the basis for long term biodiversity monitoring and provide a basis for the Park to apply for World Heritage status on biodiversity grounds for the extension area.

Due to limited survey time and resources, the survey focused on two forest areas on limestone mountains in Thuong Hoa and Hoa Son communes. The topography of both sites is dominated by limestone karst formations, dissected by a series of small and relatively flat valleys. The limestone karst formations support significant areas of relatively undisturbed limestone forest.

During the field survey, a total of 159 bird species were recorded. Of these, 151 species were confirmed records, and eight species were provisionally recorded.

A total of five globally Near-threatened species were recorded and, additionally, two other species considered Vulnerable at national level were also recorded.

Three of the seven Restricted-range species which define the Annamese Lowlands Endemic Bird Area, were recorded from the extension area, namely Short-tailed Scimitar-babbler *Jabouilleia danjoui*, Sooty Babbler *Stachyris herberti* and Grey-faced Tit Babbler *Macronous kelleyi*.

During the field survey, a number of significant observations, from a conservation perspective, were made:

- Six flocks of the globally Near-threatened Sooty Babbler were encountered during the survey in both survey sites. This species was found in only one other site in central Vietnam - the Dakrong Nature Reserve – but with much smaller population.
- A Restricted-range species Grey-faced Tit Babbler was confirmed in Mo O area, Thuong Hoa commune. This is the first record for the Ke Bang Important Bird Area, including the extension area.
- The presence of Limestone Leaf Warbler *Phylloscopus calciatilis* was confirmed at two localities in Thuong Hoa commune. This species was recently described as a new species for science in 2010.
Sooty Babbler and Limestone Leaf Warbler are restricted to limestone forest formations and they are only found at a few sites in Vietnam.

A threat evaluation identified the major threats to biodiversity at the two sites to be timber extraction and trade, hunting, oil extraction from *Cinnamomum* spp. and potential clearance of forest for agricultural cultivation. Conservation actions to mitigate each of these threats were proposed, and evaluated.

Based on the results of the analysis outlined above, together with the threat evaluations, the following main conservation recommendations were made for the extension area:

- Workshops on the Park boundaries delineation should be organized at district and communal levels involving all local stakeholders who are owners/users of the land in the extension area;
- Boundary demarcation and installation of markers should be conducted using a participatory approach with local authorities, representatives of villages and national park management board;
- A study on hunting, logging and wildlife trade in the buffer zone of the park, including extension area, should be conducted;
- Regular ranger patrolling schedules in relation to the forest and wildlife protection should be formulated and introduced.
- Law and park regulations relating to hunting, logging and non-timber forest product (NTFP) collection should be effectively enforced.
- Regular contacts with the Border Army (585) and local authorities (communes and villages) should be developed and PNKBNP should actively involve them in preventing illegal activities, especially hunting and logging.
- Training of rangers in a variety of skills, in particular park laws, eligible enforcement measures and patrolling techniques, and provision of necessary equipment to guard stations are urgently required to increase enforcement capacity and efficiency.
- Training should be provided in mounting effective patrols and a regular patrolling schedule for each guard station should be drawn up.
- Communication strategy for Phong Nha-Ke Bang National Park should be developed with clear goal, objectives and key messages.
- Conservation awareness raising and education work should be implemented in local communities focusing on children, hunters and villagers in the buffer zone of the Park, including the extension area.

The following additional conservation research and monitoring are proposed:

- Further surveys on birds within Thuong Hoa and Hoa Son communes should be carried out *before* conducting boundary demarcation and markers in the extension area to ensure that all areas of distribution of key bird species in PNKB region are protected within the Park's boundaries.
- Additional bird surveys should be conducted in winter and spring times (November to June), and in the remote area near the border between Vietnam and Laos to ensure a comprehensive knowledge of the avifauna of the Park's extension area, including migratory species that winter or stop over at the site.
- Recommended key bird species for long-term monitoring are Sooty Babbler, Great Hornbill, Austen's Brown Hornbill and Siamese Fireback.
- Biodiversity monitoring programme should be developed in accordance with management objectives and key threats to the biodiversity conservation of the Park;
- Monitoring of forest resource use by local communities living in and around the Park should be undertaken on a regular basis to provide a basis for resolving conflicts between conservation and economic development programmes in the buffer zone, and improving the appropriateness of management activities.

- A suitable monitoring information system (for example, MIST) should be introduced to store and manage monitoring data to facilitate and measure impacts of improved park management.

1. Introduction and background

1.1. Overview of this report

From July to August 2011, as part of the project entitled “the *Nature Conservation and Sustainable Natural Resource Management in Phong Nha-Ke Bang Region, Quang Binh Province, Vietnam*”, scientists from BirdLife International Vietnam Programme conducted a baselines survey on birds in the extension area of PNKBNP, which encompasses Thuong Hoa and Hoa Son communes of Minh Hoa district, linking the former PNKBNP and Hin Nammo National Biodiversity Conservation Area in Laos.

The aim of the survey was to collect baselines data on birds in the extension area of PNKBNP to inform the management plan of the Park and its implementation, form the basis for long term biodiversity monitoring and provide a basis for the Park to apply for World Heritage status on biodiversity grounds for the extension area.

This document presents the results of the above-mentioned mission, highlighting:

- Summary of information from any prior bird surveys and studies in the PNKBNP extension area;
- Scope of and methodology applied in this survey;
- Survey results, including status of the avifauna in the surveyed area, identification and assessment of threats;
- Conservation recommendations
- Key bird species proposed for long term monitoring and monitoring strategy and protocols.

1.2 Phong Nha-Ke Bang National Park and the KfW project

The *Nature Conservation and Sustainable Natural Resource Management in Phong Nha – Ke Bang Region Project, Vietnam (2008-2016)*, is managed by the Quang Binh Provincial People’s Committee (PPC). The estimated total project cost is approximately EUR 15.77 million, including EUR 4.63 million of loan, EUR 8.0 million of financial contribution and approximately EUR 3.2 million of counterpart contribution.

The Phong Nha-Ke Bang project area consists of the core zone of the Phong Nha – Ke Bang National Park (PNKB NP) with an area of 116,824 ha (including the extension area of 31,070 ha) and a buffer-zone of 225,000 ha, consisting of parts of 13 adjacent communes in three districts of Bo Trach, Minh Hoa and Quang Ninh, in the west of Quang Binh Province, Vietnam (see Map 2).

The project has two components: the KfW and GIZ ones. GIZ’s responsibility is mainly in technical cooperation, and leading buffer-zone and tourism planning. KfW’s responsibility is largely investment, complementing and scaling-up GIZ’s pilot projects, in addition to leading the development and implementation of a management plan for PNKBNP and complementary technical assistance to improve management, in particular law enforcement.

In the context of management formulation and improvement, in 2011, the project organized biodiversity baseline surveys on a number of key taxa in PNKBNP, including birds, to inform the future park management plan and its implementation, form the basis of long term biodiversity monitoring, a/o to assess the impact of improved management; and to provide a basis to apply for World Heritage status on biodiversity grounds for the extended PNKBNP.

1.3 The history of Phong Nha-Ke Bang National Park

Phong Nha was included on Decision No. 194/CT of the Chairman of the Council of Ministers, dated 9 August 1986, which decreed the establishment of a 5,000 ha Cultural and Historical Site (MARD 1997). The principal objective of which was not biodiversity conservation but the protection of the extensive cave systems at the site (Tordoff *et al.* 2004).

In 1992, an investment plan was prepared for the site, which proposed the establishment of a 41,132 ha nature reserve (Anon. 1992). Following the approval of the investment plan, a nature reserve management board was established by Quang Binh Provincial People's Committee on 5 December 1993 (Quang Binh Provincial FPD *in litt.* 2000).

In 1999, the Forest Inventory and Planning Institute prepared a revised investment plan for the site. This investment plan proposed extending the site to incorporate the Ke Bang limestone area to the north-west, and revising the management category from nature reserve to national park. Following the approval of this investment plan, the establishment of Phong Nha-Ke Bang National Park was decreed by Decision No. 189/TTg of the Prime Minister, dated 12 December 2001. According to the Prime Minister's decision, the total area of the national park is 85,754 ha, comprising a strict protection area of 64,894 ha, a forest rehabilitation area of 17,449 ha, and an administration and services area of 3,411 ha. The boundaries of the National Park decreed by the Prime Minister do not include an approximately 60,000 ha section of the Ke Bang limestone area in Minh Hoa district, which was proposed for inclusion within the national park in the investment plan (Tordoff *et al.* 2004) (see Map 2).

Following the revision of the establishment of Phong Nha-Ke Bang National Park, the nature reserve management board was restructured as a national park management board, by Decision No. 24/QD-UB of Quang Binh Provincial People's Committee, dated 20 March 2002. The management board currently has 228 members of staff, based at eight guard stations, and is under the management of the Quang Binh Provincial People's Committee (Nguyen Tan Hiep, Director of Phong Nha-Ke Bang National Park *in litt.* 2003).

In 1998, the site was nominated as a UNESCO World Heritage Site. As well as its biodiversity values, the justification for inscription included the outstanding cave systems and limestone karst landscape at the site (Nguyen Ngoc Chinh *et al.* 1998). In 2003, Phong Nha-Ke Bang National Park was inscribed as Vietnam's fifth World Heritage Site.

During 1998, Fauna and Flora International (FFI) implemented a two-part project at Phong Nha-Ke Bang. The first part consisted of a training course for national park staff, while the second part consisted of a survey of large mammals, bats and birds (Timmins *et al.* 1999).

Quang Binh Tourism Company have been operating at Phong Nha-Ke Bang since 1995, handling tourism to Phong Nha cave.

With funding from the UK Department for International Development and WWF-UK, the WWF Indochina Programme implemented a project entitled *Linking Hin Namno and Phong Nha through Parallel Conservation*. The first phase of this project ran from 1998 to 1999, and the second phase ran from 2000 to 2002. These phases focused on capacity building for national park staff, collecting baseline data and environmental education.

With funding from the British Environmental Fund and the Flagship Species Fund of the UK Department of Environment, Food and Rural Affairs, FFI implemented the *Phong Nha-Ke Bang Conservation Awareness Project* between 2001 and 2003. The focus of this project was primate surveys and awareness-raising for school children and visitors (Tordoff *et al* 2004).

1.4 Phong Nha-Ke Bang physical structure and climate

Geographical setting

Phong Nha-Ke Bang National Park is located in western Bo Trach district, close to the international border with Laos. The National Park is situated in one of the largest areas of contiguous limestone karst in Indochina, which also includes Hin Namno National Biodiversity Conservation Area in Laos. The limestone massif is located in a transitional zone between the northern and central Annamite Mountains.

The topography of the national park is characterised by precipitous karst ridges, which rise to elevations of around 600 m. Scattered among these ridges are narrow valleys and pockets of igneous rock formations. Because of the limestone topography, drainage is complex and there are few permanent water-courses. There are, however, the Chay, Son and Trooc rivers, all of which are fed by underground streams, which emerge from the En, Vom, Toi and Phong Nha cave systems. All three rivers flow into the Gianh River, which empties into the South China Sea.

Biogeographical setting

Phong Nha Ke Bang has been variously placed in the Annamese Lowlands Endemic Bird Area (EBA) and biogeographical sub-unit 05c, North Annam, of the Indomalayan Realm (MacKinnon 1997, Stattersfield *et al.* 1998). The system of Wikramanayake *et al.* (1997) placed Phong Nha Ke Bang National Park in the Annamite Range Moist Forests Ecoregions (Wege, D. C *et al.* 1999).

An Endemic Bird Area (EBA) is an area that encompasses the overlapping breeding ranges of Restricted-range bird species, such that the complete ranges of two or more Restricted-range species are entirely included within the boundary of the EBA. This does not necessarily mean that the complete ranges of all of an EBA's Restricted-range species are entirely included within the boundary of that single EBA, as some species may be shared between EBAs. A Restricted-range bird species is a land bird that is judged to have had a breeding range of less than 50,000 km² throughout historical times (since 1800) (Stattersfield *et al.* 1998). There are seven Restricted-range species that are confined to the Annamese Lowlands EBA, of which Edwards's Pheasant and Vietnamese Pheasant are currently considered to be globally threatened (BirdLife International 2011).

Phong Nha-Ke Bang NP lies within most area of two Important Bird Areas (IBAs): Phong Nha (VN039) and Ke Bang (VN040) which were identified by BirdLife International (2002). The two IBAs support four of seven restricted range species of the Annamese Lowlands EBA (see Table 1)

Table 1: Restricted range species of the Endemic Bird Area 143: Annamese Lowlands

Common Name	Scientific Name	VN039	VN040
Edwards's Pheasant	<i>Lophura edwardsi</i>		
Vietnamese Pheasant	<i>Lophura hatinhensis</i>		
Crested Argus	<i>Rheinardia ocellata</i>	X	X
White-cheeked Laughingthrush	<i>Garrulax vassali</i>		
Short-tailed Scimitar Babbler	<i>Jabouilleia danjoui</i>	X	X
Sooty Babbler	<i>Stachyris herbeti</i>	X	X
Grey-faced Tit Babbler	<i>Macronous kelleyi</i>		X

Notes: X = confirmed to regularly occur in significant numbers

1.5 Previous ornithological surveys at Phong Nha-Ke Bang

The first specific ornithological survey of Phong Nha National Park was undertaken during June 1994 by staff from BirdLife International in collaboration with the Species Survival Commission of IUCN. The aim of this survey was to identify areas supporting populations of endemic *Lophura* pheasants, which, if not already protected, would be suitable for protected area establishment (Eames *et al.* 1994, Lambert *et al.* 1994). This survey recorded several species of conservation concern for Phong Nha area such as Sooty Babbler *Stachyris herbeti*, Red-collared Woodpecker *Picus rabieri* and Austen's Brown Hornbill *Anorrhinus austeni*.

From March to May 1997, the Vietnam-Russia Tropical Centre (VRTC) conducted a biodiversity expedition in Ke Bang Area, Thuong Hoa commune, Minh Hoa district. This location is a part of the extension area or former buffer zone of Phong Nha-Ke Bang National Park. The survey team visited several sites during the expedition: primary and secondary forests on limestone karst and narrow valley 12-18 km long to the south-west from Yen Hop village; anthropogenic habitats around Yen Hop and Mo O villages in Thuong Hoa commune (Kalyakin 1999). With regard to birds, this survey recorded four Near-threatened species, including Crested Argus *Rheinardia ocellata*, Sooty Babbler, Red-collared Woodpecker and Austen's Brown Hornbill (Kalyakin 1999 and BirdLife International 2011).

Another comprehensive biodiversity survey, including birds, was conducted by Robert Timmins in Timmins *et al.* (1999). This survey recorded several globally threatened and Near-threatened species, including Crested Argus, Chestnut-necklaced Partridge *Arborophila charltonii*, Red-collared Woodpecker and Short-tailed Scimitar Babbler *Jabouilleia danjoui*. Timmins *et al.* (1999) considered Phong Nha-Ke Bang to be of particular importance for bird conservation, because the populations of species of conservation concern are not at immediate risk of extirpation or major population declines. Both Phong Nha and the adjacent Ke Bang limestone

areas (including the portion in Minh Hoa district, outside of the national park) qualify as Important Bird Areas (Tordoff 2002).

1.6 Aims and objectives of this bird survey

This survey aims to collect baseline biodiversity information on birds in the extension area of Phong Nha - Ke Bang NP.

The specific objectives of this mission were to:

- Conduct a literature review of previous published data on the birds of Phong Nha-Ke Bang National Park;
- Collect data on occurrence of birds at each site visited;
- Evaluate the status of nationally and globally threatened species at each site;
- Identify and evaluate the threats to biodiversity in survey area;
- Make management and technical recommendations specific to biodiversity conservation in the Park.
- Propose key bird species for long term monitoring and monitoring strategy and protocols.

1.7 Study areas and survey effort

The extension area of Phong Nha-Ke Bang NP is located and lies within the area of two communes: Thuong Hoa and Hoa Son in Minh Hoa District in the north-west of the province. The proposed extension area is about 30,000 ha, of which 22,000 and 8,000 ha belong to Thuong Hoa and Hoa Son communes respectively. Two key survey locations were selected, one in each of the two communes.

The topography of the both locations is characterised by limestone karst and narrow valleys between limestone karst. The survey locations support primary and secondary forests on limestone, and additional mosaic of land-use types, including fragmented forest patches, secondary forests, and permanent and shifting cultivation. Elevation ranges from 285 to 650 m above sea level. The dominant geology in the region is limestone. Regional hydrology is dominated by the Gianh River, and there are relatively few permanent streams in the extension area.

The survey team was based at three camp sites (see Map1):

- Camp 1: in the “Mo O” village, in the south-west of Thuong Hoa commune; at coordinates 17°40.866’N 105°54.973’E
- Camp 2: in the “Da Lat 3” region, 12-15 km to the west of Mo O village; at coordinates 17°38.211’N; 105°54.972’E; and,

- Camp 3: in the “Tang Hoa” village, in the north-east of the Hoa Son commune, at coordinates 17^o40.866’N; 105^o54.978’E.

Within these regions, bird surveys were conducted in several survey routes:

Route 1: from camp 1 to the north-west: this route was placed along the foot of limestone mountains from Thuong Hoa commune to Hoa Son commune; other survey routes from this main route were placed up to limestone karst ridges and down to streams, which go along a narrow valley (see Map1).

Route 2: from camp 1 to west about 15 km: this is a path/patrolling trail used by frontier guard station No: 585 (Ca Xeng). This area is covered by primary forest on limestone karst and in the narrow valleys between limestone karst. Several locations have been named by local people in this area: Dat Lat 1 (as here it is windy and cool like weather in Da Lat, Lam Dong, Vietnam), Thung Bim Bim (because valley bottom often is flooded during the rainy season), Da Lat 2, Da Lat 3 and International boundary markers between Vietnam and Laos (see Map 1).

Route 3: from camp 3 to the south-east and then turning to the west direction: this trail is covered by three main types of habitat, including bushes as result of shifting cultivation, secondary and primary forests on limestone and narrow valleys. Several locations have been named by local people in this area: Hung Voi or Thung Voi (Elephant valley) and Hung Nuoc Thoi (Addled water valley) (see Map 1).

Route 4: from end point of route 3 to the west and then to the north-west: forest habitat within this trail is mainly primary forest on wider valleys and low hills with elevations ranging from 450 to 650 m a.s.l (see Map1).

Both survey locations lie within the limestone karst landscape between Vietnam and Laos, supporting forest on limestone formation with different types of land-use, including primary broadleaf and secondary evergreen forest on limestone and at the bottom of the valleys in between them. In addition, there are also secondary forest and scrub growing after shifting cultivation. This habitat is often seen near by or not far from villages in Thuong Hoa and Hoa Son communes.

The survey team included four ornithologists. In addition, two technical staff from Phong Nha-Ke Bang contributed to the survey as trainees and assistants for the BirdLife team. 20 man-days were spent in the field by each team member, thus the total field survey effort amounts to 80 man-days, not including travelling time to and from survey sites.

- Survey duration at Mo O, Thuong Hoa: from 5 to 15 July 2011;
- Survey duration at Tang Hoa, Hoa Son: from 16 to 23 July 2001

2. Birds

2.1 Overview

Birds were surveyed and recorded throughout the field survey. The data on birds were collected by four observers between 5 July and 24 July 2011 from two main survey locations within Thuong Hoa and Hoa Son communes, Minh Hoa District. Birds were detected both by sight and by call. Birds were observed using 8x42, 10x40 and 8x30 binoculars.

This section describes the results of the survey using the two above-mentioned techniques, gives an annotated list of the notable species and species of conservation concern and discusses the importance of the extension area for bird conservation. Appendix 1 gives a list of bird species recorded during the survey.

2.2 Methodology

The bird survey was conducted at two locations in the survey area over a 20-day period, not including travelling time. At each of the survey localities, data was collected on the bird community, using the method outlined in MacKinnon and Phillipps (2000) - a modification of the method outlined in Bibby *et al.* (1996) - to get information on species composition and measure the relative abundance. *Ad hoc* sightings of the key birds were also recorded during the transect walks. Sightings of globally threatened bird species were located by hand GPS and mapped.

Weather permitting, active searches were made from shortly after dawn until late morning (11h00), and, again, from late afternoon (16h00) until dusk each day. Occasional nocturnal forays were also made. Trails in the forest were walked slowly and deliberately, with frequent stops to observe mixed feeding flocks or birds feeding at fruiting trees. Birds were detected both by sight (observation), using 8x42 binoculars, and by identification of call. The bird encounter rate was enhanced by frequent imitation of the call of the partly diurnal Collared Owlet *Glaucidium brodiei* using a bamboo whistle. This disturbs and agitates mixed species flocks and stimulates them to closely approach the source of the noise, thereby facilitating their identification.

All species of bird that were seen or heard during the field survey were recorded. During the survey, and at each of the survey localities, data were collected on the bird community, using a modification of the method outlined in MacKinnon and Phillips (2000). This involves making a list of the first 10 species recorded, and then repeating the process until 10 such lists have been made. A species may be recorded on any list only once. The start-time and end-time for each list was noted. The observer walked at a slow walking-pace with pauses to identify birds. Basic habitat parameters (vegetation type) were noted. The same transect was never walked twice, to avoid recording the same individual birds. Plotting the accumulated total number of species recorded against the number of lists made gives a species discovery curve, whose steepness reflects species richness and indicates how many more species are likely to still be found at the locality (Figure 1). Species that occur on a high proportion of lists are the most abundant or conspicuous species of the local avifauna (MacKinnon and Phillips 2000).

Mist nets

Using mist nets were not mentioned in the technical proposal but BirdLife team decided to use it for this survey with an aim to provide training for the two trainees from Phong Nha-Ke Bang NP. In practice, mist-nets are used by ornithologists and bat biologists to capture wild birds and bats for banding or other research purposes. Mist nets are typically made of nylon mesh suspended between two poles, resembling an oversized volleyball net. When properly deployed, the nets are virtually invisible. The grid size of the mesh netting varies according to the size of the species targeted for capture. Net dimensions were approximately 1-2 m high by 6-15 m long. When mist nets were placed on the field, surveyors made regular checks, at least every 30 minutes, to avoid any casualties to the birds.

2.3 Results

2.3.1 Diversity and composition (resident forest avifauna)

A total of 159 bird species were recorded during this survey at the two locations. Of these, 151 species were directly recorded by observation or identification of calls and eight species recorded on the basis of interviews with local hunters or identification of feathers and remaining parts of the birds found in hunters' houses (Appendix 1).

Of the total 159 species, 143 and 121 species were recorded in Thuong Hoa and Hoa Son respectively. Composition of bird communities recorded from the two survey locations is very similar to each other because they are located on the same limestone landscape between Phong Nha-Ke Bang, Vietnam and Hin Namno, Laos.

Of the total number of species confirmed during this survey, five species are considered Near-threatened at a global level (BirdLife International 2011) (Table 2). Additionally, two other species are considered Vulnerable at a national level (Anon 2007). Three of the seven Restricted-range species which define the Annamese Lowlands Endemic Bird Area, were recorded from the extension area (Table 2).

Table 2: Globally and nationally threatened and Near-threatened bird species recorded during the field survey

Common name	Scientific name	IUCN 2011	VN-RDB 2007
Chestnut-necklaced Partridge	<i>Arborophila charltonii</i>	NT	
Blyth's Kingfisher	<i>Alcedo hercules</i>	NT	
Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	NT	VU
Short-tailed Scimitar-babbler	<i>Jabouilleia danjoui</i>	NT, RRS	
Sooty Babbler	<i>Stachyris herberti</i>	NT, RRS	VU
Grey-faced Tit Babbler	<i>Macronous kelleyi</i>	RRS	

Notes: Global status: NT = Near Threatened as per BirdLife International (2011). National status: R = Rare; V = Vulnerable; VU = Vulnerable as per Anon. (2007); RRS = Restricted-range Species

2.3.2 Species lists

During the survey a total of 47 lists were made from two survey locations, and a total of 100 species were recorded on one or more list (Figure 1). The two most commonly recorded bird species were Pin-striped Tit-babbler *Macronous gularis* and White-bellied Yuhina *Erpornis zantholeuca*, which were recorded on 22 lists (47%). The next four commonly recorded species were Fork-tailed Sunbird *Aethopyga christinae*, Red-vented Barbet *Megalaima lagrandieri*, Mountain Fulvetta *Alcippe peracensis*, and Emerald Dove *Chalcophaps indica*, which were recorded on 18 lists (38%), 17 lists (36%), 17 lists (36%) and 16 lists (34%) respectively. The next four commonly recorded species were Greater Racket-tailed Drongo *Dicrurus paradiseus*, Scarlet Minivet *Pericrocotus flammeus*, Black-naped Monarch *Hypothymis azurea* and White-crested Laughingthrush *Garrulax leucolophus*, which were recorded on 14 lists (30%), 14 lists (30%), 14 lists (30%) and 13 lists (27%) respectively. The next four species were Streaked Wren Babbler *Napothera brevicaudata*, Scaly-crowned Babbler *Malacopteron cinereum*, Red-headed Trogon *Harpactes erythrocephalus* and Asian Fairy Bluebird *Irena puella*, which were recorded on 11 lists (23%), 10 lists (21%) and 9 lists (19%) and 9 lists (19%) respectively (Figure 1).

Species Discovery Curve

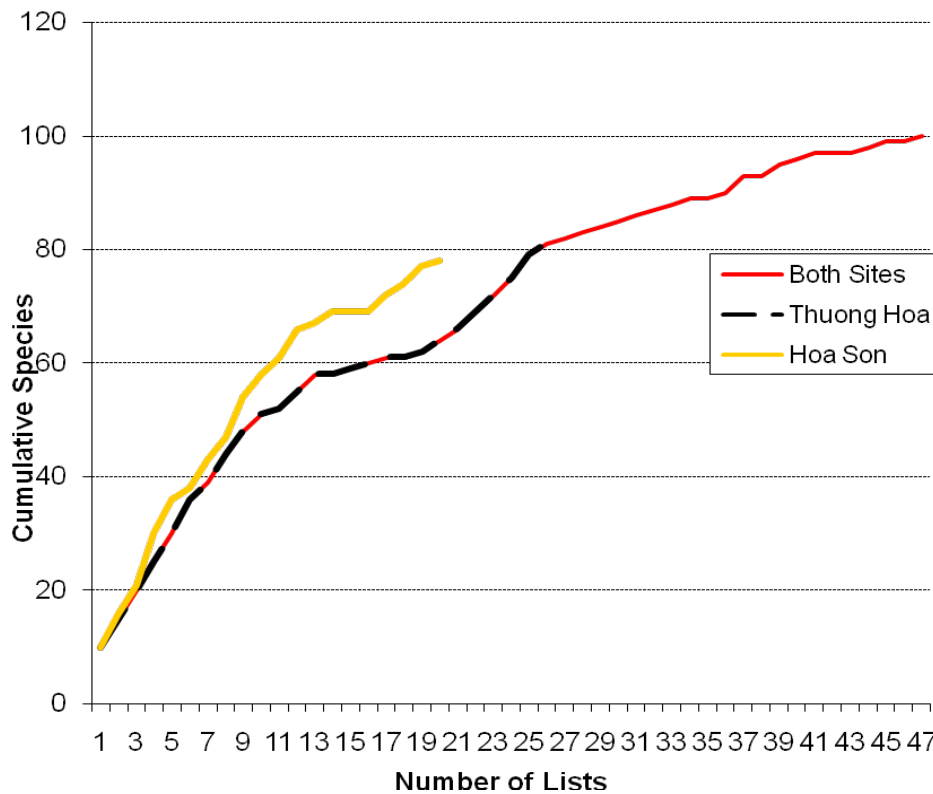


Figure 1: Bird species discovery curves for two sites in the extension area of Phong Nha-Ke Bang National Park during the survey.

The relatively steep species discovery curve on Figure 1 indicated that the number of additional species to the lists increased with further survey effort and was still increasing with the lists at the end of the survey period. This reflects the high species diversity at the sites and that further survey effort will discover more species.

2.3.3 Mist netting

As mentioned above, using mist net aims to collect some bird specimens to train the two staff from Phong Nha-Ke Bang National Park on bird identification.

A total of 12 mist nets were placed for seven days at each survey location. Mist nets used were 4 meter tall and of various length, such as 6, 8, 12 and 15 meters.

A total of 25 species from 108 specimens were caught during the survey. These species are members of ten families such as Trogonidae, Alcedinidae, Pycnonotidae, Rhipiduridae, Timaliidae, Sylviidae, Muscicapidae, Nectriniidae, Dicruridae and Corvidae (See Appendix 2). Of these, a globally near-threatened Blyth's Kingfisher *Alcedo hercules* was trapped. This species was not otherwise seen in the wild during the survey. In addition, one specimen was identified as Limestone Leaf Warbler *Phylloscopus calciatilis*. This species was recently described as a new species for science in 2010 (Alstrom *et al.* 2010).

2.3.4 Species of conservation concern

Included here are records of all species whose conservation status is judged to be Globally Threatened or Globally Near-threatened by BirdLife International (2011).

Chestnut-necklaced Partridge *Arborophila charltonii* Globally Near-threatened

A pair was observed on a trail in secondary evergreen forest on 7 July, at 17°40.902'N 105°54.966'E, 285 m a.s.l elevation. Calls from three other different groups were heard on 7, 8 and 11 July in the first camp site, at elevations ranging from 280 to 300 m a.s.l. Two birds were seen in a group on 18 July in a valley bottom at 17°44.857'N 105°52.007'E, 317 m a.s.l elevation, in Hoa Son commune.

Blyth's Kingfisher *Alcedo hercules* Globally Near-threatened

A single bird was captured by mist net at a permanent stream near camp site No. 1 in Mo O village on 11 July, at 17°40.866'N 105°54.973'E. This species depends on forest streams and rivers. In Vietnam it is locally fairly common in west Tonkin and Annam. Given its linear distribution along rivers, and thus restricted extent of occurrence, the total population size is possibly relatively small (see Photo).



Austen's Brown Hornbill *Anorrhinus austeni*

Globally Near-threatened

A single flock was heard calling at Thung Voi (Elephant valley) on 20 July, at 17°43.008'N 105°53.739'E in Hoa Son commune during this survey. Two birds were observed flying over the forest canopy at the same valley. This species is classified as Near-threatened by BirdLife International (2011), while it is considered as 'Vulnerable' in Vietnam Red Data Book (Anon 2007). Local informants reported that this species and other two species of hornbill are fairly commonly encountered in valleys from Dat Lat 1 to Dat Lat 3 during September and October annually. In Vietnam, however, this species is facing threat of being hunted for food at local level.

Recently, *Anorrhinus tickelli* was split into *A. tickelli* and *A. austeni* (Rasmussen and Anderton, 2005). *Anorrhinus austeni* occurs in China (rare), India (a small population), Myanmar, Thailand (generally uncommon), Laos, Vietnam (rare to uncommon in Tonkin and Annam) and Cambodia (scarce) (BirdLife International 2011).

Short-tailed Scimitar-babbler *Jabouilleia danjoui*

Globally Near-threatened and RRS

A pair was observed at Thung Bim Bim on 11 July (17°40.231'N 105°55.344'E). Other calls were heard on the same day along this valley bottom. This species was also recorded previously (Timmin *et al.* 1999). This species is a Restricted-range species and is known from East Tonkin, North, Central and South Annam, Vietnam, where small numbers have been recorded at many sites, and central Laos, where a fairly large population survives near the Vietnamese border. In East Tonkin it occurs very close to the border with China and probably occurs in suitable habitat there also (BirdLife International 2011).

Sooty Babbler *Stachyris herberti*

Globally Near-threatened and RRS

A total of six flocks were encountered during the survey within Thuong Hoa and Hoa Son communes. Detailed records are as follows:

A group of more than ten birds were encountered on 9 July in limestone forest at 17°41.349'N 105°53.56'E, 548-550 m a.s.l elevation. The second group of 12 birds were seen in the same habitat and date but at 17°41.236'N 105°53.498'E, 645 m a.s.l elevation. The third group of more than four birds was encountered on 10 July on at 17°41.483'N 105°53.528'E, 450 m a.s.l. elevation, about 15 km from camp site No.1 to the north-west in Thuong Hoa forest. The fourth

group of more than 10 birds was seen on 11 July in the Da Lat area, at 17°40.368'N 105°55.284'E, 431 m a.s.l elevation. The fifth group of seven birds was seen on 12 July in Dat Lat 2 area, at 17°39.661'N 105°54.803'E, 397 m a.s.l elevation. The sixth group of five birds was seen on 20 July in Thung Voi (Elephant valley) at 17°43.008'N 105°53.739'E, 510 m a.s.l. elevation.

In Vietnam, this species is listed as Vulnerable (Anon. 2007) because it is only known from two protected areas in Vietnam: Phong Nha-Ke Bang (Quang Binh) and Dakrong (Quang Tri). The Phong Nha-Ke Bang area is believed to support a much bigger population of this species, while Dakrong Nature Reserve, Quang Tri Province supports only a small population (Cress. 2006). In other words, suitable habitat for this species is only present in wider limestone forest in Phong Nha-Ke Bang and a small patch of this habitat in Dakrong Nature Reserve (see photo).



Sooty Babbler *Stachyris herberti*, taken in limestone forest in Thuong Hoa area

Grey-faced Tit Babbler *Macronous kelleyi*

RRS

This species was observed in two occasions during the survey and was often seen feeding in the same flock with other species such as Mountain Fulvetta, White-bellied Yuhina and Fork-tailed Sunbird. This species is not a threatened species according to assessments by BirdLife International but it has a restricted distribution range in Vietnam and Laos.

Limestone Leaf Warbler *Phylloscopus calciatilis*

Not Evaluated

A single bird was mist netted in limestone karst forest in Mo O village, Thuong Hoa commune, near camp site No 1 (17°40.866'N 105°54.973'E) at 284 m a.s.l. elevation. Two birds were seen on 10 July at 17°41.533'N 105°53.419'E, 435 m a.s.l. in limestone forest.

This species is a limestone forest specialist in Vietnam and Laos. The new species is very similar to the Sulphur-breasted Warbler *P. ricketti* in morphology, but smaller with a proportionately larger bill and rounder wing. Its song and calls are diagnostic. This species is a resident breeding species in the karst limestone region of central Vietnam and Laos. Although the species is not believed to be under any immediate threat, we think that the conservation status of this bird species will be assessed in the future by BirdLife International (see Photo).



Limestone Leaf Warbler *Phylloscopus calciatilis*, a specialist to limestone forest in Phong Nha-Ke Bang National Park

2.3.5 Species of conservation concern with unconfirmed records during this survey

This section described some species of conservation concern of whom no confirmed record was made during this survey. Information of the occurrence or extinction of these species was gathered from interviews with local hunters or villagers in Thuong Hoa and Hoa Son communes (in the extension of Phong Nha-Ke Bang).

Siamese Fireback *Lophura diardi*

Globally Near-threatened

No records during the survey but four interviewers were familiar with this species. Informants indicated that this species occurred in the secondary forest at valley bottom in Thuong Hoa and Hoa Son communes and it is hunted with snares.

Grey Peacock-pheasant *Polyplectron bicalcaratum*

Nationally Vulnerable

This pheasant species was not recorded during this survey but many hunters and villagers were very familiar with it. In addition, two pairs of legs with two spurs on each leg were seen in the house of a local hunter in Tang Hoa village, Hoa Son commune. In Vietnam, this species has been classified as nationally vulnerable as a result of overhunting for local consumption.

Crested Argus *Rheinardia ocellata*

Globally Near-threatened

No record was made for this species during the survey. Results from interviews indicated that this species was present formerly but may have been locally extinct for about ten years. This species is listed as Vulnerable in the Red Data Book of Vietnam (Anon 2007).

Green Peafowl *Pavo muticus*

Globally Endangered

No record was made for this species during the survey. Results from interviews indicated that this species was formerly present but has been locally extinct for about twenty years. This species is also considered as nationally Endangered in the Red Data Book of Vietnam (Anon 2007).

[Great Hornbill] *Buceros bicornis*

Globally Near-threatened

No record was made for this species during the survey but interviewees indicated that this species still occurred in the survey area. Some records of this species were made in Yen Hop, Thuong Hoa commune by Kalyakin in 1999 (Kalyakin 1999). This species is often shot at fruiting trees.

[Bare-faced Bulbul] *Pycnonotus hualon*

Species nova.

No record was made for this species during this survey but it was observed that the extension area supported very suitable habitat for this species. The Bare-faced Bulbul *Pycnonotus hualon*, described in 2009 and known only from limestone karst in Laos, was reported from Phong Nha IBA in February 2010 (Woxvold *et al.* 2009; Nguyen Hoai Bao pers comm)

3. Discussion

3.1 Biological Evaluation

3.1.1 Species Richness and Diversity

A total of 151 bird species were directly recorded during this survey in Thuong Hoa and Hoa Son. When these data are compared with the result of 213 species recorded for Phong Nha-Ke Bang National Park from three main expeditions before 1999, the absence of members of migrant species from this survey is revealed. The fact is that this survey was conducted in July, outside the migratory season of many forest birds. Of 213 species recorded for the park, 15% are migratory forest birds, which are members of Sylviidae, Accipitridae and Turdidae families. It was believed that bird communities in the extension of Phong Nha-Ke Bang are very similar to those of Phong Nha-Ke Bang National Park.

3.1.2 Globally and Nationally Threatened Species and Restricted Range Species

No globally threatened species was recorded in the extension area. During this survey a total of five globally Near-threatened species were recorded. These comprise Chestnut-necklaced Partridge, Blyth's Kingfisher, Austen's Brown Hornbill, Short-tailed Scimitar-babbler and Sooty Babbler. The extension area of Phong Nha-Ke Bang supports three of the seven Restricted-range species that define the Annamese Lowlands Endemic Bird Area, including Short-tailed Scimitar-babbler, Sooty Babbler and Grey-faced Tit Babbler. The records of Sooty Babbler in this survey were its first time records in the Ke Bang area. Moreover, Limestone Leaf Warbler was both trapped and observed during the survey. This species is a specialist in limestone forest and it may be a Restricted-range species. In Vietnam, Phong Nha-Ke Bang and Dakrong Nature Reserve have had confirmed records of Sooty Babbler, and Limestone Leaf-warbler was only confirmed in Phong Nha-Ke Bang, including the extension area. Therefore, limestone forest formations in the extension area is home and typical habitat for limestone specialist bird species such as Sooty Babbler and Limestone Leaf-warbler and could support Bare-faced Bulbul and therefore is significant for their conservation. This habitat is only present at a few sites within the Annamese Lowlands EBA.

Two species with confirmed records during this survey are classified as nationally Vulnerable. These include Austen's Brown Hornbill and Sooty Babbler (see Table 3).

Table 3: Globally threatened and Restricted-range species in PNKB and Study area

Common name	Scientific name	IUCN	PNKB	Extention area
Chestnut-necklaced Partridge	<i>Arborophila charltonii</i>	NT	X	X
Siamese Fireback	<i>Lophura diardi</i>	NT	X	
Crested Argus	<i>Rheinardia ocellata</i>	NT, RRS	X	
Blyth's Kingfisher	<i>Alcedo hercules</i>	NT	X	X
Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	NT	X	X
Great Hornbill	<i>Buceros bicornis</i>	NT	X	
Red-collared Woodpecker	<i>Picus rabieri</i>	NT	X	
Japanese Paradise-flycatcher	<i>Terpsiphone atrocaudata</i>	NT	X	
Short-tailed Scimitar-babbler	<i>Jabouilleia danjoui</i>	NT, RRS	X	X
Sooty Babbler	<i>Stachyris herberti</i>	NT, RRS	X	X
Grey-faced Tit-babbler	<i>Macronous kellei</i>	RRS		X

Note: Conservation status as per BirdLife International 2011: NT = Near-threatened; RRS = Restricted Range Species

3.1.3 Similarity

The degree of similarity among the Avifauna of two survey localities within the Thuong Hoa and Hoa Son was measured using Sorenson's Similarity Index (Magurran 1988). The index is given by the formula:

$$C_s = \frac{2j}{(a + b)}$$

Where: j = The shared species of two areas
 a = Number of species in area A
 b = Number of species in area B

Based on numbers of species recorded for Thuong Hoa and Hoa Son, which are 143 and 121 species respectively, of these, 105 species are shared between two sites, the value of Sorenson's Similarity Index (C_s) is 0.795. This figure of C_s is quite high, indicating a high degree of similarity between the species assemblages at Thuong Hoa and Hoa Son.

3.1.4 Important Bird Area Criteria

Ke Bang, including the extension area, supports four of the seven Restricted-range species that define the Annamese Lowlands EBA, including Sooty Babbler, a species restricted to limestone forest habitats in central Vietnam and Laos. At Khe Bang IBA, Sooty Babbler is relatively common in areas of primary limestone forest (Tordoff 2002). Three other species include

Crested Argus, Short-tailed Scimitar-babbler and Grey-faced Tit-babbler; the last species being recorded for the first time at Ke Bang IBA during this survey (See Table 4).

Ke Bang, including the extension area, supports 14 of the 30 bird species restricted to the Indochinese Tropical Moist Forests (Biome 09) (Tordoff *et al.* 2002). In addition, the study area is also supported populations of Ha Tinh Langur *Trachypithecus hatinhensis*, which is a globally threatened primate and Restricted-range primate species. This species is restricted to limestone forest in central Vietnam and Laos (Phong Nha-Ke Bang, Quang Binh Province and Bac Huong Hoa Nature Reserve, Quang Tri Province, Hin Namno National Biodiversity Conservation Area, Laos).

Table 4: Bird species that meet IBA criteria in Ke Bang and Study Area

Species	IBA Criteria	Global Threat Status	Ke Bang IBA	Study Area
Crested Argus <i>Rheinardia ocellata</i>	A1, A2	NT, RRS	X	[X]
Chestnut-necklaced Partridge <i>Arborophila charltonii</i>	A1	NT	X	X
Red-collared Woodpecker <i>Picus rabieri</i>	A1, A3	NT	X	
Great Hornbill <i>Buceros bicornis</i>	A1	NT	X	[X]
Austen's Brown Hornbill <i>Anorrhinus austeni</i>	A1, A3	NT	X	X
Japanese Paradise-flycatcher <i>Terpsiphone atrocaudata</i>	A1	NT	X	
Short-tailed Scimitar Babbler <i>Jabouilleia danjoui</i>	A1, A2	NT, RRS	X	X
Sooty Babbler <i>Stachyris herbeti</i>	A1, A2	NT, RRS	X	X
Grey-faced Tit-babbler	A2	RRS		X

Notes: [] = unconfirmed record.

Category A1: Globally threatened species: This category refers to bird species classified as globally Critically Endangered, Endangered, Vulnerable, Near threatened or Data Deficient according to BirdLife International (2011).

Category A2: Restricted-range species: This category refers to Restricted-range bird species, which are species with a total global breeding range of less than 50,000 km².

Category A3: Biome-restricted assemblages: This category applies to groups of bird species with largely shared distributions of greater than 50,000 km², which occur mostly or wholly within all or part of a particular biome, and are, therefore, of global importance.

3.1.5 Importance of the Avifauna of Phong Nha-Ke Bang National Park including the extension area

Phong Nha-Ke Bang National Park, including the extension area is located in the central Indochina Limestone (Tordoff *et al.* 2003). There are three protected areas in this priority landscape. These include Nakai Nam Theun, Hin Nammo in Laos and Phong Nha-Ke Bang in Vietnam. All of them support limestone forest formations and lowland evergreen forest, and it is home of a number of endemic species found nowhere else in the world, such as Sooty Babbler

and Hatinh Langur. Moreover, the avifauna of PNKBNP, including the extension area, is typical of the Annamese Lowlands Endemic Bird Area (see Figure 3). To date, 233 species of birds have been recorded in PNKBNP (Appendix 1). Four of the seven restricted-range species which define the Annamese Lowlands Endemic Bird Area, have been recorded from PNKBNP. Comparing the number of Restricted-range species recorded in each of the other 13 protected areas in the Annamese Lowlands Endemic Bird Area (in Vietnam and Laos), Phong Nha-Ke Bang, Ke Go, Dakrong and Bac Huong Hoa are ranked second after Phong Dien Nature Reserve and Bach Ma National Park, which are at the top of the ranking (see Figure 2) (Eames *et al.* 2001).

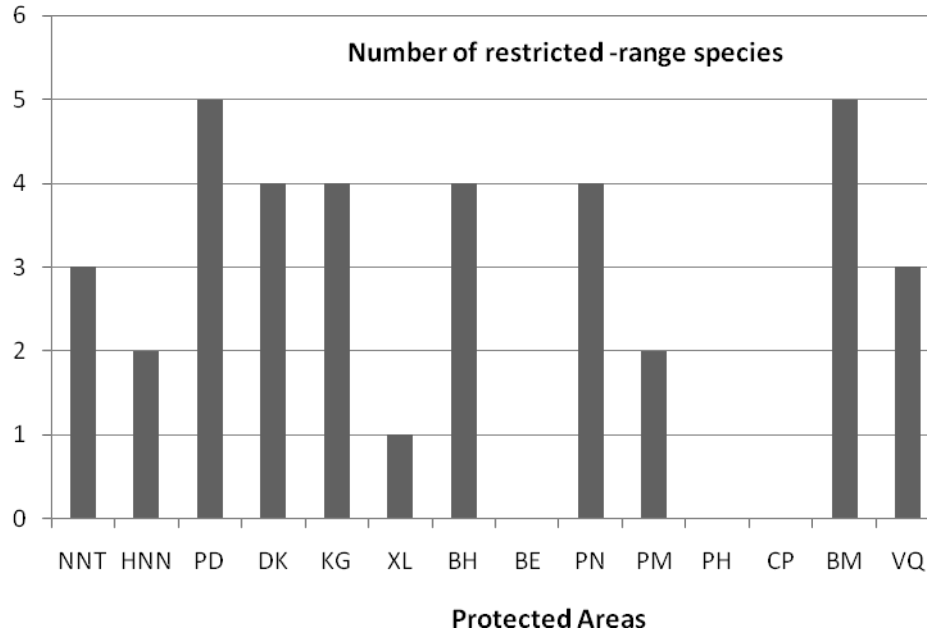


Figure 2. The number of Restricted-range bird species in protected areas in the Annamese Lowlands Endemic Bird Area

Note: NN = Nakai Nam Theun; HN = Hin Nammo; PD = Phong Dien; DK = Dakrong; KG = Ke Go; XL = Xuan Lien; PH = Pu Huong; BE = Ben En; PN = Phong Nha-Ke Bang; PM = Pu Mat; PT = Pu Hoat; CP = Cuc Phuong; BM = Bach Ma; VQ = Vu Quang; BH = Bac Huong Hoa. Data for protected areas were taken from Eames *et al.* (2001).

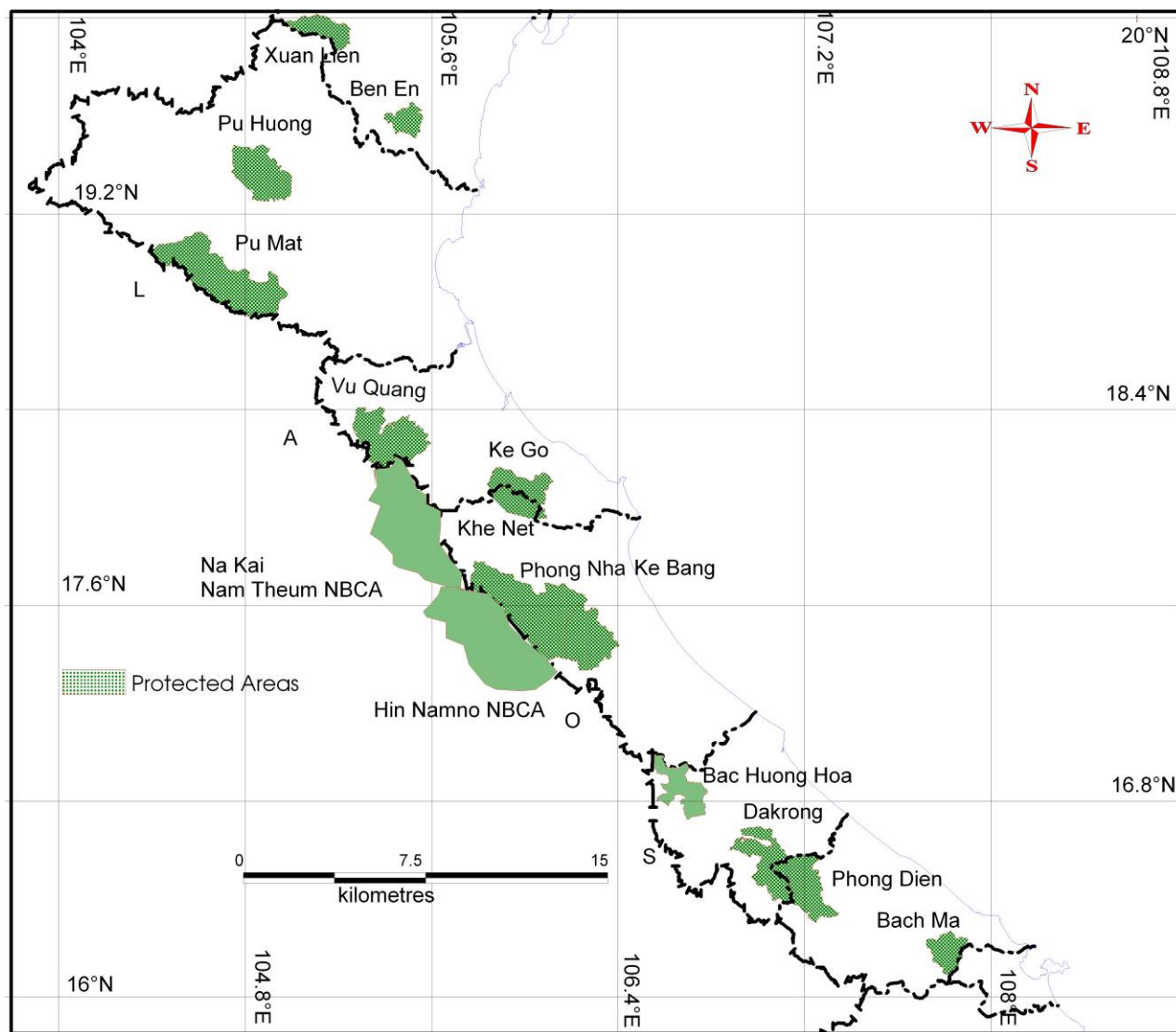


Figure 3. Location of protected areas in the Annamese Lowlands Endemic Bird Area

3.2 Threats to the forests and biodiversity in the survey sites

3.2.1 Timber extraction

Timber extraction observed in the survey sites is conducted for two main purposes: commercial and domestic uses (e.g. house building). Loggers are mainly local people in the buffer zone villages of the extension part of the Park, namely On, Yen Hop and Mo O villages of Thuong Hoa Commune, Tang Hoa and Hoa Luong villages of Hoa Son Commune, and some other villages of Trung Hoa Commune.

Logging pattern: Trees are felled and cut into blocks or planks in sizes agreed in advance with timber traders. The timbers are then transported out of the forest using local porters alone or in combination with domestic buffalos in case of Thuong Hoa Commune.

During the survey, two illegal logging routes were observed in the area of Hoa Son Commune:

- One route starts from the trail to Ca Boi, going up to the 500m a.s.l. ridgeline, then down to Thung Voi (Hung Voi) valley, then over the ridge to Thung Nuoc Thoi (Hung Nuoc Thoi) valley or to Da Liep stream. This route goes over both limestone and earthen mountains, with many trails in the forest on lower earthen hills.
- The other route starts from the far end of Tang Hoa village, going up stream and then following earthen trails to Doi Ong Gia (Ong Gia Hill) and on to Mo Ro area.

Both these routes seem to be old ones and used regularly by local people for timber and non-timber forest product exploitation purposes.

The most common kinds of wood extracted from the survey areas are: *Michelia* spp. (*Gioi*), *Magnolia* ssp (*Vang tam*) and *Actinodaphne* spp. (*Bop*). These tree species have very nice in texture, light and light-coloured timber. Forest in these areas is still quite rich with many big standing *Vatica* spp. (*Tau*) trees. It was reported by local people that *Tau* timber was very heavy (meaning more difficult to transport) and therefore not a favourable target of logging.

3.2.2 Timber transportation and trading

Though big trucks of timber were not observed during the survey, smaller vans which are a very common means of timber transportation, were seen frequently in the buffer zone of the extension area of the Park. There were at least three vans of this type noted in the three surveyed villages of Thuong Hoa Commune, and four in Hoa Son Commune. These vans had several common features: i) all the passenger seats were removed to give space for timber transportation; ii) they had no registration permit, and iii) thus can only be used within these remote villages.

It was reported by local people that in this area there was at least one local timber trading establishment run by Kinh people, where timber illegally extracted from the local forest were bought from illegal loggers.

3.2.3 Hunting

No hunters or trap/snare lines were observed during the survey. Only two gun shots were heard in the “Da Lat 1” area to the west of Mo O village on 11th July 2011.

Interviews with local people revealed that:

- Wildlife hunting is very common in this area and it’s a long tradition;
- The hunting season in this area is from August to January (or Tet – the Vietnamese lunar New Year). Professional hunters often use guns, or snares made from steel wires (e.g. bicycle brake wires) (See Appendix 6);
- Wildlife hunting and trapping in the surveyed area is often conducted by local villagers or people from other communes of Minh Hoa district. Some hunters even come from the further Quang Trach district of Quang Binh province;
- Hunting and trapping has resulted in the extinction of Green Peafowl and Crested Argus in the area;

- Wildlife products are often used locally as food or made into a kind of condensed “glue” called *Cao* for medicinal use. Commercially valuable wildlife such as live civets or cobras is often sold-on to the wealthier town such as Quy Dat in Minh Hoa district.

Local people in Tang Hoa village admitted that 80 out of 85 households in the village were involved in wildlife hunting and trapping, among them there were ten very skilful or professional hunters using both guns and traps. However, it was also reported that wildlife in the nearer forest (within one day’s walk) had become much scarcer; only some squirrels, rats and civets remained, if any. Wild pigs, deer and muntjac could now only be trapped in remote valleys, probably those near the borders with Laos. However, primate species such as Ha Tinh Langur, Rhesus Macaque *Macaca mulatta*, Sump-tailed Macaque *Macaca arctoides* and Northern Pig-tailed Macaque *Macaca leonina* could be found, hunted or trapped rather easily near the buffer-zone villages.

3.2.4 *Cinnamomum* oil extraction

Cinnamomum oil extraction is still being carried out in Hoa Son forest. Currently, tree species for oil extraction have been over-harvested in the area and now only the stem and roots, which were abandoned before, remain. Therefore, the *Cinnamomum* oil extraction activity will not last long, as species used to be harvested for oil extraction will go extinct soon in the area. During our survey, only one group of people extracting *Cinnamomum* oil was observed in the Thung Nuoc Thoi and Khe Da Liep valleys. These people came from Ron commune, Quang Trach district. An old *Cinnamomum* oil extraction camp was also observed near the stream between Minh Hoa Forest Company and the extension area of the Park in Hoa Son commune (17°43.634’N 105°52.306’E).

3.2.5 Honey collection

This activity is very common in the honey season. It is a traditional activity which poses no threats to the forest and biodiversity (as long as trees are not felled to reach hives) and at the same time brings some marginal income for local communities. Many groups of people collecting honey were seen in the forest in On, Mo O and Yen Hop villages. It’s also known that some of the honey collectors, while they are in the forest, also hunt or look for high value timber trees such as *Dalbergia tonkinesis*, *Diospyros* spp..

3.2.6 Agricultural cultivation

No agricultural cultivation was observed in the survey area. However, in Hoa Son commune, there exist quite large flat forest areas which could be potentially used for farming. Extra vigilance will be needed in future ranger patrolling to ensure they are not targeted for clearing.

4. Conservation recommendations

4.1 Management issues

The extension area lies within Thuong Hoa and Hoa Son communes with an area of about 30,000 ha, of which 22,000 and 8,000 ha are belonging to Thuong Hoa and Hoa Son respectively. The fact is that this plan is only on the paper, not on the ground. Boundary demarcation and installation of boundary markers on the ground have not been conducted yet. That is why rangers of the Park from two guard stations in the extension area and local people can only dubiously recognise the boundaries of the park in the field.

Proposed actions for this issue are as follows:

- Workshops on the Park boundaries delineation should be organized at district and communal levels involving all local stakeholders who are land owners/users in the extension area;
- Boundary demarcation and installation of markers should be conducted in a participatory manner with local authorities, representatives of villages and national park management board.

4.2 Hunting and Logging

Recommended management actions:

- Conduct a study on hunting, logging and wildlife trade in the buffer zone of the park, including extension area;
- Develop and introduce regular ranger patrolling schedules in relation to the forest and wildlife protection;
- Enforce law and park regulations relating to hunting, logging and NTFP collection;
- Establish regular contacts with the Border Army (585) and local authorities (communes and villages) and actively involve them in preventing illegal activities, especially hunting and logging;
- Provide training for rangers in a variety of skills, in particular park laws, eligible enforcement measures and patrolling techniques, and provide guard stations with necessary equipment to increase enforcement capacity and efficiency;
- Provide training on effective patrolling techniques, draw up and carry out a regular patrolling schedule for each guard station;
- Develop and implement a communication strategy for Phong Nha-Ke Bang National Park with clear goal, objectives and key messages;
- Carry out conservation awareness raising and education in local communities focusing on children, hunters and villagers in the buffer zone of the park, including the extension area.

Table 5: Summary threats to biodiversity and proposed mitigation

Threat	Causes	Mitigation
Hunting, trapping	Domestic demand Demand from wildlife trade	Enforce management regulations Conduct trade chain survey Conduct conservation awareness activities Control wildlife trade Collaborate with Border Army in forest law enforcement
Timber extraction	Domestic demand Commercial demand	Enforce management regulations Intensify forest patrols Conduct conservation awareness activities Collaborate with Border Army in forest law enforcement
Timber transportation and trade	Domestic demand Commercial demand from traders	Enforce management regulations Conduct conservation awareness activities Provide patrol equipment for ranger
Oil extraction (<i>Cinnamomum spp.</i>)	Commercial demand	Enforce management regulations Intensify forest patrols Conduct conservation awareness activities Collaborate with Border Army in forest law enforcement activities.
NTFPs (Honey) collection	Domestic demand Family income	Promote sustainable exploitation methods through conservation awareness activities
Clearance of forest for agriculture/shifting cultivation	Natural population growth Settlement of migrants	Improve access to family planning Allocate forest land in the buffer zone to local people Prevent/Control in-migration

4.3 Conservation Research and Monitoring

Further surveys on birds

Prior to this survey, there is only one survey conducted by the Vietnam-Russia Tropical Centre (VRTC), which covered a small area in Yen Hop, Thuong Hoa commune. The survey conducted by BirdLife International this time covered only a small portion of Thuong Hoa and Hoa Son communes. Both expeditions of bird surveys covered only small areas due to limited access in limestone karst. To fill this information gap on the avifauna in the extension area of PNKBNP, further surveys and their timing are proposed as follows:

- Further surveys on birds within Thuong Hoa and Hoa Son communes should be carried out before conducting boundary demarcation and boundary marker installation in the extension area. This would ensure that all area of distribution of key bird species of Phong Nha – Ke Bang region, namely Sooty Babbler, Austen’s Brown Hornbill and Great Hornbill, would be protected within the Park’s boundaries.
- Additional bird surveys should be conducted in both winter and spring times (November to June), and in the remote area near the border between Vietnam and

Laos. These surveys would aim to capture a comprehensive knowledge of the avifauna of the Park's extension area, including migratory species that winter or stop over at the site.

Monitoring programme

- A biodiversity monitoring programme should be developed and implemented in accordance with management objectives and in response to key threats to the biodiversity of the park;
- Monitoring of forest resource use by local communities living in and around the park should be undertaken on a regular basis to provide a basis for resolving conflicts between conservation and economic development programmes in the buffer-zone, and for reviewing the appropriateness of management activities.
- A suitable monitoring information system (for example, MIST) should be introduced to store and manage monitoring data to facilitate and measure impacts of improved park management.

Recommended key bird species for long-term monitoring

- A major threat to bird species in PNKBNP is hunting and trapping. Birds in the Hornbill family, such as Great Hornbill, Austen's Brown Hornbill, Oriental Pied Hornbill and Wreathed Hornbill, are mainly threatened by hunting with guns, while other birds in the Pheasant family are mainly threatened by trapping. Therefore, together with the Restricted-range, globally Near-threatened species Sooty Babbler, Hornbill and Pheasant species which are large-bodied and ground-dwelling in the latter case, are recommended key bird species for long term monitoring.
- The following actions are recommended to protect Hornbill and Pheasant species:
 - Regular and effective patrolling, law enforcement and conservation awareness raising for local communities and the general public;
 - More intensive patrolling conducted during September – October in forest areas with lots of fruit trees, where Hornbill species are often attracted by their favorite food.
- For Sooty Babbler, the following actions are recommended:
 - Develop a detailed distribution map of this species in PNKBNP with the main criteria as follows:
 - + limestone forest habitat,
 - + covered by broad-leaved evergreen forest (i.e. undisturbed forest),
 - + at elevations under 650m above sea level.
 - Design a species monitoring scheme with transects traversing suitable habitats;
 - Collect monitoring data along monitoring transects quarterly (every three months);
 - Comply with general biodiversity monitoring protocols applicable in PNKBNP in terms of monitoring cycle, surveyors, data format, database management, analysis and reporting, and the use of monitoring data by the Park Management Board, etc.

5. Other species of conservation interest recorded during the survey

Hatinh Langur *Trachypithecus hatinhensis*

Globally Endangered

Five animals were observed on a limestone karst cliff on 7 July, about 150-200 m from camp site 1 (Mo O). Other calls were heard in Thung Bim Bim (17°40.147'N 105°55.272'E) on 11 July. The species is relatively common in the forest of Phong Nha-Ke Bang area.

Rhesus Macaque *Macaca mulatta*

Nine animals were observed on 12 July in Mo O area (17°41.035'N 105°54.960'E).

Black Giant Squirrel *Ratufa bicolor*

Globally Near-threatened

This species was observed on many occasions during the survey in Thuong Hoa and Hoa Son and seems to be very common in the extension area.

References

- Alstrom, P., Davidson, P., Duckworth, J. W., Eames, J. C., Le Trong, T., Nguyen, C., Olsson, U., Robson, C. R., and Timmins R. (2010) *Description of a new species of Phylloscopus warbler from Vietnam and Laos*. *Ibis* 152, 145–168.
- Anon. (2007) [*Red data book of Vietnam, volume 1, animals.*] Hanoi: Scientific Publishing House. (In Vietnamese.)
- Bibby, C. J., Burgess, N.D., Hill, D.vA., and Mustoe, S.vH. (1996). *Bird Census Techniques*, London: Academic Press.
- BirdLife International (2011) *The BirdLife checklist of the birds of the world, with conservation status and taxonomic sources. Version 4.* Downloaded from <http://www.birdlife.info/im/species/checklist.zip> [xls zipped 1 MB].
- CRES (2006) [Dakrong Nature Reserve. Series of reports]. Scientific and technical Publishing House. [In Vietnamese].
- Eames, J. C., Eve, R., Tordoff, A. W. (2001) *The importance of Vu Quang Nature Reserve, Vietnam, for bird conservation in the Annamese Lowlands Endemic Bird Area*. *Bird Conservation International* 11: 247-285.
- Eames, J. C., Lambert, F. R., Nguyen Cu. (1994) *A survey of the Annamese Lowlands, Vietnam, and its implications for the conservation of Vietnamese and Imperial Pheasants Lophura hatinhensis and L. imperialis*. *Bird Conservation International* 4: 343-382.
- I. A. Woxvold, J. W. Duckworth and R. J. Timmins (2009) *An unusual new bulbul (Passeriformes: Pycnonotidae) from the limestone karst of Lao PDR*. *FORKTAIL* 25 (2009): 1–12.
- Kalyakin, M. V. (1999) *Ornithological studies in Ke Bang area, central Vietnam in March-April 1999*. Unpublished report to the Vietnam-Russia Tropical Centre, Hanoi.
- Lambert, F. R., Eames, J. C. and Nguyen Cu (1994). *Surveys for endemic pheasants in the Annamese Lowlands of Vietnam, June-July, 1994: status and conservation recommendations for Vietnamese pheasant Lophura hatinhensis and imperial pheasant L. imperialis*. IUCN Species Survival Commission, Gland, Switzerland and Cambridge, U.K.
- MacKinnon, J. R. (1997). *Protected areas system review of the Indo-Malayan Realm*. The Asian Bureau for Conservation (ABC) and the World Conservation Monitoring Centre (WCMC), Gland.
- MacKinnon, J. R. and Phillips, K. (2000) *A field guide to the birds of China*. Oxford, U.K.: Oxford University Press.
- Rasmussen, P.C. and Anderton, J.C. (2005) *Birds of South Asia: the Ripley Guide*. Barcelona, Spain: Lynx Edicions.
- Robson, C. R., Eames, J. C., Wolstencroft, J. A., Nguyen Cu and Truong Van La (1989) *Recent records of birds from Viet Nam*. *Forktail* 5: 71-97.
- Stattersfield, A. J., Crosby, M. J., Long, A. J. and Wege, D. C. 1998. *Endemic bird areas of the world*. BirdLife International, Cambridge, U.K. (Birdlife Conservation Series 7).

- Timmins, R. J., Do Tuoc, Trinh Viet Cuong and Hendrichsen, D. K. (1999) *A preliminary assessment of the conservation importance and conservation priorities of the Phong Nha-Ke Bang proposed national park, Quang Binh province, Vietnam*. Hanoi, Vietnam: Fauna and Flora International Indochina Programme.
- Tordoff, A. W. ed. (2002) *Directory of important bird areas in Vietnam: key sites for conservation*. Hanoi: BirdLife International in Indochina and the Institute of Ecology and Biological Resources.
- Tordoff, A. W., Tran Quoc Bao, Nguyen Duc Tu and Le Manh Hung eds. (2004) *Sourcebook of existing and proposed protected areas in Vietnam. Second edition*. Hanoi: BirdLife International in Indochina and the Ministry of Agriculture and Rural Development.
- Tordoff, A., Timmins, R., Smith, R., Mai Ky Vinh. (2003) *A biological assessment of the Central Truong Son Landscape*. Central Truong Son Report No. 1. WWF Indochina, Hanoi, Vietnam.
- Wege, D. C., Long, A. J., Mai Ky Vinh, Vu Van Dung and Eames, J. C. (1999) *Expanding the protected areas network in Vietnam for the 21st century: an analysis of the current system with recommendations for equitable expansion*. Hanoi, Vietnam: BirdLife International Vietnam Programme
- Wikramanayake, E., Dinerstein, E., Hedao, P. and Olson, D. 1997. *A conservation assessment of terrestrial ecoregions of the Indo-Pacific Region*. WWF-US Conservation Science Programme, Washington D.C.

Appendix 1: Birds recorded for Phong Nha-Ke Bang National Park and Extension Area in Thuong Hoa and Hoa Son Comunes

No:	Family name	Common name	Scientific name	IUCN 2011	VNRDB 2007	CITES	Decree 32	PNKB before 2011	This survey 2011	Thuong Hoa	Hoa Son
	Galiformes										
1.	Phasianidae	Bar-backed Partridge	<i>Arborophila brunneopectus</i>		LR			X	X		X
2.		Chestnut-necklaced Partridge	<i>Arborophila charltonii</i>	NT	LR	Ap.II I	IIB	X	X	X	X
3.		Red Junglefowl	<i>Gallus gallus</i>		-			X	X	X	X
4.		Silver Pheasant	<i>Lophura nycthemera</i>		LR		IB	X	[X]	[X]	[X]
5.		Siamese Fireback	<i>Lophura diardi</i>	NT	VU		IB	X	[X]	[X]	[X]
6.		Grey Peacock-pheasant	<i>Polyplectron bicalcaratum</i>		VU	Ap.II	IB	X	[X]	[X]	[X]
7.		Crested Argus	<i>Rheinardia ocellata</i>	NT	VU	Ap.I	IB	X	[X]	[X]	[X]
8.		Green Peafowl	<i>Pavo muticus</i>	EN	EN	Ap.II	IB		[X]	[X]	[X]
	Ciconiiformes										
9.	Ardeidae	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>					X			
10.		Striated Heron	<i>Butorides striata</i>					X			
	Falconiformes										
11.	Falconidae	Pied Falconet	<i>Microhierax melanoleucos</i>					X			
12.		Peregrine Falcon	<i>Falco peregrinus</i>					X			
13.	Accipitridae	Black Baza	<i>Aviceda leuphotes</i>					X			
14.		Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>					X	X	X	X
15.		Black-winged Kite	<i>Elanus caeruleus</i>					X			
16.		Crested Serpent-eagle	<i>Spilornis cheela</i>				IIB	X	X	X	X
17.		Crested Goshawk	<i>Accipiter trivirgatus</i>					X			
18.		Shikra	<i>Accipiter badius</i>						X	X	X
19.		Japanese Sparrowhawk	<i>Accipiter gularis</i>					X			
20.		Black Eagle	<i>Ictinaetus malayensis</i>					X	X	X	
21.		Rufous-bellied Eagle	<i>Hieraaetus kienerii</i>					X			
22.		Mountain Hawk-eagle	<i>Spizaetus nipalensis</i>						X	X	
	Gruiformes										
23.	Rallidae	White-breasted Waterhen	<i>Amauornis phoenicurus</i>					X			
24.	Turnicidae	Barred Buttonquail	<i>Turnix suscitator</i>					X			
	Charadriiformes										
25.	Charadriidae	Red-wattled Lapwing	<i>Vanellus indicus</i>						X		X
26.	Scolopacidae	Common Sandpiper	<i>Actitis hypoleucos</i>					X			
	Columbiformes										
27.	Columbidae	Oriental Turtle-dove	<i>Streptopelia orientalis</i>					X			

28.		Red Collared-dove	<i>Streptopelia tranquebarica</i>					X			
29.		Spotted Dove	<i>Stigmatopelia chinensis</i>					X	X	X	X
30.		Barred Cuckoo-dove	<i>Macropygia unchall</i>					X	X	X	X
31.		Emerald Dove	<i>Chalcophaps indica</i>					X	X	X	X
32.		Thick-billed Green-pigeon	<i>Treron curvirostra</i>					X	X	X	X
33.		Pin-tailed Green-pigeon	<i>Treron apicauda</i>					X	X	X	X
34.		Yellow-vented Green-pigeon	<i>Treron seimundi</i>					X			
35.		Wedge-tailed Green-pigeon	<i>Treron sphenurus</i>					X			
36.		Mountain Imperial-pigeon	<i>Ducula badia</i>					X	X	X	X
		Psittaciformes									
37.		Psittacidae	Vernal Hanging-parrot	<i>Loriculus vernalis</i>				X			
38.			Grey-headed Parakeet	<i>Psittacula finschii</i>			IIB		X		X
		Cuculiformes									
39.		Cuculidae	Chestnut-winged Cuckoo	<i>Clamator coromandus</i>				X	X	X	
40.			Indian Cuckoo	<i>Cuculus micropterus</i>					X	X	X
41.			Common Cuckoo	<i>Cuculus canorus</i>				X			
42.			Banded Bay Cuckoo	<i>Cacomantis sonneratii</i>				X	X	X	X
43.			Plaintive Cuckoo	<i>Cacomantis merulinus</i>				X	X	X	X
44.			Drongo Cuckoo	<i>Surniculus lugubris</i>				X	X	X	
45.			Asian Koel	<i>Eudynamys scolopaceus</i>				X	X	X	X
46.			Green-billed Malkoha	<i>Phaenicophaeus tristis</i>				X	X	X	X
47.			Greater Coucal	<i>Centropus sinensis</i>				X	X	X	X
48.			Lesser Coucal	<i>Centropus bengalensis</i>				X	X		X
		Strigiformes									
49.		Tytonidae	Barn Owl	<i>Tyto alba</i>				X	X	X	
50.			Oriental Bay-owl	<i>Phodilus badius</i>				X			
51.		Strigidae	Mountain Scops-owl	<i>Otus spilocephalus</i>			Ap.II	X	X	X	X
52.			Oriental Scops-owl	<i>Otus sunia</i>				X			
53.			Collared Scops-owl	<i>Otus bakkamoena</i>			Ap.II	X	X	X	X
54.			Collared Owlet	<i>Glaucidium brodiei</i>			Ap.II	X	X	X	X
55.			Asian Barred Owlet	<i>Glaucidium cuculoides</i>			Ap.II	X	X	X	X
56.			Brown Hawk-owl	<i>Ninox scutulata</i>				X			
		Caprimulgiformes									
57.		Caprimulgidae	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>				X	X	X	
		Apodiformes									
58.		Apodidae	Himalayan Swiftlet	<i>Collocalia brevirostris</i>				X			
59.			Asian Palm-swift	<i>Cypsiurus balasiensis</i>				X	X	X	X
60.			Fork-tailed Swift	<i>Apus pacificus</i>				X	X	X	X
61.			House Swift	<i>Apus nipalensis</i>				X			
62.		Hemiprocnidae	Crested Treeswift	<i>Hemiproctne coronata</i>				X			
		Trogoniformes									
63.		Trogonidae	Red-headed Trogon	<i>Harpactes erythrocephalus</i>				X	X	X	X
		Coraciiformes									
64.		Coraciidae	Indian Roller	<i>Coracias benghalensis</i>					X	X	X

65.		Asian Dollarbird	<i>Eurystomus orientalis</i>					X	X	X	X
66.	Alcedinidae	Banded Kingfisher	<i>Lacedo pulchella</i>					X			
67.		White-throated Kingfisher	<i>Halcyon smyrnensis</i>					X	X	X	X
68.		Black-backed Kingfisher	<i>Ceyx erithaca</i>					X	X	X	
69.		Blyth's Kingfisher	<i>Alcedo hercules</i>	NT					X	X	
70.		Common Kingfisher	<i>Alcedo atthis</i>					X	X	X	X
71.		Blue-eared Kingfisher	<i>Alcedo meninting</i>					X			
72.		Crested Kingfisher	<i>Megaceryle lugubris</i>					X			
73.	Meropidae	Blue-bearded Bee-eater	<i>Nyctyornis athertoni</i>					X			
74.		Chestnut-headed Bee-Eater	<i>Merops leschenaulti</i>						X		X
75.		Blue-throated Bee-eater	<i>Merops viridis</i>					X			
76.	Bucerotidae	Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	NT	VU	Ap.II	IIB	X	X		X
77.		Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>			Ap.II		X	[X]	[X]	[X]
78.		Great Hornbill	<i>Buceros bicornis</i>	NT		Ap.I	IIB	X	[X]	[X]	[X]
79.		Wreathed Hornbill	<i>Aceros undulatus</i>		VU	Ap.II	IIB	X	[X]	[X]	[X]
	Piciformes										
80.	Ramphastidae	Red-vented Barbet	<i>Megalaima lagrandieri</i>					X	X	X	X
81.		Green-eared Barbet	<i>Megalaima faiostricta</i>					X	X	X	X
82.		Golden-throated Barbet	<i>Megalaima franklinii</i>					X	X		X
83.		Blue-eared Barbet	<i>Megalaima australis</i>					X	X	X	X
84.	Picidae	White-browed Piculet	<i>Sasia ochracea</i>					X	X	X	X
85.		Grey-capped Woodpecker	<i>Dendrocopos canicapillus</i>					X	X	X	
86.		Common Flameback	<i>Dinopium javanense</i>						X	X	X
87.		Greater Flameback	<i>Chrysocolaptes lucidus</i>						X		X
88.		Lesser Yellownape	<i>Picus chlorolophus</i>					X	X	X	X
89.		Greater Yellownape	<i>Picus flavinucha</i>					X	X	X	X
90.		Laced Woodpecker	<i>Picus vittatus</i>					X			
91.		Red-collared Woodpecker	<i>Picus rabieri</i>	NT				X			
92.		Bay Woodpecker	<i>Blythipicus pyrrhotis</i>					X	X	X	X
	Passeriformes										
93.	Eurylaimidae	Long-tailed Broadbill	<i>Psarisomus dalhousiae</i>					X	X	X	X
94.		Silver-breasted Broadbill	<i>Serilophus lunatus</i>					X	X	X	X
95.	Pittidae	Blue-rumped Pitta	<i>Pitta soror</i>					X	X	X	X
96.		Blue Pitta	<i>Pitta cyanea</i>					X	X	X	
97.		Bar-bellied Pitta	<i>Pitta elliotii</i>					X	X	X	X
98.		Blue-winged Pitta	<i>Pitta moluccensis</i>					X			
99.	Artamidae	Ashy Woodswallow	<i>Artamus fuscus</i>					X	X		X
100.	Aegithinidae	Common Iora	<i>Aegithina tiphia</i>					X	X	X	X
101.		Great Iora	<i>Aegithina lafresnayeii</i>					X	X	X	X
102.	Campephagidae	Large Woodshrike	<i>Tephrodornis gularis</i>					X	X	X	X
103.		Large Cuckooshrike	<i>Coracina macei</i>					X	X	X	X
104.		Black-winged Cuckooshrike	<i>Coracina melaschistos</i>					X	X	X	
105.		Grey-chinned Minivet	<i>Pericrocotus solaris</i>					X			
106.		Scarlet Minivet	<i>Pericrocotus flammeus</i>					X	X	X	X

107.		Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>					X	X	X	
108.	Laniidae	Brown Shrike	<i>Lanius cristatus</i>					X			
109.		Long-tailed Shrike	<i>Lanius schach</i>					X	X	X	X
110.		Grey-backed Shrike	<i>Lanius tephronotus</i>					X			
111.	Oriolidae	Black-hooded Oriole	<i>Oriolus xanthornus</i>					X			
112.		Maroon Oriole	<i>Oriolus traillii</i>						X	X	
113.	Dicruridae	Black Drongo	<i>Dicrurus macrocercus</i>					X	X		X
114.		Ashy Drongo	<i>Dicrurus leucophaeus</i>					X	X	X	
115.		Crow-billed Drongo	<i>Dicrurus annectans</i>					X	X	X	
116.		Bronzed Drongo	<i>Dicrurus aeneus</i>					X	X	X	
117.		Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>					X	X		X
118.		Hair-crested Drongo	<i>Dicrurus hottentottus</i>					X	X	X	
119.		Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>					X	X	X	X
120.	Rhipiduridae	White-throated Fantail	<i>Rhipidura albicollis</i>					X	X	X	
121.	Monarchidae	Black-naped Monarch	<i>Hypothymis azurea</i>					X	X	X	X
122.		Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>					X	X	X	
123.		Japanese Paradise-flycatcher	<i>Terpsiphone atrocaudata</i>	NT				X			
124.	Corvidae	Blue Magpie	<i>Urocissa erythrorhyncha</i>					X	X	X	X
125.		White-winged Magpie	<i>Urocissa whiteheadi</i>					X	X	X	X
126.		Green Magpie	<i>Cissa chinensis</i>					X	X	X	X
127.		Yellow-breasted Magpie	<i>Cissa hypoleuca</i>					X	X	X	X
128.		Racket-tailed Treepie	<i>Crypsirina temia</i>					X	X	X	X
129.		Ratchet-tailed Treepie	<i>Temmurus temmurus</i>					X	X	X	X
130.		Large-billed Crow	<i>Corvus macrorhynchos</i>					X	X	X	
131.	Paridae	Great Tit	<i>Parus major</i>					X			
132.		Sultan Tit	<i>Melanochlora sultanea</i>					X	X	X	X
133.	Hirundinidae	Sand Martin	<i>Riparia riparia</i>						X	X	
134.		Barn Swallow	<i>Hirundo rustica</i>					X			
135.	Cisticolidae	Hill Prinia	<i>Prinia atrogularis</i>					X			
136.		Grey-breasted Prinia	<i>Prinia hodgsonii</i>					X	X	X	
137.		Yellow-bellied Prinia	<i>Prinia flaviventris</i>					X	X	X	
138.		Plain Prinia	<i>Prinia inornata</i>					X			
139.	Pycnonotidae	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>					X			
140.		Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>					X	X	X	X
141.		Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>					X	X	X	X
142.		Stripe-throated Bulbul	<i>Pycnonotus finlaysoni</i>					X	X	X	X
143.		Bare-faced Bulbul	<i>Pycnonotus hualon</i>					X			
144.		Grey-eyed Bulbul	<i>Iole propinqua</i>					X			
145.		Puff-throated Bulbul	<i>Alophoixus pallidus</i>					X	X	X	X
146.		Asian Black Bulbul	<i>Hypsipetes leucocephalus</i>					X	X	X	
147.	Sylviidae	Common Tailorbird	<i>Orthotomus sutorius</i>					X	X	X	X
148.		Dark-necked Tailorbird	<i>Orthotomus atrogularis</i>					X	X	X	X
149.		Striated Grassbird	<i>Megalurus palustris</i>					X			
150.		Grey-bellied Tesia	<i>Tesia cyaniventer</i>					X			

151.		Asian Stubtail	<i>Urosphena squameiceps</i>					X			
152.		Lanceolated Warbler	<i>Locustella lanceolata</i>					X			
153.		Radde's Warbler	<i>Phylloscopus schwarzi</i>					X			
154.		Inornate Warbler	<i>Phylloscopus inornatus</i>					X			
155.		Greenish Warbler	<i>Phylloscopus trochiloides</i>					X			
156.		Davison's Leaf-warbler	<i>Phylloscopus davisoni</i>					X			
157.		Southern Blyth's Leaf-warbler	<i>Phylloscopus reguloides</i>					X			
158.		Sulphur-breasted Warbler	<i>Phylloscopus ricketti</i>					X			
159.		Limestone Leaf-warbler	<i>Phylloscopus calciatilis</i>						X	X	
160.		Green-crowned Warbler	<i>Seicercus burkii</i>					X			
161.		Grey-cheeked Warbler	<i>Seicercus poliogenys</i>					X			
162.	Timaliidae	Spot-throated Babbler	<i>Pellorneum albiventre</i>					X	X	X	
163.		Puff-throated Babbler	<i>Pellorneum ruficeps</i>					X	X	X	X
164.		Buff-breasted babbler	<i>Trichastoma tickelli</i>					X	X	X	X
165.		Abbott's Babbler	<i>Malacocincla abbotti</i>					X			
166.		Scaly-crowned Babbler	<i>Malacopteron cinereum</i>					X	X	X	X
167.		Large Scimitar-babbler	<i>Pomatorhinus hypoleucos</i>					X	X	X	X
168.		Streak-breasted Scimitar-babbler	<i>Pomatorhinus ruficollis</i>					X	X	X	X
169.		Short-tailed Scimitar-babbler	<i>Jabouilleia danjoui</i>	NT	LR			X	X	X	X
170.		Streaked Wren-babbler	<i>Napothera brevicaudata</i>					X	X	X	X
171.		Eyebrowed Wren-babbler	<i>Napothera epilepidota</i>					X	X	X	X
172.		Sooty Babbler	<i>Stachyris herberti</i>	NT	VU			X	X	X	X
173.		Grey-throated Babbler	<i>Stachyris nigriceps</i>					X	X	X	X
174.		Spot-necked Babbler	<i>Stachyris striolata</i>					X	X	X	X
175.		Grey-faced Tit-babbler	<i>Macronous kelleyi</i>						X	X	
176.		Pin-striped Tit-babbler	<i>Macronous gularis</i>					X	X	X	X
177.		Masked Laughingthrush	<i>Garrulax perspicillatus</i>						X		X
178.		White-throated Laughingthrush	<i>Garrulax albogularis</i>					X			
179.		White-crested Laughingthrush	<i>Garrulax leucolophus</i>					X	X	X	X
180.		Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>					X	X	X	X
181.		Rufous-cheeked Laughingthrush	<i>Garrulax castanotis</i>					X	X	X	
182.		Chinese Hwamei	<i>Garrulax canorus</i>					X			
183.		Rufous-throated Fulvetta	<i>Alcippe rufogularis</i>					X	X	X	X
184.		Brown-cheeked Fulvetta	<i>Alcippe poioicephala</i>					X			
185.		Mountain Fulvetta	<i>Alcippe peracensis</i>					X	X	X	X
186.		Grey-cheeked Fulvetta	<i>Alcippe morrisonia</i>					X			
187.		Indochinese Yuhina	<i>Staphida torqueola</i>					X	X	X	X
188.		White-bellied Yuhina	<i>Erpornis zantholeuca</i>					X	X	X	X
189.	Zosteropidae	Oriental White-eye	<i>Zosterops palpebrosus</i>					X			
190.	Irenidae	Asian Fairy-bluebird	<i>Irena puella</i>					X	X	X	
191.	Sturnidae	Hill Myna	<i>Gracula religiosa</i>			Ap.II	IIB	X	X	X	
192.		Common Myna	<i>Acridotheres tristis</i>					X	X	X	
193.		Crested Myna	<i>Acridotheres cristatellus</i>					X	X	X	
194.		Chestnut-tailed Starling	<i>Sturnus malabaricus</i>					X	X	X	

195.		White-shouldered Starling	<i>Sturnus sinensis</i>					X	X		X
196.		Black-collared Starling	<i>Sturnus nigricollis</i>					X	X	X	X
197.	Turdidae	Blue Whistling-thrush	<i>Myophonus caeruleus</i>					X	X	X	X
198.		Orange-headed Thrush	<i>Zoothera citrina</i>					X			
199.		Siberian Thrush	<i>Zoothera sibirica</i>					X			
200.		Eurasian Scaly Thrush	<i>Zoothera dauma</i>					X			
201.		Grey-winged Blackbird	<i>Turdus bouboul</i>					X			
202.	Muscicapidae	Rufous-tailed Robin	<i>Luscinia sibilans</i>					X			
203.		Siberian Blue Robin	<i>Luscinia cyane</i>					X			
204.		Oriental Magpie-robin	<i>Copsychus saularis</i>					X	X	X	X
205.		White-rumped Shama	<i>Copsychus malabaricus</i>				IIB	X	X	X	
206.		Slaty-backed Forktail	<i>Enicurus schistaceus</i>					X	X	X	X
207.		White-crowned Forktail	<i>Enicurus leschenaulti</i>					X	X	X	X
208.		Blue Rock-thrush	<i>Monticola solitarius</i>					X			
209.		Asian Brown Flycatcher	<i>Muscicapa dauurica</i>					X	X	X	X
210.		Red-breasted Flycatcher	<i>Ficedula parva</i>					X	X	X	
211.		White-tailed Flycatcher	<i>Cyornis concretus</i>					X	X	X	X
212.		Hainan Blue-flycatcher	<i>Cyornis hainanus</i>					X	X	X	X
213.		Pale Blue-flycatcher	<i>Cyornis unicolor</i>					X	X		X
214.		Fujian Niltava	<i>Niltava davidi</i>					X			
215.		Grey-headed Canary-flycatcher	<i>Culicicapa ceylonensis</i>					X	X	X	
216.	Chloropseidae	Blue-winged Leafbird	<i>Chloropsis cochinchinensis</i>					X	X	X	
217.		Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>					X	X	X	X
218.		Orange-bellied Leafbird	<i>Chloropsis hardwickii</i>					X	X	X	X
219.	Dicaeidae	Thick-billed Flowerpecker	<i>Dicaeum agile</i>					X			
220.		Yellow-vented Flowerpecker	<i>Dicaeum chrysorrheum</i>					X	X		X
221.		Plain Flowerpecker	<i>Dicaeum concolor</i>					X	X	X	X
222.		Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>					X	X	X	X
223.	Nectariniidae	Purple-naped Sunbird	<i>Hypogramma hypogrammicum</i>					X	X		X
224.		Fork-tailed Sunbird	<i>Aethopyga christinae</i>					X	X	X	X
225.		Crimson Sunbird	<i>Aethopyga siparaja</i>					X	X	X	X
226.		Little Spiderhunter	<i>Arachnothera longirostra</i>						X	X	
227.		Streaked Spiderhunter	<i>Arachnothera magna</i>					X	X	X	X
228.	Passeridae	Eurasian Tree Sparrow	<i>Passer montanus</i>					X	X	X	X
229.	Estrildidae	White-rumped Munia	<i>Lonchura striata</i>					X	X	X	X
230.		Scaly-breasted Munia	<i>Lonchura punctulata</i>					X	X	X	X
231.	Motacillidae	White Wagtail	<i>Motacilla alba</i>					X			
232.		Grey Wagtail	<i>Motacilla cinerea</i>					X			
233.		Olive-backed Pipit	<i>Anthus hodgsoni</i>					X			

Notes: Species taxonomy and sequence follows BirdLife International Checklist version 4 (2011).

Conservation status: EN=Endangered; VU= Vulnerable; NT = Near-threatened as per BirdLife International 2011 or The IUCN Red List of Threatened Species 2011.

LR: Lower risk as per Vietnam Red Data Book (2007)

X = confirmed records, [X] = Unconfirmed records. Ap I, II, III: CITES Appendices. IB, IIB: as per Decision 32/2006/ND-CP

Total 216 species confirmed before 2011

This survey: 159 species (143 and 121)

Confirmed records this time: 151

Thuong Hoa: 135 and 113 confirmed records for Thuong Hoa and Hoa Son

Appendix 2: Bird Species caught by mist net during the survey in Thuong Hoa and Hoa Son

English name	Vietnamese name	Scientific name	No. of specimens
Red-headed Trogon	Nước bưng đỏ	<i>Harpactes erythrocephalus</i>	1
Black-backed Kingfisher	Bồng chanh đỏ	<i>Ceyx erithaca</i>	5
Common Kingfisher	Bồng chanh	<i>Alcedo atthis</i>	2
Blyth's Kingfisher	Bồng chanh rừng	<i>Alcedo hercules</i>	1
Puff-throated Bulbul	Cành cạch lớn	<i>Alophoixus pallidus</i>	2
Sooty-headed Bulbul	Bông lau tai trắng	<i>Pycnonotus aurigaster</i>	2
Stripe-throated Bulbul	Bông lau họng vạch	<i>Pycnonotus finlaysoni</i>	11
Red-whiskered Bulbul	Chào mào	<i>Pycnonotus jocosus</i>	1
Mountain Fulvetta	Lách tách vành mắt	<i>Alcippe parencensis</i>	13
Pin-striped Tit-babbler	Chích chạch má vàng	<i>Macronous gularis</i>	14
Grey-throated Babbler	Khướu bụi đầu đen	<i>Stachyris nigriceps</i>	14
White-bellied Yuhina	Khướu mào bụng trắng	<i>Erpornis zantholeuca</i>	3
Lesser Necklaced Laughingthrush	Khướu khoang cổ	<i>Garrulax monileger</i>	4
Streaked Wren-babbler	Khướu đá đuôi ngắn	<i>Napothera brevicaudata</i>	1
Striated Yuhina	Khướu mào khoang cổ	<i>Yuhina castaniceps</i>	1
Buff-breasted Babbler	Chuối tiêu đất	<i>Trichastoma tickelli</i>	4
Puff-throated Babbler	Chuối tiêu ngực đỏm	<i>Pellorneum ruficeps</i>	5
Limestone Leaf-Warbler	Chích đá vôi	<i>Phylloscopus calciatilis</i>	1
Common Tailorbird	Chích bông đuôi dài	<i>Orthotomus sutorius</i>	3
Yellow-bellied Prinia	Chiền chiện bụng vàng	<i>Prinia flaviventris</i>	1
Black-naped Monarch	Đớp ruồi xanh gáy đen	<i>Hypothymis azurea</i>	2
Hainan Blue-Flycatcher	Đớp ruồi hải nam	<i>Cyornis hainanus</i>	5
Crimson Sunbird	Hút mật đỏ	<i>Aethopyga siparaja</i>	6
Crow-billed Drongo	Chèo bẻo mỏ quạ	<i>Dicrurus annectans</i>	2
Racket-tailed Treepie	Chim khách	<i>Crypsirina temia</i>	4
			108

Appendix 3: GPS readings for key sightings and camp sites during the survey

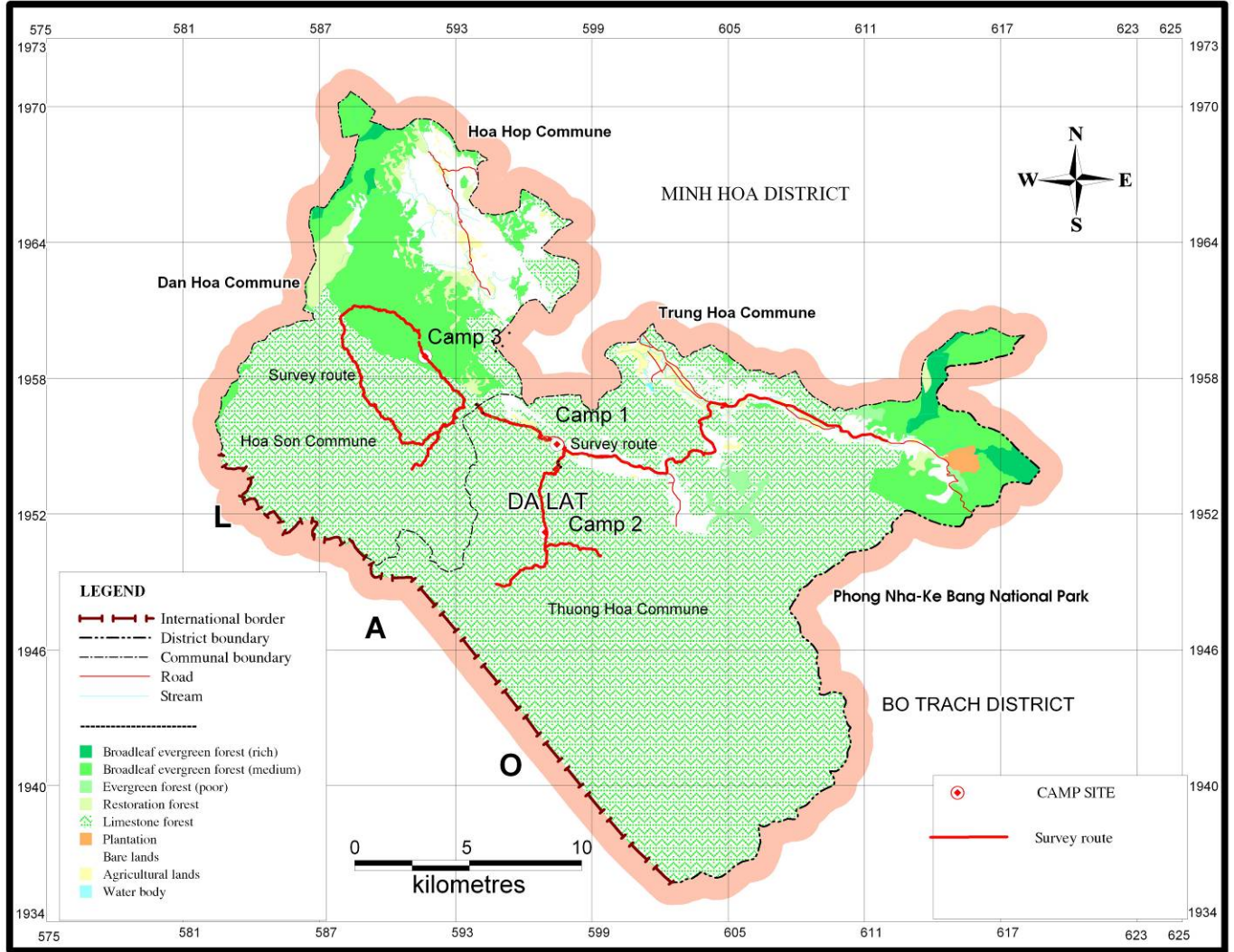
Item	Date	Lat & Long	Elevation
Sooty Babbler	09-JUL-11 10:06:55AM	17°41.349'N 105°53.563'E	546 m
Sooty Babbler (11 birds)	11-JUL-11 3:35:50PM	17°40.368'N 105°55.284'E	431 m
Sooty Babbler	09-JUL-11 11:19:17AM	17°41.239'N 105°53.502'E	611 m
Sooty Babbler (4 birds)	10-JUL-11	17°41.483'N 105°53.528'E	>400 m
Sooty Babbler/Thung voi	20-JUL-11 1:00:21PM	17°43.008'N 105°53.739'E	510 m
Sooty Babbler (Dalat 2)	12-JUL-11 1:00:21PM	17°39.661'N 105°54.803'E	397 m
Boundary	22-JUL-11 1:35:14PM	17°43.791'N 105°52.337'E	519 m
Brown Hornbill	20-JUL-11 1:00:21PM	17°43.008'N 105°53.739'E	510 m
Limestone Leaf Warbler	10-JUL-11 12:26:00PM	17°41.533'N 105°53.419'E	435 m
Camp site 1 (Mo O)	09-JUL-11 6:50:01AM	17°40.866'N 105°54.973'E	284 m
Camp site 3 (Tang Hoa)	17-JUL-11 4:30:42PM	17°44.513'N 105°53.326'E	248 m
Camp site 2 (Da Lat 2)		17°38.211'N 105°54.972'E	469 m
Dalat1	11-JUL-11 2:48:56PM	17°40.280'N 105°55.283'E	473 m
Daliep stream	22-JUL-11 11:45:57AM	17°43.366'N 105°52.570'E	512 m
Mo Ro	22-JUL-11 10:28:13AM	17°42.696'N 105°53.129'E	490 m
Short-tailed Scimitar BB	11-JUL-11 8:56:39AM	17°40.231'N 105°55.344'E	400 m
Short-tailed Scimitar BB	20-JUL-11 11:29:56AM	N17°43.133'N 105°53.909'E	462 m
Stream	10-JUL-11 10:00:34AM	17°41.735'N 105°53.249'E	416 m
Forest station Hoa Son	16-JUL-11 10:37:18AM	17°46.984'N 105°52.558'E	301 m
Ca Boi	20-JUL-11 3:17:06PM	17°43.444'N 105°54.081'E	349 m
Ha Tinh Langur (less than 10 animals)		17°41.035'N 105°54.960'E	380 m
Rhesus Macaque (12 animals)		17°41.035'N 105°54.960'E	380 m
Ha Tinh Langur (calls heard at Thung Bim Bim)		17°40.147'N 105°55.272'E	325 m

**Appendix 4: GPS readings for key sightings and camp sites
during the survey (UTM VN2000-METER)**

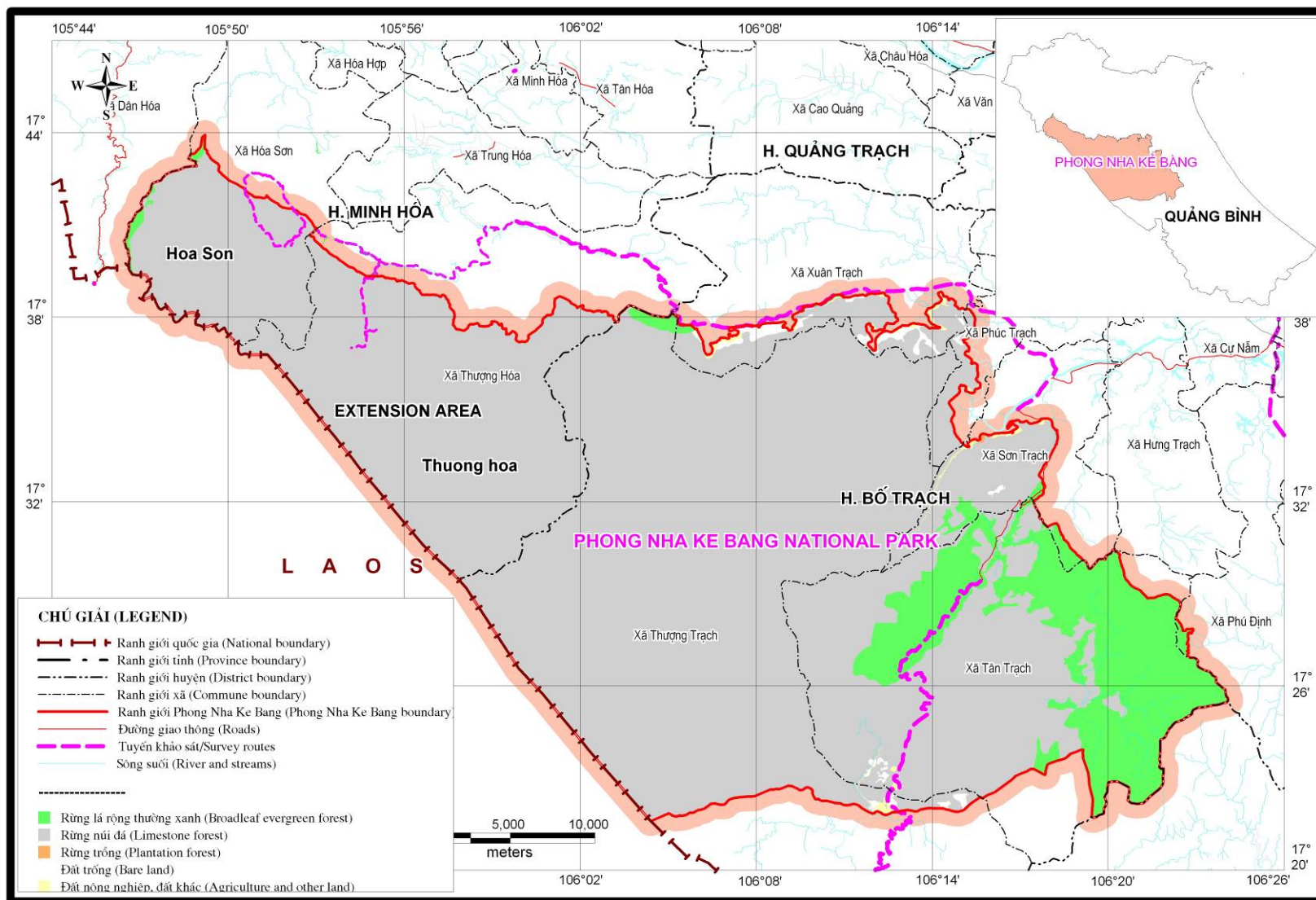
NAME	POSITION	ALTITUDE
Sooty Babbler	594476N 1956129E	546 m
Sooty Babbler&Limestone Leaf Warbler	594369N 1955925E	611 m
Sooty Babbler (11)	597527N 1954334E	431 m
Sooty Babbler (12)	595072N 1959421E	462 m
Sooty Babbler	594220N 1956467E	435 m
Sooty Babbler/Dalat 2	596683N 1953026E	397 m
Bounday (PNKB&Minh Hoa State Forest Enterprise	592287N 1960622E	519 m
Brown Hornbill & Sooty Babbler	594772N 1959189E	508 m
Camp 1 (Mo O)	596972N 1955250E	284 m
Camp 3 (Tang Hoa)	594029N 1961961E	248 m
Camp 2 (DaLat 2)	596994N 1950354E	469 m
Dalat1	597526N 1954172E	473 m
Daliep stream	592703N 1959840E	512 m
Hatinh langur (less than 10)	596948N 1955561E	380 m
Hatinh langur 2 (heard of calls)	597508N 1953927E	325 m
Forest station Hoa Son	592651N 1966511E	301 m
Moro stream	593697N 1958609E	490 m
Rhesus Macaque (12 animals)	596948N 1955561E	
Shortail S.babbler	597634N 1954082E	400 m

Appendix 5: Maps

Map 1: Survey locations and routes in the extension area within Thuong Hoa and Hoa Son Communes



Map 2: Survey locations and routes in Phong Nha-Ke Bang National Park and Extension Area



Appendix 6: Selected photographs taken in Thuong Hoa and Hoa Son Areas



Sooty Babbler *Stachyris herberti* taken in Thuong Hoa limestone forest (Photo: Ngo Xuan Tuong)



Limestone Leaf Warbler *Phylloscopus calciatilis*, a specialist to limestone forest habitat, captured by mist netting (Photo: Ngo Xuan Tuong).



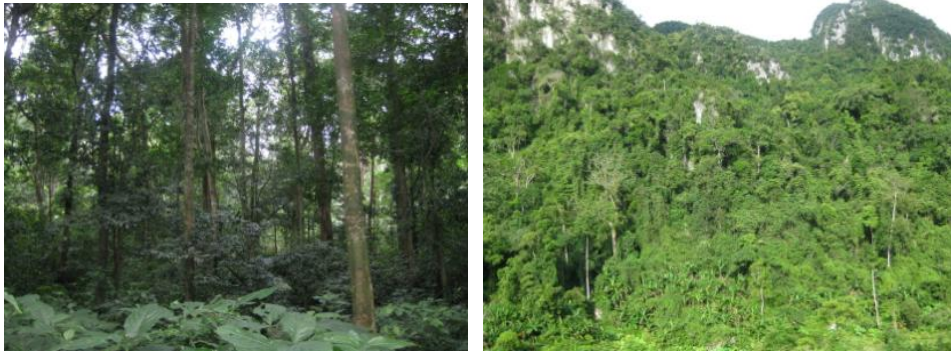
Blyth's Kingfisher *Alcedo hercules*, the first confirmed record for Phong Nha-Ke Bang. Its habitat is streams associated with broadleaved evergreen forest and secondary growth (Photo: Ngo Xuan Tuong).

Threats to forest in the extension area (logging activity, *Cinnamomum* oil extraction)



An old place for *Cinnamomum* oil extraction found in the border between PNKB extension area and Minh Hoa State Forest Enterprise

Main habitat in the extension area



Limestone forest and forest on valley bottoms



Limestone forests



Da Liep stream (Hoa Son) and the valley bottom of Thung Bim Bim (Thuong Hoa)



Limestone forest associated with limestone outcrops, a typical habitat for Sooty Babbler

Trainees from the Park and BirdLife saff in the field work



Appendix 7: Report on the training on birds survey techniques for Phong Nha – Ke Bang National Park.

Trainees:

1. Pham Kim Vuong, technical staff, Phong Nha- Ke Bang National Park Center for Wildlife Research and Rescues, Quang Binh Province.
2. Nguyen Chi Phuong, technical staff, Phong Nha- Ke Bang National Park Center for Wildlife Research and Rescues, Quang Binh Province.

Training topics: birds survey techniques and bird-focused site assessment.

Training materials: already sent to the Phong Nha – Ke Bang Provincial Project Management Unit.

Training programme:

Date	Activities
5/7/2011	<p>Morning: Meeting with the two trainees from Phong Nha Ke Bang National Park to agree on the training and survey plan in Thuong Hoa and Hoa Son communes.</p> <p>Afternoon: logistic preparation and permit arrangement for the work in Thuong Hoa and Hoa Son communes (in collaboration with Border Guard Station 585 (Ca Xeng))</p>
6/7/2011	<p>Bird survey in Thuong Hoa area:</p> <ul style="list-style-type: none"> • Agreed on survey plan and provided training materials to the two trainees; • Explained survey methodology, data collection techniques and field survey protocols; • Conducted on the job-training for the trainees. <p>The survey team was divided into two groups, each accompanied by one trainee. One group mainly focused on birds data collection in the field, following the planned survey routes. The other focused on mist-netting method and technique, placing the mist nets not very far from the camp sites.</p>
7-16/7/2011	<p>Continued on-the-job training on bird data collection in the field for the two trainees;</p> <p>Collected data on threats to forests and biodiversity (for example, signs of hunting and trapping, timber extraction and transportation, number local people or encroachers encountered in the forests, etc.);</p> <p>Conducted interviews with people living in the Park's buffer zone villages on the hunting/trapping and logging issues, as well as their knowledge about key species in the region.</p>
17-24/7/2011	<p>Conducted survey in Hoa Son Commune (Tang Hoa village):</p> <ul style="list-style-type: none"> • Continued on-the-job training on bird data collection in the field for the two trainees; • Collected data on threats to forests and biodiversity (for example, signs of hunting and trapping, timber extraction and transportation, number local people or encroachers encountered in the forests, etc.);

	<ul style="list-style-type: none"> Conducted interviews with people living in the Park’s buffer zone villages on the hunting/trapping and logging issues, as well as their knowledge about key species in the region.
25/7/2011	<p>Meeting of the survey team (including the two trainees):</p> <ul style="list-style-type: none"> Summarizing preliminary results of the survey, including initial findings and assessment on bird richness and diversity of the surveyed areas (Thuong Hoa and Hoa Son Communes) as well as threats to biodiversity and conservation. Providing guidance to the trainees on survey technical reporting writing (in case the Park/project requested such a report from them).

Training method

The two technical staff of the Park were provided with on-the-job training on the following field survey techniques:

1. Birds data collection through transect and point observations using binoculars; using bamboo whistles to agitate and attract mixed species flocks of birds to the source of the noise so that they could be observed and identified more easily; taking notes on the findings each day in surveyor’s field diary.
2. Using mist nets for birds data collection: selection of mist netting locations, how to deploy the mist nets, protocols and required frequency for net checking, and how to take captured birds from the nets to avoid any casualties to them.
3. Practicing identification of the captured birds with the help of the trainers and a local language field guide to the birds of Vietnam; marking and releasing the captured birds after their identification.

Besides, the trainees were also taught on how to use a hand-held GPS.

Conclusion and recommendations:

Conclusions:

In the team meeting at the end of the survey period, the following conclusion were reached:

- This was the first time the two technical staff members of Phong Nha – Ke Bang National Park got trained on practical forest birds survey skills and techniques provided by professional ornithologists from BirdLife.
- At the end of the training period, the two trainees were able to identify about 50 species of birds in the surveyed area using binoculars and through the specimen collected with mist nets.
- At the end of the training period, the two trainees were able to identify about 10 birds species through their calls (for example: the species of Barbet *Megalaima* spp., White-crested Laughingthrush *Garrulax leucolophus*, Lesser Necklaced Laughingthrush *Garrulax monileger*, Thick-billed Green-pegeion *Treron curvirostra*, Emerald Dove *Chalcophaps indica*, Bay Woodpecker *Blythipicus pyrrhotis* etc.).
- At the end of the training period, the two trainees were able to make and use “bamboo whistles” to attract flocks of (smaller) birds to come nearer for easier identification.
- At the end of the training period, the two trainees were able to use mist nets to capture birds for research purposes.

- Last but not least, the two trainees also gained experience on logistics arrangements for field surveys and indeed they actively assisted the survey team this matter throughout the survey.

Recommendations on biodiversity research and studies and technical capacity building for PNKBNP staff:

- More on the job training should be provided to technical staff of the Park;
- For Park technical staff, birds data collection along patrol routes in combination with regular forest patrolling could be the most suitable and effective way, therefore they should be trained and requested to do so in the future;
- Phong Nha – Ke Bang National Park should select suitable technical staff and have them provided with in-depth/specialized training in specific taxon groups, so that in the long run, they can take care of biodiversity monitoring and research work in the Park. For example, three park staff members can be selected to “specialize” in primate work, two on birds, etc.
- Essential field survey equipment, such as binoculars, hand-held GPS, compass, etc. should be provided to the Park’s field survey staff.
- Local language (Vietnamese) field guides on birds, mammals, which are readily available in Vietnam, should be provided to the Park’s technical staff.
- Newest versions of topographical maps of Phong Nha–Ke Bang region in UTM VN2000 should be provided to the Park and, in particular, the Park’s guard stations;
- All the GIS layers of the Park and its buffer zone must be adjusted to the same projection which is the currently applicable projection in Vietnam – the UTM VN2000.

INDEX

ACKNOWLEDGEMENTS	3
1. Introduction	4
1.1. Overview report.....	4
1.2. National Park, Phong Nha Ke Bang National and Regional Project Phong Nha Ke Bang.....	4
1.3. Personal history research at the National Park Phong Nha - Ke Bang	5
1.4. Natural conditions and climate in Phong Nha Ke Bang area.....	5
1.4.1. The natural conditions	5
1.4.2. Regional climate Phong Nha - Ke Bang	6
1.4.3. Hydrological regime of Phong Nha - Ke Bang	6
1.5. The survey of fish biodiversity in the region before Phong Nha Ke Bang	7
2. The objective of the survey	9
2.1. The purpose and objectives of the survey fish biodiversity	9
2.2. Scope of survey fish biodiversity	9
3. The survey has fish biodiversity.....	10
3.1. General Information	10
3.2. Methodology, sampling plans and survey locations	10
3.2.1. Research Methods	10
3.2.1.1. Collection methods and sample handling.....	10
3.2.1.2. Research Methodology morphological classification	10
3.2.1.3. Classification method	10
3.2.1.4. Data processing method	11
3.2.2. Sampling plan and survey sites	11
3.3. Research results	12
3.3.1. Fish species composition National Park Phong Nha - Ke Bang	12
3.3.1.1. Fish species composition in the basin system	26
3.3.1.2. Fish species composition in the Cave.....	26
3.3.1.3. Fish species composition according to administrative units	26
3.3.1.4. Fish species composition of economic value	26
3.3.1.5. Fish species composition of conservation value	26
3.3.1.6. Endemic fish species composition.....	27

3.3.2. The distribution maps of fish.....	27
3.3.2.1. Distribution in the caves.....	27
3.3.2.2. The species of conservation value.....	28
3.3.2.3. The economic value species	28
3.3.3. The threat to fish biodiversity in the study area.	29
3.3.4. The proposals on the protection and conservation of fish biodiversity in the study area.....	29
4. Conclusions and recommendations	30
4.1. Status of fish biodiversity in the national park Phong Nha-Ke Bang	30
4.2. Threat Assessment.....	30
4.3. The recommended action	30
4.4. Recommendations for Park Management Plan	31
5. References	31
The photo habitat survey	34
Pictures of fish species in addition to the National park Phong Nha Ke Bang	36

ACKNOWLEDGEMENTS

During project implementation, Fish Research Group survey of the Biodiversity Centre North Truong Son has received support from organizations and individuals:

- Project Conservation and Sustainable Management of Natural Resources National Park Regional Phong Nha-Ke Bang funding for implementation.
- Personnel management and conservation project on Sustainable Management of Natural Resources National Park Regional Phong Nha - Ke Bang has helped in the process to implement the project.
- Mr. Le Dinh Thuc - Vice President for Scientific Research Center, Park National officials Phong Nha - Ke Bang has created conditions for delegation during fieldwork.
- The local fishermen helped in the process of collecting samples and directions.
- Board of Vinh University, Committee Chairman Department of Biology has created conditions of time and equipment support for research. Student course 49 B of Biology, Faculty of Biology have participated in the process of analyzing the samples.

Individual research group we would like to thank the precious help that!

1. Introduction

1.1. Overview report

National Park, Phong Nha - Ke Bang National Park has a total area of 85,754 ha including strict protection subdivision 64 894 ha, area 17,449 ha ecological restoration and zoning administration services 3411 ha. In the area of the park buffer zone of Phong Nha - Ke Bang has a population of 12 villages with a total area of 1479.45 km² buffer zone as Minh Hoa district (the Dan Hoa, Hoa Son, China, Shanghai Chemical) ; Bo Trach (the Tan Trach and Thuong Trach Trach Xuan Phuc Trach and Son Trach, Phu Dinh, Hung Trach) and Quang Ninh (Truong Son). The area is primarily residential living along the rivers are Chay, Son river and stream valleys have east and northeast of the national park. Residents mainly live on agriculture and exploitation of forest products. In recent years, Nguyen Thai Tu had work conserve the unique fish fauna of mountain Phong Nha Ke Bang area thoroughly. There are many precious materials in terms of species and conservation measures intact ecosystems, the conservation and rational use of fish resources in the Phong Nha Ke Bang. However, lack of work on the material composition of fish land mountains, deep caves and the National Park. The topic is to address the shortcomings above.

1.2. National Park, Phong Nha Ke Bang National and Regional Project Phong Nha Ke Bang

In 2005, the German government supports more than 12.6 million euros for the protection of biological diversity of Phong Nha - Ke Bang.

In 2007, the German government support for Vietnam 1.8 million euros to help protect biodiversity, improve income for residents in the buffer zone.

National Park, Phong Nha-Ke Bang also received \$ 132,000 funding for the conservation of primates in the national park and buffer zone from Conservation of wild fauna International (FFI)

1998, The Protection of Fauna International (FFI) conducted training for project managers this national park. Department for International Development of Britain also supports the Fund World Wildlife (WWF) to carry out conservation projects parallel this national park and protected areas Namno Hin. FFI also has received funding from the environmental fund and fund of species typical department Environment, Food and

Rural England project to raise conservation awareness for local students as well as visitors.

1.3. Personal history research at the National Park Phong Nha - Ke Bang

Until now only the team's Fish Nguyen Thai Tu and colleagues at the National Park, Phong Nha Ke Bang. (1999 - 2003)

1.4. Natural conditions and climate in Phong Nha Ke Bang area

1.4.1. The natural conditions

National Park Phong Nha - Ke Bang is located northwest of Quang Binh province, Vietnam Laos border. with coordinates 17 ° 21 'to 17 ° 39' north latitude and 105 ° 57 'to 106 ° 24' east longitude. Where the longest vertical is 70 km from Mu Gia Pass to Mount U Beef Northwest - Southeast. Horizontally where the widest is 31km from Tây Gát, Xuan Trach (Bo Trach district) to the Vietnamese border in Laos northeast - southwest.

Phong Nha - Ke Bang is located on the territory of the nine communes in two districts of Minh Hoa, Bo Trach (Dan Hoa, Son Hoa, Trung Hoa Thuong Hoa Xuan Trach and Thuong Trach, Tan Trach and Son Trach, Phuc Trach) and the social boundaries are adjacent Hung Trach, negative (Bo Trach district), Truong Son (Quang Ninh district).

Area Phong Nha - Ke Bang terrain is mainly limestone, the average height of about 600 - 700m form a long strip about 150 km along the Vietnam - Laos. Topography strongly divided, with steep cliffs, placement, jagged peaks. The typical peaks above 800 m form a nearly continuous band along the Vietnam - Laos. Cat ears and rocky caves known as a result of Karst topography is here. Besides, there are many narrow valleys run streams as long as the slot Am, Cha Lo Khe, Khe Chua untouched and extreme Southwest Commercial Fencing along the valley. The rivers in limestone areas have become fragmented by the underground river.

Phong Nha - Ke Bang domain of the limestone terrain IV. This area is quite unique limestone and scattered lasted from Thanh Hoa, Nghe An, Quang Binh through the West. The limestone is formed on the Devonian limestone structure to carbon soon.

Ke Bang area terrain - Horizontal Slot Cambrian geological age, Devon, carbon, but carbon - Permian is the most popular. In areas Trooc River Fault and other faults with the process of chemical eats, dissolves, driftwood washed limestone millions of years to form diverse cave system of Phong Nha - Ke Bang

1.4.2. Regional climate Phong Nha - Ke Bang

Phong Nha - Ke Bang is one of abundant solar radiation. The total amount of solar radiation between 110 Kcal/cm², the largest amount of radiation in May and least in December.

The average temperature in the Phong Nha - Ke Bang lower khoang 10C (oscillations in the delta 24 - 250C, the Phong Nha mountain 240C). Cold season runs from late November last year until early March next year (average temperature below 200C). In high mountain winter temperatures can drop below 100C. Hot season starts from mid April to early October, long time about 170 days (average temperature over 250C), at up to 400C. In addition there are two seasons heater temperature stable period of about 20 - 250C. It is the transition season climate.

Average rainfall is quite large, from 2000 - 2500mm/nam. The total rainfall during the rainy season, accounting for 88% of total annual rainfall. The rainy season starts in August at the upper end of the week in December. Wettest period from mid September to mid October 65 - 80%.

Wet period extending from September to April next year. During these months the relative humidity, the average monthly reach 80-90%. Maximum humidity occurred in 2, 3 is the period covered area clouds, rain, rain. Humidity lowest monthly average in June, 7. The time of the hot dry southwest wind power can only humidity 30-35%, the lowest absolute humidity of 27%.

1.4.3. Hydrological regime of Phong Nha - Ke Bang

With the special nature of the block Karst Phong Nha - Ke Bang, the phenomenon is common ground water. In some areas small streams flowing down the stream Showers Trade opencast each interrupted by the flow into the caves to form the underground river to river and then converge on the Chay River confluence Trooc and Son River to create a tributary of the river on the upstream Gianh. The flood season starts in September and ends in November. There are five flood occurs earlier: the end

of August and reappeared in late December. In addition to the main flood season, Son Basin is influenced by chronic primary rain in 5.6 months.

Drought index for the Phong Nha - Ke Bang usually occurs in June, 7. These days the water can evaporate greater than 1.5 to 2 times the amount of rain.

Due to topography and climate that National Park, Phong Nha - Ke Bang is the interference of multiple threads of plants and animals, forming biota diversity has a unique medium with lots of rare and precious species .

1.5. The survey of fish biodiversity in the region before Phong Nha Ke Bang

1. Nguyen Thai Tu (Member), 1996. Biodiversity Survey Phong Nha Ke Bang RAS/93/102 by WWF and sponsored VNDP
2. Nguyen Thai Tu, Le Thang, Le Thi Binh, 1997. Phong Nha - Ke Bang paradise of ichthyologists. Journal of Science, Technology and Environment of Quang Binh. Number 7: 27-29.
3. Nguyen Thai Tu, Le Thang, 1998. A new species of the genus Chela (Hamilton, 1822). Workshop on Biodiversity in the North Truong Son (2nd). Summary Report: 30.
4. Nguyen Thai Tu, Le Thang, Le Thi Binh, Nguyen Xuan Khoa, 1999. Just Cyprinus Linnaeus, 1758 and a new species Cyprinus quidatensis path formed by geographical isolation. Proceedings of Workshop on Biodiversity North Truong Son (2nd). Publishing House of Hanoi National University: 7-8.
5. Nguyen Thai Tu, Le Thang, Nguyen Xuan Khoa, 1999. A new species of the genus Chela (Hamilton, 1822). Proceedings of Workshop on Biodiversity North Truong Son (2nd). Publishing House of Hanoi National University: 16-21.
6. Nguyen Thai Tu, Vietnamese Le Thang, Nguyen Xuan Khoa, 1999. Fish fauna of Phong Nha - Ke Bang. Proceedings of Workshop on Biodiversity North Truong Son (2nd). Publishing House of Hanoi National University: 22-23
7. Nguyen Thai Tu (Chairman), 2000 - 2003. Conservation of unique and Valuable fish diversity in Phong Nha-Ke Bang Limestone Mountains Asean Regional Centre for Biodiversity Conservation and the European Commission funding. Code: RE - VNM - 008.

8. Nguyen Thai Tu, Le Thang. Nguyen Xuan Khoa, 2000. Just Lissocheilus, Weber et de Beaufort, 1916 and two new species discovered in Quang Binh Vietnam. The basic research problem in biology. Science and Technology Publishing House Hanoi: 475-476.
9. Nguyen Thai Tu, 2003. New species of Acrossoscheilus, Oshima, in Phong Nha Ke Bang 1919 - Viet Nam. East Asian Regional Seminar on River Restoration 13-15 January 2003, Kuala Lumpur.
10. Nguyen Thai Tu, 2003. Two species of unique and precious Quang Binh Province. Journal of Engineering Science and Quang Binh. Number 1: 65-67.
11. Nguyen Thai Tu, 2003. Spring Festival and beating drums Biodiversity conservation of fish. Journal of Engineering Science and Quang Binh. Number 2: 83-84.
12. Nguyen Thai Tu, Ho Anh Tuan, 2003. Phong Nha Ke Bang is one of the nation's center Cyprinini arise. The problems of basic research in life sciences. Science and Technology Publishing House Hanoi: 1129-1133.
13. Nguyen Thai Tu, 2003. Central Vietnam with issues geographical boundaries and animals. National workshop on aquaculture. Bac Ninh.
14. Thai Nguyen Tu, 2003. Conservation of unique and Valuable fish diversity in Phong Nha-Ke Bang Limestone Mountains. Research Grant ARCBC Regional Conference Bangkok - Thailand. -December 01-01.
15. Nguyen Thai Tu, 2003. Fish fauna of karst Phong Nha - Ke Bang. National Conference. The Ecology of Vietnam. Hanoi.
16. Nguyen Thai Tu et al, 2005. Geography freshwater fish fauna of Vietnam. National Conference on Life Sciences. Science and Technology Publishing House Hanoi: 1106-1109.
17. Nguyen Thai Tu, Ho Anh Tuan, 2008. To conserve the unique and precious individual Biodiversity karst Phong Nha Ke Bang. Symposium Proceedings of the scientific value of the global World Heritage National Park Phong Nha - Ke Bang. Journal of Engineering Science and Quang Binh.

2. The objective of the survey

2.1. The purpose and objectives of the survey fish biodiversity

- Biodiversity of fish species composition in the study area by
- Identify existing threats to fish stocks.
- Propose measures to exploit and use of fish resources appropriately.

2.2. Scope of survey fish biodiversity

Based on the timing and scope of our research were divided into 5 Route survey that included 14 specific locations as follows:

2.2.1. Route Son Đoong (Khe Lanh Cave, Hang En Cave & Khe Ry Cave)

Survey areas

Khe Lanh Cave	Hang En Cave	Khe Ry Cave
N: 17 ⁰ 25' 41"	N: 17 ⁰ 26' 088''	N: 17 ⁰ 23' 17"
E: 106 ⁰ 18' 31"	E: 106 ⁰ 17' 952''	E: 106 ⁰ 14' 58"
Altitude: 185m asl.	Altitude: 197m asl.	Altitude: 298m asl.

2.2.2. Route "road 20" (Cha Ang bridge, km 15, 16, 17)

Survey areas

Cha Ang bridge	Km 15	Km 17
N: 17 ⁰ 31' 117''	N: 17 ⁰ 31' 252''	N: 16 ⁰ 32' 0077''
E: 106 ⁰ 16' 390''	E: 106 ⁰ 15' 478''	E: 106 ⁰ 14' 959''
Altitude: 42m asl.	Altitude: 59m asl.	Altitude: 51m asl.

2.2.3. Route Truong Son (Zin Zin rivulet, Len Đa Chet rivulet, Khe Lo O rivulet)

Survey areas

Zin Zin rivulet	Len Đa Chet rivulet	Lo O rivulet
N: 17 ⁰ 19' 288''	N: 17 ⁰ 13' 952''	N: 17 ⁰ 06' 737''
E: 106 ⁰ 26' 558''	E: 106 ⁰ 27' 478''	E: 106 ⁰ 29' 959''
Altitude: 70m asl.	Altitude: 159m asl.	Altitude: 51m asl.

2.2.4. Route Cha Noi (Hung Dang, Hung Ha Ca Tot)

Survey areas

Transect in Hung Dang	Transect in Hung Ha Ca Tot
N: 17 ⁰ 37' 752''	N: 17 ⁰ 36' 780''
E: 106 ⁰ 04' 086''	E: 106 ⁰ 03' 549''
Altitude: 83m asl.	Altitude: 302m asl.

2.2.5. Route Thuong Hoa (Hung Bung, Hung Sac, Hung Tre)

Survey areas

Hung Bung	Hung Sac	Hung Tre
N: 17 ⁰ 43' 573''	N: 17 ⁰ 41' 070''	N: 17 ⁰ 44' 063''
E: 105 ⁰ 58' 217''	E: 105 ⁰ 58' 055''	E: 105 ⁰ 59' 606''
Altitude: 298m asl.	Altitude: 320m asl.	Altitude: 298m asl.

3. The survey has fish biodiversity

3.1. General Information

Phong Nha - Ke Bang (PN-KB) is a massive limestone territory of both the Vietnam - Laos. West roof (Laos) was M.Kottelat (1998) published a list of record fish in the Nam Theun and Xebangfai 165 species. The roof to the east, near the sea should have more invasive species in marine fish make the fish fauna more diverse here. Preliminary survey results (1997, 2003), we have seen many unique fish fauna of the limestone PN-KB.

The scheme aims to thoroughly investigate the species composition and distribution of fish fauna PN - KB. On that basis, further clarify the diversity and unique fish fauna here, as well as building a classification system and record fish list integration with other countries in the region. Finding interdisciplinary measures are feasible to conserve the fish fauna of the unique and valuable karst PN-KB.

3.2. Methodology, sampling plans and survey locations

3.2.1. Research Methods

3.2.1.1. Collection methods and sample handling

Specimens mainly direct fishermen in the study sites on. Instruments include net fishing, tennis, fishing, sentences have different sizes and some other instruments of fishermen such as nursing, which, sluggishness ... In some areas, models are purchased from fishermen or by fishermen. Samples collected logs, image capture and fixed in formalin 8-10% and preserved in Formalin 5% solution and stored in Laboratory Animals, Department of Biology, University of Vinh.

3.2.1.2. Research Methodology morphological classification

Analysis of morphological characteristics by Pravdin IF (1963) and additional documents: Kottelat M. (1990), Jörg Freyhof (2007)

3.2.1.3. Classification method

The main materials used to type: Mai Dinh Yen (1978, 1992), Nguyen Van Hao, Van Ngo Sy (2001), Nguyen Van Hao (2005a, 2005b), Rainboth W. J. (1996), Kottelat M. (1990, 1996, 1998, 2000, 2001, 2005), Xinluo Chu et al (1989), Chen Yiyu et al (1998), Peiqi Yue et al (2000), Jörg Freyhof, (2000, 2001, 2002, 2003) , A. M. Prokofiev (2009, 2010). The classification system we are going to sort fishbase.org system / search.php use.

3.2.1.4. Data processing method

Photos and maps are processed on Adobe Photoshop 7.0 software and info Map 10.5. The measured data were processed on a Microsoft Office Excel 2007.

3.2.2. Sampling plan and survey sites

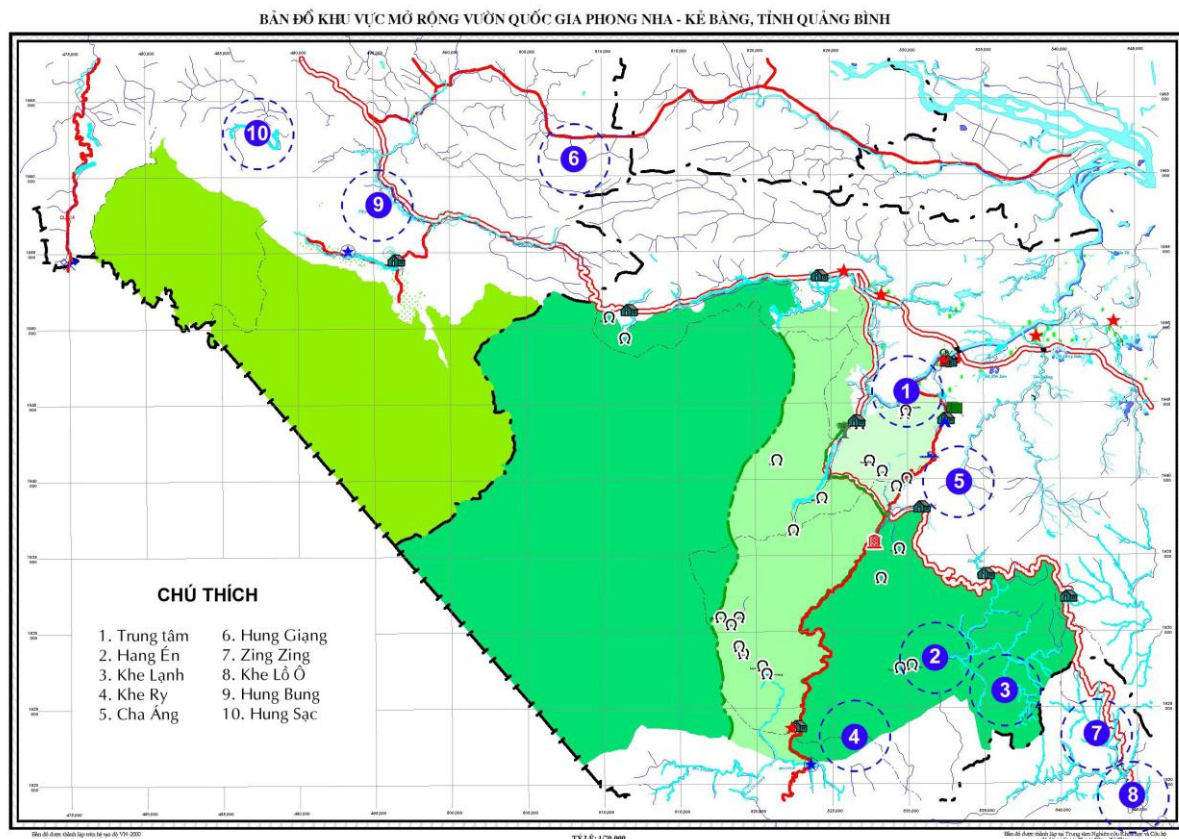


Figure 1. Sampling locations in the field

- Route Son Doong (Khe Lanh, Hang En and Khe Ry). From 10/08/2011 to 14/08/2011
- Route 20 (Bridge Cha Ang, Km 15, 16, 17). From 15/08/2011 to 16/08/2011
- Route Truong Son (Khe Zin Zin, Len Da Chet, Lo O). From 17/08/2011 to 08/20/2011
- Route Cha Noi (Hung Dang, Hung Ha Ca Tot). From 21/08/2011 to 08/24/2011
- Route Thuong Hoa (Hung Bung, Hung Sac, Hung Tre). From 25/08/2011 to 28/08/2011

3.3. Research results

3.3.1. Fish species composition National Park Phong Nha - Ke Bang

Table 1. Fish species composition National Park Phong Nha - Ke Bang

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
I	Notopteriformes													
(1)	Notopteridae													
1.	<i>Notopterus notopterus</i> (Pallas, 1769)	+		KT	+									
II	Anguilliformes													
(2)	Anguillidae													
2.	<i>Anguilla marmorata</i> Quoy & Gaimard, 1824 ®	+		VU, KT	+	+	+	+	+		+	+	+	+
3.	<i>Anguilla bicolor</i> Mc Clelland, 1844	+		VU										
(3)	Moringuidae													
4.	<i>Moringua javanica</i> (Kaup, 1856)	+												
III	Clupeiformes													
(4)	Clupeidae													
5.	<i>Clupanodon thrissa</i> (Linnaeus, 1758)	+		EN, KT	+									
6.	<i>Konosirus punctatus</i> (Tem. & Sch., 1846)	+		VU	+									
IV	Cypriniformes													
(5)	Cyprinidae													
7.	<i>Aspidoparia morar</i> (Hamilton, 1822)	+												

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
8.	<i>Aspidoparia viridis</i> Tu, 2003*	+												
9.	<i>Danio fangfangae</i> Kottelat, 2000		+										+	+
10.	<i>Danio gigber</i> Kottelat, 2000		+										+	+
11.	<i>Leptobarbus trunghoaensis</i> Tu, 2003*	+												
12.	<i>Nicholsicypris normalis</i> (Nic. & Pope, 1927)	+												
13.	<i>Nicholsicypris dorsohorizontalis</i> Ng. & Do., 1969		+	KT	+	+	+	+	+		+	+	+	+
14.	<i>Opsarichthys bidens</i> Günther, 1873	+		KT	+	+	+	+	+		+	+	+	+
15.	<i>Rasbora argyrotaenia</i> (Bleeker, 1849)	+												
16.	<i>Rasbora steineri</i> Nichols & Pope, 1927	+			+			+			+	+	+	+
17.	<i>Rasbora parasteineri</i> Tu, 2003*	+												
18.	<i>Rasbora</i> sp2. Tu, 2003®	+												
19.	<i>Yaoshanicus macrocorpus</i> Tu. 2003*	+												
20.	<i>Ctenopharyngodon idella</i> (Val., 1844)	+			+							+		
21.	<i>Squaliobarbus curriculus</i> (Richardson, 1846)	+			+							+		
22.	<i>Chela chrysotaeniatus raobutensis</i> Tu, 2003	+												
23.	<i>Hemiculter leucisculus</i> (Basilewsky, 1855)	+		KT	+	+					+	+	+	+
24.	<i>Metzia lineata</i> (Pellegrin, 1907)	+												
25.	<i>Metzia mesembrinum</i> (Jor. & Eve., 1902)	+												
26.	<i>Pseudohemiculter serata</i> (Koller, 1927)	+									+	+		
27.	<i>Rasborinus albus</i> Tu, 2003*	+												

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
28.	<i>Rasborinus hautus</i> Tu, 2003*	+												
29.	<i>Rasborinus</i> sp. Tu, 2003	+												
30.	<i>Hemibarbus labeo</i> (Pallas, 1776)	+		KT	+			+			+	+	+	+
31.	<i>Microphysogobio kachekensis</i> (Oshima, 1926)	+			+									
32.	<i>Sarcocheilichthys nigripinnis</i> (Günther, 1873)	+			+						+	+		
33.	<i>Squalidus argentatus</i> (Sau. & Dab. Thi., 1874)	+			+									
34.	<i>Squalidus atromaculatus</i> (Nic. & Pop., 1927)	+			+									
35.	<i>Acheilognathus lamus</i> Tu, 1983	+			+									
36.	<i>Acheilognathus tonkinensis</i> (Vailant, 1892)		+	KT	+						+	+	+	+
37.	<i>Rhodeus microcorpus</i> Tu, 2003*	+												
38.	<i>Rhodeus ocellatus</i> (Kener, 1867)		+									+		
39.	<i>Rhodeus vietnamensis ylengensis</i> Tu, 2003*	+												
40.	<i>Rhodeus vietnamensis trunghoaensis</i> Tu, 2003*	+												
41.	<i>Rhodeus phongnhaensis</i> Tu, 2003*	+												
42.	<i>Acrossocheilus albus</i> Tu, 2003*	+												
43.	<i>Acrossocheilus benasi vuha</i> Tu, 2003*®	+												
44.	<i>Acrossocheilus carongensis</i> Tu, 2003*	+												
45.	<i>Acrossocheilus fissirostralis</i> Tu, 2003*	+												
46.	<i>Acrossocheilus lineatus</i> Tu, 2003*	+												
47.	<i>Acrossocheilus longianalis</i> Tu, 2003*	+												

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	KI	HG	ZZ	LO	HB	HS
48.	<i>Acrossocheilus macrosquamatus</i> (Mai, 1978)	+												
49.	<i>Acrossocheilus krempfi hangenensis</i> Tu, 2003*	+												
50.	<i>Acrossocheilus yeni</i> Tu, 2003*	+												
51.	<i>Hypsibarbus annamensis</i> (Pel. & Che., 1936)		+	VU							+	+		
52.	<i>Neolissochilus benasi</i> (Pel. & C., 1936)®		+	KT	+	+	+	+	+		+	+	+	
53.	<i>Neolissochilus cf. benasi</i> (Pel. & C., 1936)®		+			+	+	+	+					
54.	<i>Onychostoma gerlachi</i> (Peters, 1881)	+		KT	+	+	+	+	+		+	+	+	+
55.	<i>Onychostoma cf. gerlachi</i> (Peters, 1881)		+		+	+	+	+	+					
56.	<i>Onychostoma meridionale</i> Kottelat, 1998	+												
57.	<i>Onychostoma laticeps</i> Günther, 1896	+												
58.	<i>Onychostoma lepturum</i> (Boulenger, 1900)	+												
59.	<i>Onychostoma macrostomus</i> Tu, 2003*	+												
60.	<i>Onychostoma</i> sp2. Tu, 2003	+												
61.	<i>Poropuntius krempfi</i> (Pel. & Chevey, 1934)	+												
62.	<i>Poropuntius solitus</i> Kottelat, 2000 ®		+	KT	+	+	+	+	+		+	+	+	
63.	<i>Puntius brevis</i> (Bleeker, 1850)		+		+	+	+	+	+		+	+	+	+
64.	<i>Puntius semifasciolatus</i> (Günther, 1868)	+			+	+	+	+	+		+	+	+	+
65.	<i>Paraspinibarbus macracanthus</i> (Pel. & C., 1936)	+			+				+		+	+		
66.	<i>Spinibarbus denticulatus</i> (Oshima, 1926)	+		KT	+	+	+	+			+	+	+	+
67.	<i>Spinibarbus hollandi</i> Oshima, 1919	+			+	+			+					

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	KI	HG	ZZ	LO	HB	HS
68.	<i>Sytomus binotatus</i> (Valenciennes, 1842)		+									+		
69.	<i>Cirrhinus molitorella</i> (Valenciennes, 1844)	+		KT	+						+	+	+	+
70.	<i>Garra gracilis</i> (Pellegrin & Chevey, 1936)	+												
71.	<i>Garra imberba</i> Garman, 1912 ®	+		KT	+	+	+		+		+	+	+	+
72.	<i>Lobocheilos</i> sp. ®		+					+						
73.	<i>Osteocheilus longicarpus</i> Tu, 2003*	+												
74.	<i>Osteocheilus microstomus</i> Tu, 2003*	+												
75.	<i>Osteochilus salsburyi</i> Nichols & Pope, 1927	+		KT	+	+	+	+	+		+	+	+	+
76.	<i>Carassioides acuminatus</i> (Richardson, 1846)	+		KT	+				+		+	+	+	+
77.	<i>Carassioides phonghaensis</i> Tu & Tuan, 2003*	+												
78.	<i>Carassius auratus</i> (Linnaeus, 1785)	+		KT	+	+	+	+	+		+	+	+	+
79.	<i>Cyprinus carpio</i> Linnaeus, 1758	+		KT	+	+	+	+	+		+	+	+	+
80.	<i>Cyprinus hieni</i> Tu & Tuan, 2003*	+											+	+
81.	<i>Cyprinus quidatensis</i> Tu, 1999*	+												+
(6)	Cobitidae													
82.	<i>Acanthopsoidea yeni</i> (Tu, 2003)*	+												
83.	<i>Misgurnus anguillicaulatus</i> (Cantor, 1842) ®	+		KT	+						+	+	+	+
84.	<i>Misgurnus mizolepis</i> Günther, 1888®	+		KT	+						+	+	+	+
85.	<i>Cobitis taenia</i> Linnaeus, 1758®		+	KT	+				+		+	+	+	
(7)	Balitoridae													

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
86.	<i>Annamia normani</i> (Hora, 1931)		+		+	+	+		+		+	+		
87.	<i>Balitora microbarbata</i> Tu, 2003*	+												
88.	<i>Micronemacheilus pulcher</i> (Nic. & Pope, 1927)	+		KT	+	+	+		+		+	+	+	+
89.	<i>Schistura bolavenensis</i> Kottelat, 2000		+								+	+		
90.	<i>Schistura chapaensis</i> (Randal, 1944)		+									+		
91.	<i>Schistura cf. chapaensis</i> (Randal, 1944)		+			+								
92.	<i>Schistura fasciolata</i> (Nichols & Pope, 1927)	+			+									
93.	<i>Schistura finis</i> Kottelat, 2000		+									+		
94.	<i>Schistura hingi</i> (Herre, 1934)		+								+			
95.	<i>Schistura cf. hingi</i> (Herre, 1934)		+			+								
96.	<i>Schistura huongensis</i> Freyhof & Serov, 2001		+						+					
97.	<i>Schistura inserta</i> (Nichols, 1931)	+												
98.	<i>Schistura longicorpus</i> Tu, 2003*	+												
99.	<i>Schistura magnifluvis</i> Kottelat, 1990		+						+					
100.	<i>Schistura cf. magnifluvis</i> Kottelat, 1990		+						+					
101.	<i>Schistura nudidorsum</i> Kottelat, 1998		+						+					
102.	<i>Schistura obeini</i> Kottelat, 1998		+						+					
103.	<i>Schistura pellegrini</i> (Rendahl, 1944)		+						+					
104.	<i>Schistura spiloptera</i> (Valenciennes, 1846)		+										+	
105.	<i>Schistura psittacula</i> Freyhof & Serov, 2001		+										+	

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
106.	<i>Schistura hungdang1.</i>		+								+			
107.	<i>Schistura hungdang2.</i>		+								+			
108.	<i>Schistura</i> sp1. Tu, 2003	+												
109.	<i>Schistura</i> sp2. Tu, 2003	+												
110.	<i>Schistura</i> sp3. Tu, 2003	+												
111.	<i>Schistura</i> sp4. Tu, 2003	+												
112.	<i>Schistura</i> sp5. Tu, 2003	+												
113.	<i>Schistura</i> sp6. Tu, 2003	+												
114.	<i>Schistura</i> sp7. Tu, 2003	+												
115.	<i>Schistura</i> sp8. Tu, 2003	+												
116.	<i>Schistura</i> sp9. Tu, 2003	+												
117.	<i>Schistura</i> sp10. Tu, 2003	+												
118.	<i>Schistura</i> sp11. Tu, 2003	+												
119.	<i>Schistura</i> sp12. Tu, 2003	+												
120.	<i>Schistura</i> sp13. Tu, 2003	+												
121.	<i>Schistura</i> sp14. Tu, 2003	+												
122.	<i>Schistura</i> sp15. Tu, 2003	+												
123.	<i>Schistura</i> sp16. Tu, 2003	+												
124.	<i>Schistura</i> sp17. Tu, 2003	+												
125.	<i>Sewellia lineolata</i> (Valenciennes, 1836)		+		+	+	+	+	+		+	+		

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	KI	HG	ZZ	LO	HB	HS
126.	<i>Vanmanenia hexaloba</i> Tu, 2003*	+												
127.	<i>Vanmanenia multiloba</i> Tu, 2003*	+												
128.	<i>Vanmanenia raobutensis</i> Tu, 2003*	+												
129.	<i>Vanmanenia ylengensis</i> Tu, 2003*	+												
V	Siluriformes													
(8)	Bagridae													
130.	<i>Hemibagrus centralus</i> Mai, 1978	+		KT	+	+	+	+	+		+	+		
131.	<i>Hemibagrus vietnamicus</i> Mai, 1978	+												
132.	<i>Pelteobagrus vinhensis</i> Tu, 1983	+												
(9)	Cranoglanididae													
133.	<i>Cranoglanis boudierius</i> (Richardson, 1846)	+												
(10)	Siluridae													
134.	<i>Silurus asotus</i> Linnaeus, 1758 ®	+		KT	+	+	+	+	+		+	+	+	+
135.	<i>Pterocryptis cochinchinensis</i> (Val., 1840) ®	+		KT	+	+	+	+	+		+	+	+	+
(11)	Sisoridae													
136.	<i>Euchiroglanis microdordalis</i> Tu, 2003*	+												
137.	<i>Glyptothorax honghensis</i> Li, 1984	+												
138.	<i>Glyptothorax laosensis</i> Fowler, 1934		+					+	+		+	+		
139.	<i>Glyptothorax interspinalus</i> (Mai, 1978)	+												
140.	<i>Glyptothorax raobutensis</i> Tu, 2003*	+												

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	KI	HG	ZZ	LO	HB	HS
141.	<i>Glyptothorax quadriocellatus</i> (Mai, 1978)		+		+					+				
142.	<i>Glyptothorax zanaensis</i> Wu, He & Chu, 1981		+		+					+				
(12)	Clariidae													
143.	<i>Clarias fuscus</i> (Linnaeus, 1758)	+		KT	+	+	+	+	+		+	+	+	+
(13)	Ariidae													
144.	<i>Netuma thalassina</i> (Rüppell, 1837)	+			+									
VI	Beloniformes													
(14)	Hemirhamphidae													
145.	<i>Hyporhamphus sinensis</i> (Günther 1866)	+			+									
(15)	Adrianichthyidae													
146.	<i>Oryzias latipes</i> (Temminck & Schlegel, 1846)	+												
VII	Synbranchiformes													
(16)	Synbranchidae													
147.	<i>Monopterus albus</i> (Zuiew, 1793) ®	+		KT	+					+		+	+	+
(17)	Mastacembelidae													
148.	<i>Mastacembelus aculeatus</i> (Basilewsky)®	+												
149.	<i>Mastacembelus armatus</i> (Lacepède, 1800) ®	+		KT	+	+	+	+	+		+	+	+	+
150.	<i>Mastacembelus</i> cf. <i>armatus</i> (Lacepède, 1800) ®		+		+	+					+	+		
VIII	Scorpaeniformes													

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
(18)	Platycephalidae													
151.	<i>Platycephalus indicus</i> (Linnaeus, 1758)	+			+									
IX	Perciformes													
(19)	Ambassidae													
152.	<i>Ambassis commersoni</i> Cuvier, 1828	+			+									
153.	<i>Ambassis gymnocephalus</i> (Lacepède, 1802)	+												
(20)	Percichthyidae													
154.	<i>Coreoperca whiteheadi</i> Boulenger, 1900	+			+									
(21)	Latidae													
155.	<i>Lates calcarifer</i> (Bloch, 1790)	+			+									
(22)	Serranidae													
156.	<i>Cephalopholis boenak</i> (Bloch, 1790)	+												
(23)	Terapontidae													
157.	<i>Rhynchopelates oxyrhynchus</i> (Tem. & Sch., 1842)	+												
158.	<i>Terapon jarbua</i> (Forsskål, 1775)		+		+									
159.	<i>Terapon theraps</i> Cuvier, 1829	+												
(24)	Leiognathidae													
160.	<i>Leiognathus equulus</i> (Forsskål, 1775)	+			+									
(25)	Lutjanidae													
161.	<i>Pinjalo pinjalo</i> (Bleeker, 1850)	+												

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
(26)	Caesionidae													
162.	<i>Caesio cuning</i> (Bloch, 1791)	+												
(27)	Gerreidae													
163.	<i>Gerres limbatus</i> Cuvier, 1830	+												
164.	<i>Gerres filamentosus</i> Cuvier, 1829	+												
165.	<i>Gerres oyena</i> (Forsskål, 1775)	+												
(28)	Monodactylidae													
166.	<i>Monodactylus argenteus</i> (Linnaeus, 1758)	+			+									
(29)	Mugilidae													
167.	<i>Liza macrolepis</i> (Smith, 1846)	+			+									
168.	<i>Valamugil cunnesius</i> (Valenciennes, 1836)	+												
(30)	Cichlidae													
169.	<i>Oreochromis mossambicus</i> (Peters, 1852)	+												
170.	<i>Oreochromis niloticus</i> (Linnaeus, 1758)		+	KT	+						+	+	+	+
(31)	Eleotridae													
171.	<i>Bostrychus sinensis</i> Lacepède, 1801		+	CR	+									
172.	<i>Butis butis</i> (Hamilton, 1822)	+			+									
173.	<i>Butis koilomatodon</i> (Bleek, 1849)	+			+									
174.	<i>Eleotris fusca</i> (Forster, 1801)	+												
175.	<i>Eleotris melanosoma</i> Bleeker, 1853	+												

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
176.	<i>Neodontobutis tonkinensis</i> (Mai, 1978)	+		KT	+	+	+		+		+	+	+	+
177.	<i>Odontobutis</i> sp1. Tu, 2003	+												
178.	<i>Odontobutis</i> sp2. Tu, 2003	+												
179.	<i>Sineleotris chalmersi</i> Nichols & Pope, 1927	+			+									
180.	<i>Sineleotris namxamensis</i> Chen & Kottelat, 2000	+			+	+	+				+	+	+	+
(32)	Gobiidae													
181.	<i>Acentrogobius nebulosus</i> (Forsskål, 1775)		+											
182.	<i>Ctenogobius gympauchen</i> (Bleeker, 1860)	+												
183.	<i>Favonigobius aliciae</i> (Herre, 1936)		+		+									
184.	<i>Glossogobius giuris</i> (Hamilton, 1822)®	+		KT	+	+	+		+		+	+	+	+
185.	<i>Glossogobius fasciatopunctatus</i> (Richard., 1838)	+			+									
186.	<i>Gnatholepis calliurus</i> Jordan et Seale, 1905		+		+									
187.	<i>Oligolepis acutipennis</i> (Valenciennes, 1837)	+												
188.	<i>Oxyurichthys microlepis</i> (Bleek, 1849)		+		+									
189.	<i>Oxyurichthys tentacularis</i> (Valenciennes, 1837)		+		+									
190.	<i>Oxyurichthys</i> sp. Tu, 2003	+												
191.	<i>Paragobiodon echinocephalus</i> (Ruppell, 1828)		+		+									
192.	<i>Parapocryptes serperaster</i> (Richardson, 1846)	+												
193.	<i>Papuligobius uniporus</i> (Kottelat, 2001)		+								+	+		
194.	<i>Psammogobius biocellatus</i> (Valenciennes, 1837)		+		+									

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
195.	<i>Pseudapocryptes elongatus</i> (Cuvier, 1816)		+											
196.	<i>Rhinogobius brunneus</i> (Tem. & Sch., 1845)		+								+	+		
197.	<i>Rhinogobius giurinus</i> (Rutter, 1897)	+			+	+	+		+		+	+	+	+
198.	<i>Rhinogobius honghensis</i> Chen, Yang, 1999	+												
199.	<i>Rhinogobius leavelli</i> (Herre, 1935)	+												
200.	<i>Rhinogobius nammaensis</i> Chen & Kottelat, 2001	+												
201.	<i>Rhinogobius vermiculatus</i> Chen & Kottelat, 2001	+												
202.	<i>Tridentiger trigonocephalus</i> (Gill, 1859)	+			+									
203.	<i>Trypauchen vagina</i> (Bloch & Schneider, 1801)	+												
204.	<i>Yongeichthys criniger</i> (Valenciennes, 1837)		+		+									
(33)	Scatophagidae													
205.	<i>Scatophagus argus</i> (Linnaeus, 1766)	+			+									
(34)	Anabantidae													
206.	<i>Anabas testudineus</i> (Bloch, 1792)	+		KT	+						+	+	+	+
(35)	Belontiidae													
207.	<i>Macropodus opercularis</i> (Linnaeus, 1758)	+			+						+	+	+	+
208.	<i>Trichogaster trichopterus</i> (Pallas, 1770)		+		+						+	+	+	+
(36)	Channidae													
209.	<i>Channa striata</i> (Bloch, 1797)	+		KT	+	+	+	+	+		+	+	+	+
210.	<i>Channa orientalis</i> Schneider, 1801®	+		KT	+	+	+	+	+		+	+	+	+

No	Scientific name	2003	Additional	KT & BT	The Routes survey									
					TT	HE	KL	KR	K1	HG	ZZ	LO	HB	HS
X	Pleuronectiformes													
(37)	Paralichthyidae													
211.	<i>Tephrinectes sinensis</i> (Lacepède, 1802)	+												
(38)	Pleuronectidae													
212.	<i>Verasper variegatus</i> (Tem. & Sch., 1846)	+			+									

Note the abbreviations in Table 1:

2003: According to research by Nguyen Thai Tu and colleagues, KT & BT: The Fishes species have Economic and Conservation, TT: Phong Nha market, HE: En cave, KL: Lanh gill, KR: Ry Gill, K17: along route 20, HG: Hung Giang, Hung Ha Ca Tot, ZZ: Zing Zing Gill, LO: Lo O Gill, HB: Hung Bung, HS: Hung Sac

KT: The Fishes species have Economic valuable, VU: Will endangered EN: Endangered, CR: Critically Endangered, (*): The endemic species, ®: The species distribution in the cave.

The survey for 20 days at 5 route of the National Park Phong Nha Ke Bang has collected 1599 fish samples. By analyzing the type along with the research of Nguyen Thai Tu and colleagues (from 1998 to 2000) having 212 species of 107 genus, 38 families, 10 order. The survey identified 111 species, adding 50 species to the study area.

3.3.1.1. Fish species composition in the basin system

In the basin system studies show there are 82 species in the center of Son River area , En cave: 34 species, Lanh Gill: 29 species, Ry Gill: 26 species, along the road 20: 41 species, Hung Giang : 2 species, Zing Zing Gill: 51 species, Lo O Gill: 56 loai, Hung Bung: 43 species, Hung Sac: 39 species.

3.3.1.2. Fish species composition in the Cave

According to Nguyen Thai Tu and colleagues in 2003 and our research at the National Park Phong Nha Ke Bang National Park 14 species of fish are distributed in the cave. Fish species *Lobocheilos* sp is only distributed in Lanh gill (Table 1)

3.3.1.3. Fish species composition according to administrative units

During the research, our survey in National Park, Phong Nha - Ke Bang has determined there are 58 species in Quang Ninh district, Bo Trach district: 95 species, Minh Hoa district: 44 species

3.3.1.4. Fish species composition of economic value

According to a survey of our research there are 34 species of fish in the study area is relatively large volume and high cost that people usually exploite and use everyday. Therefore, we consider these 34 species as the fish species of economic value in the National Park Phong Nha - Ke Bang (Table 1).

3.3.1.5. Fish species composition of conservation value

According to Vietnam's Red Book of Animals (2007) and fish species we have identified there are 6 species Which should be protected in the National Park, Phong Nha Ke Bang.

No	Scientific name	The level of conservation	Notes
1.	<i>Anguilla marmorata</i> Quoy & Gaimard, 1824	VU	KT
2.	<i>Anguilla bicolor</i> Mc Clelland, 1844	VU	
3.	<i>Clupanodon thrissa</i> (Linnaeus, 1758)	EN	KT
4.	<i>Konosirus punctatus</i> (Tem. & Sch., 1846)	VU	
5.	<i>Hypsibarbus annamensis</i> (Pel. & Che., 1936)	VU	
6.	<i>Bostrychus sinensis</i> Lacepède, 1801	CR	

VU: Vulnerable

EN: Endangered

CR: Critically Endangered

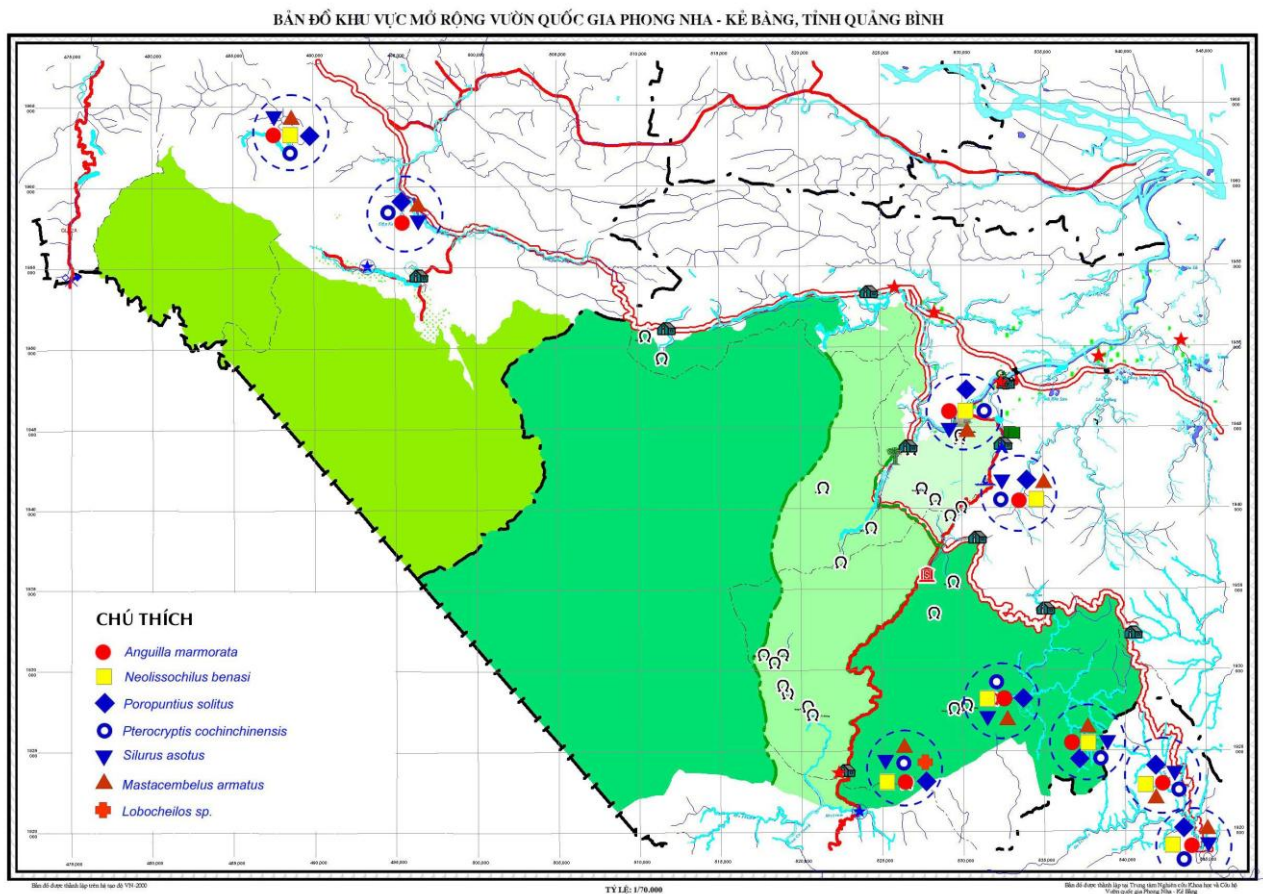
Among six species Which are recorded in the Red Book in the study area two species: *Anguilla marmorata*, *Clupanodon thrissa* Which we encounter with a relatively large amount.

3.3.1.6. Endemic fish species composition

Based on the species composition table in National Park, Phong Nha - Ke Bang National Park has 33 species are distributed there, so these 33 species are considered endemic to the National Park, Phong Nha Ke Bang.

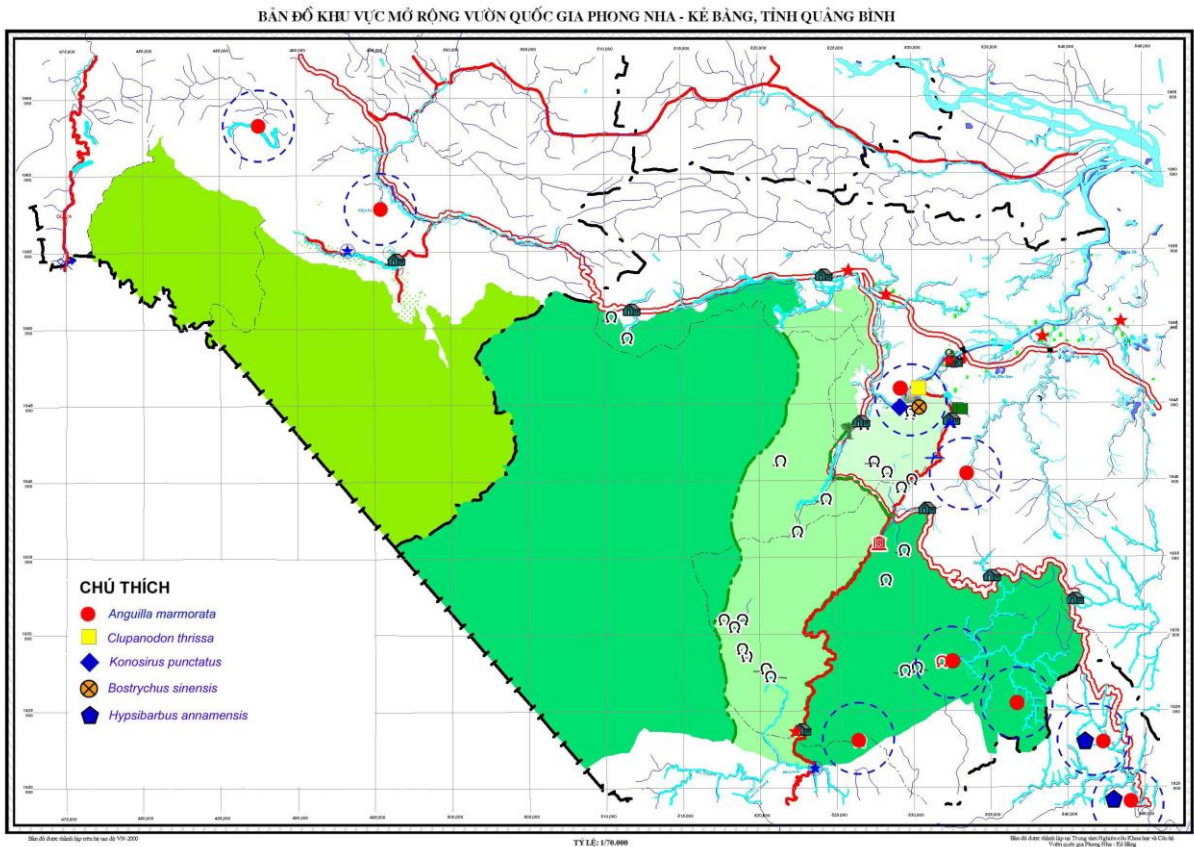
3.3.2. The distribution maps of fish

3.3.2.1. Distribution in the caves



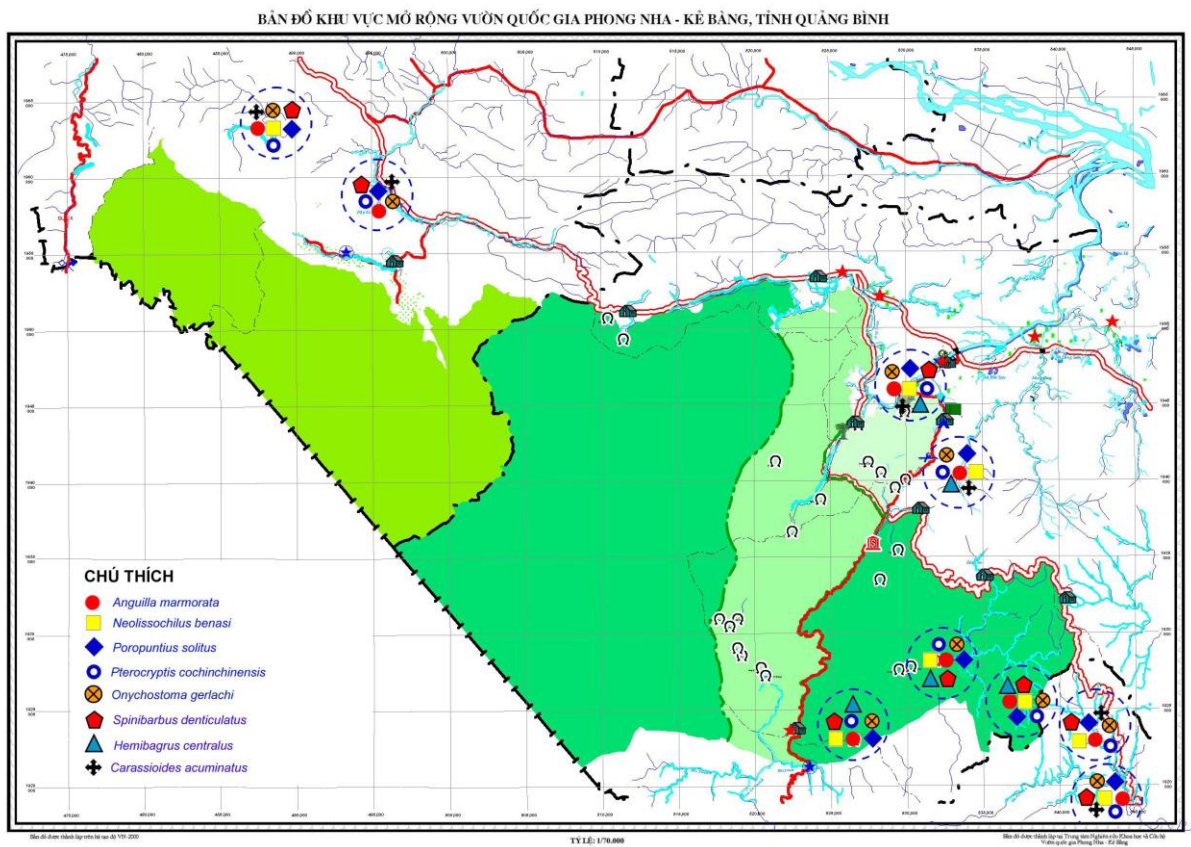
Map of the cave fish

3.3.2.2. The species of conservation value



Map of valuable fish species conservation

3.3.2.3. The economic value species



Map of valuable fish species Economy

3.3.3. The threat to fish biodiversity in the study area.

In the recent years, the prohibition of exploitation, hunting of wild animals has been done strictly, at the locals. However the hunting of the large animals such as birds, wild animals has been stopped, the fish becomes the object of people's hunting because this is a species of large amount and widely distributed, easy to catch. It can be said that the fish fauna in national parks play an important role as a source of food for local people. In particular there are some species of high economic value are purchased in bulk as fish Chình, fish Mat, fish Lang ...have become the target of people fishing.

During investigations in National Parks, the activities have been detected. They are considered as threats to fish stocks, including fishing activities and exploitation of forest products.

- Intensive method of fishing used to be used are explosives, poisons and electric pulses. The use of explosives in fishing was prohibited entirely due to the tight control, but for the activity of using electric pulses to poison fishing still takes place in National Parks.

- Some other activities also harm the fish such as the use of nets, fishing with small mesh size, fishing during the breeding season or at birth are also the direct cause declining fish stocks.

- Due to difficult economic life, the demand for human food has been grown intensive, so the fishing also affects wild fish production.

- The excessive exploitation of forest products, particularly in the area on both sides of streams is also an indirect cause to fish habitat.

3.3.4. The proposals on the protection and conservation of fish biodiversity in the study area.

We can say the diversity of fish in this area shows clearly the importance of the fish fauna of the biodiversity of national parks as well as its role in the livelihood problems of the people.

However, people fishing in national parks has caused strong impact on the number of fish species. Therefore, some specific measures to protect fish biodiversity in the study area which are suitable for the actual situation of the locality are proposed including:

- Pay special attention to the patterns of fishing destructive remain as poison, electric pulses.

- For the fish species of economic value can be domesticated, learning environment, nutrition, reproductive ... to put in extensive breeding locally. Since then habits of the people fishing to fish farming. Should be changed.

- Introduction of techniques and methods of fishing sustainable for the people as a seasonal fishing, real output in the local regulation of fishing gear such as the size reasonable eye net ...

- Disseminating of knowledge through training and retraining and training for local communities in the exploitation of fisheries resources; the legal regulations for the conservation of valuable species, endangered species.

4. Conclusions and recommendations

4.1. Status of fish biodiversity in the national park Phong Nha-Ke Bang

By analyzing the type along with research of Nguyen Thai Tu and colleagues (from 1998 to 2000) We have identified the study area has 212 species of 107 genus, 38 families, 10 order.

Of which:

- Collect samples are 111 species, adding 50 species.
- 14 species are mainly distributed in the caves.
- 34 species of fish have economic value
- 6 species are recorded in Vietnam Red Book
- 33 endemic species of the National Park, Phong Nha Ke Bang.

4.2. Threat Assessment

Fish is the main food sources daily so that local people still exploit it with the destructive methods such as using poison, electric pulses.

4.3. The recommended action

On the basis of data on natural conditions, socio-economic, religious customs, traditional experience of the local ethnic people, we have developed a plan to conserve fish biodiversity in 6 basic principles:

- To protect the integrity of natural ecosystems in particular need to thoroughly banned alien invasive species.

- Combined beliefs and habits of local people with modern principles of biodiversity conservation

- The consensus among leaders at all levels with local people on the principle of conservation of fish biodiversity and the interests of local people.

- Raising awareness on the conservation of fish biodiversity in the PN-KB seminars, articles and broadcasting of Quang Binh.

- Make known to local people not use destructive fishing facilities such as electric pulses, poisons, explosives ..

- To raise awareness for local fishermen on how to exploit the types of fishing gear in accordance with the developmental stages of fish.

4.4. Recommendations for Park Management Plan

- Do not allow local fishermen with equipment operators with destructive analysis.
- Restrictions on the exploitation of spawning months.
- Have plans for fishermen so that they can get accustomed to tame some economic subjects to actively fish food daily.

5. References

1. Chen Yiyu et al, 1998. *Fauna Sinica Osteichthyes Cypriniformes II*. Science Fresh Beijing China, 531p (Chinese).
2. Chu Xinluo, Chen Yinrui et al, 1989. *The fishes of Yunnan China part II*. Science press Beijing China (Chinese).
3. Nguyễn Văn Hào, Ngô Sỹ Vân, 2001. *Cá nước ngọt Việt Nam. Tập I. Họ cá chép (Cyprinidae)*. Nxb Nông Nghiệp, Hà Nội. tr. 132 - 138.
4. Nguyễn Văn Hào, 2005. *Cá nước ngọt Việt Nam, Tập 2, 3*. NXB Nông Nghiệp.
5. Heok Hee Ng, Maurice Kottelat, 2000. *Descriptions of three new species of catfishes (Teleostei: Akysidae and Sisoridae) from Laos and Vietnam*. J. South Asian Nat. Hist., ISSN 1022-0828. June, 2000. Vol. 5, No. 1, pp. 7–15, 4 figs
6. Heok Hee Ng, Maurice Kottelat, 2000. *Cranoglanis henrici* (Vaillant, 1893), a valid species of cranoglanidid catfish from Indochina (Teleostei, Cranoglanididae). *Zoosystema* 22 (4) : 847-852. Publications Scientifiques du Muséum national d'Histoire naturelle, Paris.
7. Heok Hee Ng and Jorg Freyhof, 2001. *Oreoglanis infulatus, a new of glyptosternine catfish from Central Vietnam*. The Fisheries Society of the British Isles. Journal of Fish Biology.
8. Hee Ng and Jorg Freyhof, 2003. *Akysis clavulus, a new species of catfish from Central Vietnam*. Ichthyol. Explor. Freshwater, Vol. 14, No. 4.
9. Heok Hee Ng and Jorg Freyhof, 2005. *A new species of Pseudomystus from Central Vietnam*. American Society of Ichthyologists and Herpetologists. No.
10. Nguyễn Khắc Hùng, 1974,1991,1993. *Cá biển Việt Nam, tập 2 quyển 2, tập 2 quyển 3, tập 3 quyển 1*. NXB Khoa học và Kỹ Thuật.
11. Nguyễn Khắc Hùng, 2007. *Động vật chí - Cá biển. Tập 20*. Nxb Khoa học & Kỹ thuật, Hà Nội
12. Jörg Freyhof, Dmitri V. Serov, 2000. *Review of the genus Sewellia with descriptions of two new species from Vietnam (Cypriniformes: Balitoridae)*. Ichthyol. Explor. Freshwater, Vol.11,No.3,pp. 217 - 240, 18 fig.
13. Jorg Freyhof and Fabian H., 2001. *Tanichthys micagemmae, a new miniature cyprinid fish from Central Vietnam*. Ichthyol. Explor. Freshwater, Vol. 12, No. 3.
14. Jörg Freyhof, Dmitri V. Serov, 2001. *Nemacheiline loaches from Central Vietnam with description of a new genus and 14 new species (Cypriniformes: Balitoridae)*. Ichthyol. Explor. Freshwater, Vol.12,No.2,pp. 133 – 191, 57 fig.
15. Jörg Freyhof, Fabian Herder, 2002. *Records of Hemimyzon in Vietnam with the description of a new species (Cypriniformes: Balitoridae)*. Ichthyol. Explor. Freshwater, Vol.13,No.1,pp. 53 – 58, 3 fig.
16. Jörg Freyhof, 2003. *Sewellia albisuera, a new balitorid loach from Central Vietnam (Cypriniformes: Balitoridae)*. Ichthyol. Explor. Freshwaters, Vol. 14, No. 3, pp. 225-230, 4 figs.

17. Nguyễn Văn Lục, Lê Thị Thu Thảo, Nguyễn Phi Uy Vũ, 2007. *Động vật chí - Cá biển (bộ cá Vược)*. Tập 19. Nxb Khoa học & Kỹ thuật, Hà Nội
18. Maurice Kottelat, 1990. *Indochinese nemacheilines - A revision of nemacheiline loaches (Pisces: Cypriniformes) of Thailand, Burma, Laos, Cambodia and southern Viet Nam*. Verlag Dr. Friedrich Pfeil Munchen, Germany.
19. Maurice Kottelat, 1996. *Fishes of the Nam Theun and Xe Bangfai basins Lao*. P. D. pp. 9-31.
20. Maurice Kottelat, 1998. *Ichthyological Exploration of Freshwaters*. Vol 9, N^o 1. Verlag Dr. Friedrich Pfeil Munchen, Germany.
21. Maurice Kottelat, 2000. *Diagnoses of a new genus and 64 new species of fishes from Laos (Teleostei: Cyprinidae, Balitoridae, Bagridae, Syngnathidae, Chaudhuriidae and Tetraodontidae)*. J. South Asian Nat. Hist., ISSN 1022-0828. June, 2000. Vol. 5, No. 1, pp. 37-82, 73 figs.
22. Maurice Kottelat, 2001. *Freshwater Fishes of Northern Vietnam*.
23. Đỗ Thị Như Nhung, 2007. *Động vật chí - Cá biển (bộ cá Vược)*. Tập 17. Nxb Khoa học & Kỹ thuật, Hà Nội
24. Shiung Chen, M. Kottelat, 2005. *Four new freshwater gobies of the genus Rhinogobius (Teleostei: Gobiidae) from northern Vietnam*. Journal of Natural History, 2005; 39(17): 1407 - 1429
25. Nguyễn Hữu Phụng, 2001. *Động vật chí Việt Nam, tập 10*. NXB Khoa học và Kỹ thuật.
26. Nguyễn Nhật Thi, 1991. *Cá biển Việt Nam - Cá xương vịnh Bắc Bộ*. NXB Khoa học và Kỹ thuật.
27. Nguyễn Nhật Thi, 2000. *Động vật chí Việt Nam - Phân bộ cá bống*. NXB Khoa học và Kỹ thuật.
28. Nguyễn Thái Tụ (Thành viên), năm 1996. Điều tra Đa dạng Sinh học Phong Nha Kẻ Bàng do RAS/93/102 W.W.F và VNDP tài trợ
29. Nguyễn Thái Tụ, Lê Viết Thắng, Lê Thị Bình, 1997. Phong Nha - Kẻ Bàng thiên đường của các nhà ngư loại học. Tạp chí Khoa học Công nghệ và Môi trường Quảng Bình. Số 7: 27 - 29.
30. Nguyễn Thái Tụ, 1998. Các hướng triển khai của đề tài Đa dạng Sinh học Bắc Trường Sơn. Hội thảo Đa dạng Sinh học Bắc Trường Sơn (lần thứ 2). Báo cáo tóm tắt: 28 - 29.
31. Nguyễn Thái Tụ, Lê Viết Thắng, 1998. Một loài cá mới thuộc giống Chela (Hamilton, 1822). Hội thảo Đa dạng Sinh học Bắc Trường Sơn (lần thứ 2). Báo cáo tóm tắt: 30.
32. Nguyễn Thái Tụ, Lê Viết Thắng, Lê Thị Bình, Nguyễn Xuân Khoa, 1999. Giống Cyprinus Linnaeus, 1758 và một loài cá mới *Cyprinus quidatensis* được hình thành bằng con đường cách ly địa lý. Tuyển tập Hội thảo Đa dạng Sinh học Bắc Trường Sơn (lần thứ 2). Nxb Đại học Quốc Gia Hà Nội: 7- 8.
33. Nguyễn Thái Tụ, Lê Viết Thắng, Nguyễn Xuân Khoa, 1999. Một loài cá mới thuộc giống Chela (Hamilton, 1822). Tuyển tập Hội thảo Đa dạng Sinh học Bắc Trường Sơn (lần thứ 2). Nxb Đại học Quốc Gia Hà Nội: 16 - 21 .
34. Nguyễn Thái Tụ, Lê Viết Thắng, Nguyễn Xuân Khoa, 1999. Khu hệ cá Phong Nha - Kẻ Bàng. Tuyển tập Hội thảo Đa dạng Sinh học Bắc Trường Sơn (lần thứ 2). Nxb Đại học Quốc Gia Hà Nội: 22 - 23
35. Nguyễn Thái Tụ (Chủ nhiệm), năm 2000 - 2003. Conservation of unique and valuable fish diversity in Phong Nha- Ke Bang Limestone Mountains do Asean Regional Centre for Biodiversity Conservation and the European Commission tài trợ. Mã số: RE - VNM - 008.

36. Nguyễn Thái Tự, Lê Việt Thắng. Nguyễn Xuân Khoa, 2000. Giống *Lissocheilus*, Weber et de Beaufort, 1916 và hai loài cá mới được phát hiện ở Quảng Bình Việt Nam. Những vấn đề nghiên cứu cơ bản trong Sinh học. Nxb Khoa học và Kỹ thuật Hà Nội: 475 - 476.
37. Nguyen Thai Tu, 2003. New species of *Acrossocheilus*, Oshima, 1919 in Phong Nha Ke Bang - Viet Nam. East Asian Regional Seminar on River Restoration 13 - 15 January 2003, Kuala Lumpur.
38. Nguyễn Thái Tự, 2003. Hai loài cá độc đáo và quý báu của tỉnh Quảng Bình. Tạp chí Khoa học và Kỹ thuật tỉnh Quảng Bình. Số 1: 65 - 67.
39. Nguyễn Thái Tự, 2003. Lễ hội đập trồng xuân và bảo tồn Đa dạng Sinh học cá. Tạp chí Khoa học và Kỹ thuật tỉnh Quảng Bình. Số 2: 83 - 84.
40. Nguyễn Thái Tự, Hồ Anh Tuấn, 2003. Phong Nha Kẻ Bàng là một trong những trung tâm phát sinh của tộc *Cyprinini*. Những vấn đề nghiên cứu cơ bản trong khoa học sự sống. Nxb Khoa học và Kỹ thuật Hà Nội: 1129 – 1133.
41. Nguyễn Thái Tự, 2003. Miền trung Việt Nam với vấn đề ranh giới địa lý động vật. Hội thảo quốc gia về nuôi trồng thủy sản. Bắc Ninh.
42. Nguyen Thai Tu, 2003. Conservation of unique and valuable fish diversity in Phong Nha- Ke Bang Limestone Mountains. ARCBC Regional Research Grant Conference Bangkok - Thailand. 01-01-December.
43. Nguyễn Thái Tự, 2003. Khu hệ cá vùng núi đá vôi Phong Nha - Kẻ Bàng. Hội thảo quốc gia. Hội Sinh thái học Việt Nam. Hà Nội.
44. Nguyễn Thái Tự và ctv, 2005. Địa lý động vật cá nước ngọt Việt Nam. Hội thảo quốc gia về Khoa học sự sống. Nxb Khoa học và Kỹ thuật Hà Nội: 1106 - 1109.
45. Nguyễn Thái Tự, Hồ Anh Tuấn, 2008. Bảo tồn tính độc đáo và quý báu của Đa dạng Sinh học cá vùng núi đá vôi Phong Nha Kẻ Bàng. Kỷ yếu hội thảo khoa học các giá trị khoa học mang tính toàn cầu của di sản thiên nhiên thế giới vườn Quốc gia Phong Nha - Kẻ Bàng. Tạp chí khoa học và Kỹ thuật Quảng Bình.
46. Yasuhiko Taki, 1975. *Geographic Distribution of Primary Freshwater Fishes in Four Principal Areas of Southeast Asia*. South East Asian Studies. Vol.13, No. 2, 200 - 204.
47. Mai Đình Yên, 1969. *Các loài cá kinh tế nước ngọt miền Bắc Việt Nam*. Nxb Khoa học và Kỹ thuật, Hà Nội.
48. Mai Đình Yên, 1978. *Định loại cá nước ngọt các tỉnh phía bắc Việt Nam*. NXB Khoa học và Kỹ Thuật.
49. Mai Đình Yên, Nguyễn Văn Thiện, Lê Hoàng Yên, Nguyễn Văn Trọng, 1992. *Định loại cá nước ngọt Nam Bộ Việt Nam*. Nxb Khoa học và Kỹ Thuật, Hà Nội, trang 36 - 135.
50. Ying Gui Dai, Jun Xing Yang, 2003. *Phylogeny and Zoogeography of the Cyprinid Hemicultrine Group (Cyprinidae: Cultrinae)*. Zoological Studies 42(1). pp. 73 - 92.
51. Yue Peiqi et al, 2000. *Fauna Sinica Osteichthyes Cypriniformes III*. Science Press Beijing China, 661 p (chinese).
52. Walter J. Rainboth, 1996. Rainboth W. J., 1996. *Fishes of the Cambodian Mekong* FAO, 1996.
53. <http://www.fishbase.org/search.php>

The photo habitat survey



Zing Zing



Lồ Ô



Dụng cụ thu mẫu



Cố định và chụp ảnh mẫu vật



Khe Ry



Khe Lạnh



Hang Én



Hang Én



Hung Giàng



Hung Giàng



Thu mẫu ở Hà Cà Tốt



Lẩn thợ săn Hà Cà Tốt



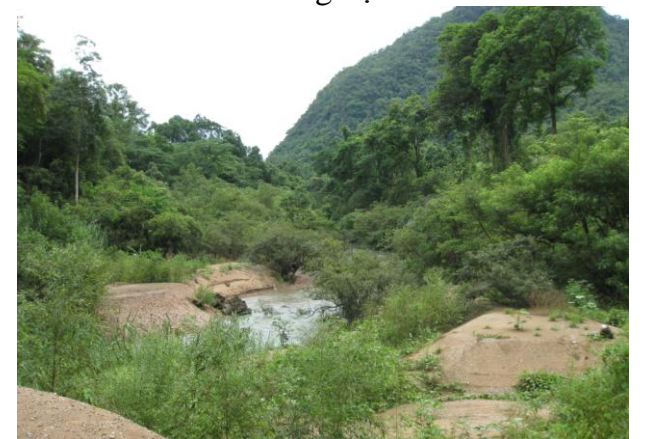
Hung Bùng



Hung Sạc



Moặc Bà Đa



Chà Ang

Pictures of fish species in addition to the National park Phong Nha Ke Bang



Danio gigber Kottelat, 2000



Danio fangfangae Kottelat, 2000



Nicholsicypris dorsohorizontalis Ng. & Do., 1969



Acheilognathus tonkinensis (Vailant, 1892)



Rhodeus ocellatus (Kener, 1867)



Hypsibarbus annamensis (Pel. & Che., 1936)



Neolissochilus benasi (Pel. & C., 1936)



Neolissochilus cf. benasi (Pel. & C., 1936)



Onychostoma cf. gerlachi (Peters, 1881)



Poropuntius solitus Kottelat, 2000



Puntius brevis (Bleeker, 1850)



Sytomus binotatus (Valenciennes, 1842)



Lobocheilos sp.



Cobitis taenia Linnaeus, 1758



Annamia normani (Hora, 1931)



Schistura bolavenensis Kottelat, 2000



Schistura chapaensis (Randal, 1944)



Schistura cf. *chapaensis* (Randal, 1944)



Schistura finis Kottelat, 2000



Schistura hingi (Herre, 1934)



Schistura cf. hingi (Herre, 1934)



Schistura huongensis Freyhof & Serov, 2001



Schistura magnifluvis Kottelat, 1990



Schistura cf. magnifluvis Kottelat, 1990



Schistura nudidorsum Kottelat, 1998



Schistura obeini Kottelat, 1998



Schistura pellegrini (Rendahl, 1944)



Schistura spilopectera (Valenciennes, 1846)



Schistura psittacula Freyhof & Serov, 2001



Schistura hungdang 1.



Schistura hungdang2.



Sewellia lineolata (Valenciennes, 1836)



Glyptothorax laosensis Fowler, 1934



Glyptothorax quadriocellatus (Mai, 1978)



Glyptothorax zanaensis Wu, He & Chu, 1981



Mastacembelus cf. armatus (Lacepède, 1800)



Terapon jarbua (Forsskål, 1775)



Oreochromis niloticus (Linnaeus, 1758)



Bostrychus sinensis Lacepède, 1801



Favonigobius aliciae (Herre, 1936)



Gnatholepis calliurus Jordan et Seale, 1905



Oxyurichthys microlepis (Bleek, 1849)



Oxyurichthys tentacularis (Valenciennes, 1837)



Paragobiodon echinocephalus (Ruppell, 1828)



Papuligobius uniporus (Kottelat, 2001)



Psammogobius biocellatus (Valenciennes, 1837)



Pseudapocryptes elongatus (Cuvier, 1816)



Rhinogobius brunneus (Tem. & Sch., 1845)



Yongeichthys criniger (Valenciennes, 1837)



Trichogaster trichopterus (Pallas, 1770)

List of participants and those who have contributed to the survey

No.	Full name	Office	Position
1.	TS. Nguyễn Thái Tự	Vinh University	Team Leader
2.	ThS. Hồ Anh Tuấn	Vinh University	Member
3.	TS. Hoàng Ngọc Thảo	Vinh University	Member
4.	SV. Hoàng Quốc Dũng	Vinh University	Member
5.	SV. Nguyễn Thị Hằng	Vinh University	Member
6.	SV. Nguyễn Thị Hoàn	Vinh University	Member
7.	SV. Nguyễn Thị Thiện	Vinh University	Member
8.	SV. Nguyễn Thị Xuyên	Vinh University	Member
9.	SV. Nguyễn Thị Mỹ Yến	Vinh University	Member
10.	Nguyễn Văn Đại	PN - KB National park	Rangers
11.	Nguyễn Văn Tiến	Son Trach - Bo Trach	Specimens collection supporters
12.	Nguyễn Văn Minh	Son Trach - Bo Trach	Specimens collection supporters
13.	Nguyễn Văn Chóc	Thuong Trach - Bo Trach	Local guides
14.	Nguyễn Văn Chiêu	Thuong Trach - Bo Trach	Specimens collection supporters
15.	Hoàng Văn Quyền	Truong Son - Quang Ninh	Local guides
16.	Võ Văn Bắc	Truong Xuan - Quang Ninh	Specimens collection supporters
17.	Nguyễn Văn Hoàn	Xuan Trach - Bo Trach	Local guides
18.	Nguyễn Hữu Mạnh	Xuan Trach - Bo Trach	Specimens collection supporters
19.	Hoàng Xuân Đồng	Thuong Hoa - Minh Hoa	Specimens collection supporters
20.	Cao Văn Thành	Thuong Hoa - Minh Hoa	Local guides

**Nature Conservation and
Sustainable Natural Resource
Management in Phong Nha – Ke
Bang National Park Region
Project**

FINAL REPORT:

**Biodiversity Survey of Cave Invertebrates
In and Around the Phong Nha – Ke Bang
National Park, Quang Binh, Vietnam.**

**Pham Dinh Sac, PhD
February 2012**



Vietnam-Germany Development Cooperation (BMZ 2004 65 989)



Table of Content

Abstract.....	4
Acknowledgements.....	7
1. Introduction	8
1.1 Phong Nha - Ke Bang National Park and the PNKB Regional Project.....	8
1.2 Brief history of the Phong Nha - Ke Bang National Park relevant to cave invertebrate survey.....	8
1.3 PNKB physical structure and climate	8
1.3.1 PNKB physical condition.....	9
1.3.2 Climate.....	10
1.4 Previous biodiversity survey work on cave invertebrates in and around the PNKB National Park	13
2. Objectives of the survey	13
2.1 Aims and objectives of the biodiversity survey on cave invertebrates.....	13
2.2 Scope of the survey on cave invertebrates	14
3. Cave Invertebrate Survey	14
3.1 Overview	14
3.2 Methodology, sampling scheme, and survey locations	16
3.3 Results	17
3.3.1 Cave invertebrate species group in the PNKB National Park and the extension area.....	17
3.3.2 Threats to and management concerns of the cave invertebrate biodiversity in the PNKB National Park and the extension area	40
4. Conclusions and Recommendations	42
4.1 The status of the cave invertebrate biodiversity at the PNKB National Park... ..	42
4.2 Threat assessments.....	42
4.3 Recommended actions	42
4.4 Recommendations for the NP Management Plan	43

Annex 1 Report on the training for park and survey staff.	45
Annex 2 Map of survey sites.....	46
Annex 3 Some photographs the during the survey.....	47
Annex 4 List of participants and contributors	50
Annex 5 Species-group diversity and abundance from caves in and around of the Phong Nha – Ke Bang National Park	51

Abstract

Survey on the invertebrate in caves of Phong Nha Ke Bang National Park and the extension area was carried in two times, the 1st time in August 2011, the 2nd time in November 2011. The survey were done in 16 caves of the core area (17 cave; 18 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, E cave, dry E cave, Thien Duong cave, 11 cave, Son Doong cave back gate, Tien Son cave, Toi cave, Nui Doi cave) and 5 caves in the extension area (Ruc cave, Cha Ra cave, Da Voi cave, Mu Nganh cave, Mo O cave)

The survey result collected 730 individuals including 58 species-groups of 7 classes, 22 orders in caves of Phong Nha- Ke Bang National Park and the extension area.

There are many special achievements:

- Two new scorpion species of new genus (**Vietbocap**) has been published. The first species was named scientifically *Vietbocap thienduongensis* Lourenco & Pham and was published in the C.R.Biologies. Vietnamese name of this scorpion species is *Thien Duong scorpion* (since they were found in Thien Duong cave). The second was found in Tien Son cave with scientific name of *Vietbocap canhi* Lourenco & Pham, which was published in Zookeys. Two of these species belong to the Pseudochactidae family. So far, in the world, for Pseudochactidae family, only 4 species of 3 genera (1 species of *Troglokhammouanus* genus found in Laos; 1 species of *Pseudochatas* genus found in Uzbekistan and Tajikistan and 2 species of *Vietbocap* genus found in Vietnam) have been found. They are specific species, adapting to the living environment inside caves. The isolation with outside environment and the special light condition and humidity condition have generated the endemic species in the area.

- Besides, there are many new and endemic species which were found in the surveyed caves; However, they have not been published yet due to the not enough the time and specimens.

Currently, there are hundreds caves in Phong Nha Ke Bang while this survey was only conducted in 21 caves, so the result only reflects little about the biological diversity of the area. More comprehensive surveys should be implemented to assess the fauna diversity in Phong Nha- Ke Bang National Park. This will contribute to increase our knowledge on biological diversity and endemic species in this area.

The large and long caves with a complicated structure with many corners are more valuable in term of biological diversity than the small caves with a simple structure.

The main differences in faunal assemblage shown by the current survey are the dramatic differences in faunal diversity and abundance between areas used by tourists and the wild sections of the same caves. Most of the invertebrates are found in the wild sections. In addition, all of the species intended to be new taxon are found in the wild sections.

These survey results lead to several very important recommendation to ensure the caves maintain their biodiversity in the future:

- Immediately make defined pathways in the tourist caves marked by posts and rope to stop the cave floors being destroyed by people walking on them. This destroys habitat for many cave invertebrates that live in the cave. Ultimately raised walkways should be installed in all tourist areas to minimise impact to cave floors.

- Clean up the rubbish left throughout the cave. Rubbish attracts rats into the cave that will eat cave invertebrates. Besides, stop people eating and drinking inside the caves as food scraps dropped also encourage rats to live in the caves.

- Reduce noise in the caves as this is disturbing the bat and swiftlet populations which support diverse insect communities in the caves. If the noise continues, the bats and swiftlets may leave the cave permanently, destroying the cave guano insect ecosystem.

- Enforce the “no smoking” ban inside the caves as this is also disturbing the bat and swiftlet populations, and also increases rubbish dropped on floors as butts and empty packets.

- Change the lighting in the caves as it is causing the growth of lampenflora (plants that grow under artificial light in caves). The lampenflora is providing an artificial food source for surface species not usually found in caves, and thus affecting the diversity and abundance of cave invertebrates.

These recommendations were asserted for Timothy Moulds, Renee Mouritz, and Pham Dinh Sac (2010), to stop the destruction of the caves and formations and ensure World Heritage Values are maintained, but are made here in order to ensure the biodiversity values of the caves are preserved.

Acknowledgements

To finish this survey, apart from the efforts of the scientists, we received a kind cooperation and the enthusiastic support of the following organizations and individuals:

- The Project Management Board of Nature Conservation and Sustainable Natural Resource Management in Phong Nha- Ke Bang National Park Region Project.

- The Vietnam-Germany Development Cooperation,

- The management board of Phong Nha- Ke Bang National Park.

- Mr. Nguyen Trung Thuc, Mr. Le Duc Duong, Ms Vu Thi Binh Minh, Ms Nguyen Thi Ngoc Lan (Phong Nha-Ke Bang project).

- Mr. Bas van Helvoort (KfW).

- Mr. Luu Minh Thanh, Mr. Nguyen Van Huyen, Mr. Dang Dong Ha, Mr. Dinh Huy Tri, Mr. Le Thuc Dinh, Mr. Dang Ngoc Kien, Nguyen Tri Phuong (Phong Nha- Ke Bang National Park), Mr. Ho Khanh (Bo Trach District, Quang Binh Province).

This study was commissioned by the PNKB NP Region Project with funding from the Vietnam-Germany Development Cooperation.

1. Introduction

1.1. Phong Nha - Ke Bang National Park and the PNKB Regional Project

Phong Nha- Ke Bang National Park was recognized by UNESCO to be the world natural heritage in 2003 based on the geologic and geomorphic criteria with the valuable carxto areas and the scene of caves. This area is valuable in biological diversity and becomes the international tourist destination as well as the domestic tourist destination with the number of increasing tourists. The average number of tourist turns to Phong Nha- Ke Bang National Par is 350.000 turns each year. The project of conservation and unsustainable management of the Natural resource in PNKB National Park targets to enhance the management and the conservation of the PNKB natural heritage and reduce the stress on the natural resource of the National Park.

The project of conservation and unsustainable management of the natural resource in Phong Nha- Ke Bang covers the internal area of Phong nha- Ke Bang National Park of 116,824 ha (including the extended area of 31,070 ha), the outside intermediate zone includes 13 surrounding communes of 3 districts, Bo Trach, Minh Hoa and Quanh Ninh, the National park is located at the west of Quang Binh, Vietnam. The 13 surrounding communes are Truong Son in Quang Ninh, Thuong Hoa, Trung Hoa, Hoa Son, Dan Hoa, Trong Hoa of the Minh Hoa district, Thuong Trach, Tan Trach, Phu Dinh, Hung Trach, Son Trach, Phuc Trach and Xuan Trach of Bo Trach district. All of the Tan Trach commune areas of Bo Trach are in the Internal Area of Phong Nha- Ke Bang National Park.

1.2. Brief history of the Phong Nha - Ke Bang National Park relevant to cave invertebrate survey

The Phong Nha- Ke Bang National Park is located in Quang Binh province, Vietnam North Central Area. Thanks to the geologic and geomorphic

characteristics, Phong Nha- Ke Bang was recognized to be World Natural Heritage in 2003 by Unesco. The internal area is about 860 km² with more than 300 recognized caves with the Son Dong world biggest cave. The first cave was discovered by the British Scientists. The discovery continues with the interval of 2 years and 17 caves in Phong Nha and 3 caves in Ke Bang were founded. Although the fauna in the area is highly endemic featured, thorough survey had not been conducted.

1.3. PNKB physical structure and climate

1.3.1. Physical condition

Phong Nha- Ke Bang World Natural Heritage is located in the West of Quang Binh province, along the Vietnam- Laos border.

Geographic position: 17°20' - 17°48' North Latitude and 105°46' - 106°24' East Longitude

The longest longitudinal dimension from Mu Gia mountain pass to U Bo mountain along the North West- South East direction is 70 km. The largest horizontal dimension from Tay Gat, Xuan Trach Commune (Bo Trach District) to Vietnam- Laos is about 50 km.

The area of Phong Nha- Ke Bang National Park is covered in 9 communes including Dan Hoa, Hoa Son, Trung Hoa, Thuong Hoa (of Minh Hoa District) and Xuan Trach, Thuong Trach, Tan Trach, Phuc Trach, Son Trach (of Bo Trach district). The surrounding communes include Hung Trach (Bo Trach District), Phu Dinh (Bo Trach district) and Truong Son (of Quang Ninh district)

The National Park is bordered with 15^a national road by the North, with Laos by the South and South West, with 561 national road (the former 12 A national road) by the West, with Truong Son commune (Quang Ninh District), Phu Dinh,

Hung Trach (Bo Trach District) and U Bo mountain's East lope by the East and the South East.

The total area of the national park is located in North West of The Gianh river, 26 km far from the national road 1 A, 40 km from Dong Hoi district to the North West, and 500 km from Hanoi to the South.

1.3.2. Climate

The surveyed area is a dangerous stone mountain and forest without any dedicated weather station, so the data must be collected from the nearby Tuyen Hoa, Ba Don and Dong Hoi stations. The data from observation over the past years of these stations can be reliable for assessing the weather condition of the National Park.

Thermology condition

The annual temperature varies from 23⁰C to 25⁰C. The average monthly temperature fluctuates largely, up to maximum 29⁰C in July and minimum 17⁰C on January. The absolute highest point is 41.6⁰C (May,1992). The absolute lowest point is 5,5⁰C (November, 1993).

The coldest period during a year includes December, January and February. The hottest period during a year includes June, July and August with the average temperature of over 28⁰C.

In a big lime stone mountainous area, the temperature deviation between day time and night time is very large, especially during the hot summer day, the deviation is usually over 10⁰C. In the winter day, the deviation is still over 8⁰C.

The humidity and rain condition

The National Park is of the area with high recipitation, averagely from 2000 mm to 2500 mm annually. In the mountainous areas near Vietnam- Laos Border,

the precipitation has ever been measured to be 3000 mm/ year (Minh Hoa). Three rainy months are September, October and November. The total precipitation over the rainy season (from May to December) is very high, accounting for up to 88% of the total precipitation each year. Rain is concentrated with high intensity, even 415mm/day.

In the coastal area, the number of rainy days is only 135 days, but this number increases to 160 days for the mountainous area with the extremely heavy rain accounting for 20% mainly in September and October. The corrosion and heavy flood occurs during this time.

The rain varying process exists with two maximum points: Primary point in October (500- 600 mm) or secondary point in May or June (more than 100 mm); one minimum point in February or March (30- 40 mm). The value of precipitation is low in dry season but the minimum number of rainy days is 10 days .

The evaporation is relatively high, varying from 1000 mm/ year to 1300 mm/year. The highest evaporation occurs in May, Jun, July and August because of being affected by the dry and hot westernly wind from Laos.

The average humidity is at average level (83- 84%) with the much lower humidity in dry season at 66- 68%, even down to 28%, especially under the strong western wind from Laos with dry, hot weather potential for the forest fire and combustion.

Wind condition

Two main windy seasons are winter and summer.

Winter wind: From November to January next year, prevailly the North East wind with some days under the East or South East wind.

Summer wind: Due to the geographic feature, from May to August, the South West wind is turned to North West wind by high mountains. The wind is hot and dry causing hardship for the agriculture and forest protection.

Annually, there are 50 days under the thunderstorm and 1 or 2 days under the storms of over level 8.

Therefore, the Phong Nha- Ke Bang bears the climate characteristics of Quang Binh climate which is the monsoon tropical climate with dry and hot summer and late rainy season (in Autumn and Winter) and the affection from storms and coldness from the North.

Hydrologic condition

The National Park area is located totally in the streams and rivers like Rao Thuong, Chay river, Trooc river, Son river and so on which all are the mountain stream of the Gianh river. The national park includes a large lime stone area leading to the underground water flow. On the ground, there are some little flumes together to Rao Thuong, but flow separately under the ground across the caves, then together to Chay river, Trooc river, confluent to Son river, then pour to Gianh River's mountain stream. In the rainy season, the water level increases in the dried streams, creating the heavy flow and local flood; however, after the rain, water level is down fast through the "suction eyes". The flood season usually occurs in middle September till October.

Apart from the main rainy season, Son river is also affected by the primary rains in May and June. This rain sometimes causes the heavy flood. After the flood, the riverbank areas are deposited with alluvium, causing the deformation of the river from the phenomena of "extended in one side and broken in other side"

The dry season in January to July, the little flumes become "dead flumes". Chay river and Son river has the low water level and the minimum flow rate.

1.4 Previous biodiversity survey work on cave invertebrate in and around the PNKB National Park

Up to now, there is only a survey on the invertebrate diversity in Phong Nha-Ke Bang National park conducted by Drs. Pham Dinh Sac (Vietnam), Tim Moulds and Renee Mouritz (Australia). The survey was conducted during 5 days, in 3 caves including Phong Nha cave, Tien Son cave and Toi cave. The primary results show that there are 248 invertebrate individuals, 41 morphological species. Most of the samples collected from this survey are keeping in Phong Nha-Ke Bang National Park, the work of giving a scientific name for the species has not been implemented. In this survey, a new scorpion species(Vietbocap) was found in Tien Son cave (Lourenco and Pham, 2010)

2. Objectives of the survey

2.1. Aims and objectives of the biodiversity survey on cave invertebrate

- Carry out surveys, produce species inventories and give statistics on invertebrate groups living in the caves in the karst of Phong Nha – Ke Bang;
- Study diversity including new records and taxons new for science;
- Evaluate the impacts of human disturbance in Phong Nha cave and species vulnerability
- Propose monitoring plans and management solutions to conserve the cave biodiversity value.
- Training for National Park staffs on practising in the field and developing a simple monitoring plan for cave biodiversity value.

2.2. Scope of the survey on cave invertebrate

- Conduct surveys, investigate, and study to classify invertebrates in two types of caves including natural caves and impacted caves by human in the studied areas.
- Analyze samples collected after the survey to find out new records for the invertebrate fauna, and the new taxons to science;

The survey on invertebrate fauna in the Phong Nha Ke Bang National Park was conducted into 2 phases:

We carried out the survey on invertebrates in 21 caves of Phong Nha- Ke Bang National Park including the core area and extension area.

The first time was conducted during 10 days, from 4th August to 15th August, 2011 in the core area of Phong Nha-Ke Bang National Park. Thirteen (13) caves were selected for doing survey including 17 cave, 18 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, E cave, dry-E cave, Thien Duong cave, 11 cave, Son Doong cave back gate.

The second time was also conducted during 10 days from 18th November to 28th November, 2011. Eight caves were selected for doing survey including 5 caves in extension area (Ruc cave, Cha Ra cave, Da Voi cave, Mu Nghanh cave, Mo O cave) and 3 additional caves in core area (Tien Son cave, Toi cave, Nui Doi cave)

3. Cave invertebrate survey

3.1. Overview

Howarth (1983) shows that invertebrates living in caves are not only diversified in number of species and individuals but also very typical in morphology and carry high endemism. It is separation from the external environment, together with

differences in light regime as well as moisture that helps form specialized species adapted to living conditions in caves. Thus many new taxons have been recorded in the caves around the world.

Besides, many invertebrate species are threatened by human impacts and are at risk of extinction if not preserved. Due to the local economic development, many caves have been exploited to serve the tourism activities. The development of tourism has not only destroyed the natural structure of the caves, but also affected the fauna living in the caves.

Many large and small caves which have been discovered in Phong Nha – Ke Bang region, are seen as living natural museum, a residence for many local invertebrates and carry very special characteristic but have not been studied. The most remarkable discovery is a new genus of Scorpionida, *Vietbocap*, described in 2010 by Lourenço and Pham.

The discovery and description of new taxons for science will evidently occur given the poor knowledge and known level of endemicy of the invertebrate fauna in Phong Nha – Ke Bang: it has to be carried out urgently so as to clarify the potential value of biodiversity in this region.

Beside new records for the invertebrate fauna and new taxon description, the proposed study of solutions to conserve the habitat of invertebrates is extremely important.

The survey's focuses are clarifying the biodiversity value of invertebrates in caves of the studied region replacing results in a larger regional context, training of managers as well as staffs of the National Park to explore invertebrate fauna living in the caves – a field that is very new in Vietnam, raising awareness of policy makers, contributing as a basis for the sustainable use and management of the caves system in Phong Nha – Ke Bang.

3.2. Methodology, sampling scheme, and survey locations

Sampling methods:

Methods of investigation, collection of standard samples for cave invertebrates include:

- Using lights to observe and collect specimens by hand;
- Use a sieve to collect specimens in the rubbish or debris on the cave floor;
- Pitfall traps were used to collect cave floor-active invertebrate and to measure their relative abundance
- In addition, some terrestrial groups will be sampled by hand (using small brush, forceps and aspirator), by litter screening, and by guano, soil and litter sampling with fauna extraction on Berlese funnels.

Specimens will be deposited at the Institute of Ecology and Biological Resources and other International Museums for further taxonomic studies.

Survey locations:

Two phases of survey will be carried out in August and November 2011.

The first time was conducted during 10 days, from 4th August to 15th August, 2011 in the core area of Phong Nha-Ke Bang National Park. Thirteen (13) caves were selected for doing survey including 17 cave, 18 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, E cave, dry-E cave, Thien Duong cave, 11 cave, Son Doong cave back gate.

The second time was also conducted during 10 days from 18th November to 28th November, 2011. Eight caves were selected for doing survey including 5 caves in extension area (Ruc cave, Cha Ra cave, Da Voi cave, Mu Nghanh cave, Mo O cave) and 3 additional caves in core area (Tien Son cave, Toi cave, Nui Doi cave)

Caves chosen for the study are divided into two types including the impacted caves by human and natural caves. Selecting caves for highest possible spatial coverage of the study area and highest diversity of habitats is essential for efficient biodiversity survey.

Space inside caves is divided into several different biological zones: the entrance zone is the cave gate, followed by a transition zone, and finally the dark zone. The regions have different light regime and environmental conditions. Surveys are conducted in all three zones to determine the main residence of the invertebrates in caves.

3.3. Results

3.3.1 Cave invertebrate species group in the PNKB National Park and the extension area

According to the survey result in the caves of core zone and extension area of Phong Nha-Ke Bang, there are 730 invertebrate individuals including 58 species groups from 21 caves. They are of 7 classes, 22 orders.

A. ARACHNIDA:

Classical cave Arachnid groups were found in Ke Bang caves includes of 5 orders: Araneae, Scorpionida, Opiliones, Pseudoscorpionida, Schizomida, Acarina. The most diversified were spiders, which include a number of troglobitic and obscuricole species in all visited caves

Order Araneae:

Family Oonopidae:

One species of the family Oonopidae collected at Phong Nha Ke Bang. Most of specimens found in cave entrance zone.



Oonopidae sp.

Thien Duong cave, Son Doong cave, Mo O cave.

Family Sparassidae:

Two species of the family Sparassidae recorded. One of them are troglobitic species. The rest species no troglobitic and present at all visited caves.



Heteropoda sp.

Tien Son cave, 17 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Cau Chay cave, Sot cave, E cave, dry-E cave, Thien Duong cave, Toi cave, Ruc cave, Da Voi cave, Mo O cave.

Family Amaurobiidae:

Two species of Amaurobiidae family were found in Phong Nha Ke Bang, scattered in entrance zone, transition zone and dark zone. One species is new to science.



Coelotes sp.

Tien Son cave, 18 cave, Thien Duong cave, Cha Ra cave, Da Voi cave, Mo O cave.

Family Araneidae:

Two spider species with round and net casting bell were found in Phong Nha Ke Bang area. Most of spider individuals were found in entrance zone.



Araneus spp.

Tien Son cave, Son Doong cave, Toi cave, Mo O cave.

Family Ctenidae:

One species was found in Phong Nha Ke Bang area. This spider family was found in both core area and extension area.



Ctenidae sp.

Ba Da cave, E cave, Cha Ra cave, Da Voi cave

Family Gnaphosidae:

One spider species of Gnaphosidae family was found. They were found in the entrance zone and transition zone.



Gnaphosa sp.

17 cave, Phong Nha cave, Tuong cave, Son Doong cave, Mu Nghanh cave, Mo O cave.

Family Pholcidae:

One spider species of Pholcidae family was found. They were mostly seen in caves of core area of Phong Nha Ke Bang National Park.



Pholcidae sp.

17 cave, 18 cave, Lo Do cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, E cave, dry-E cave, Thien Duong cave, Toi cave, 11 cave, Mo O cave.

Family nhện lùn Linyphiidae:

Three species of Linyphiidae were found in the surveyed area. One species was new to the science with specific life in the cave. They were found in the dark area of caves. This family appeared with large number of individuals in Son Doong cave back gate.



Linyphiidae spp.

Tien Son cave, Son Doong cave, Da Voi cave, Mo O cave.

Family Leptonetidae:

One species of Leptonetidae was new to the science with specific life in the cave. They were found in the deep and dark area of the caves.



Leptoneta sp.

E cave, Son Doong cave, Mo O cave.

Family Symphytognathidae:

Two species of one genus of Symphytognathidae family were found in Phong Nha Ke Bang area. One is new to the science.



Anapistula sp.

18 cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, E cave, dry-E cave, Thien Duong cave, Son Doong cave, Mo O cave.

Family Telemidae:

One species of Telemidae family was probably new to the science, which was found in Phong Nha Ke Bang area. This is a specific species in the caves. These spider individuals were found in dark area of natural caves.



Telema sp.

Thien Duong cave, Son Doong cave, Toi cave, Da Voi cave, Mo O cave.

Family Tetrablemmidae:

One species was new to the science. This was of Tetrablemma family found in Sot cave and dry-E cave. This spider species appeared with large number of individuals in Sot cave. Samples were collected mostly in dark zone of the cave



Tetrablemma sp.

Sot cave, dry-E cave.

Family Theridiidae:

A large population of Theridiidae long-leg spider family was found in Phong Nha Ke Bang area with 85 individuals of 3 species, one genus. Samples were collected mostly in entrance zone and transition zone.



Theridion spp.

17 cave, Ba Da cave, Lo Do cave, Tuong cave, Sot cave, E cave, dry-E cave, Thien Duong cave, Son Doong cave, Toi cave, 11 cave, Nui Doi cave, Cha Ra cave, Da Voi cave, Mo O cave.

Order Scorpionida:

Family Pseudochactidae:

Two new species of scorpions have been discovered in Phong Nha Ke Bang National Park. These two species of scorpions belong to the Pseudochactidae family, scientifically named as *Vietbocap thienduongensis* Lourenco & Pham in Thien Duong cave and *Vietbocap canhi* Lourenco & Pham in Tien Son cave.

So far, only four species of three genera of the Pseudochactidae have been found in the world. They are a species of the Troglokhammouanus genus discovered in Laos, a species of the Pseudochatas genus discovered in Uzbekistan and Tajikistan, and two species of the Vietbocap, recently discovered in Vietnam.

These were special species that adapts to the living conditions in caves. The separation from the environment outside as well as the differences in lighting and humidity formed the endemic species for the region.



Vietbocap canhi

Tien Son cave



Vietbocap thienduongensis

Thien Duong cave

Order Opiliones

Opiliones are regular hosts of the Ke Bang caves, wandering as isolated specimens on cave walls in humid places. Absent in guano. Predators. At least 2 troglobitic species



Opilionida spp

Phong Nha cave, Toi cave, Mo O cave

Order Pseudoscorpionida

Always rare in caves, with very few troglobites in Southeast Asia. Predators. On the 5 collected species, at least 4 are new to science.

Family Chthoniidae

Two new species in 2 genera are the first blind Chthoniidae of Vietnam.



Lagynochthonius sp1.
Phong Nha cave, Thien Duong cave,
Son Doong cave



Lagynochthonius sp2.
Mo O cave, Nui Doi cave



Lagynochthonius sp3.
Mo O cave



Tyrannochthonius sp.
Nui Doi cave

Family Chernetidae

One species of family Chernetidae has found in Da Voi cave



Eremochernes sp.
Da Voi cave

Order Schizomida

Only one specimen of a probably troglobitic species collected in Ke Bang caves. Predator. Mostly in warm and humid tropical climates in Southeast Asia. Soil and cave species frequent in more southern tropical regions, unstudied



Schizomida sp

Phong Nha cave, Da Voi cave

Order Acarina

One or two troglobitic species. Predators. Rather frequent in caves of Southeast Asia, where they represent the probably troglobitic and free stages of species that are parasite on bat during other part of their life cycle.



Trombidioidea sp

Mo O cave, Nui Doi cave



Uropodida sp

11 cave

B. CRUSTACEA:

Terrestrial Isopoda (Oniscida) are abundant and diversified in caves, while aquatic Crustacea are by far the most diversified group of aquatic cave fauna in the world. While many Oniscida were collected during the survey, aquatic Crustacea were only represented by a single specimen of crab, in spite of careful examination

of streamlets and puddles. The same absence of large aquatic Crustacea except crabs is retrieved in the Khammouane and norther Vietnam karsts, while the small limestone outcrops of southern Vietnam and Cambodia host a rather rich cave aquatic fauna. Microcrustacea (Copepoda and Ostracoda in particuar) were however present in water sampes, but have not been listed here because of taxonomic difficulties

Isopoda:

Oniscidea are represented in all caves of the world by a large number of species. They are active decomposers of the litter. Three families (Armadillidae, Philosciidae, Styloniscidae) were present in the Ke Bang caves, all with troglobitic forms. Oniscida are also very common in forest soils of Ke Bang, with different pigmented and well oculated species.



Armadillidae sp.

Tien Son cave, 17 cave, 18 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Tuong cave, Sot cave, E cave, dry-E cave, Thien Duong cave, Son Doong cave, Toi cave, Nui Doi cave, Da Voi cave, Mu Nghanh cave, Mo O cave.



Philosciidae sp.

17 cave, Ba Da cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, Thien Duong cave, Son Doong cave, Toi cave, Ruc cave, Cha Ra cave, Da Voi cave, Mu Nghanh cave, mo O cave.



Styloniscidae sp.

Phong Nha cave, Thien Duong cave, 11 cave, Nui Doi cave, Cha Ra cave

Decapoda:

Well diversified in Southeast Asian caves, including *Nemoron nomas* Ng 1996, a monospecific endemic genus of Ke Bang karst, that L. Deharveng collected more than 15 years ago in Hang Toi. We did not retrieve this species during the survey. Another remarkable troglomorphic species (*Erebusa calobates* Yeo & Ng 1999) is frequent in the Khammouane caves, but not found so far in Ke Bang. During the present survey, only one specimen of crab, still unidentified, was collected



Brachyura sp.

Phong Nha cave, Thien Duong cave

C. MOLLUSCA:

Subulinidae và Pupilloidea are widely distributed in the caves of Southeast Asia.



Subulinidae sp.

Phong Nha cave, Thien Duong cave, Da Voi cave, Mo O cave



Pupilloidea sp.

11 cave, Toi cave, Cha Ra cave, Mo O cave

D. INSECTA:

Order Collembola:

Our survey brought unexpected results, as the dominant Collembola in the Ke Bang caves belong to a genus close to *Acrocyrtus* (family Entomobryidae, subfamily Lepidocyrtinae). Other karsts in Vietnam, in Southeast Asia or in the world host completely different lineages of Collembola. The Ke Bang (and Khammouane) karsts therefore appear as a new and unique biogeographic region regarding their troglobitic Collembolan fauna. The genus *Acrocyrtus* itself has many representatives in the forest soils of tropical Asia including the Ke Bang karst, most of them undescribed.

Family Entomobryidae:

A large family, with many tropical species, mostly epigean and in soil. They include most of the cave species of Collembola in the tropics



Acrocyrtus spp.

Thien Duong cave, Lo Do cave, Sot cave



Sinella spp.

Da Voi cave, 11 cave, Nui Doi cave

Họ Isotomidae

Rare and non-troglobite species of two genera in Ke Bang caves. Rather numerous species, some very abundant and parthenogenetic in the soil.



Folsomia sp.

Thien Duong cave, Da Voi cave, Ba Da cave, Phong Nha cave, Tuong cave, Thien Duong cave

Họ Oncopoduridae



Oncopodura sp.

Phong Nha cave, Da Voi cave

Họ Neanuridae



Ceratrimera sp.

Thien Duong cave, 11 cave, Nui Doi cave

Họ Neelidae



Megalothora sp.

Phong Nha cave, 11 cave

Order Orthoptera :

Family Rhaphidophoridae

Rhaphidophoridae crickets are at the base of subterranean terrestrial communities across caves of all regions of tropical Asia. Our survey showed that the characteristic cave genus of Phong Nha Ke Bang, *Diestrammena*, is represented by up to three morphospecies in a same cave, at different level of adaptation to cave life. *Diestrammena* sp. 1 has large eyes and dark pigment pattern, sp. 2 has medium-size eyes and uniform caramel colour, sp. 3 has small narrow eyes and uniform pale yellowish colour. All species are likely to be new to science.

Barcoding of different populations will help to detect further cryptic diversity in sp. 2 and sp. 3



Diestrammena sp1

Toi cave, 17 cave, 18 cave, Phong Nha cave



Diestrammena sp2

Lo Do cave, Tuong cave, Ruc cave, Toi cave, Da Voi cave



Diestrammena sp3

Sot cave, E cave, dry-E cave, Cha Ra cave, Thien Duong cave, Mu Nghanh cave

Order Coleoptera:

Family Carabidae

In several caves, small Carabidae from outside habitats were collected in caves. Among them, the most frequent were Scaritinae. The most remarkable discovery of the survey is a highly troglomorphic Trechinae. The most unexpected and remarkable discovery of the survey. It is a new species and a new genus (Deuve, comm. pers.), very modified for cave life, that superficially recalls the *Sinaphaenops* of south China caves. This finding extends towards the south the presence of highly troglomorphic beetles, long considered to be only present in subtemperate areas.



Carabidae spp.

Toi cave, Tien Son cave, 17 cave, Phong Nha cave, Tuong cave, dry-E cave, Nui Doi cave



Trechinae sp.

Cha Ra cave



Scaritinae spp.

11 cave, Toi cave, Ruc cave

Family Pselaphidae



Pselaphidae sp.

Sot cave, dry-E cave, Thien Duong cave

Family Staphylinidae



Staphylinidae sp. 1

Da Voi cave, 11 cave



Staphylinidae sp. 2

Nui Doi cave, Son Doong cave, Mo O cave

Family Leiodidae



Ptomaphagus sp.

Mo O cave, 18 cave, Lo Do cave, Sot cave,
dry-E cave, Thien Duong cave, Cha Ra cave

Blattodea

No cave cockroach was found during the survey, confirming that highly troglomorphic Nocticolidae characteristic of caves in warm and humid tropical climates of Southeast Asia do not reach the latitude of the Ke Bang karst. The only collected cockroach is probably not a cave species



Blattodea sp.

Da Voi cave, Mo O cave, 11 cave, Ba Da cave, Lo
Do cave

Order Hemiptera

Family Cixiidae

Some species of Cixiidae are adapted to cave life (depigmentation, reduced eyes). They are suckers, found on hanging roots in shallow caves. A single specimen was found during the survey, but favourable habitats were very few



Cixiidae sp.

Da Voi cave

Order Psocoptera

Family Psilopcosidae



Psocoptera sp.

Mo O cave

Order Heteroptera

Family Reduviidae

Large assassin bugs (of the subfamily Triatominae?), apparently adapted to subterranean life, were collected in two caves. Such Reduviidae are sporadically encountered in Southeast Asian caves, though rarely cited in the literature



Reduviidae sp.

Da Voi cave, Cha Ra cave, Mo O cave

Order Lepidoptera

Family Tineidae



Tineidae sp.

11 cave, Tuong cave

Order Diptera

Brachycera:



Brachycera sp

Mo O cave

Order Hymenoptera

Family Formicidae

Only Ponerinae were found during the survey. They are regular hosts of the caves of Ke Bang, usually not far from the entrance.



Anochetus sp.

Tien Son cave, 17 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, dry-E cave, Thien Duong cave, Toi cave, Ruc cave, Cha Ra cave, Da Voi cave, Mo O cave.



Hypoponera sp.

17 cave, Ba Da cave, Phong Nha cave, Cau Chay cave, Sot cave, dry-E cave, E cave, Toi cave, Cha Ra cave, Da Voi cave.

E. ENTOGNATHA:

Order Diplura

Family Campodeidae:

A single species collected, not troglomorphic.



Campodeidae sp.

Thien Duong cave

F. MYRIAPODA:

Diplopoda

Family Sinocallipodidae

Large millipedes, usually oculated, often cave-restricted, and endemic of continental Southeast Asia. Second record for the Ke Bang karst, as *Sinocallipus deharvengi* Stoev & Enghoff 2011 has just been described from the Ke Bang karst, in caves of the Phong Nha area.



Sinocallipus sp.

Cha Ra cave, Sot cave, dry-E cave, Thien Duong cave, Son Doong cave

Family Glomeridae

A single genus with troglobitic species in Southeast Asia: *Hyleoglomeris*, widespread in northern Vietnam, Laos and southern China caves. The specimens collected in Ke Bang caves have no eyes and no pigment. First record of the genus in Ke Bang, but present in Khammouane (Laos) with two cave species.



Hyleoglomeris sp.

Thien Duong cave

Family Cambalopsidae

Cambalopsidae have experienced a huge radiation recently brought to light by the works of Golovatch, in caves of southeast Asia, from Borneo to southern China. Species are mostly linked to cave, and many to cave guano. Several species (at least three) are included in the collected material, with eyes more or less reduced.



Cambalopsidae sp.

17 cave, Ba Da cave, Lo Do cave, Phong Nha cave, Tuong cave, Cau Chay cave, Sot cave, E cave, dry-E cave, Thien Duong cave, 11 cave, Son Doong cave, Cha Ra cave, Da Voi cave, Mo O cave.

Family Haplodesmidae

Another milliped family, including a genus (*Eutrichodesmus*) which underwent a remarkable radiation centered on Vietnam, and very recently recognized. In Ke Bang, 5 morphotypes (probably species), one in each cave where the genus was present, can be recognized, differing by the development of the dorsal crest. They are illustrated below, ordered by order of growing size of the crest



Eutrichodesmus sp.1

Thien Duong cave, Tien Son cave



Eutrichodesmus sp.2

Mo O cave, Da Voi cave



Eutrichodesmus sp.3

Phong Nha cave, Lo Do cave



Eutrichodesmus sp.4

Cha Ra cave, Son Doong cave



Eutrichodesmus sp.5

Da Voi cave

Family Pyrgodesmidae

Pyrgodesmidae are well diversified in tropical soils, but few species adapted to cave life. The one collected during our survey is probably not a troglobite.



Pyrgodesmidae sp.

Da Voi cave

Family Paradoxosomatidae

These beautiful millipede has long furcated spines on the body. They are found in soil and caves of Southeast Asia. Possibly troglotic species in Thien Duong cave.



Desmoxytes sp.

Thien Duong cave

Family Opisotretidae

Cf Opisotretidae sp., probably troglotic.



Opisotretidae sp.

Thien Duong cave

Family Polydesmidae

Near Polydesmidae, spp., probably troglotic.



Polydesmidae sp.

Thien Duong cave

G. OLIGOCHAETA:

Several Oligochaeta belongs to two families Megascolecidae và Octochaetidae has recorded in caves of Phong Nha Ke Bang. However, these specimens collected in entrance zone, not a troglobite.

Discussion:

The survey results in 21 caves in and around the Phong Nha- Ke Bang National Park shows the major differences clustered in invertebrate fauna including the dramatic differences in species diversity, number of individuals and biodiversity values (showing by the new species to science) between the cave groups.

Group 1: the 17 cave, 18 cave, Cau Chay cave, Ba Da cave, Ruc cave, Mu Nghanh cave was low in individuals, species and biodiversity values. The caves of this group have small size (length and width). Besides, the structure of the caves in this group is very simple. These characteristics are unfavorable conditions for the development and survival of invertebrate faunas in the cave.

Group 2: the Tuong cave, Lo Do cave, Sot cave, 11 cave, Toi cave, Nui Doi cave, E cave, and dry-E cave. ll of this caves have medium diversity level.

Group 3: the Phong Nha cave, Thien Duong cave, back-door Son Doong cave, Cha Ra cave, Da Voi cave, and Mo O cave. These caves have higher level of

biodiversity than other caves. They also differ from the caves in groups 1&2 in term of the size of length and width and the complex structure with many corners. These benefit characteristics are useful for the development and survival of invertebrate fauna in the cave.

Besides, the notes in survey had showed the dramatic differences in faunal diversity and abundance between areas used by tourists and the wild sections of the same caves. The typical caves of tourism development include Phong Nha cave and Thien Duong cave. The tourism area was serve affected by the activities of tourist with unidentified rails passing through the tourist routes. It makes restrict for the cave fauna area. A large amount of bins in tourist areas and the appearance of the the rubbish and food scrapes in the cave also affect the populations of burrowing animals in this area. Many species of invertebrate fauna in tourism area are the common species and can be found in the external cave area. In contrast, the wild area has high biodiversity values in species and number of individuals. Moreover, all species are new species to science which have been discovered in wild areas.

3.3.2 Threats to and management concerns of the cave invertebrate biodiversity in the PNKB National Park and the extension area

Currently, several caves have highly biodiversity value like Tien Son cave, Thien Duong cave, Toi cave, Phong Nha cave,ect have been exploited for tourism development. Especially, our survey has recorded two new species of scorpion in Thien Duong and Tien Son cave. Tourism development accompanied by cave biodiversity reservation is our great concern today.

Caves are home for bats and birds. These animals' dung is liked by some invertebrates in the caves. Scream inside caves, natural pleasure of human beings affects greatly the natural grouping of bats and birds. These animals are the

important energy source for some invertebrates in the caves. All the changes in bat and bird population will cause great changes to the animal gathering in the caves.

Some of the tourists do not respect the rules of the National Park on using food, cigarettes in the caves, which creates a great amount of garbage in caves like water bottles, fruit drink boxes, beer packages, lucky money, clothes, egg shell, peanut shell and so on. These objects generate harmful epidemic to the caves, affecting the living things in caves.

The survey has found rat species in tourism caves. Obviously, they are living in the caves. It is a notable problem. Recycle bins in caves are the food sources for harmful animals which should be moved to the cave outside.

The current lighting system some tourism caves is not conducive to creating a suitable habitat for cave fauna. The constant light is having a detrimental effect on the bat and swiftlet populations in the caves. The current lighting system also creates a fantasy world cave experience that is a potential source of the excitement (exhibited as noise) felt by visitors in the cave. This noise will be of great disturbance to the bat and swiftlet populations within the cave systems.

These problems can be greatly improved by reducing the amount of light being used as well as the type of light used and duration of time that the lights are left on throughout the cave.

Because roads in some tourism caves are not clearly identified, backgrounds of cave are treated on, causing destroy of natural ecosystems. It is urgent for tourists to move on roads separate with cave's backgrounds.

4. Conclusions and Recommendations

4.1. The status of the cave invertebrate biodiversity at the PNKB National Park

This survey shows potential for a high endemic regional fauna with many defined valuable and rare species. There were 730 individuals including 58 species-groups belonging to 7 classes, 22 orders identified in 21 caves.

The survey confirmed many special results: two new species and one new genus of scorpion (*Vietbocap*) were published. Besides, many new species were identified in survey caves but they have not been published because of limited time and quantity of collected specimens.

4.2. Threat assessments

Many endemic species were discovered in caves of Phong Nha Ke Bang. Some species were found in caves with tourism development activities such as new species of scorpion belonging to *Vietbocap* genus at Thien Duong and Tien Son caves. Their living habitat is being narrowed caused by human's impacts. These species are being threatened and in danger of extinction if they will not be reserved.

4.3. Recommended actions

- Phong Nha Ke Bang area currently has hundreds of cave and this survey was carried out in only 21 caves, showing a very limited part of biodiversity value in this region. We need to carry out more all-sided researches to be able to assess the cave invertebrate diversity at Phong Nha – Ke Bang National Park. This action will contribute to enhance our understanding on biodiversity and endemic species here.

- The necessary action before developing tourism in new caves is to investigate the cave's biodiversity in all sides to provide basic data to be able to control effect to inside regional fauna. These basic researches will also show important habitats needed to be paid attention to reservation in each cave and show important species creatures needed to be prioritized to be protected.

- Many new species found during the survey but they have not been published yet because of limited time and quantity of collected specimens need to be collected more specimens, describe and publish to confirm regional biodiversity values.

4.4. Recommendations for the NP Management Plan

These survey results lead to several very important recommendation to ensure the caves maintain their biodiversity in the future:

- Immediately make defined pathways in the tourist caves marked by posts and rope to stop the cave floors being destroyed by people walking on them. This destroys habitat for many insects and spiders that live in the cave. Ultimately raised walkways should be installed in all tourist areas to minimise impact to cave floors.

- Clean up the rubbish left throughout the cave. Rubbish attracts rats into the cave that will eat cave invertebrates. Besides, stop people eating and drinking inside the caves as food scraps dropped also encourage rats to live in the caves.

- Reduce noise in the caves as this is disturbing the bat and swiftlet populations which support diverse insect communities in the caves. If the noise continues, the bats and swiftlets may leave the cave permanently, destroying the cave guano insect ecosystem.

- Enforce the “no smoking” ban inside the caves as this is also disturbing the bat and swiftlet populations, and also increases rubbish dropped on floors as butts and empty packets.

- Change the lighting in the caves as it is causing the growth of lampenflora (plants that grow under artificial light in caves). The lampenflora is providing an artificial food source for surface species not usually found in caves, and thus affecting the diversity and abundance of cave invertebrates.

These recommendations were asserted for Timothy Moulds, Renee Mouritz, and Pham Dinh Sac (2010), to stop the destruction of the caves and formations and ensure World Heritage Values are maintained, but are made here in order to ensure the biodiversity values of the caves are preserved.

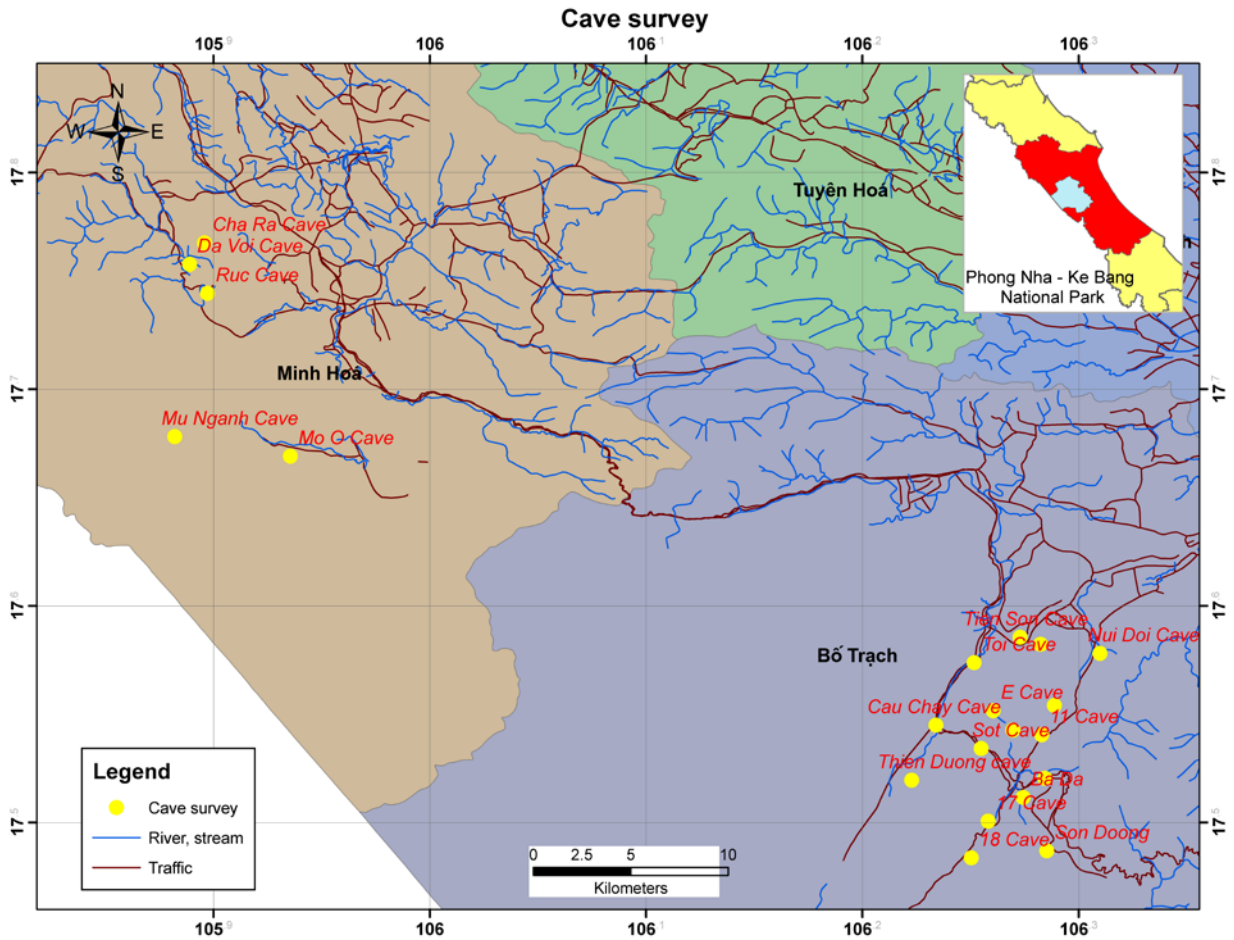
Annex 1: Report on the training for park and survey staff.

Some staffs of Phong Nha Ke Bang National Park and some local people were trained in scene to approach and enhance the knowledge on cave invertebrate biodiversity (the list as follows). The training content included:

- Basic knowledge on cave biodiversity.
- The survey methods toward cave invertebrate species included: method of observation, collecting specimens, usage of equipment and tools specialized in cave survey...
- The way to identify some typical groups of cave invertebrates.
- Current cave biodiversity situation at Phong Nha Ke Bang
- Threats to cave biodiversity.

Mr. Nguyen Tri Phuong	PNKB National Park	Staff
Mr. Dang Ngoc Kien	PNKB National Park	Staff
Mr. Ho Khanh	Bo Trach, Quang Binh	Local people
Mr. Dinh Van Nghi	Minh Hoa, Quang Binh	Local people
Mr. Cao Van Tam	Minh Hoa, Quang Binh	Local people

Annex 2: Map of survey sites.



Annex 3: Some photographs the during the survey



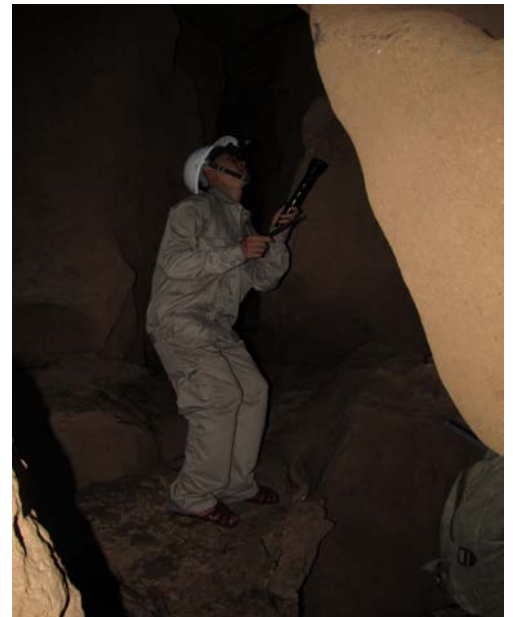
Members of survey at Thien Duong cave



Preparing for survey in cave



To located for cave



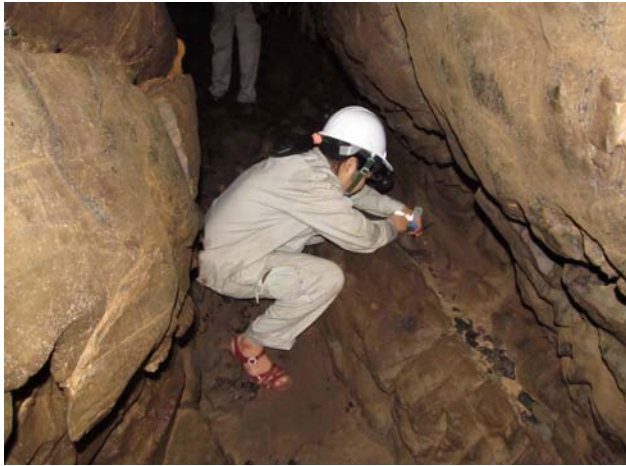
Sampling on the wall of cave



Sampling in a small branch of cave



Sampling on the wall of cave



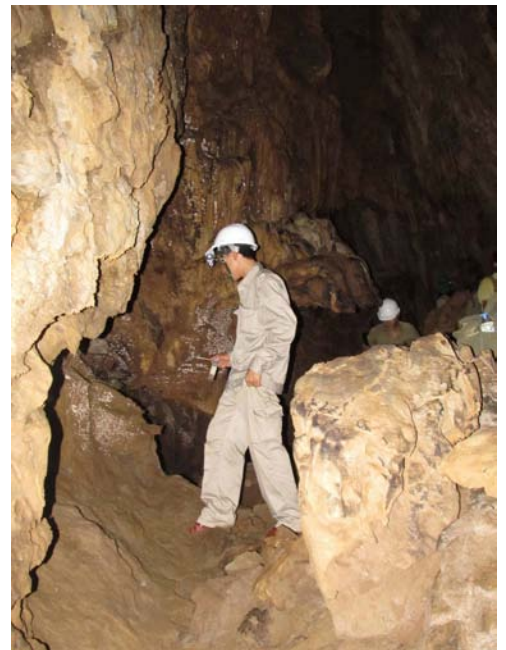
Sampling at the corner of cave



Short rest at cave



Mr Hồ Khanh checking the information of cave



Sampling



Sampling on the wall of cave



Sampling on the cave floor



Moving on the branch of cave



Sampling on the small branch of cave



Discovery in the corner of cave



Sampling together



In Thien Duong cave



New scorpion *Vietbocap thienduongensis* find in Thien Duong cave

Annex 4: List of participants and contributors

Dr. Pham Dinh Sac	Institute of Ecology and Biological Resources (IEBR)	Team leader
TS. Louis Deharveng	Muséum National d'Histoire Naturelle de Paris, France	Survey member
TS. Anne Bedos	Muséum National d'Histoire Naturelle de Paris, France	Survey member
Dr. Le Hung Anh	IEBR	Survey member
Mr. Tran Duc Luong	IEBR	Survey member
MSc. Nguyen Van Tao	IEBR	Survey member
MSc. Le Quang Tuan	IEBR	Survey member
Ms. Phung Thi Hong Luong	IEBR	Survey member
Mr. Dang Van An	IEBR	Survey member
Mr. Nong Van Minh	IEBR	Survey member
Mr. Nguyen Tri Phuong	PNKB National Park	Survey member
Mr. Dang Ngoc Kien	PNKB National Park	Survey member
Mr. Ho Khanh	Bo Trach, Quang Binh	Local people
Mr. Dinh Van Nghi	Minh Hoa, Quang Binh	Local people
Mr. Cao Van Tam	Minh Hoa, Quang Binh	Local people

Annex 5

Species-group diversity and abundance from caves in and around the Phong Nha – Ke Bang National Park

Taxon			Hang khảo sát																							
Lớp	Bộ	Nhóm loài	Động Tiên Sơn	Hang 17	Hang 18	Hang Ba Đa	Hang Lò Đờ	Động Phong Nha	Hang Tượng	Hang Cầu Chày	Hang Sốt	Hang E	Hang E cận	Động Thiên Đường	Hang 11	Hang Sơn Đòng cửa sau	Hang Tối	Hang Núi Đồi	Hang Rục	Hang Cha Ra	Hang Đá Voi	Hang Mu Ngành	Hang Mò O			
Arachnida	Araneae	Onopidae												2		4							2			
		Sparassidae	4	2		1	2	5			3	5	11	2	2	2		4		3	2	1		1		
			Amaurobiidae	2		2										4						1	3		1	
			Araneidae	1													6	2							2	
			Ctenidae				2						1								1	2				
			Gnaphosidae		1				1	2							2							1	1	
			Pholcidae		1	2			5	1	1	3	9	1	3	2	1		4						2	
			Linyphiidae	1														12					2		2	
			Lycosidae	1	2				1	2					1		1				1	1				
			Leptonetidae											1			1								1	
			Symphytognathidae			1				4	1	1	3	2	1	3		3							2	
			Telemidae													3		2	4				2		3	
			Tetrablemmidae										9		1											
			Theridiidae		3	4	6	13			19		6	7	2	7	2	15	1	2		1	3		4	
			Scorpionida	Vietbocap sp1	3																					
				Vietbocap sp2																						
			Opiliones	Stylocellidae	1											1	4									
				Triaenonychidae					4	2								2	1			2	4		1	
			Pseudoscorpionida	Chernetidae																			2		2	
				Chthoniidae						2								2		3					4	
	Schizomida	Hubbardiidae						1													1					
	Acarina	Uropodida													1			1								
		Trombidioidea						1															1			
Crustacea	Isopoda	Armadillidae	2	1	4	2	3	5	1		2	1	2	6		5	1	1			18	1	2			
		Philosciidae		2		4		2	1	3	1				4		5	1	1	4	1	1	2			
		Styloniscidae						1							1	1			1	1						
	Decapoda	Brachyura					2																			
Mollusca	Gastropoda	Subulinidae						1						1								1	1			
		Pupilloidea														1		1			1		1			
Insecta	Collembola	Entomobryidae					3				1				1	1			2		1					
		Isotomidae				2		1	2																	
		Neanuridae														2			2							
		Oncopoduridae						1														1				
		Neelidae					1								1											

Orthoptera	Rhaphidophoridae		2	1	4	1	1	1	2	6	3	1	1	2	2	2	4	3	2	1	1	
Coleoptera	Carabidae	1	1				1	2				1	1	2	6	1	2	2				
	Pselaphidae									4		2	6									
	Staphylinidae													1	1		1				2	
	Leiodidae			2		4				3		6	1					1				
Blattodea	Blattellidae				2	1														1		
Hemiptera	Cixiidae																			1		
Psocoptera	Psilopcosidae																				2	
Heteroptera	Reduviidae																			2	1	1
Lepidoptera	Tinaeidae						1							1								
Hymenoptera	Formicidae	2	4	2	3	1	4	1	2	7		4	2		6	5	4	2	3	4		1
Diptera	Brachycera																					1
Entognatha	Diplura												3									
Myriapoda	Diplopoda																					
	Sinocallipodidae									4		1	1		1					1		
	Cambalopsidae		2	1	4	12	1	3	1	5	2	9	3	2	1		1			1		2
	Haplodesmidae	2				6	1						2		1					1	1	
	Polydesmidae												1							1		
	Opisotretidae												1									
	Paradoxosomatidae												2									
	Glomeridae												1							1		
	Pyrgodesmidae																				1	
Chilopoda	Scutigera						1														1	
Oligochaeta	Haplota																					
	Megascolecidae											1										
	Octochaetidae													1								
Total		20	21	19	30	56	41	35	15	65	29	37	69	23	71	32	21	13	30	54	4	45

Phong Nha-Ke Bang National Park

World Heritage Property



World Heritage Management Planning Requirements



Mission Report

Prepared by Dr Graeme L. Worboys, Jagumba Consulting Pty Ltd
31 August 2012



AHT GROUP AG

Management & Engineering

Phone +49 201 2016-224

Fax +49 201 2016-226

Mail Huyssenallee 66-68

D-45128 Essen —Germany

Web www.aht-group.com

The Consultant has prepared this report for AHT in accordance with the instructions of the client, Quang Binh Province KfW, for their sole and specific use. Any other persons who use any information contained herein do so at their own risk.

Contents

1.	INTRODUCTION.....	1
1.1.	INTRODUCTION.....	1
1.2.	MISSION OBJECTIVES.....	1
1.3.	MISSION REPORT CONTENTS.....	1
1.4.	ACKNOWLEDGEMENTS.....	1
2.	OBSERVATIONS AND FINDINGS.....	3
2.1.	MAIN FINDINGS.....	3
2.2.	MAIN OBSERVATIONS.....	6
3.	CONCLUSIONS AND RECOMMENDATIONS.....	13
3.1.	CONCLUSIONS.....	13
3.2.	RECOMMENDATIONS.....	15
4.	AREAS OF ATTENTION FOR MANAGEMENT PLANNING.....	17
4.1.	INTRODUCTION.....	17
4.2.	STATEMENT OF OUTSTANDING UNIVERSAL VALUE.....	17
4.3.	A UNESCO ENDORSED MANAGEMENT PLAN.....	17
4.4.	A MANAGEMENT PLAN WITH AUTHORITY.....	18
4.5.	(DRAFT) OBJECTIVES OF MANAGEMENT FOR WORLD HERITAGE OUV.....	18
4.6.	A LANDSCAPE LEVEL VISION.....	19
4.7.	KARST OUV MANAGEMENT.....	19
4.8.	TOURIST CAVE MANAGEMENT.....	20
4.9.	SON DOONG CAVE DEVELOPMENT PRESSURES.....	22
4.10.	THE ROAD 20 WORKS.....	22
4.11.	ENVIRONMENTAL IMPACT ASSESSMENTS.....	23
4.12.	RESEARCH: THE CONCEPT OF A WORLD HERITAGE INSTITUTE.....	24
5.	ANNEXURES.....	25
5.1.	ANNEXURE: Checklist for World Heritage Planning.....	27
5.2.	ANNEXURE: Briefing by PNKB NP Director.....	37
5.3.	ANNEXURE: Management Plan World Heritage Contents Gap Analysis.....	39
5.4.	ANNEXURE: <i>Preliminary Draft</i> Statement of OUV.....	49
5.5.	ANNEXURE: PNKB NP Karst Values.....	55
5.6.	ANNEXURE: Chronology of Decisions.....	57
5.7.	ANNEXURE: Presentation of the World Heritage Convention.....	61
5.8.	ANNEXURE: UNESCO Periodic Reporting Guidelines.....	63
5.9.	ANNEXURE: UNESCO Reactive Monitoring Guidelines.....	65
5.10.	ANNEXURE: UNESCO World Heritage Nomination Timetable.....	67
5.11.	ANNEXURE: Persons Consulted.....	69
5.12.	ANNEXURE: Itinerary.....	71
6.	REFERENCES.....	73

[Cover Photo: Endangered Hatinh Langurs of Phong Nha-Ke Bang National Park. Source: Dirk Euler, Frankfurt Zoological Society]

1. INTRODUCTION

1.1. INTRODUCTION

This Mission Report aims to ensure that the Phong Nha-Ke Bang (PNKB) management plan adequately addresses UNESCO and IUCN requirements for World Heritage Sites regarding management, reporting, monitoring and change. The contents of the Report have been prepared consistent with the requirements of the brief for the Mission.

1.2. MISSION OBJECTIVES

The specific objectives for the Mission prepared by AHT on behalf of the German Development Bank (KfW) were to:

- (1) List World Heritage Site specific requirements, issues and aspects that apply to the PNKB NP and therefore must be looked into during the planning process covering at least:
 - (i) Institutional environment, mandates and relationships in Vietnam and international which are pertinent to World Heritage Sites;
 - (ii) World Heritage Site-specific reporting cycles, data/information need and content, reporting formats and submission process
 - (iii) Periodic and Reactive Monitoring requirements, cycles, formats, prescriptions
 - (iv) Working draft of specific Limits of Acceptable Change (LAC's)
- (2) Formulate World Heritage Site Specific management issues for further detailing by the management planning team
- (3) Draft text (chapters, sections, paragraphs) for inclusion in the management plan
- (4) Discuss and seek consensus on those draft texts with the Working Group and stakeholders
- (5) Review, comment and advice on management plan drafts

1.3. MISSION REPORT CONTENTS

The Mission brief required the contents of the Mission Report to include 1) Observations and Findings; 2) Definitive Conclusions and Recommendations; 3) Specific areas of concern for management planning, including potential management planning text; and 4) Annexures of supporting material including the itinerary and a schedule of persons consulted.

1.4. ACKNOWLEDGEMENTS

Many people assisted this Mission. Appreciation is extended to Phong Nha-Ke Bang National Park Director Luu Minh Thanh and his staff for their positive assistance. Special appreciation is extended to the KfW (German Development Bank) Component of the project and AHT Consultant Office staff and consultants including Chief Technical Adviser Mr Bas van Helvoort; Mr Nguyen Van Tri Tin, Deputy CTA; Mr Le Trong Trai of Birdlife; Mr Bill Bleisch of CERS; Secretary Ms Nguyen Viet Ha and Interpreters Mrs Nguyen Thi Ngoc Lan and Mrs

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

Hoang Thi Hoa. Mr Nguyen Trung Thuc Director of the Project Management Unit assisted with this work as did Mrs Pham Thi Lien Hoa of the GIZ (German Technical Cooperation) Component of the Project.

2. OBSERVATIONS AND FINDINGS

2.1. MAIN FINDINGS

(UNESCO/IUCN Requirements)

Introduction

(a) Consistent with the Mission Objectives, the World Heritage management planning requirements and issues for the Phong Nha-Ke Bang National Park World Heritage property were assessed and key findings have been presented here.

The 2011 Referral

(b) The State Party is implementing actions in order to respond to the World Heritage Committee referral decision (Decision 35.COM.8b.12). Progress with the World Heritage Committee 2011 decision was assessed using a Checklist (Annexure 5.1) and the information provided was supplemented by a briefing by the Park Director Mr Luu Minh Thanh (Annexure 5.2). The referral will respond to a nomination for World Heritage criteria (viii), (ix) and (x) and for the larger National Park for February 2013 and will necessarily include a Statement of Outstanding Universal Value and revised Management Plan. The World Heritage Committee process of dealing with World Heritage nominations including the context for referrals, has been summarised [Annexure 5.11].

Management Plan contents

(c) Additional World Heritage management planning topics were needed for the Phong Nha-Ke Bang National Park Management Plan. The proposed Park Management Plan contents were tested against the contents needed for a UNESCO World Heritage property (using a gap analysis (Annexure 5.3) based on UNESCO's 2012 Resource Manual; IUCN guidance material (IUCN 2008b); UNESCO's Periodic Reporting Guidelines and the 2012 Asia-Pacific World Heritage Periodic Report (UNESCO 2012 a)).

Statement of Outstanding Universal Value

(d) No Statement of Outstanding Universal Value (SOUV) for three World Heritage criteria existed for Phong Nha-Ke Bang National Park in August 2012. UNESCO advises that the SOUV for a property shall be the basis for its future protection and management (UNESCO 2011, Paragraph 155) and World Heritage management planning objectives, priorities and simple targets are based on the SOUV (UNESCO 2012). A preliminary draft Statement was prepared to provide guidance for developing management objectives for the OUV of the property and was based on UNESCO's Operational Guidelines and other guidelines (IUCN 2008a, UNESCO 2010, UNESCO 2012) (Annexure 5.4).

Developing a Statement of Outstanding Universal Value (SOUV)

(e) The preliminary draft SOUV prepared during this Mission (Annexure 5.4) is a starting point contribution only to the official process of developing an SOUV. UNESCO advises that any changes to the approved Phong Nha-Ke Bang National Park Retrospective SOUV for Criterion (viii) (for Criteria (ix) and (x) information) needs to be initiated by the State Party in liaison with UNESCO's World Heritage Centre (UNESCO 2012). The changes completed then need to be assessed by the advisory body IUCN and approved by the World Heritage Committee (UNESCO 2012) (See Section 4.2).

UNESCO approved Management Plan

(f) The Phong Nha-Ke Bang National Park Management Plan is the plan that UNESCO will be asked (by the State Party) to endorse as part of the World Heritage referral process. UNESCO's Operational Guidelines (Paragraph 108) advise that a property should have an appropriate Management Plan (or other documented management system) which "must specify how the OUV of a property should be preserved" (UNESCO 2011). There were at least two other plans and planning processes that proposed developments within the World Heritage property in August 2012. These plans will need to be consistent with and subordinate to the requirements of the endorsed World Heritage property and National Park Management Plan with its protection of OUV (See Section 4.3).

Authority of the Phong Nha-Ke Bang National Park Management Plan

(g) UNESCO's World Heritage Committee will need assurance that the Management Plan has authority and will be implemented given "The purpose of a management system [management plan] is to ensure the effective protection of the (...) property for present and future generations" (Paragraph 109) (UNESCO 2011). Such authority means that the Management Plan provisions and defined processes UNESCO endorses are identified requirements for the State Party and that the management of the property needs to be in accordance with the Plan (See Sections 4.3 and 4.4)

A brief Management Plan

(h) The Management Plan should be brief and in the order of 20 to 30 pages in length, (UNESCO 2012) though it should also recognise subordinate and more specific plans such as (in the case of Phong Nha-Ke Bang National Park) an operations plan, a buffer zone plan, and a visitor use plan.

Objectives of management for OUV

(i) Objectives of management for OUV for the three World Heritage Criteria [(viii), (ix) and (x)] were developed after reviewing the special Phong Nha-ke Bang World Heritage values and their integrity and management needs (UNESCO 2012) (See Section 4.5). They apply (spatially) across all three Zones recognised for the Park. The Management Plan will need to deal in detail with existing modified lands in the Administration Zone that are exceptions to

these objectives. At the request of Phong Nha-Ke Bang National Park Director, more specific management targets for Karst OUV management were analysed and prepared and in addition, even more specific Targets were written for managing the OUV of tourist caves (See Section 4.7).

Ecologically sustainable use

(j) Tourism use of the World Heritage property must not impact adversely with the World Heritage OUV. UNESCO requires that use of the property, including tourism is ecologically sustainable and non-impacting. “The State Party and its partners must ensure that such sustainable use (...) does not impact adversely on the Outstanding Universal Values of the property” (Paragraph 119) (UNESCO 2011). The World Heritage Committee has specifically encouraged the State Party about sustainable tourism development in their 2011 decision. The Management Plan specifically will need to be clear about the accountability and responsibility for the management and protection of the World Heritage OUV within the Phong Nha Cave and the Paradise Cave Lease area (50 hectares) and within Paradise Cave (See Section 4.4). It should be guided by the UNESCO and IUCN Sustainable Tourism framework.

Proposed tourism developments

(k) Two draft plans observed in August 2012 sought to develop the recently discovered Son Doong Cave, a wild cave, a natural treasure of Vietnam and a World Heritage natural wonder. The proposals included pedestrian access construction, an aerial cableway, the provision of high-voltage power supply lines, and tourist cave developments for this and other caves all located well within the Strictly Protected Zone of the Park. The proposals directly threaten the OUV and are not consistent with UNESCO’s World Heritage Committee 2011 decision. They would be incompatible with its inscription on the World Heritage List. They are inconsistent with UNESCO’s Operational Guidelines (UNESCO 2011). The on-going pressure for development of the discovered Son Doong Cave needs to be responded to and rejected by the State Party (See Section 4.9). The Park Management Plan also needs to complement such responses by providing clear direction and supplementary planning that ensures the complete protection of the natural (undeveloped) condition of Son Doong Cave and OUV-sensitive management of future access to and within the cave (See Section 4.7 (d)).

Impacts of road works

(l) The environmental impact on the World Heritage OUV of the Road 20 upgrading works observed in August 2012 is of serious concern as is the potential future use of the completed, improved road. The Road 20 cuts through the Park along the boundary between the Strictly Protected Zone and the Restoration Zone and extends to Laos. The impacts include soil erosion run-off effects that may affect caves; the potential pollution of caves from petroleum wastes and width-of-road impacts to fauna movement. Potential future

impacts include heavy vehicle traffic and improved access for poachers and illegal activities (See Section 4.10). The World Heritage Committee and IUCN have both previously expressed concerns about the threat of road developments in Phong Nha-Ke Bang National Park. The Management Plan will need to provide clear guidelines for the immediate management of construction impacts and the future use of the Road 20 in order to help conserve the OUV of the property.



Road construction, Road 20, Phong Nha-Ke Bang National Park at the Rem Minority Village, August 2012
Source: Graeme L. Worboys

2.2. MAIN OBSERVATIONS

(UNESCO/IUCN Requirements)

Commitment

(a) It was very clear that Phong Nha-Ke Bang National Park Director Mr Luu Minh Thanh and his staff were very proud of their World Heritage property and committed to its effective management, conservation and protection.

Significance

(b) It was a privilege to witness the natural Karst environments of the Phong Nha-Ke Bang National Park. They are outstanding and in combination, help to establish an exemplar natural World Heritage property (Annexure 5.5). The Son Doong Cave, found within the strictly protected area of the Park is the World's largest cave with a passage that is 5 kilometres long, 150 metres wide and 200 metres high. Photographs taken by speleologist-explorers help illustrate that this cave is a natural wonder of the World. Son Doong Cave is the largest cave known on Earth and has immense value simply for its existence. Vietnam is no doubt very proud of this untouched natural World Heritage wonder. All efforts need to

be made to keep this World Heritage Cave in its *completely* natural state. Access to and within the cave needs to be managed professionally and at the cutting edge of wild cave management in order to protect its OUV. World Heritage presentation does not need tourist cave development. It can be achieved through films and research (See Section 4.7 (d)).



Son Doong Cave, Phong Nha-Ke Bang National Park World Heritage Property, Vietnam
Source: Edward Longstreet

Biodiversity and ecosystems significance

(c) The biodiversity values of the Phong Nha-Ke Bang National Park include the World's best conservation sampling (in conjunction with Hin Namno National Park of Laos) of the WWF Global 200 Annamites Ecoregion. The extension area to the Park and part of the future World Heritage property (the paperwork for which is forecast to be presented to the Prime Minister for adding in September 2012) was visited and includes this forest type including untouched old growth rainforest at its core (Mr Doan Thanh Binh pers comm). Important endangered fauna species are found in the Karst landscapes and forests including the World's greatest concentration of the Hatinh langur (*Trachypithecus hatinhensis*) a karst endemic with a very restricted range. The karst ecosystems include troglobitic invertebrate species, such as the endemic cave scorpion (*Vietbocap canhi*). Rangers and Forest Guards are helping to protect these biodiversity values though pollution of Karst environments (such as the disposal of waste petroleum products that can infiltrate the permeable limestone rocks) is a potential problem, as is illegal logging and wildlife poaching.



Hatinh Langur, Source: Dirk Euler, Frankfurt Zoological Society



Vietbocap canhi Lourenco & Pham

Troglobitic Scorpion from Phong Nha-Ke Bang National Park Source: Dr Pham Dinh Sac

Chronology

(d) Based on the referral decision by the World Heritage Committee in July 2011, the latest date the State Party has for a response to the World Heritage Committee is February 2014, though usually a State Party referral response is earlier than the maximum period. A chronology of decisions and reports made for the Phong Nha-Ke Bang World Heritage property has been developed and provides a context for the World Heritage Committee 2011 decision (Annexure 5.6).

Law enforcement

(e) The World Heritage Committee 2011 decision recommended enhanced law enforcement. This work is a high priority of the Park. Progress in improving the effectiveness of on-ground law enforcement management has been achieved through a collaborative pilot project between the Phong Nha-Ke Bang National Park and Mr Dirk Euler of the Frankfurt Zoological Society. This work should continue if possible and be extended to the entire Park with the information generated potentially contributing to UNESCO Periodic Reporting requirements. The MIST management information system used in Uganda and Cambodia could potentially be used as a tool here to integrate information collected by patrols for Park managers (BPAMP 2006). Despite these efforts, advice is that both wildlife poaching and illegal timber removal are still serious issues for the Park.

Fauna conservation management

(f) The World Heritage Committee has sought a landscape level vision for the conservation and management of key species and this would include maintaining naturalness for the entire World Heritage Property and would apply to all three management zones recognised by regulation for the Park. This has been addressed by the (draft) Objectives of Management for the OUV provided.

Process of Management

(g) Processes of management (in addition to prescriptive management) need to be described by the Management Plan for dealing with management actions such as proposed developments in the World Heritage property. The World Heritage Committee has sought an Environmental Impact Assessment process (UNESCO Operational Guidelines Paragraph 110) and this should be part of a Management Plan's process of management (See Section 4.11). In addition, a weakness in the EIA process exists if it is prepared by a proponent and assessed remotely/independently to those responsible for managing the World Heritage OUV. To ensure that the World Heritage OUV is not impacted from any developments, it is strongly suggested that the Park Director position or an Authority directly responsible for the management of the National Park be formally accountable for approval or non-approval of Environmental Impact Appraisals for developments within Phong Nha-Ke Bang National Park, and that any developments that may significantly impact the OUV are referred to the World Heritage Committee as specified by the Operational Guidelines.

World Heritage presentation

(h) Presentation of World Heritage at Phong Nha-Ke Bang National Park has commenced, though more needs to be done and the Management Plan needs to identify a strategic approach for how this is achieved. How the World Heritage OUV and its presentation is managed within the Paradise Cave Tourist Lease area for example needs to be clarified. Guidance information on presentation has been prepared by UNESCO (Annexure 5.7).

Visitor use management (including LAC)

(i) Visitor use of the Park is growing rapidly. A visitor use strategy, guided by use of the Recreation Opportunity Setting method is needed for the Park. In addition, specific plans for each Tourist Cave are needed. The Limits of Acceptable Change (LAC) method is supported for monitoring and responding to visitor impacts if there are sufficient financial resources available and the research can be sustained over a long period. Low cost alternatives to the LAC method are available such as basic photo point monitoring and air quality monitoring in caves and can be described further by the Visitor Use Strategy (Toomey 2009).

Buffer Zone

(j) The Management Plan needs to ensure that the Buffer Zone and its planning meet the conservation and protection requirements of the World Heritage property and that any plans developed for the Zone are subordinate to the Management Plan. Karst hydrological catchments outside of the National Park and within the buffer zone may require special management inputs from the Park.

Transboundary management

(k) The World Heritage Committee has encouraged the development of a larger, transboundary World Heritage property involving Phong Nha-Ke Bang National Park and the adjacent Hin Namno National Park of Laos. Whilst this is an important vision, advice has been received that it is not considered possible to achieve this in the immediate future. The regular (annual) meetings between Vietnam and Laos park staff are planned to continue. In addition, Laos Park staff recently advised Park Director Luu Minh Thanh that they were independently nominating Hin Namno National Park under criterion (x) despite UNESCO's policy for a joint, co-operative, transboundary nomination for the two parks. Whilst extended direct cooperation may not be feasible at this point, the retention of the vision for a transboundary World Heritage property is strongly encouraged¹. A transnational World Heritage nomination could (for example) be developed in parallel with opportunities arising at some point in the future. IUCN and UNESCO could be encouraged to play a brokerage role in this respect between the two countries at such an appropriate time.

¹ Late August an early confidential draft for a GIZ project with the work title "Regional Cooperation between Phong Nha-Ke Bang and Him Nam No" is circulating among selected agencies.

Research

(l) Phong Nha-Ke Bang National Park has considerable scope for research. The Greater Blue Mountains World Heritage Area has established a non-profit “World Heritage Institute” which aims to facilitate research and education for the property. The Greater Blue Mountains World Heritage Institute works to foster management oriented research between Universities and the park management authorities. This type of model may work well for the Park. (see Section 4.12)

Monitoring and reporting

(m) The World Heritage Periodic Reporting is most useful when it is supported by empirical data (Annexure 5.8). Data collection processes need to be carefully thought through and sustained given a six year reporting cycle. Use of World Heritage reporting requirements as an integral part of the Park’s annual management cycle is recommended as it will help the park with its routine management. A plan for monitoring and reporting is needed where simple, low cost, but effective data gathering and analysis is completed and reported on annually. The World Heritage Periodic Reporting form should guide the data that is collected. OUV monitoring (for example) could focus on the retention of catchment forest cover and water quality, water flow regime and water yield as surrogate indicators for the natural condition of the property. The MIST management system for ranger-law enforcement monitoring and analysis used by Uganda and Cambodia should be considered for use in Phong Nha-Ke Bang National Park. It could be integrated with the pilot data recovery programs already developed between the Park and Frankfurt Zoo (BPAMP 2006). This same reporting information could be used to assist with any reactive monitoring required for the property (Annexure 5.9).



Phong Nha Cave entrance, Phong Nha-Ke Bang National Park & WHS Source: Graeme L Worboys

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. CONCLUSIONS

Introduction

(a) The following conclusions arise from research and analysis into World Heritage management planning needs for Phong Nha-Ke Bang National Park World Heritage property that included briefings by Park staff, KfW's Chief Technical Adviser and other experts; field inspections; inputs from UNESCO guidelines and a review of the literature.

It is concluded that for *World Heritage management planning*:

(b) The contents of the Phong Nha –Ke Bang National Park Management Plan require additional World Heritage management topics as guided by the gap analysis (completed by this Mission - Annexure 5.3)

(c) The Management Plan be brief (approximately 30 pages) and be supported by supplementary, subordinate and detailed plans

(d) The approved Management Plan has authority that guarantees its implementation and pre-eminence for World Heritage OUV protection and management decisions

(e) The Management Plan ensures that subterranean Phong Nha-Ke Bang National Park World Heritage OUV with its caves are protected by the authority of the Plan or other appropriate legal mechanism

(f) The Objectives of Management for the World Heritage National Park OUV are the principal basis of management for the property

(g) The OUV Objectives of Management apply to the entire World Heritage property. This includes leased lands, village lands and the three management zones (Strictly Protected Zone, Restoration Zone and the Administration Zone). Specific guidance planning will be needed for some parts of the Park

(h) The urgent preparation and implementation of a Wild Cave conservation, management and protection plan (including Son Doong Cave) needs to be the basis for the protection and conservation of these natural, non-development caves

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

(i) The preparation of a Phong Nha-Ke Bang National Park Visitor Use Management Plan needs to provide the basis for managing World Heritage presentation, quality visitor experiences and the protection of the OUV for the World Heritage property

(j) The preparation of individual Tourist Cave Management Plans should provide the basis for managing World Heritage presentation, quality visitor experiences and the protection of the OUV for the specific cave

(k) World Heritage risk management planning is a basis for better protecting the OUV of the property

For World Heritage management:

(l) A permanent National Park (in-house) expert, a Karst Management Specialist, is needed to manage for the Karst OUV protection, conservation, and presentation (including Karst processes, karst ecosystems, and Troglitic species)

(m) On-ground protection and strict management of access to Son Doong cave is needed immediately

(n) Supervision of the EIS for the Road 20 construction to help protect the World Heritage OUV, especially from erosion runoff, excessive widening and potential pollution is needed immediately.

For World Heritage monitoring and reporting:

(o) That a plan be developed to identify data to be collected routinely and analysed and produced as an annual statement for both World Heritage reporting and Park management effectiveness assessment purposes.

3.2. RECOMMENDATIONS

Introduction

(a) The following recommendations are Mission specific. They target World Heritage management planning requirements and guidance for the Phong Nha-Ke Bang National Park World Heritage property.

It is recommended that the Phong Nha-Ke Bang National Park Management Plan:

(b) Is brief (up to 30 pages), and is developed with reference to its surrounding environments and especially the buffer zone

(c) Is UNESCO's (only) endorsed plan for the management of Phong Nha-Ke Bang National Park World Heritage property

(d) Identifies Objectives of Management for the protection and conservation of the World Heritage Outstanding Universal Values for the entire property

(e) Has authority, and that its provisions are legally binding in Vietnam, and that any actions such as tourism developments, leasing and licensing, or other actions are subject to Management Plan's provisions and processes, and, potentially, to the involvement of the World Heritage Committee

(f) Includes supplementary World Heritage topics identified by the Mission's gap analysis

(g) Recognises supplementary specific but subordinate plans that include the *Park Operations Plan*; the *Buffer Zone Plan* and the *Park Visitor Use Plan*

(h) Recognises planning process for dealing with OUV management issues that includes *Environmental Impact Assessment* and *Risk Management Assessment* consistent with UNESCO's 2012 Guidelines

(i) Provides an Environmental Impact Assessment decision making accountability process for the Park Director position (or an equivalent senior authority directly responsible for the management of the World Heritage Outstanding Universal Values) for proposed developments that may impact the World Heritage OUV of the Phong Nha-Ke Bang National Park property, and the possible involvement of the World Heritage Committee.

4. AREAS OF ATTENTION FOR MANAGEMENT PLANNING

4.1. INTRODUCTION

Further background has been provided here to describe some Phong Nha-Ke Bang National Park World Heritage planning issues to assist the process of developing the Management Plan and, as a potential text resource for the Plan.

4.2. STATEMENT OF OUTSTANDING UNIVERSAL VALUE

The SOUV for Phong Nha-Khe Bang National Park for criteria (viii), (ix) and (x) for the expanded Park is to be developed by the State Party with guidance and input from the Advisory body IUCN and UNESCO's World Heritage Centre. A retrospective SOUV was approved for the 85,754 ha Phong Nha-Khe Bang National Park under Criterion (viii) in July 2012. However, Decision 35 COM 8B.12 of the Committee recommended that the State Party submit World Heritage nomination referral response papers for the additional Criteria (ix) and (x). Given World Heritage Management and the Management Plan for the Park are guided by the SOUV, a preliminary draft SOUV was prepared during the Mission for all three Criteria. The approved SOUV for Criterion (viii) was used as the base document, with text sourced from IUCN technical reports added to describe Criteria (ix) and (x). However, considerable improvement work is needed with this draft document (Annexure 5.4). The *preliminary draft* SOUV is indicative but has assisted with the drafting of value based objectives of management for the Management Plan. The National Park Management Plan will need to be consistent with the SOUV to ensure that the State Party documents used in the referral process are complementary. There would be a distinct advantage if the Management Plan planning team was kept briefed on the content of this critical document as it is developed.

4.3. A UNESCO ENDORSED MANAGEMENT PLAN

In August 2012, three concurrent planning processes existed for parts or all of the World Heritage Property. These included the official UNESCO recognised (State Party) Management Plan process; a Vietnamese Ministry for Construction and Development planning study which proposed an aerial cableway and tourism development of Son Doong Cave in the World Heritage Property; and, a GIZ, (the German Technical Cooperation Organisation) Sustainable Tourism Development Plan for the Buffer Zone which extended its planning into the World Heritage property to propose tourist pedestrian access development to the Son Doong Cave (but not into the cave). The two additional and concurrent planning processes with their proposed developments are inconsistent with the World Heritage status of the Property, UNESCO's 2011 decision and are inappropriate in

their current form for the World Heritage property. Ministry planners, GIZ planners and the Phong Nha-Ke Bang National Park World Heritage Management plan planners need to work together as the National Park Management Plan is finalised for UNESCO endorsement. Any planning completed needs to be compliant with the officially recognised World Heritage planning process and subordinate and complementary to the management of the World Heritage Property and buffer zone. UNESCO will only recognise the National Park Management Plan and its supplementary specific plans.

4.4. A MANAGEMENT PLAN WITH AUTHORITY

Three legal and mandate issues were raised for the world Heritage Property that need clarification and confirmation as part of the planning process. They are: 1) The status of the legal protection offered to subsurface (cave) environments within the National Park; 2) The authority and legal mandate of the Management Plan; and, 3) The requirement for the universal application of World Heritage OUV objectives across all management zones of the Park. The Management Plan will need to be precise about the accountability and responsibility for the management and protection of the World Heritage OUV within the Phong Nha Cave, for the Paradise Cave Lease area (50 hectares) and within the Paradise Cave

4.5. (DRAFT) OBJECTIVES OF MANAGEMENT FOR WORLD HERITAGE OUV

Draft objectives of management for the World Heritage OUV for Phong Nha-Ke Bang National Park have been prepared based on a *preliminary draft SOUV*. The OUV objectives apply equally to all 3 management zones, though it is understood that the modified parts of the Administration Zone may need to be recognised as such. The OUV objectives would accompany additional Park Management objectives prepared specifically for each zone.

OUV objective for Criterion (viii) values

To effectively manage for the protection and conservation of Phong Nha-Ke Bang National Park's natural heritage including its scenery; karst environments; karst hydrology; karst processes; geology; geomorphology; soils; and, caves [with their associated formations and speleothems], natural air quality, meteorology, biodiversity and cave ecosystems

OUV objective for Criterion (ix) values

To better understand, conserve and manage the Phong Nha-Ke Bang National Park ongoing ecological and biological processes in the evolution and development of terrestrial and aquatic ecosystems both surface and sub-surface

OUV objective for Criterion (x) values

To effectively protect and manage the Phong Nha-Ke Bang National Park World Heritage fauna and flora, habitats, migratory routes and supporting ecosystems and ecosystem processes to help ensure ecological viability and the on-going conservation and evolution of species

4.6. A LANDSCAPE LEVEL VISION

The World Heritage Committee specifically recommended a landscape level vision for the revised management plan with a focus on wide ranging keystone species conservation. This is considered to have particular (and equal) significance for all management zones of the World Heritage property (and beyond) and should influence conservation management and research for species such as the Tiger and the Gaur, especially their potential movement patterns across the National Park landscape. Tourism initiatives within any zone of the Park would be considered subordinate to these World Heritage species conservation needs.

4.7. KARST OUV MANAGEMENT

A number of management Targets have been prepared to guide the management of the Karst Outstanding Universal Value of the Phong Nha-Ke Bang World Heritage Property (Gilleson 1996; IUCN 1997; IUCN 2008). More specific actions would be expected to be developed from these Targets.

The Targets are:

- (a) Identify and effectively manage for the protection of the entire surface and sub-surface Karst catchments and Karst hydrological regimes

- (b) Regularly monitor for any non-natural disturbance to any part of the Karst surface and sub-surface catchments as a basis for rapid response to threats

- (c) Assess the risk of threats and plan for and respond to any impacts to Karst surface and sub-surface environments and especially from petroleum or chemical pollution

- (d) Work with researchers and speleologists in the development of a Wild Cave protection, access and conservation management plan for all known caves other than the official National Park tourist caves that include Phong Nha and Paradise Caves

- (e) Work with researchers to identify the nature of the cave biodiversity and cave ecosystems of the World Heritage property as a basis for their effective management

- (f) Actively manage to retain intact the large natural areas of the Park in all management zones including protecting the natural scenery, protecting wildlife migratory routes, restoring disturbed sites, removing weeds, and preventing disturbance
- (g) Understand and monitor the natural atmosphere and meteorology of caves as a basis for effectively conserving cave environments
- (h) Prepare individual Tourist Cave Management Plans that facilitate the protection, restoration and professional presentation of the existing tourist caves [which are World Heritage caves]
- (i) Prepare legal agreements for Tourism operations within the World Heritage property that recognise compliance with the provisions of the National Park Management Plan [and any supplementary specific plans] and the conservation and protection of the World Heritage OUV.

4.8. TOURIST CAVE MANAGEMENT

- (a) The Phong Nha-Ke Bang Management Plan should identify that a cave management plan be developed for the Phong Nha, Paradise and other existing tourist caves of the Park as a basis for protecting and professionally presenting the World Heritage OUV.
- (b) The cave management plan should have regard to the management guidelines for show caves developed by the International Speleological Society (UIS 2012). Cave formations are mostly a non-renewable resource and need to be protected.
- (c) The cave management plan needs to include an environmental impact assessment process for any non-maintenance management intervention or change that may impact the World Heritage OUV (See section 4.11)
- (d) For infrastructure to be placed within the cave, regard shall be had for minimising impacts. Crowd control infrastructure and within cave access facilities (such as fences, steps and elevated walkways) should not impact speleothems or other natural phenomena such as cave ecosystems. Cave lighting placement and use should be undertaken carefully and *lampenflora* removed and controlled (UIS 2012). Cave lighting needs to be respectful of the natural phenomena (use of white light) and the placement of electricity cables needs to be very sensitively achieved. The placement of backlit sign-posting including World Heritage presentation information and emergency evacuation lighting needs to be carefully achieved.
- (e) Any infrastructure present or installed in the cave should be professionally designed, of high quality and worthy of World Heritage presentation status. The materials used and the

construction techniques applied need to be suitable for a cave environment. Wood or other organic material, for example, is not recommended by the International Union of Speleology (UIS 2012) and welding (with its associated waste-gas generation) would be a major impact to the cave.

(f) For World Heritage Presentation, the World Heritage status and OUV of Phong Nha-Ke Bang National Park and the particular cave is professionally presented for all visitors including through verbal presentations by guides, through signs and through printed information. Ideally, the World Heritage OUV presentation information would be designed to suit the unique characteristics for each cave, guides would be professionally trained and the cave presentation information provided in more than one language. The OUV information could be presented simply as well as technically (for more discerning visitors).

(g) The World Heritage cave experience for visitors is very important. It should be high quality and safe. This should usually include: 1) Pre-cave inspection literature, a safety briefing, a briefing about speleothem protection and the World Heritage status (and what this means) for individuals and groups; 2) Pre-departure logistic advice about how the group is to be managed, pre-visit comfort stops and advice about a non-smoking policy and the reasons for this; 3) Crowd control and strictly controlled group size and frequency of group use for all parts of the visit that is consistent with visitor use prescriptions provided by the cave management plan; 4) Quiet enjoyment of the visit and noise minimisation on the visit; and 5) The provision of a diversity of group experiences, from full technical karst explanations to lay-language presentations

(h) Impacts to the tourist cave's World Heritage OUV need to be minimised. The effective management of people is a key to achieving this. This includes:

- For groups: Designing a maximum group size, including an accompanying guide
- Visitor ticketing and group management systems to, from, and within the cave that are organised so that groups receive an optimum World Heritage cave experience that minimises group interaction including orchestrated movements of groups that prevent chances of crowding
- Financial return that is based on \$ yield rather than visitor volume and with return visitation targeted thanks to the provision of quality visitor experiences.
- Group control and surveillance by guides to ensure visitors stay on the official pathways, don't touch or damage formations, do not steal speleothems nor leave any waste in the cave
- Management of groups to minimise noise
- Management of visitors to the cave (non-tourists such as electrical maintenance contractors) to minimise any potential impacts to the cave formations, cave

atmosphere, cave hydrology or cave ecosystems through thorough pre-work briefings and within-cave operational guidelines

- Management of within cave official functions to be respectful of the World Heritage status and to ensure they do not impact the cave in any way, especially the cave atmosphere from pollution (fireworks and the burning of hydrocarbons within the cave for example should never happen)
- No solid or liquid pollution of the cave
- Removal of all waste from the cave, undertake restoration work and, if appropriate, cave cleaning work
- The development of non-cave visit alternative recreation opportunities.

4.9. SON DOONG CAVE DEVELOPMENT PRESSURES

Tourism development pressures for Son Doong Cave from planners, private interests, tourists and solo adventurers needs to be actively responded to, including advice that Son Doong Cave is protected through its National Park and World Heritage status. It is a natural treasure of Vietnam and a natural wonder of the world that should remain natural, undeveloped, protected and special. It is special because of its existence values. It is not necessary to develop this cave for tourism because World Heritage presentation can be achieved through documentary films and scientific research. Any wild access to the cave needs to be planned, very strictly managed with approved access routes (to minimise damage) defined as early as possible. This may also mean active on-ground protection of the access to Son Doong Cave in the short term. Alternative cave access is available for tourists with the outstanding Phong Na and Paradise Caves of Phong Nha-Ke Bang National Park and these should be restored further, improved, protected and promoted.

4.10. THE ROAD 20 WORKS

The environmental impact of the Road 20 upgrading works is of concern. The section of the road inside the Park splits a large area of natural land that provides protection for many fauna species; such fragmentation reduces available habitat. Large natural areas are necessary for the survival of species and of specific interest to the World Heritage Committee. The potential for future heavy vehicle use of the road needs to be very closely managed. In August 2012, the environmental impact of road construction work on the Road 20 was considered to be a potential threat to the World Heritage OUV given the excessive soil disturbance and run-off that must occur in heavy rain. Matters of detailed environmental protection supervision were also considered important such as the minimising the width of the road and retaining canopy cover where possible (to assist wildlife movements); minimising soil erosion in the karst landscape; confining work operations and disturbance at any given time to single operational sites; confining the size and impact of temporary construction depots; and the removal of all solid and liquid waste

products. For the post road construction environment, the Management Plan should identify road access, control and management matters such as speed limits, local vehicle traffic, and potentially the controlled access of the road at night to minimise illegal activities.



Road construction, Road 20, Phong Nha-Ke Bang National Park near the Rem Minority Village, August 2012
Source: Graeme L. Worboys

4.11. ENVIRONMENTAL IMPACT ASSESSMENTS

The World Heritage Committee has urged the State Party to undertake and act on Environmental Impact Assessments (EIA's) to ensure that there are no adverse impacts on the OUV from infrastructure, tourism or other developments. It is strongly suggested that the Management Plan define a process for any (non-basic maintenance) developments that may impact the World Heritage Property so that the process becomes part of the EIA decision making process. This process would include the Park with its operations as well as other organisations. It is suggested that the Management Plan describe an EIA process which could include (for example):

- The types of developments or proposals that are subject to an EIA. For example, a lease for a tourism development or a tourism service may be subject to an EIA
- An EIA that describes the OUV that may be impacted and measures to minimise any impact
- Process steps to consider:
 - a. Identification that the proposed development (or service) is consistent with the Management Plan
 - b. Opportunity for third party input
 - c. Process sign off by the chief executive of the National Park administration or management board that the World Heritage values will not be significantly impacted

4.12. RESEARCH: THE CONCEPT OF A WORLD HERITAGE INSTITUTE

The Greater Blue Mountains World Heritage Institute which successfully facilitates and promotes research for this World Heritage property may be of interest to the managers of Phong Nha-Ke Bang National Park. A great deal of research and discovery is needed for the Park and an Institute may help facilitate a great deal of this work.

5. ANNEXURES

DRAFT

5.1. ANNEXURE: Checklist for World Heritage Planning

Phong Nha-Ke Bang National Park World Heritage Property

A Checklist for Potential World Heritage Planning Considerations [A Planning Working Paper]

Dr Graeme L. Worboys August 2012

[Note: This document has no status other than as a working paper that aims to facilitate discussions on PNKB NP World Heritage management planning considerations]

INTRODUCTION

This is a checklist of potential World Heritage planning considerations for the Phong Nha-Ke Bang National Park (PNKB NP) World Heritage Property. It has been prepared to help facilitate the identification of World Heritage management planning needs for the Park consistent with three objectives (Source: Brief to the World Heritage advisor, 2012)

- (i) To ensure that the (draft) management plan for the PNKB NP/WH Property adequately addresses UNESCO/IUCN requirements for World Heritage Properties regarding management, reporting, monitoring, and change;
- (ii) To list WH Property-specific requirements, issues, and aspects that apply to the PNKB NP and therefore must be looked into during the planning process; and
- (iii) To help formulate World Heritage Site specific management issues for further detailing by management planning team.

The checklist has been prepared in two parts.

Part One is a checklist of specific recommendations, encouragement and advice of the World Heritage Committee's decision of July 2011 (Decision 35 COM 8B.12); and

Part Two is a checklist of World Heritage routine management guidelines based principally on UNESCO's 2011 *Operational Guidelines* and UNESCO's 2012 *Managing Natural World Heritage Guidelines* that *may or may not* have application at PNKB NP but serve as a basis for planning discussions.

The checklist is planned to be used at Phong Nha-Ke Bang National Park as a working paper only to guide and assist discussions with appropriate experts.

Dr Graeme L. Worboys
August 2012

CHECKLIST OF POTENTIAL WORLD HERITAGE PLANNING NEEDS: PART ONE

1. UNESCO Recommendations, encouragement and advice (Including any additional IUCN Recommendations) (2011 Decision 35 COM 8B.12)		
UNESCO recommendations, encouragement and advice (Abbreviated)	Checklist	
Expand the Phong Nha-Ke Bang National Park	The expansion of the Phong Nha-Ke Bang National Park from 85,754ha to 125,729 ha <i>has/has not</i> been finalised	
Prepare a revised nomination [which necessarily includes an upgraded the Statement of Outstanding Universal Value (SOUV)]	The 2012 approved Retrospective SOUV for the 85,754 ha Phong Nha-Ke Bang National Park and Criterion (viii) <i>has/has not</i> been upgraded to recognise the larger 125,729ha Park and Criteria (ix) and (x) (IUCN Technical Evaluation ID No 951bis)	
Update the PNKB National Park Plan of Management	The Phong Nha-Ke Bang National Park Management Plan <i>has/has not</i> been updated to deal with the 125,729 ha Park and Criteria (viii), (ix) and (x) (IUCN Technical Evaluation ID No 951bis)	
Involve all relevant stakeholders in the updating of the Management Plan through a participatory process	The Phong Nha-Ke Bang National Park Management Plan <i>has/has not</i> involved all relevant stakeholders in its development and updating (IUCN Technical Evaluation ID No 951bis)	
Deal with poaching and timber removal	Responses to poaching and illegal timber removal in the 125,729 ha Phong Nha-Ke Bang National Park <i>have/have not</i> been planned, organised, implemented and <i>have/have not been</i> effective as demonstrated by quantitative performance results.	
Improve interagency co-operation and co-operation with Vietnam's border police and army to improve law enforcement in the region to reduce the illegal harvest of wildlife and trade in timber, and non-timber forest products	The management of the 125,729 ha Phong Nha-Ke Bang National Park <i>has/has not</i> undertaken this initiative. The Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include this initiative (IUCN Technical Evaluation ID No 951bis)	
Strengthen the conservation management of the Park and the buffer zone	The 125,729 ha Phong Nha-Ke Bang National Park management <i>is/is not</i> being strengthened through the completion and adoption of a Management Plan in 2012 with goals, objectives and guidelines for the three management zones, and improvements to the management of the illegal wildlife trade (IUCN Technical Evaluation ID No 951bis)	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

A landscape level vision for the Management Plan and potential regional co-operation for species recovery management	The 125,729 ha Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include Targets and Action Statements for the recovery of wide-ranging and significant keystone species which may require regional co-operation (IUCN Technical Evaluation ID No 951bis)	
Achieve environmentally sustainable use of resources and benefits equitably shared	Use of resources in the 125,729 ha Phong Nha-Ke Bang National Park <i>does/does not</i> take place. If it does take place, use of the resources <i>is/is not</i> managed so that it is sustainable and the benefits equitably shared as demonstrated by quantified performance results	
Utilise Environmental Impact Assessment and implement their findings	The 125,729 ha Phong Nha-Ke Bang National Park <i>does/does not</i> utilise mandatory environmental impact procedures and approval processes and it <i>is/is not</i> included in the Management Plan (IUCN Technical Evaluation ID No 951bis)	
Utilise monitoring	The 125,729 ha Phong Nha-Ke Bang National Park <i>does/does not</i> undertake independent and transparent monitoring of law enforcement actions (IUCN Technical Evaluation ID No 951bis) The Sustainable Tourism Development Plan <i>has/has not</i> been approved. Monitoring the implementation of the Sustainable Tourism Development Plan <i>has/has not</i> been recognised in the Phong Nha-Ke Bang National Park Management Plan (IUCN Technical Evaluation ID No 951bis)	
Seek additional technical and financial assistance to undertake a number of key tasks.	The management of the 125,729 ha Phong Nha-Ke Bang National Park <i>has/has not</i> undertaken this initiative. (IUCN Technical Evaluation ID No 951bis)	
Key task: Staff training and obtain equipment to strengthen law enforcement management and monitoring capacity	The Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include this initiative (IUCN Technical Evaluation ID No 951bis)	
Key task: Management and monitoring capacity	The Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include this initiative (IUCN Technical Evaluation ID No 951bis)	
Key task: Undertake improved heritage interpretation at local and landscape scales	The Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include this initiative (IUCN Technical Evaluation ID No 951bis)	
Key task: Undertake further Management Effectiveness Evaluation	The Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include this initiative (IUCN Technical Evaluation ID No 951bis)	
Manage for a Transboundary approach with Lao Peoples Democratic Republic	The management of the 125,729 ha Phong Nha-Ke Bang National Park <i>has/has not</i> undertaken this initiative. The Phong Nha-Ke Bang National Park Management Plan <i>does/does not</i> include this initiative (IUCN Technical Evaluation ID No 951bis)	

CHECKLIST OF POTENTIAL WORLD HERITAGE PLANNING NEEDS: PART TWO

<p>World Heritage National Park Management This is a working paper only. It is a checklist of potential World Heritage National Park Management Needs sourced from UNESCO guidance documents. [UNESCO (2011) <i>Operational Guidelines</i>; UNESCO (2012) <i>Managing Natural World Heritage Resource Manual</i>]</p>		
<p>Legal framework</p>		
Legal framework	[REVIEW] The legislative and regulatory measures at national and local levels <i>do/do not</i> assure the protection and conservation of the property and its OUV (UNESCO 2012 p35)	
<p>Statement of Outstanding Universal Values <i>The SOUV should give a clear picture of management priorities for WH sites</i> (UNESCO 2012 p37)</p>		
A revised SOUV is needed for the enlarged Phong Nha Ke Bang National Park and for Criteria (viii), (ix) and (x)	[REVIEW] The revised SOUV <i>has/has not</i> been completed ready for the updated Management Plan and the resubmitting of the WH Nomination for Criteria (ix) and (x)	
<p>The Management Plan <i>The best plans are succinct (20-30 pages), based on achievable, measurable targets and linked to implementation systems, budgeting processes and monitoring and business plans</i> (UNESCO 2012 p37, p40)</p>		
<p>The Management Plan: Goals and Objectives</p>		
Establish Overall Planning Goal	[REVIEW] The goal for WH property management plan <i>does/does not</i> specify how the Outstanding Universal Value of the property will be preserved (UNESCO 2012 p37)	
Establish <i>OUV</i> Objectives (“values based management”)	[REVIEW] The management objectives and prescriptions <i>do/do not</i> describe the conservation and enhancement of the <i>Outstanding Universal Values</i> of Phong Nha Ke Bang National Park (UNESCO 2012 p37)	
Establish <i>Other</i> Objectives (“values based management”)	[REVIEW] The management objectives and prescriptions <i>do/do not</i> conserve and enhance <i>other values</i> of Phong Nha Ke Bang National Park (UNESCO 2012 p37)	
<p>The Management Plan: Systems and procedures</p>		
Multi layered management system	[REVIEW] Phong Nha Ke Bang National Park <i>does have/does not have</i> a multi-layered management system for the Park comprising Three Management Zones; area based Recreation Opportunity Zones; Lease/Licensed areas; and Within-Cave Management Zones (after UNESCO 2012 p38)	
Effective management system	[REVIEW] Phong Nha Ke Bang National Park <i>does have/does not have</i> a thorough and shared understanding of the property by all stakeholders (UNESCO 2011 Paragraph 111)	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

Management Framework and Management cycle	[REVIEW] Phong Nha Ke Bang National Park <i>does have/does not have</i> a management Framework such as the <i>IUCN Framework</i> and a cycle of management activities which includes planning, implementation, monitoring, evaluation and feedback (UNESCO 2012 p38)	
Transparent management system	[REVIEW] Phong Nha Ke Bang National Park <i>does have/does not have</i> an accountable, transparent description of how the management system functions (UNESCO 2012 p38)	
Tactical and Operational Plans	[REVIEW] In addition to the <i>Strategic Level</i> Phong Nha Ke Bang National Park Management Plan; <i>Tactical Level</i> Plans (for issues such as Transboundary Management, Business Planning and Law Enforcement Management) and <i>Operational Level</i> Plans (for issues such as Tourism Management; Cave Management; and Annual Operation Work Plan) <i>are/are not</i> being recognised in the Management Plan (UNESCO 2012 p40).	
Management Effectiveness Evaluation Tool	[REVIEW] Phong Nha Ke Bang National Park <i>does /does not</i> plan to use the IUCN Management Effectiveness Evaluation Tool (UNESCO 2012 p78)	
World Heritage Business Planning Tool	[REVIEW] Phong Nha Ke Bang National Park <i>does /does not</i> plan to use the Shell World Heritage Business Planning Tool (UNESCO 2012 p51)	
UNESCO Enhancing Our Heritage Toolkit	[REVIEW] Phong Nha Ke Bang National Park <i>does /does not</i> plan to use the UNESCO Enhancing Our Heritage Tool Kit for a range of actions such as assessing staff training requirements and monitoring and evaluation (UNESCO 2012 p54)	
IUCN Sustainable Tourism and Natural World Heritage Guidelines	[REVIEW] Phong Nha Ke Bang National Park <i>does /does not</i> plan to use the IUCN sustainable Tourism Guidelines with its management (UNESCO 2012 p67)	
<p>The Management Plan: Targets <i>Translating the SOUV into a set of simple targets, each of which has associated indicators, thresholds, and responses (UNESCO 2012 p38)</i></p>		
Karst OUV Target One: Retention of the natural integrity of the (Zoned) remote area Karst system and Karst ecosystems	<p>[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>has /has not</i> identified <i>Targets</i> and <i>Attributes</i> suitable for effectively managing Karst OUV. Possible examples could include:</p> <p>Attribute 1: Undisturbed catchment forest cover <i>Threshold:</i> Zero tolerance for any illegal human caused disturbance [Indigenous people needs?] <i>Monitoring:</i> Regular remote sensing imagery? <i>Management action:</i> Immediate removal of the cause, restoration of the impact</p> <p>Attribute 2: Natural water yield; water flow regime and</p>	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

	<p>water quality <i>Threshold:</i> Zero tolerance for human caused disturbance <i>Monitoring:</i> Routine water monitoring for key catchments/rivers <i>Management actions:</i> Immediate removal of the cause, immediate restoration of the impact</p>	
Karst OUV: Tourist Cave Development and Use	[REVIEW] Phong Nha Ke Bang National Park Tourist Caves are developed and used in a manner that <i>does/does not</i> impact adversely on the OUV of the property and its integrity. Their use <i>is/is not</i> ecologically and culturally sustainable (UNESCO 2011 Paragraph 119)	
Karst OUV Target Two: Retention of cave speleothems, karst geomorphic and ecosystem values and achieve sustainable visitor use of show caves	<p>[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>has /has not</i> identified <i>Targets</i> and <i>Attributes</i> suitable for effectively managing Karst OUV for Tourist Caves. Possible examples could include:</p> <p>Attribute 1. Speleothem disturbance</p> <p>Attribute 2. Within cave pollution</p> <p>Attribute 3. Karst ecosystem disturbance</p>	
Criterion (ix) Target One	[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>has /has not</i> identified <i>Targets</i> and <i>Attributes</i> suitable for effectively managing Criterion (ix) OUV such as ?:	
Criterion (x) Target One	[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>has /has not</i> identified <i>Targets</i> and <i>Attributes</i> suitable for effectively managing Criterion (x) OUV such as?:	
The Management Plan: Pressures		
Threat: Catchment disturbance-roading	[REVIEW] There <i>are/are no</i> roading threats to Phong Nha Ke Bang National Park	
Threat: Catchment disturbance – deforestation	[REVIEW] There <i>are/are no</i> deforestation threats to Phong Nha Ke Bang National Park	
Threat: Impacts to wildlife – poaching	[REVIEW] There <i>are/are no</i> poaching threats to Phong Nha Ke Bang National Park	
The Management Plan: Strategies and Actions for Management (UNESCO 2011 Paragraph 111g)		
A supportive planning context	[REVIEW] The plan identifies a need for Phong Nha Ke Bang National Park management to engage and seek to influence surrounding landuse and development plans as a basis protecting the WH values (UNESCO 2012 p37)	
The involvement of partners and stakeholders	[REVIEW] Phong Nha Ke Bang National Park management <i>does/does not</i> involve partners and stakeholders (UNESCO 2012 p38)	
Staff capacity building	[REVIEW] Phong Nha Ke Bang National Park Management	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

	Plan <i>does/does not</i> include staff capacity building for nine needs identified by UNESCO (UNESCO 2012 p54)	
Education	[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>does/does not</i> include education investments. The investments <i>do/do not</i> target greater understanding by local communities of WH and management of the OUV (UNESCO 2012 p61)	
Presentation and site interpretation	[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>does/does not</i> include a plan for presentation and interpretation investments including the prominent presentation of the logo (UNESCO 2012 p64).	
Tourism management	[REVIEW] Phong Nha Ke Bang National Park Management Plan <i>does/does not</i> include a plan for managing Tourism and leasing/licensing (UNESCO 2012 pp64-69).	
The Management Plan: Resources		
The necessary financial and human resources are allocated for management	[REVIEW] Phong Nha Ke Bang National Park management <i>does/does not</i> receive sufficient human and financial resources to protect the OUV of the WH property (UNESCO 2012 p38)	
A portfolio of opportunities for resourcing PNKB Park are identified	[REVIEW] The Phong Nha Ke Bang National Park Management Plan <i>has/has not</i> identified mechanisms for achieving financial sustainability (UNESCO 2012 p49)	
The preparation of a Business Plan has been identified	[REVIEW] The Phong Nha Ke Bang National Park Management Plan <i>has/has not</i> identified that a Business Plan be prepared (UNESCO 2012 p50)	
The economic benefits the World Heritage Site brings to the Region are recognised and managed	[REVIEW] The Phong Nha Ke Bang National Park Management Plan <i>has/has not</i> identified the important economic role the WH property plays in the local economy and how this is balanced with the protection of its OUV (UNESCO 2012 p59)	
The Management Plan: Research		
Encourage research	[REVIEW] The Phong Nha Ke Bang National Park Management Plan <i>has/has not</i> identified the important role of research along with actions to encourage and support this role (UNESCO 2012 pp75,76)	
The Management Plan: Monitoring, Indicators and Evaluation (UNESCO 2011 Paragraph 111b)		
Establish monitoring and evaluation	[REVIEW] Monitoring and evaluation procedures and evaluation subjects <i>have/have not been</i> planned that strengthen the management of OUV and that account for specific UNESCO World Heritage Committee requirements (UNESCO 2012 p37, p43; Decision 35 COM 8B.12)	
Undertake regular monitoring and	[REVIEW] Monitoring and evaluation procedures <i>have/have</i>	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

evaluation	<i>not been planned</i> to be undertaken regularly (using UNESCO recommended tools) (UNESCO 2012 p40; p74)	
Undertake management effectiveness evaluation	[REVIEW] Management effectiveness evaluation using the UNESCO <i>Enhancing Our Heritage Tool</i> and the <i>IUCN Management Framework</i> has/has not been recognised in The Phong Nha Ke Bang National Park Management Plan (UNESCO 2012 p78-81)	

5.2. ANNEXURE: Briefing by PNKB NP Director

BRIEFING BY PHONG NHA-KE BANG NATIONAL PARK

DIRECTOR MR LUU MINH THANH

(In relation to progress against the World Heritage Committee Decision 35 COM 8B.12, July 2011)

A comprehensive review checklist of World Heritage considerations (Annexure 4.1) was used to help review the current status of World Heritage management in Phong Nha-Ke Bang National Park. The checklist included matters arising from the World Heritage Committee's Decision 35 COM 8B.12 of July 2012. Advice was provided by National Park Director Mr Luu Minh Thanh on progress for the four World Heritage Committee Recommendations of Decision 35 COM 8B.12.

Director Thanh advised:

- a. The Management Plan was still being developed
- b. Action to extend the Property from 85,754 ha to 125,729 ha was current and approval will be sought from the Prime Minister by the end of September 2012
- c. No action has been taken on a Laos (Hin Namno National Park) transboundary World Heritage cooperative approach given advice received by Mr Thanh in 2011 that Laos has independently submitted a World Heritage nomination
- d. For the World Heritage Referral, Consultant Mr Dung from FIPI (Forest Inventory and Planning Institute) was working on Criterion (x) including for the extension area
- e. For Criterion (ix) more background information was sought
- f. Law enforcement was being strengthened including through Frankfurt Zoo and Cologne Zoo

5.3. ANNEXURE: Management Plan World Heritage Contents Gap Analysis

Phong Nha-Ke Bang National Park Management Plan

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
EXECUTIVE SUMMARY FOREWORD PREFACE TABLE OF CONTENTS ABBREVIATIONS/ACRONYMS ACKNOWLEDGEMENTS CONCLUSION INTRODUCTION (Scope)			
1			
<ul style="list-style-type: none"> • • • • • 			
<p><i>(Including assessment of natural, socio- and economic status, defense, security, ecology, biodiversity, biological gene source, historical monument, culture, landscape, etc.;</i>)</p> <p>1. Background</p> <p>1.1 History of the establishment of the National Park</p> <p>1.2 Location</p> <p style="padding-left: 20px;">1.2.1 Where.</p> <p style="padding-left: 20px;">1.2.2 Boundaries.</p> <p style="padding-left: 20px;">1.2.3 Access routes to the National Park</p> <p>1.3 Physical features</p> <p style="padding-left: 20px;">1.3.1 Topography</p> <p style="padding-left: 20px;">1.3.2 Geology and geomorphology</p> <p style="padding-left: 20px;">1.3.3 Climate.</p> <p style="padding-left: 20px;">1.3.4 Hydrology</p>			

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
1.3.5 Caves and cave systems			
<p>1.4 Socio-economic features</p> <ul style="list-style-type: none"> 1.4.1 Population 1.4.2 Ethnic grouping 1.4.3 Historical and cultural heritage 1.4.4 Defence and security 1.4.5 Land-use and land tenure 1.4.6 Labour and employment 1.4.7 Industry, regional & NP tourism 1.4.8 Administrative units/agencies 1.4.9 Stakeholders <p>1.5 Biological resources</p> <ul style="list-style-type: none"> 1.5.1 Biogeography 1.5.2 Ecosystems 1.5.3 Vegetation 1.5.4 Flora 1.5.5 Fauna 1.5.6 Key species of conservation concern <p>1.6 Legal Framework and Institution for the National Park</p> <p><i>(Including factual foundations, identify organization, management, conservation and sustainable use of special use forests)</i></p> <ul style="list-style-type: none"> 1.6.1 Legal basis 1.6.2 Institutional structure 1.6.3 Working mechanism 1.6.4 Infrastructure & equipment 1.6.5 Funding <p>1.7 Current management</p> <ul style="list-style-type: none"> 1.7.1 Scientific research, monitoring and wildlife rescue 1.7.2 Forest protection, management and law enforcement 1.7.3 Cave protection and management. 1.7.4 Environmental education and awareness raising 1.7.5 Community development 1.7.6 Tourism development 1.7.7 Infrastructure development 			

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
1.7.8 Cooperation 1.7.9 Projects – programs			
Legal status <ul style="list-style-type: none"> • Legal protection with depth? (eg to the centre of the Earth) to cover the protection of caves 			
Ownership and control <ul style="list-style-type: none"> • Inscribed World Heritage area • PNKB National Park • Other Protected Area lands • Leasehold lands 			
Adjacent land uses			
CHAPTER 2 ANALYSIS AND EVALUATION			
1. Analysis of the description. Key targets for protection			
Summary of all values <ul style="list-style-type: none"> • OUV (criteria, integrity, management) • Water catchment • Indigenous values • Historic values • Recreation and tourism values • Wilderness values • Social and economic • Research and education • Scenic and aesthetic • Other 			
2. Objectives and Tasks of the National Park (as assigned by law)		■	
3. Formulation of a management mission and 5-year objectives			
Non-human factors impacting management (abridged) <ul style="list-style-type: none"> • Wind • Climate change • Severe weather events • Invasive species 		■	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
<ul style="list-style-type: none"> • Alien species • Flooding • Earthquake? • Fire 			
<p>4. Evaluation of strengths, opportunities, threats and constraints</p> <p>4.1 Human pressures.</p> <p>4.2 Socio-economic and socio-political threats and constraints.</p> <p>4.3 Regional threats</p> <p>4.4 Climate change</p> <p>4.5 Institutional concerns</p> <p>4.6 Institutional control</p> <p>4.7 Organizational management</p> <p>4.8 Personnel</p> <p>4.9 Funding and budgetary control</p> <p>4.10 Infrastructure and equipment</p>			
<p>2011 negative factors affecting World Heritage Properties</p> <p>Illegal activities</p> <p>Housing</p> <p>Effects of transportation infrastructure</p> <p>Fishing</p>		■	
<p>Values and Objectives for management</p> <ul style="list-style-type: none"> • Criterion (viii) <ul style="list-style-type: none"> ○ Karst hydrology ○ Karst ecosystems ○ Karst processes ○ Tourist cave conservation ○ Presentation management ○ Karst research • Criterion (ix) <ul style="list-style-type: none"> ○ PNKB Ecosystem and process conservation • Criterion (x) <ul style="list-style-type: none"> ○ Conserve PNKB fauna ○ Conserve PNKB flora ○ Restore damaged sites 	■		

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
<ul style="list-style-type: none"> • Criteria (viii), (ix), (x) <ul style="list-style-type: none"> ○ Maintain intactness 			
<p>Pressures</p> <ul style="list-style-type: none"> • Summary of threats to OUV • Major impacts identified 			
<p>Description of the OUV management targets</p> <ul style="list-style-type: none"> • Clear, measurable management targets • Targets are the focus of management actions to achieve the objectives including response to threats 			
<p>Indicators for targets</p> <ul style="list-style-type: none"> • A list of measurable indicators for the agreed targets • Used to monitor success of management • Use of this monitoring to report on the condition and trend in condition of the World Heritage OUV 			
<p>Strategies and actions for management (P111g)</p> <ul style="list-style-type: none"> • These are based on the Targets • The Targets are often supported by supplementary, specific plans 			
<p>5. Management strategy</p> <p>5.1 Protection of biota and ecosystem management</p> <p>5.2 Geology, geomorphology, caves, flows, underground river... management</p> <p>5.3 Patrolling and law enforcement</p> <p>5.4 Public awareness</p> <p>5.5 Community relations</p> <p>5.6 Tourism and visitor management</p> <p>5.7 Regional development plans and regional integration</p> <p>5.8 Research and monitoring.</p> <p>5.9 Institutional control, organizational management and administration.</p>			

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
Specific action: <ul style="list-style-type: none"> • Presentation of World Heritage • Use of the World Heritage logo 		■	
Specific action: Disaster risk management planning, risk reduction and risk preparedness		■	
CHAPTER 3. PRESCRIPTION. THE ACTION PLAN			
<p>3.1 ZONATION, <i>(Including planning of spaces of functional zones; strict protection zones, rehabilitation zones, administration-service zones; Planning of boundaries of SUF.)</i></p> <p style="margin-left: 40px;">3.1.1 Boundaries, functional zones.</p> <p style="margin-left: 40px;">3.1.2 Development of regulations for zones</p> <p style="margin-left: 80px;">Strictly protected zone (Core zone)</p> <p style="margin-left: 80px;">Ecological restoration zone</p> <p style="margin-left: 40px;">3.1.3 Tourism sub-zone</p> <p style="margin-left: 40px;">3.1.4 Species protection sub-zone</p> <p style="margin-left: 40px;">3.1.5 Rehabilitation sub-zone</p> <p style="margin-left: 40px;">3.1.6 Other sub-zones</p> <p style="margin-left: 80px;">Administration and services zone</p> <p style="margin-left: 80px;">Buffer Zone</p>			
Systematic management framework and management process <ul style="list-style-type: none"> • Use of the (Hockings) IUCN Framework • Use of Environmental Impact approval processes as part of decision making processes 		■	
<p>3.2 BIOTA, ECOSYSTEM AND HERITAGE MANAGEMENT</p> <p><i>(Including planning of forest protection items, ecological rehabilitation, biodiversity conservation, protection and enhancement of natural landscape, cultural, historical values and environment; wildlife and plant rescue; and scientific study.)</i></p> <p style="margin-left: 40px;">3.2.1 Ecosystem management (Ecosystems of soil mountains, karst mountains, streams, caves, etc.)</p> <p style="margin-left: 40px;">3.2.2 Biota management (fauna, flora and microorganism)</p> <p style="margin-left: 40px;">3.2.3 Geological heritage</p>			

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
3.2.4 Cultural and historical heritage			
<p>3.3 PROTECTION AND LAW ENFORCEMENT</p> <p>3.3.1 Patrolling and protection</p> <p>3.3.2 Forest fire prevention and fire fighting</p> <p>3.3.3 Supervision and controlling activities of forest rangers.</p> <p>3.3.4 Joint patrolling activities of participating government forces (forest rangers, forest guards, policemen, army, border forces, local authorities etc).</p> <p>3.3.5 Handling violations and legal evidence (exhibits)</p> <p>3.3.6 Community-based protection, fire prevention, fire fighting, etc.</p>			
<p>Managing Illegal activities</p> <ul style="list-style-type: none"> • Monitoring and reporting • Spatial identification of activities and patterns 		■	
<p>3.4 PUBLIC AWARENESS <i>(Including Planning of forest protection items, ecological rehabilitation, biodiversity conservation, protection and enhancement of natural landscape, cultural, historical values and environment; wildlife and plant rescue; and scientific study.)</i></p> <p>3.4.1 Interpretation for visitors</p> <p>3.4.2 Environmental education for children</p> <p>3.4.3 Awareness building and public relations for surrounding community</p> <p>3.4.4 Sponsorships, promotion & marketing.</p>		■	
<p>3.5 COMMUNITY RELATIONS <i>(Including planning of buffer zone development.)</i></p> <p>3.5.1 Sustainable rural development: Buffer Zone development and alternative livelihoods</p> <p>3.5.2 Co-management of human-wildlife conflict (crop damage, etc.)</p> <p>3.5.3 Economic opportunities for the Park</p>			
<p>Working with local communities</p> <ul style="list-style-type: none"> • Working with indigenous communities • Co-operative partnerships in the buffer zone 		■	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
<ul style="list-style-type: none"> • Connectivity conservation management 			
Change in traditional life and knowledge <ul style="list-style-type: none"> • Managing for change 		■	
Transboundary initiatives with Laos <ul style="list-style-type: none"> • Regular transboundary liaison • Shared fauna research and management • Shared hydrology research and management • Cooperative law enforcement 			
3.6 TOURISM AND VISITOR MANAGEMENT <i>Including planning for the development and management of ecotourism; and planning of tourism works.)</i> <ul style="list-style-type: none"> 3.6.1 Tourism development and promotion 3.6.2 Tourism management and control 3.6.3 Interpretation and communications 			
Preparation of a Specific visitor use management plan and implement <ul style="list-style-type: none"> • Response to negative impacts • Visitor numbers (trends) • Recreation Opportunity Spectrum planning • Access planning • Levels of Service planning • Assets management planning • Visitor safety management • Market segments management • Supply and demand management • Incident management • Risk management 		■	
3.7 REGIONAL INTEGRATION <ul style="list-style-type: none"> 3.7.1 Relationships among National Park with other units and agencies and organizations in the region 3.7.2 Transboundary cooperation 3.7.3 Major development impacts 3.7.4 Environmental Impact Assessments (EIAs) and certificates. 		■	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
<p>3.8 RESEARCH AND MONITORING <i>(Including organizing monitoring activities on forest resource changes, biodiversity, ecological rehabilitation, use of SUFs resources and environmental services; planning of SUF information system; and planning of scientific study.)</i></p> <p>3.8.1 Biological geological, geomorphological, climate, water flows, socio-economic and protection research</p> <p>3.8.2 Biological, geological, geomorphological, climate, water flows, socio-economic and protection monitoring</p> <p>3.8.3 Coordination with outside researchers and NGOs</p> <p>3.8.4 Management of specimen collections</p>	■	■	
<p>3.9 INSTITUTIONAL CONTROL, ORGANIZATIONAL MANAGEMENT & ADMINISTRATION <i>(Including planning of infrastructure development for management, technical works, offices)</i></p> <p>3.9.1 National Park organization.</p> <p>3.9.2 Personnel, staff training & development</p> <p>3.9.3 Administration, budget & funding</p> <p>3.9.4 Information management system</p> <p>3.9.5 Equipment</p> <ul style="list-style-type: none"> • For management, • For patrolling and protection, • For forest fire prevention and fire fighting, • Transportation <p>3.9.6 Infrastructure development and management</p> <ul style="list-style-type: none"> • Patrol roads and trails • Offices and guard posts • Technical work stations • Tourism centre and visitor facilities in the Park • Botanical garden • Rescue centre • Boundary markers and sign boards <p>3.9.7 Financial management and procurement management</p>			
<p>Transport and infrastructure</p> <ul style="list-style-type: none"> • Manage transport and infrastructure proposals to prevent any impacts to the property 		■	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

PNKB MANAGEMENT PLAN DRAFT CONTENTS	SOUV Objectives	Asia-Pacific Periodic Reporting	PNKB Periodic Report
Management Effectiveness Evaluation <ul style="list-style-type: none"> • Use of the World Heritage Enhancing our Heritage framework • Use of the IUCN Framework • Use of Ecological integrity for context in the future • Specific assessment of the condition and trend in condition of the WH site OUV 			
World Heritage Periodic reporting <ul style="list-style-type: none"> • This information is often supplementary to the monitoring of the Targets • Prepare a plan to organise the data collection • List the core periodic reporting information needed • Determine what data is to be collected • Report annually for these matters 			
4.0 STAFF TRAINING AND CAPACITY BUILDING		■	
Training opportunities <ul style="list-style-type: none"> • Research and monitoring • Community outreach • Interpretation • Education • Visitor management • Conservation • Administration • Tourism • Enforcement • Business development 		■	
4			
1.0 WORK PLAN <i>(Including planning of investment for infrastructure development for management, protection, forest fire prevention and fighting, transportation, patrol roads, technical and tourism works, offices, boundaries of SUF; SUF information system; Specifying investment for each category, total investment, financing source and investment periods.)</i> 1.1 SCHEDULE 1.2 BUDGET TABLE			
ANNEXURES			

5.4. ANNEXURE: *Preliminary Draft Statement of OUV*

PRELIMINARY DRAFT STATEMENT OF OUTSTANDING UNIVERSAL VALUE

Note

1. This is a very preliminary document prepared only to assist discussions and planning work at PNKB NP in August 2012. It requires further input and improvement by biologists and ecologists and other experts
2. This statement has been written as a future statement. Ultimately, it is the State Party's responsibility to prepare a draft SOUV for criteria (viii), (ix) and (x) as part of the referral process
3. The data cited needs to be updated
4. The underline identifies new or changed text

PHONG NHA - KE BANG NATIONAL PARK – WORLD HERITAGE SITE

Preliminary Draft Statement of Outstanding Universal Value for the expanded (125, 729 ha) Phong Nha – Ke Bang National Park (Vietnam)*¹ **(Prepared August 2012)**

*1. Based on the World Heritage Committee July 2012 approved Retrospective SOUV for the 85,754 ha Phong Nha – Ke Bang National Park with any changes shown by underline)

BRIEF SYNTHESIS

Phong Nha - Ke Bang National Park is located in the middle of the Annamite Mountain Range in Quang Binh province, Vietnam and shares its boundary with the Hin Namno Nature Reserve in Lao PDR to the west. The property comprises an area of 125,729 ha and contains terrestrial and aquatic habitats, primary and secondary forest, sites of natural regeneration, tropical dense forests and savanna and is rich in large, often spectacular and scientifically significant caves including the World's largest known cave passage (Son Doong Cave). Part of the property (85,754 ha) was inscribed on the World Heritage List in 2003 under criterion (viii). In 201? the World Heritage Committee inscribed the property for criteria (viii), (ix) and (x).

The property contains and protects over 104km of caves and underground rivers making it one of the most outstanding limestone karst ecosystems in the world. The karst formation has evolved since the Palaeozoic period (some 400million years ago) and as such is the oldest major karst area in Asia. Subject to massive tectonic changes, the karst landscape is extremely complex, comprising a series of rock types that are interbedded in complex ways and with many geomorphic features. The karst landscape is not only complex but also ancient, with high geodiversity and geomorphic features of considerable significance.

The karst formation process has led to the creation of not only underground rivers but also a variety of cave types including; dry caves, terraced caves, suspended caves, dendritic caves and intersecting caves. With a length of over 44.5 km the Phong Nha cave is the most famous of the system with tour boats able to penetrate inside to a distance of 1,500 m.

A large number of faunal and floral species occur within the property with over 568 vertebrate species recorded comprising 113 mammals, 81 reptiles and amphibians, 302 birds and 72 fish. This impressive level of biodiversity and species richness includes a number of endemic species as well as threatened species including tiger, Asiatic black bear, Asian Elephant, Giant Muntjac, Asian Wild Dog, Gaur and the recently discovered Sao la.

Criterion viii:

Phong Nha is part of a larger dissected plateau, which also encompasses the Ke Bang and Hin Namno karsts. The limestone is not continuous and demonstrates complex interbedding with shales and sandstones. This, together with the capping of schists and apparent granites has led to a particularly distinctive topography.

The caves demonstrate discrete episodic sequences of events, leaving behind various levels of fossil passages, formerly buried and now uncovered palaeokarst (karst from previous, perhaps very ancient, periods of solution); evidence of major changes in the routes of underground rivers; changes in the solutional regime; deposition and later re-solution of giant speleothems and unusual features such as sub-aerial stromatolites. The location and form of the caves suggests that they might owe much of their size and morphology to some as yet undetermined implications of the schists and granites which overlay the limestone. On the surface, there is a striking series of landscapes, ranging from deeply dissected ranges and plateaux to an immense polje. There is evidence of at least one period of hydrothermal activity in the evolution of this ancient mature karst system. The plateau is probably one of the finest and most distinctive examples of a complex karst landform in southeast Asia.

Phong Nha displays an impressive amount of evidence of earth's history. It is a property of very great importance for increasing our understanding of the geologic, geomorphic and geo-chronological history of the region.

Criterion ix:

The property represents a large, essentially intact conservation sampling of a Global 200 priority ecoregion whose biodiversity values were not otherwise represented on the World Heritage List. The property belongs to Udvardy's Indochinese Rainforest province in the Tropical Humid Forests biome of the Indomalayan realm. According to the more recent classification of terrestrial ecoregions by Olson et al, (2001), the property belongs to the Northern Annamites Rain Forests ecoregion, as well as two freshwater ecoregions (Northern Annam and Southern Annam). It is different to the two biodiversity World Heritage sites in Thailand that belong to the Global 200 ecoregions: Indochina Dry Forests (Dong Phrayayen-Khao Yai) and Kayah-Karen/Tenasserim Moist Forests (Thungyai-Huai Kha Khaeng). The karst environment hosts many important ecological and evolutionary processes. The many isolated caves, and cave systems, provide ample opportunity for speciation of cave fauna, as illustrated by the 2010 and 2011 discovery of new scorpion species in the Park's caves. Over 40 species of bats are found in the forests and caves of the World Heritage property and their guano provides important ecosystem benefits for invertebrate, fish and bird populations. The nine species of primates help spread forest fruits and seeds within the property, and the deep cave systems host important troglobitic species such as the blind scorpion that survives from externally derived food sources. It is the large scale of the enlarged property and its direct connectivity with the Hin Namno National Biodiversity

Conservation Area in Laos (and ultimately to the Nakai-Nam Theun NBCA in Laos) that provides the opportunities for many rare and endangered South-east Asian species to move across the landscape, for interaction, for evolutionary development and for survival.

Criterion x:

The property is of global significance for the conservation of biodiversity because its forest ecosystems, both karst and non-karst, support a comparably high diversity of plants and animals including a number of karst specialist species, many endemic species and a number of species that are globally threatened. Its rich diversity of endangered species include the Tiger, Giant Muntiac, Saola, Asiatic Black Bear, the Malayan Sun Bear, the the Binturong and the Gaur. The property's fauna includes a 'Lazarus taxon': the Laotian Rock Rat belongs to a genus that disappeared from the fossil record for 11 million years but was recently discovered by western science in the property. Almost 94% of the property is forested and 84% is primary forest. The property is also part of a Global 200 priority ecoregion and an Endemic Bird Area which are not yet represented on the World Heritage List, as well as the Indo-Burma global biodiversity hotspot. The property is home to 2,651 vascular plant species including 419 species endemic to Vietnam and 735 vertebrate species including over 70 of which are globally threatened. Seven of the nine primate species occurring in the park are globally threatened and the property is one of the most important refuges for three of them. The property probably has the largest remaining population of the globally endangered Hartinh langur, a karst specialist primate endemic to central Vietnam and Laos.

INTEGRITY

Covering an area of 125,729 ha and bounded on the west by the Lao People's Democratic Republic, all elements necessary to manifest the outstanding geological values of the property of Phong Nha – Ke Bang National Park are contained within the boundaries of the property. The inscribed property is completely surrounded and protected by a buffer zone of approximately 200,000 ha and is designated into three management zones; strictly protected (64,894 ha), ecological recovery (17,449 ha) and administrative service (3,411 ha).

There are a number of issues that affect the integrity of the property. These include the fact that a part of the major watershed is not contained within the boundaries of the property and that a road crosses the property. While former problems with poaching posed a threat to the values contained within the site these are now considered to be under effective control. However, continued management actions and monitoring is required to ensure poaching does not become an issue in the future.

The property is situated within an area of high population density and as such a number of activities, such as cultivation, tourism, transport and fisheries also impact on the integrity of the property. However, these activities are currently under strict control and management. As a result, the natural landscape, geologic and geomorphic values, and key features such as primitive forest, caves, rivers and streams within the inscribed area are all intact.

PROTECTION AND MANAGEMENT

Originally designated as a Nature Reserve in 1986, Phong Nha - Ke Bang National Park was established in 2001 under the Decision 189/QĐ-TTg by the Prime Minister and is managed by a Management Board. The management board is responsible for protection of forest resources and biodiversity and was established in 1994. Cave conservation and the provision of a tourism service are the responsibility of the Cultural and Ecological Tourist Centre under the Management Board. The site management is conducted by more than 470 staff members from many different technical backgrounds. The property is also included in the Special National Heritage List (2009), and the Special Use Forest system (1999). The Phong Na-Ke Bang National Park was extended from 85,754 ha to 125,729 ha in 201? The National Park is effectively protected by a number of national laws and government decisions, which prohibit any action to be under taken inside or outside the boundaries of the National Park or a World Heritage property that may have a significant impact on the heritage values. The Management Plan was completed in 201? and provides detailed clarity of purpose and protection for the World Heritage property, including strictly protecting its three zones, the strictly protected zone, the ecological restoration zone and the administration zone. Proposed developments that could impact the World Heritage Karst, biodiversity or ecological processes would not be permitted.

A specific World Heritage property visitor management plan was completed in 201? This plan provides detailed guidance for the management of visitor use including identifying recreation opportunity zones, levels of service, visitor flow management designs, visitor information management within-cave management, river traffic management, wild cave management, visitor safety and support, waste management, and leasing and licensing management. Action has been taken to control hunting and trade in wildlife, including setting up ten ranger stations and a mobile patrol unit to prevent poaching within the property. The rugged nature of the country, difficulty of control, low income of many local families and relative shortage of resources for control purposes means that wildlife poaching and illegal timber gathering are difficult to eliminate and this challenging issue will require further efforts into the future if it is not to continually impact the property.

The Ho Chi Minh highway, constructed outside and to the north of the property is clearly justifiably and appropriately located. It provides important and valuable benefit to the National Park in terms of opening up views of and access to the Ke Bang forest area. The highway also greatly enhances year-round traffic flow from the North and South of the country as a whole, constructed with a high level of environmental responsibility the road linking the highway and route 20, which crosses the property, is small and has little impact on its natural values. Other road construction in the area requires careful planning and construction as impacts from construction processes as well as indirect impacts on the property may threaten the values of the site.

Impacts of increased development pressure and tourism numbers also require further consideration, planning and management. In the long-term, management of the property focuses on ensuring the integrity of the geological and geomorphologic values, the rich biodiversity and important ecological/evolutionary processes as well as the property's environment; strengthening the legislative provisions; carefully monitoring the socio-economic activities within the national park; designing suitable eco-tours; increasing the usage of technology in heritage management; undertaking research to gain a better

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

understanding of the property's values; improving the staff capacity and enhancing community awareness and involvement.

5.5. ANNEXURE: PNKB NP Karst Values

PHONG NHA-KE BANG NATIONAL PARK KARST VALUES

Phong Nha-Ke Bang (PNKB) National Park Criterion (viii) and other Karst WH properties		
World Heritage Site (and other) locations	Notes	Reference
Phong Nha-Ke Bang National Park Criterion (viii) (85,754 ha)	PNKB is almost as twice as large as Gunung Mulu and the South China Karst. It is one of 50 World Heritage sites with Karst identified by Elery Hamilton Smith	IUCN Technical Evaluation 2010
	PNKB is Big River Karst, one of just three such WH sites in the world identified by EH Smith	Smith, E.H. (undated) "Thinking about Karst and World Heritage"
	PNKB is part of a distinctive Karst ecosystem ....namely a Eurasian Tropic-Sub-Tropic type with hard limestone (Yuan Daoxin)	Yuan Daoxian (undated)
	PNKB includes Son Doong Cave, the largest cave known on Earth	British Cave Research Association
WH Ha Long Bay Vietnam Criterion (vii); (viii) (150,000 ha)	The World's most extensive and best known example of tropical tower karst invaded by sea	IUCN Technical Evaluation 2010
WH Gunung Mulu Malaysia Criterion (vii), (viii), (ix), (x) (52,864 ha)		IUCN Technical Evaluation 2010
WH South China Karst, China Criterion (vii), (viii) (47,588 ha)		IUCN Technical Evaluation 2010

5.6. ANNEXURE: Chronology of Decisions

CHRONOLOGY OF DECISIONS

Phong Nha-Ke Bang National Park: World Heritage Establishment, Nomination, Re-Nomination, Inscription, Re-Nomination and World Heritage Committee Decisions
(Sources: Written memos, reports and UNESCO's Operational Guidelines)

Year	Event	Notes and Reference
2014	<p>1st February 2014: The absolute deadline for receipt of re-nomination papers Based on a requirement that:</p> <ol style="list-style-type: none"> 1) A State Party must submit the additional information by the 1st February of the year the examination is required 2) No date was set by the WH Committee 3) The limit of referral information being set at 3 years. 	<p>"A referred nomination which is not presented to the Committee within three years of the original Committee decision will be considered as a new nomination when it is resubmitted for examination" [UNESCO 2011 Paragraph 159]</p>
2012	<p>Draft Management Plan: Target date: To be prepared by September 2012</p>	<p>Draft Plan of Management text to be prepared in time for renomination for the Parks biodiversity values</p>
2012	<p>Statement of Outstanding Universal Values Submitted to the 36th Session for approval July 2012. For the 85,740 ha property</p>	<p>SOUV to be upgraded to account for the larger national park and Criteria (ix) and (x)</p>
2011	<p>Decision: 35 COM 8B.12 Refers the re-nomination of PKNB NP under additional criterion (x) back to the State Party to allow it to address the integrity, protection and management issues affecting the property. (Three years to achieve the referral requirements)</p> <p>Referral: "(...) the Committee decides to refer back to the State Party for additional information (...) The additional information must be received (...) by the 1 February of the year in which the examination by the Committee is required. (...) A referred nomination which is not presented to the Committee within three years (...) will be considered a new nomination (...)". (Paragraph 159 p39)</p>	<p>WHC-11/35.COM/20 Paris 7 July 2011 These issues include:</p> <ul style="list-style-type: none"> • Dealing with poaching and timber removal • Updating the Plan of Management • Expand the park to 125,729 ha • Pursue the transboundary approach with Lao...a potential nomination • A revised nomination for Criteria (viii), (ix) and (x) • Strengthen conservation and management of the park and the buffer zone ...environmentally sustainable use of resources and benefits equitably shared • Use of EIA's and implementation of their findings • Further staff training; MEE; monitoring; improved heritage interpretation
2010	<p>Criterion x: The IUCN evaluation identifies that PKNB meets this criterion, but not WH status</p>	<p>IUCN Recommends Deferral:</p> <ul style="list-style-type: none"> • Extend the park

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

Year	Event	Notes and Reference
	<p>for integrity reasons</p> <p>Deferral: "(...) defer a nomination for more in depth assessment or study or a substantial revision (...). (...) must be received (...) by 1st February (...) reevaluated again (...)"(Paragraph 160 p40)</p>	<ul style="list-style-type: none"> • Liaise with PDR Lao with a view to potential nomination of Hin Namno National Biodiversity Conservation Area as a transboundary approach • Law enforcement strengthening • Update of the plan of management • Nominating for (ix) as well as (x) • Strengthen management of the Buffer Zone • Use EIA's for infrastructure and tourism developments • More training and equipment for law enforcement • Improved heritage interpretation • Improved conservation • Introduce a Management Effectiveness Evaluation framework <p>(IUCN 2010 Technical Evaluation)</p>
2010	<p>Proposal: To expand PNKB northward and to 125,000 ha by 2012 (an additional 40,000 ha of the Karst Plateau</p>	IUCN Technical Evaluation 2010
2010	<p>Evaluation: 27 September-2 October 2010: IUCN Technical Evaluation Phong Nha-Ke Bang National Park (85,754 ha) World Heritage Nomination</p>	<p>Evaluation completed by Cristi Nozawa and Bastian Bomhard (ID No. 951bis)</p> <ul style="list-style-type: none"> • Protection status of the property does not meet the Operational Guidelines. Illegal harvest and trade of forest products needs to be eliminated. • Renomination does not include the 40,000 ha extension area and is considered premature • No management plan in place <p>Deferral Recommended (IUCN 2010 Technical Evaluation)</p>
2010	<p>Nomination: 15 March 2010: Re-nomination of the property to recognise biodiversity values under criterion (x)</p>	The nomination was based on new information about the area's biodiversity values that had become available since 2003
2003	<p>Recommendation: World Heritage Committee Decision 27 COM 8C.8</p>	<p>Encouragement of the State Party to:</p> <ul style="list-style-type: none"> • Fix the impact of the HCM Highway • Undertake a thorough review of PNKB boundaries in order to provide more complete coverage of the natural values • Prepare a visitor management plan and actions control poaching • Reiterates the request in 1999 to continue dialogue with Lao Peoples Democratic Republic for a transboundary agreement <p>(IUCN 2010 Technical Evaluation)</p>
2003	<p>Inscription: Phong Nha-Ke Bang (PNKB) National Park (85,754 ha) was inscribed on the</p>	

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

Year	Event	Notes and Reference
	World Heritage List under Criterion (viii)	
2002	Nomination: A further revised nomination for the newly established Phong Nha-Ke Bang (PNKB) National Park (85,754 ha) was submitted	IUCN concluded that the property itself did not meet criterion (x) noting that a larger area may have potential to meet this criterion
2001	Decision December 12 2001: The Vietnamese Prime Minister turned the Nature Reserve into a National Park	Decision 189/2001
2000	Nomination: Revised nomination of a larger area (147,945 ha) submitted	Not considered further because of road plans that could impact the OUV
1998	Nomination: Phong Nha-Ke Bang Nature Reserve (41,132 ha) was nominated as a World Heritage Property	23 rd Session of the World Heritage Bureau (Paris 1998) deferred a decision pending a possible expansion of the boundaries
1991	Phong Nha Nature Reserve was extended to 41,132 ha	
1986	Phong Nha Nature Reserve was established on the 9 th August 1986 (5000ha)	

5.7. ANNEXURE: Presentation of the World Heritage Convention

PRESENTATION OF THE WORLD HERITAGE CONVENTION

World Heritage Property management – Encouraging support for the World Heritage Convention		
Subject	Notes	Reference
Objectives	“(...) <ul style="list-style-type: none"> (a) to enhance capacity building and research (b) to raise (...) awareness, understanding and appreciation, (...) need to preserve cultural and natural heritage (c) to enhance the function of WH in the life of the community (d) to increase the participation of (...) populations in the protection and presentation of heritage” 	Operational Guidelines (Paragraph 211 p57)
Research	“(…) State Parties are encouraged to make resources available to undertake research” (...)	Operational Guidelines (Paragraph 215 p58)
Awareness	“State Parties are encouraged to raise awareness of the need to preserve WH. (...) they should ensure that the WH status is adequately marked and promoted on-site”	Operational Guidelines (Paragraph 217 p58)
Education	“The WH Committee encourages and supports the development of educational materials, activities and programmes”	Operational Guidelines (Paragraph 219 p58)

5.8. ANNEXURE: UNESCO Periodic Reporting Guidelines

UNESCO PERIODIC REPORTING GUIDELINES

Periodic Reporting: World Heritage Property specific reporting requirements		
Examine the State of Conservation through Periodic Reporting	Process of Periodic Reporting (Part V)	Operational Guidelines (24b) p6
Submit reports	“State Parties are requested to submit reports to the UNESCO General Conference (...) on the legislative and administrative provisions (...) for the application of the Convention including the state of conservation of the WH properties (...)”	Operational Guidelines (199) p54
Purpose of periodic reporting	“(…) four main purposes: (a) (...) an assessment of the application of the WH Convention by the State Party (b) (...) an assessment (...) OUV (...) is being maintained over time (c) to provide updated information (...) changing circumstances (...) state of conservation (...) (d) (...) mechanism for regional cooperation (...)	Operational Guidelines (201) p54
Procedure for Periodic Reporting	(b) “(...) invited State Parties to submit periodic reports every six years (c) “(...) examine States Parties periodic reports region by region (...) [Asia and the Pacific] (d) “(...) develop regional strategies for the periodic reporting process (...)	Operational Guidelines (203) p54
Format for Periodic reporting	(...) two sections: (a) Section I (...) legislative and administrative provisions (...) (b) Section II (...) refers to the state of conservation (...)	Operational Guidelines (206) p55

5.9. ANNEXURE: UNESCO Reactive Monitoring Guidelines

UNESCO REACTIVE MONITORING GUIDELINES

Requirement	Notes	Reference
World Heritage Committee Requirement: Examine the State of Conservation of a Property		
Examine the State of Conservation through Reactive Monitoring	The process of Reactive Monitoring is described (Part IV)	Operational Guidelines (24b) p6
Reactive Monitoring Definition	“(…) the reporting by the Secretariat, other sectors of UNESCO and the Advisory Bodies to the Committee on the state of conservation of specific World Heritage properties that are under threat”	Operational Guidelines (169) p45
State Party Reactive Monitoring reporting responsibilities	“(…) State Parties shall submit by 1 February to the Committee (…) specific reports and impact studies each time exceptional circumstances occur or work is undertaken which may have an effect on the state of the conservation of the property”.	Operational Guidelines (169) p45
World Heritage in Danger	“(…) Reactive monitoring is also foreseen in reference to properties inscribed, or to be inscribed on the list of WH in Danger (…)”	Operational Guidelines (169) p45
Deletion of properties	“(…) Reactive monitoring is foreseen in the procedures for the eventual deletion of properties	Operational Guidelines (169) p45
State Party reactive monitoring information	“(…) to inform (…) of their intention to undertake or authorise (…) major restorations or new constructions which may affect the OUV of the property”. “Notice should be given as early as possible (…)”	Operational Guidelines (172) p45
State of Conservation Mission reports	“(…) reports (…) include: (a) (…) threats or significant improvement since the last report (…) (b) (…) follow-up to previous decisions of the WHC on the state of conservation of the property (c) information on any threat or damage to or loss of OUV (…)”	Operational Guidelines (173) p46
State of Conservation Report	“Information received [that a property has seriously deteriorated] (…) will be brought to the attention of the Committee in the form of a state of conservation report which may take one or more of the following steps: (a) “(…) not seriously deteriorated (…) no further action (…)” (b) “(…) seriously deteriorated, but not to the extent its restoration is impossible (…) maintained on List provided (…) State Party takes necessary measures to restore (…) within a reasonable time period (…) the World Heritage Fund (…)”	Operational Guidelines (176) pp46,47

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

Requirement	Notes	Reference
	<p>(c) “(...) may decide to inscribe the property on the list of World Heritage in Danger (...)</p> <p>(d) “(...) irretrievably lost those characteristics which determined its inscription (...) the Committee may decide to delete the property from the list (...)”</p> <p>(e) “(...) insufficient information (...) Secretariat (...) ascertain (...) with the State Party (...) the present condition of the property, the dangers to the property, and the feasibility of adequately restoring the property (...) such measures may include the sending of a fact finding or the consultation of specialists”</p>	
World Heritage in Danger	<p>(a) Ascertained Danger - The property is faced with specific and proven imminent danger such as:</p> <p>(i) (...) serious decline in the population of endangered species or the other species of OUV (...)</p> <p>(ii) Severe deterioration of the natural beauty or scientific value of the property (...)</p> <p>(iii) human encroachment on boundaries or in upstream areas (...)</p> <p>(b) Potential Danger – (...) major threats which could have deleterious effects on its inherent characteristics (...)</p> <p>(i) (...) modification of the legal protective status (...)</p> <p>(ii) (...) resettlement or development projects within (...) or so situated (...) threaten the property</p> <p>(iii) (...) armed conflict</p> <p>(iv) (...) management plan (...) is lacking or inadequate or not fully implemented</p> <p>(v) threatening impacts of climatic, geological or other environmental factors</p>	Operational Guidelines (180) p49
Desired state of conservation	“(...) the Committee shall develop (...) a desired state of conservation for the removal of the property from the List of WH in Danger and a programme for corrective measures”	Operational Guidelines (183) p51
Review of state of conservation for List of WH in Danger	“The Committee shall review annually the state of conservation of properties on the List of WH in Danger”	Operational Guidelines (190) p51

5.10. ANNEXURE: UNESCO World Heritage Nomination Timetable

UNESCO WORLD HERITAGE NOMINATION TIMETABLE

Timetable	Requirement	Reference
Before Year One 30 September	Voluntary deadline for the receipt of draft nominations from States Parties by the Secretariat	Operational Guidelines (168) pp42-44
Before Year One 15 November	Secretariat responds about the completeness of the draft nomination with guidance if incomplete	
Year One 1 February	Deadline for complete nominations to the Secretariat	
Year One 1 Feb-1 March	Registration, Assessment of completeness, transmission to Advisory bodies	
Year One 1 March	Deadline where the State Party is advised that a nomination is complete	
March Year One to May Year Two	Evaluation by Advisory bodies	
31 January Year Two	Advisory bodies can request additional information but no later than 31 January Year Two	
28 February Year Two	Deadline for additional information submitted by the State Party to the Secretariat	
Year Two 6 Weeks prior to the WHC Meeting	Evaluations delivered by the Advisory bodies to the Secretariat and to the States Parties	
Year Two 14 Days prior to the WHC Meeting	Factual errors corrected by the States Parties	
June/July	World Heritage Committee Meeting: Nominations examined and decisions made	
Immediately Post WHC Meeting	States Parties notified. Inscribed Properties contacted	
Immediately Post WHC Meeting	Updated WH List published	
One month after the WHC Meeting	WHC Decisions published and provided to all States Parties	
Annual Management Cycle World Heritage Committee		
Date	Notes	Reference
June – July each year	21 Members of the World Heritage Committee meet once a year	Operational Guidelines (19) p5
	An annual list of a maximum of 45 WH nominations is considered by the Committee	Operational Guidelines (61) p18

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

5.11. ANNEXURE: Persons Consulted

No	Full name	Position	Organization
1	Mr. Nguyen Trung Thuc	PPMU Director	Phong Nha-Ke Bang (PNKB) Provincial Project Management Unit (PPMU)
2	Tran Chi Phuong	PPMU vice- director, former BZ development support group	PNKB PPMU
3	Bas van Helvoort	Chief Technical Advisor (CTA)	AHT CO (AHT Consultant Office) acting on behalf of the German Development Bank (KfW)
4	Nguyen Van Tri Tin	Deputy CTA	AHT CO
5	Nguyen Thi Ngoc Lan	Interpreter	AHT CO
6	Nguyen Ngoc Anh	Coordinator	GIZ (German Technical Corporation)
7	Pham Thi Lien Hoa	Knowledge Management Officer	GIZ
8	Mr. Bill Bleisch	International MP consultant	China Exploration and Research Society (CERS)
9	Mr. Le Trong Trai	National MP consultant	Birdlife International – Vietnam
10	Mr. Truong Thanh Khai	Head of Administration and organization department, PNKB NP	PNKB National Park (NP) Management Plan (MP) supporting group
11	Mr. Nguyen Quang Vinh	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MP supporting group
12	Mr. Nguyen Van Lan	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MP supporting group
13	Mr. Le Chieu Nguyen	Scientific Research and Rescue Centre (SRRC), PNKB NP	PNKB NP MP supporting group
14	Mr. Doan Thanh Binh	NP FPD, PNKB NP	PNKB NP MP supporting group
15	Mr. Nguyen Van Huyen	Vice- director of NP	PNKB NP MP supporting group
16	Mr. Nguyen Van Hai	Head of Finance and Planning Department, PNKB NP	PNKB NP MP supporting group
17	Mr. Luu Minh Thanh	Director	PNKB NP Management Board
18	Mr. Le Trung Kien	Vice-head Conservation Division	Scientific Research and Rescue Centre (SRRC), PNKB NP
19	Mr. Dirk G. Euler	Project Manager	Primates Reintroduction Programme, Frankfurt Zoological Society
20	Mr. Le Thanh Loi	Director	Eco-tourist Center, PNKB NP

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

5.12. ANNEXURE: Itinerary

ITINERARY

Consultant: Dr. Graeme Worboys , Senior Expert on World Heritage Sites Management
Assignment: PNKB National Management Planning/ World Heritage Sites Management
Dates: 04/8/2012- 19/8/2012

Date	Activities/Items	Location	Participant
Week 1 from 05 – 12/8/2012			
Saturday (04/8/2012)	Arrive in Dong Hoi city (3:30pm)	Dong Hoi/ Nam Long Hotel	AHT driver (Mr Vinh) pick up at Dong Hoi Airport
Sunday (05/8/2012)			
Morning (9am-12am)	Visiting the Paradise Cave and Nuoc Moc Stream	Paradise cave and Nuoc Moc stream	Project car/ driver AHT translator (Mrs Lan)
Afternoon	- Review documents related PNKB WH Sites Meeting with Laos study tour group and Project Director, Park director, CTA, DCTA (6pm)	- Dong Hoi/ Nam Long Hotel - Nam Thanh Restaurant	Mr Thuc, Mr Thanh, Duong, CTA, DCTA, CFM, OM
Monday (06/8/2012):			
Morning	Visit forest development and livelihood models in the buffer zone with the Laos group	Hung Trach commune, Bồ Trạch District	AHT, PMU Tech. staffs, Bo Trach DPMU
Afternoon	Visit Phong Nha cave	Phong Nha Cave	AHT, Tourist Center
Tuesday (07/8/2012)			
Morning (8:30 -11:30)	Meeting with representatives of Phong Nha-Ke Bang (PNKB) National Park (NP) Management Board (MB) and PM Working Group (WG): Review of the Checklist related to the UNESCO Recommendations, encouragement and advice	PNKB Head Office	Park MB, AHT, PMU tech. staffs
Afternoon (1:30 – 4:00)	Meeting continued.	PNKB Head Office	Park MB, AHT, PMU tech staffs
Wednesday (08/8/2012)			
Whole day	Writing	Hotel/ Project Office	Consulting
Thursday 09/8/2012			
Whole day	Writing	Hotel/ Project Office	Consulting
Friday 10/8/2010			
Morning 9am – 11:30am	Discussion on the potential World Heritage Planning Needs		
Afternoon 2pm – 4:30pm	Meeting with Representatives of Buffer Zone (BZ) Development Support Group, GIZ (German Technical Organisation) team on	Project Office/ Dong Hoi	Mr. Pham Hong Thai (Head of Support Group/Director FPD/Vice-Director

Phong Nha-Ke Bang National Park
World Heritage Management Planning Requirements

	management of the buffer zone, BZ Development Planning, and Tourism Development Planning		DARD), GIZ team
Saturday 11/8/2011			
Whole day	Writing	Hotel/ Project Office	Consulting
Sunday 12/8/2012			
Whole day	Visiting Park extension area		AHT, Park rangers,
Week 2 from 13 – 19/8/2012			
Monday 13/8/2012			
Whole day	Visiting Road 20 and Ranger stations with FPD and Frankfurt Zoo.		Dirk Euler, AHT and Forest Protection Division (FPD)
Evening	Meeting with the Park Director Mr Thanh		
Tuesday 14/8/2011			
Morning	Writing	Hotel/ Project Office	Consulting
Afternoon 1:30 – 3:00pm	Meeting with the National Park Scientific Research and Rescue Center: to understand about research, monitoring, evaluation programs	Scientific Research and Rescue Center Office	Mr Tri, Director, and staffs
3:00 – 4:30pm	Meeting with the National Park Eco-tourist Center: to understand how the World Heritage Property	Eco-tourist Center Office	Mr. Loi Director of Eco-tourist Center and staffs
Wednesday 15/8/2011			
Whole day	Prepare a short report for debriefing with PMU and the National Park	Project Office or PLO	consultant
Thursday 16/8/2011			
Morning 9am -11:30am	Debriefing with PMU and Park	Project Office	consultant
Afternoon	Prepare Three Presentations for the Park visioning Workshop		PMU and Park, AHT, GIZ
Friday 17/8/2011			
Whole day Morning	Attend to the Park visioning Workshop and provide three presentations on World Heritage OUV and Management	PNKB Head Office	
Afternoon	Provide interactive feedback to the NP executive on a range of World Heritage issues		
Saturday 18/8/2011			
Whole Day	Writing		
Sunday 19/8/2011: Flying back to Australia			

6. REFERENCES

- Gilleson , D. (1996) *Caves: Processes, Development, Management*, Blackwell, Oxford
- IUCN (1997) *Guidelines for Cave and Karst Protection*, International Union for the Conservation of Nature, Rue Mauverney 28, Gland
- IUCN (2008) *World Heritage Caves and Karst: A Thematic Study*, International Union for the Conservation of Nature, Rue Mauverney 28, Gland
- IUCN (2008a) *Outstanding Universal Value, Standards for Natural World Heritage*, International Union for the Conservation of Nature, Rue Mauverney 28, Gland
- IUCN (2008b) *Natural World Heritage Nominations, A Resource Manual for Practitioners*, International Union for the Conservation of Nature, Rue Mauverney 28, Gland
- BPAMP [Biodiversity and Protected Areas Management Project] (2006) *Ranger-Based Data Collection, A Reference Guide and Training Manual for Protected Area Staff in Cambodia*, Department of Nature Conservation and Protection, Ministry of Environment, Cambodia
- Toomey, R.S. (2009) 'Geological Monitoring of Caves and Associated Landscapes', in Young, R. and Norby, L. *Geological Monitoring*, Geological Society of America, Boulder, Colorado pp 27-46
- UIS [International Union of Speleology] (Accessed 2012) *UIS Management Guidelines for Show Caves*, Available at: http://www.uis-speleo.org/documents/UIS_MANAGEMENT_GUIDELINES_FOR_SHOW_CAVES.pdf
- UNESCO [United Nations Educational, Scientific and Cultural Organisation] (2010) *Guidance for the Preparation of Retrospective Statements of Outstanding Universal Value for World Heritage Properties*, UNESCO, 7 Place de Fontenoy, Paris, pp22
- UNESCO (2011) *Operational Guidelines for the Implementation of the World Heritage Convention*, UNESCO, 7 Place de Fontenoy, Paris, pp163
- UNESCO (2012) *Managing Natural World Heritage, World Heritage Resource Manual*, UNESCO, 7 Place de Fontenoy, Paris, pp98
- UNESCO (2012a) *Final Report on the results of the second cycle of the Periodic Reporting exercise for Asia and the Pacific, WHC 12/36.COM/10A*, UNESCO, 7 Place de Fontenoy, Paris, pp98

Appendix 5b

**RELEVANT POLICIES
TO THE PHONG NHA - KE BANG NATIONAL PARK**

Government
Number: 83/TTg

Socialist Republic of Vietnam
Independence - Freedom - Happiness

Hanoi, 12 December 2001

DECISION OF PRIME MINISTER

On the upgrading Phong Nha Nature Reserve to the Phong Nha - Ke Bang National Park

PRIME MINISTER

Base on the Law of the Government Organization dated 30 September 1992

Base on the Law of Forest Protection and Development

Examine the Statement No 3697/BNN-KH dated 29 November 2001 by the Ministry of Agriculture and Rural Development; the Statement No 1149/UB dated 5 November 2001 by the People's Committee of Quang Binh province; Statement No 3557/BKH/NN dated 12 June 2000 by the Ministry of Planning and Investment, Statement No 2270 TC/DT dated 6 June 2000 by the Ministry of Finance; Statement No 1330/UB dated 18 May 2000 by the Ministry of Science, Technology and Environment; and Statement No 1783/VHTT-BTBT dated 11 May 2000 by the Ministry of Culture and Information.

DECISION

Article 1: Upgrade the Phong Nha Nature Reserve to th Phong Nha - Ke Bang National Park, located in Bos Trach district, Quang Binh province.

Name of property: **Phong Nha - Ke Bang National Park**

Article 2: Location and area management

1. Location: Phong Nha - Ke Bang National Park shares the boundary with communes of Tan Trach, Thuong Trach, Phuc Trach, Xuan Trach and Son Trach of Bo Trach district, Quang Binh

2. Co-ordinate

17⁰21'12" to 17⁰39'19" N;

105⁰57'53" to 106⁰24'19" E.

3. The area of Phong Nha - Ke Bang National Park

The total area of core zone: 85,754ha

Strictly Protection Sub-zone: 64,894 ha.

Regeneration Sub-zone: 17,449ha.

Administrative and Service Sub-zone: 3,441ha.

Article 3: Objective and duty of Phong Nha - Ke Bang National Park

- Protect forest resources and ecosystems in core zone of the Park
- Conserve typical fauna and flora in Annamite Mountain Range, especially primate species
- Organize scientific research, study and education of the natural conservation.
- Organize sustainable eco-tourism.

Article 4: Designing the People's Committee of Quang Binh province to manage directly the Phong Nha - Ke Bang National Park.

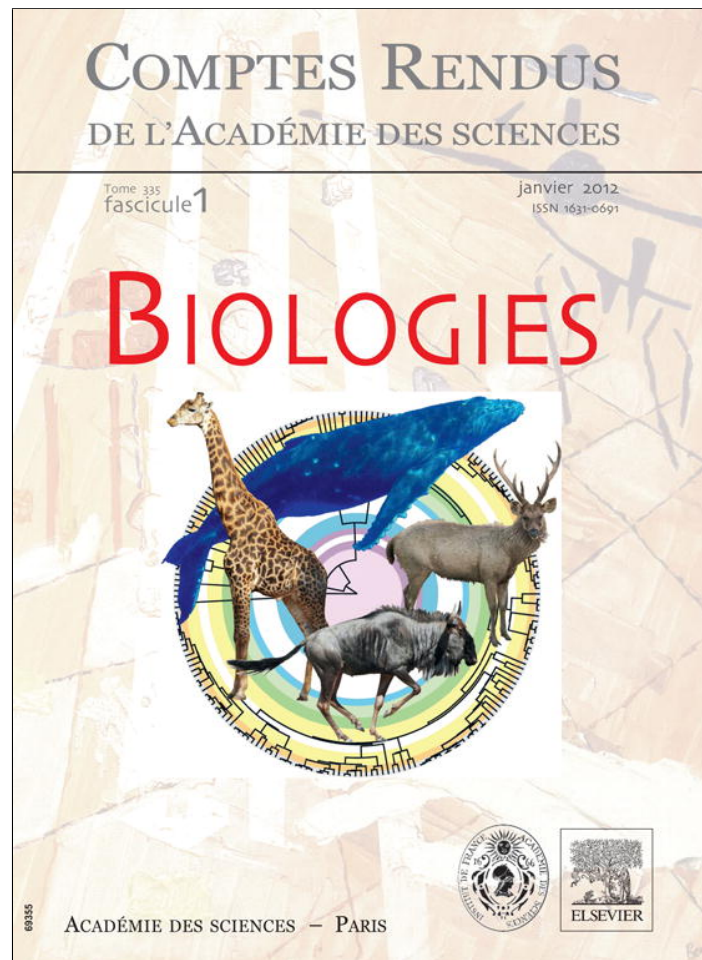
...

Article 5: Ministers of Ministries and Chairmen of Provinces have to execute this Decision.

Signature of Deputy Prime Minister

Nguyen Cong Tan

Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Biodiversity/Biodiversité

A second species of *Vietbocap* Lourenço & Pham, 2010 (Scorpiones: Pseudochactidae) from Vietnam

Une deuxième espèce de Vietbocap Lourenço & Pham, 2010 (Scorpiones : Pseudochactidae) pour le Vietnam

Wilson R. Lourenço^{a,*}, Dinh-Sac Pham^b^aUMR7205, département systématique et évolution, Muséum national d'histoire naturelle, CP 053, 57, rue Cuvier, 75005 Paris, France^bInstitute of Ecology and Biological Resources (IEBR), Vietnam Academy of Science and Technology (VAST), 18, Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam

ARTICLE INFO

Article history:

Received 7 October 2011

Accepted after revision 15 November 2011

Available online 29 December 2011

Keywords:

Scorpion

New species

Troglobite

Vietnam

Phong Nha - Ke Bang National Park

Thien Duong cave

Mots clés :

Scorpion

Nouvelle espèce

Troglobie

Vietnam

Phong Nha - Ke Bang National Park

Grotte Thien Duong

ABSTRACT

A second species of scorpion belonging to the family Pseudochactidae and to the genus *Vietbocap* is described from two specimens collected in the Thien Duong cave, which belongs to the Vom cave system, in the Phong Nha - Ke Bang National Park, Quang Binh Province, Vietnam. Like the previously described species of *Vietbocap*, the new species is also a true troglobitic element, the second known for the family Pseudochactidae. This represents the fourth known record of a pseudochactid, and the second from Vietnam.

© 2011 Académie des sciences. Published by Elsevier Masson SAS. All rights reserved.

R É S U M É

Une deuxième espèce de scorpion appartenant à la famille des Pseudochactidae et au genre *Vietbocap* est décrite à partir de deux exemplaires collectés dans la grotte Thien Duong laquelle appartient au système des grottes Vom dans le Parc National Phong Nha - Ke Bang dans la Province de Quang Binh, Vietnam. Ainsi que la première espèce décrite dans le genre *Vietbocap*, la nouvelle espèce est également un élément troglobie; le deuxième connu pour la famille des Pseudochactidae. La nouvelle espèce est la quatrième connue pour la famille des Pseudochactidae et la deuxième pour le Vietnam.

© 2011 Académie des sciences. Publié par Elsevier Masson SAS. Tous droits réservés.

1. Introduction

The family Pseudochactidae Gromov, 1998 contains some of the most remarkable scorpions described in recent years. The first species to be discovered was *Pseudochactas ovchinnikovi* Gromov, 1998, found in an

isolated mountainous region of southeastern Uzbekistan and southwestern Tajikistan, in Central Asia [1]. A second genus and species, *Troglokhammouanus steineri* Lourenço, 2007, was described from karst caves in Laos [2]. Although this species was found inside a cave, its morphological characteristics do not correspond to a troglobitic element. This Laotian species reopened the question about the origins and affinities of the Pseudochactidae and led to new biogeographical interpretations [2].

* Corresponding author.

E-mail address: arachne@mnhn.fr (W.R. Lourenço).

Very recently, scorpions have been prospected in karst cave systems in Vietnam, and several specimens of a new pseudoscorpion were collected in the Tien Son cave, which belongs to the Phong Nha system. These were described as a new genus and species, *Vietbocap canhi* Lourenço & Pham, 2010, which represents a true troglobitic element [3]. In recent months, new surveys in the cave systems of Vietnam have been carried out and again, another pseudoscorpion was collected in the Thien Duong cave, which belongs to the Vom cave system. The new species also belongs to the genus *Vietbocap*, and shows features of a true troglobitic element. The fact that three pseudoscorpion elements originating from caves within the same karst system have already been found in Laos and Vietnam, suggest that this region of Southeast Asia may represent a refuge or centre of endemism for this family.

New phylogenetic or biogeographical considerations are not proposed here, since these aspects have already been largely discussed by Lourenço [2]. More detailed information on the orogeny and geodynamics of South East Asia, and on the location, ecology and climate of the national park and caves, can be found in Lourenço & Pham [3].

2. Tien Son cave in the Phong Nha cave system and Thien Duong cave in the Vom cave system

Tien Son cave, where *Vietbocap canhi* was found is located in Son Trach Commune, Bô Trạ ch District (Fig. 1). The entrance is located 1 km from Phong Nha cave, at an altitude of 200 m. Tien Son cave is 980 m in length. A 10 m

deep hole is situated 400 m from the entrance, after which a 500 m long underground cave is open solely to professional scientists. According to British speleologists, Tien Son Cave was created tens of millions years ago, when a water current holed this limestone mountain in Ke Bang. Following a series of rock movement, this mass was levered or lowered, blocking the current and creating what is now Tien Son Cave, while the flow of the underground river was redirected to Phong Nha Cave. Although Phong Nha and Tien Son Caves are located next to each other, there are no passages linking them [4].

Thien Duong cave (Paradise cave), where the new species was found, is situated in Phong Nha-Ke Bang National Park, 60 km northwest of Đông Hói city (Fig. 1). Thien Duong cave is at an elevation of 200 meters above sea level, near the west branch of Ho Chi Minh Highway, in Son Trach Commune, Bo Trach District, Quang Binh Province, Vietnam. The cave was discovered by a local inhabitant in 2005 and initially the first 5 km of this cave were explored by scientists from the British Cave Research Association in 2005. More recently the whole extension of the cave was explored by the same Association. The cave is 31 km long, and in parts can reach 100 meters in height and 150 meters in width. There are two cave systems in Phong Nha-Ke Bang region: Phong Nha cave system and Vom cave system. However, these systems are totally isolated, with no geological connections being known between them [5].

The Phong Nha-Ke Bang karst is the oldest major karst area in Asia. It has been subjected to massive tectonic changes and comprises a series of rock types that are

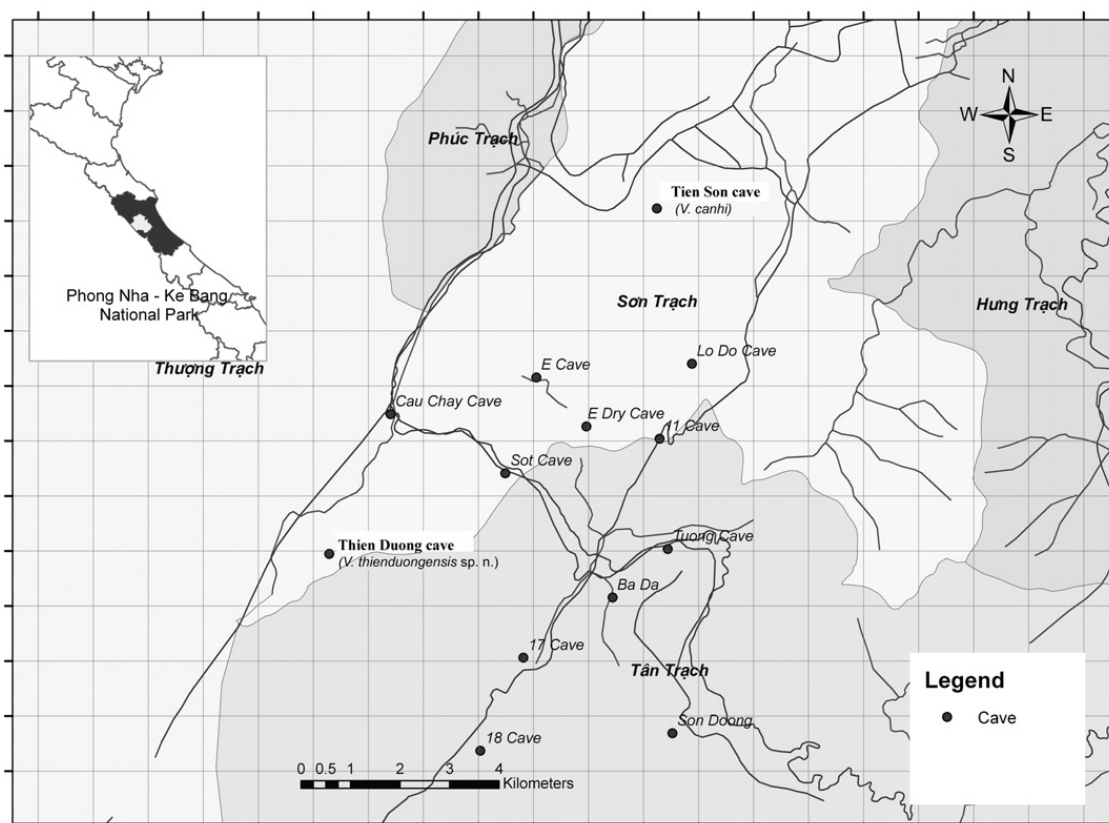


Fig. 1. Map of the Phong Nha - Ke Bang National Park showing the locations of Tien Son and Thien Duong caves.

interbedded in complex ways. Probably as many as seven major levels of karst development have occurred as a result of tectonic uplift and changing sea levels, thus the karst landscape of PNKB is extremely complex with high geodiversity and many geomorphic features of considerable significance [3,5].

3. Methods

Scorpions were collected by scientists of the IEBR and the Phong Nha-Ke Bang National Park, while exploring the caves with the help of standard electric torches. They were found on the cave walls, approximately 1800 m from the main cave entrance (while *V. canhi* was found, under rocks, 200 m from the main entrance of Tien Son Cave). This is a new distance record from a cave entrance for a scorpion (Fig. 2). Measurements and illustrations were made using a Wild M5 stereomicroscope with a drawing tube and an ocular micrometer. Measurements follow those of Stahnke [6] and are given in mm. Trichobothrial notations are those developed by Soleglad and Fet [7] and the morphological terminology mostly follows that of Hjelle [8] and Lourenço [2,9].

4. Taxonomic treatment

Family Pseudochactidae Gromov, 1998
Genus *Vietbocap* Lourenço & Pham, 2010
Vietbocap thienduongensis sp. n. (Fig. 3)

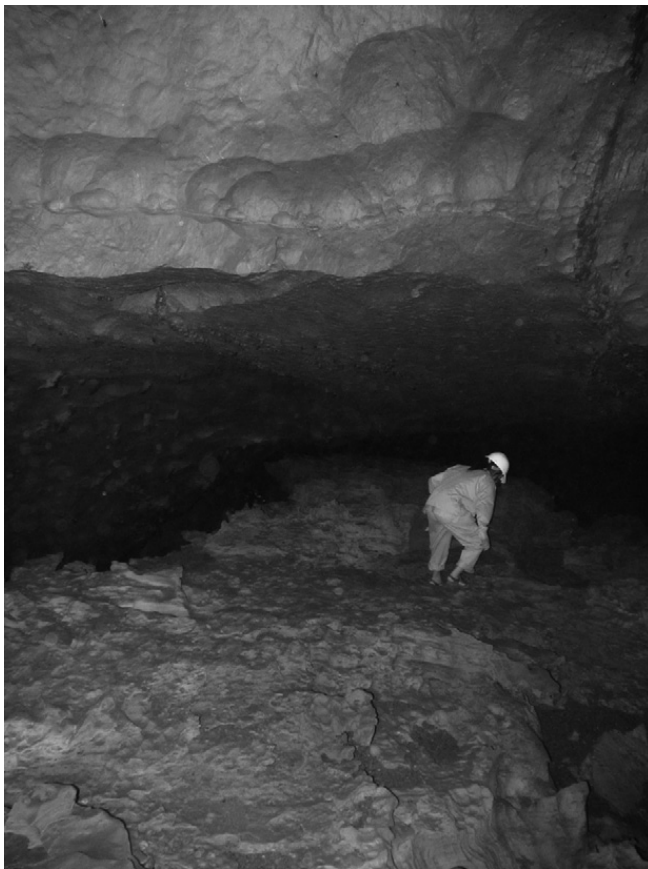


Fig. 2. Thien Duong cave, interior view, showing the walls where the new species was found.

4.1. Diagnosis

Anterior margin of carapace only slightly depressed, with a weak concavity. Lateral ocelli absent. Pair of circumocular sutures complete in the posterior region to median ocular tubercle with a broad U-shaped configuration. Median ocelli absent; median tubercle represented by a smooth but not depressed zone. Anterosubmedial carinae absent from zone delimited by circumocular sutures. Type D trichobothrial pattern [7,10] with 35 trichobothria per pedipalp: 12 on femur, of which 5 dorsal, 4 internal and 3 external (d_1 , d_4 , d_5 and i_4 extremely reduced); 10 on patella, of which 3 dorsal, 1 internal and 6 external (**est** extremely reduced); ventral surface without trichobothria; 13 trichobothria on chela, of which 5 on manus, 8 on fixed finger (ib_2 extremely reduced); dorsal trichobothria of femur with 'beta-like' configuration. Sternum pentagonal, type 1 [11], strongly compressed horizontally, slightly longer than wide, external aspect not flat, with a concave region, posteromedian depression round. Telotarsi each with several spinular setae, not clearly arranged in rows. Metasomal segment V with a weakly marked pair of ventrosubmedian carinae; no ventromedian carina between ventrosubmedian carinae. Fixed and movable fingers strongly curved; dentate margins each with median denticle row comprising seven oblique granular sub-rows; internal and external accessory granules at base of each sub-row. Respiratory spiracles small, semi-oval to round. Pro- and retrolateral pedal spurs present on legs I–IV. Tibial spurs absent from all legs.

4.2. Type material

Male holotype, male paratype. Vietnam, Quang Binh Province, Phong Nha - Ke Bang National Park, Thien Duong cave (106° 22'E–17° 52'N), mid section of cave (1800 m from cave entrance), 9/VIII/2011 (N.-K. Dang). Holotype deposited in the Muséum national d'Histoire naturelle, Paris. Paratype deposited in the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Hanoi.

4.3. Etymology

Specific name refers to Thien Duong cave, where the new species was found.

Description based on male holotype and male paratype (measurements given after the description).

4.4. Colour

General coloration yellow, less pale than *V. canhi*; cheliceral teeth, telson tip and rows of granules on pedipalp fingers dark reddish.

4.5. Morphology

Chelicerae: dorsal edge of fixed finger with four denticles (basal, medial, subdistal, distal); ventral edge with 3–4 very reduced denticles; movable finger with

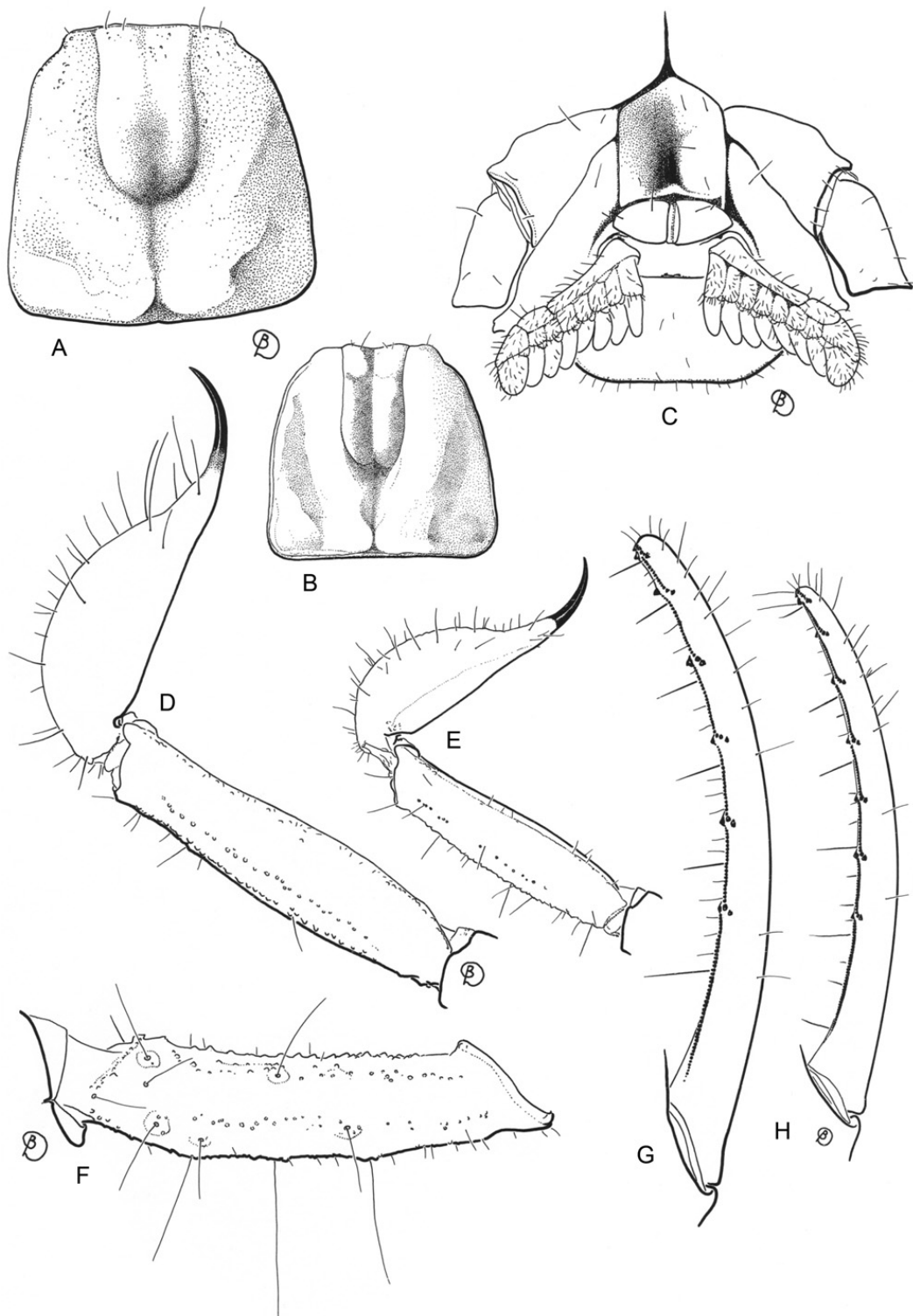


Fig. 3. A, C, D, F, G. *Vietbocap thienuongensis* sp. n., male holotype. B, E, H. *Vietbocap canhi*, male holotype (from Lourenço & Pham [3]). A–B. Carapace, dorsal aspect. C. Ventral aspect, showing sternum, genital operculum, pectines and sternite III. D–E. Metasomal segment V and telson, lateral aspect. F. Femur, dorsal aspect, showing trichobothrial pattern. G–H. Movable finger of pedipalp chela with sub-rows of granules.

three denticles (medial, subdistal, external distal) on dorsal edge, without basal denticles; ventral edge with 4–5 reduced denticles and a very weak serrula; external distal denticle smaller than internal distal denticle; ventral aspect of fingers and manus with numerous macrosetae. Carapace: anterior margin only slightly depressed with a

weakly marked concavity; lateral ocelli absent; median ocular tubercle represented by a smooth and not depressed zone; median ocelli absent; interocular furrow obsolete. One pair of weakly marked circumocular sutures with a broad U-shaped configuration, also complete behind median ocular tubercle. Anteromedian and posteromedian

furrows shallow; posterolateral furrow shallow, weakly curved; posteromarginal furrow narrow, shallow. Carapace almost totally smooth, except for some isolated granules anteriorly. Pedipalp segments apilose. Femur with five discernible carinae, all weak; intercarinal surfaces smooth. Patella with six discernible carinae; ventrointernal carinae with some spinoid granules; intercarinal surfaces smooth. Chela with dorso-external and ventral carinae weakly marked; tegument smooth. Fixed and movable fingers strongly curved; dentate margins, each with median denticle row comprising seven oblique granular sub-rows; each sub-row comprising several small granules and internal and external accessory granules. Trichobothria orthobothriotaxic, Type D [7,10], 'beta-like' configuration, **d**₂ situated on dorsal surface, **d**₃ and **d**₄ in same axis of the femur, parallel and closer to dorso-external carina than is **d**₁, angle formed by **d**₁, **d**₃ and **d**₄ opening toward internal surface; totals: femur, 12 (5 dorsal, 4 internal, 3 external); patella, 10 (3 dorsal, 1 internal, 6 external); chela, 13 (5 on manus, 8 on fixed finger). Legs I to IV: tibiae without spurs; basitarsi each with a pair of pro- and retrolateral spurs; telotarsi each with several spinular setae, not clearly arranged in rows. Sternum pentagonal, type 1 [11], strongly compressed horizontally, slightly longer than wide, external aspect not flat, with a concave region, posteromedian depression round. Pectines each with 3–4 distinct marginal lamellae and 7–8 well-delineated median lamellae in male. Fulcra absent or vestigial. Pectinal tooth count: 8–8 in males. Genital operculum completely divided longitudinally; genital plugs observed in male. Mesosoma: pre-tergites smooth and shiny; post-tergites II–VI smooth, apart from some minute granules; VII with a few granules and a pair of dorso-submedian and dorsolateral carinae, reaching posterior edge of segment. Sternites almost entirely smooth, acarinate; surfaces with scattered macrosetae; distal margins with sparse row of macrosetae; respiratory spiracles small, semi-oval to round. Metasoma with a few short macrosetae. Ten carinae on segments I to III; eight carinae on segment IV; four on segment V. Dorso-submedian carinae moderately developed on segments I–IV, absent on segment V; spinoid granules absent. Other carinae moderately to weakly developed on segments I–V. Telson long and slightly bulbous; vesicle smooth on all faces; aculeus shorter than vesicle and weakly curved, without a subaculear tubercle ventrally. Form of venom

glands unknown. Geographic distribution: only known from the type locality.

4.6. Measurements (in mm) of male holotype of *Vietbocap canhi* and male holotype of *Vietbocap thienduongensis* sp. n.

Total length 22.4/27.3. Carapace: length 2.9/3.6; anterior width 2.0/2.2; posterior width 3.2/3.5. Mesosoma length 5.5/6.7. Metasomal segments: I, length 1.2/1.4, width 1.4/1.6; II, length 1.4/1.7, width 1.3/1.4; III, length 1.5/2.0, width 1.2/1.4; IV, length 2.1/2.3, width 1.1/1.3; V, length 3.9/4.8, width 1.1/1.3, depth 0.9/1.2. Telson length 3.9/4.8; vesicle length 2.4/3.6, width 1.3/1.6, depth 1.2/1.4. Pedipalp: femur length 3.8/4.5, width 0.9/0.9; patella length 3.6/4.3, width 1.1/1.2; chela length 7.1/8.3, width 1.2/1.3, depth 1.0/1.2; movable finger length 4.2/4.6.

5. Relationships

Vietbocap canhi and *Vietbocap thienduongensis* sp. n. are rather similar in morphology. However, the new species can be distinguished from *V. canhi* by a number of features: (i) bigger size and distinct morphometric values; (ii) complete and more strongly marked circumocular sutures; (iii) chela fingers proportionally shorter (ratios of chela length/movable finger length 7.1/4.2 = 1.69 for *V. canhi* and 8.3/4.6 = 1.80 for *V. thienduongensis* sp. n.) and with 8 sub-rows of granules vs. 7 sub-rows; (iv) sternum only slightly longer than wide (ratio 1.15 for *V. canhi* and 1.30 for *V. thienduongensis* sp. n.); (v) metasomal segments less carinated and granulated and with a weaker chaetotaxy; (vi) pedipalp carinae better marked; (vii) pectines shorter and more bulkier with 8 teeth.

Moreover, the caves where the species have been found are totally isolated from one other and belong to distinct cave systems. Given that the two caves are only a few kilometres apart, it can be suggested that both *Vietbocap* species may have a common epigeal ancestor that colonized the caves independently.

6. Key to the known genera and species of *Pseudochactidae*

This is shown in Fig. 4.

- 1. Median and lateral ocelli present; leg tibial spurs present 3
- Median and lateral ocelli absent; leg tibial spurs absent..... 2
- 2. Circumocular sutures incomplete; chela fingers with 8 sub-rows of granules*Vietbocap canhi*
- Circumocular sutures complete; chela fingers with 7 sub-rows of granules*Vietbocap thienduongensis* sp. n.
- 3. Circumocular sutures incomplete; peg sensillae of pectines rounded*Troglokhammouanus steineri*
- Circumocular sutures complete; peg sensillae of pectines spatula.....*Pseudochactas ovchinnikovi*

Fig. 4. Key to the known genera and species of *Pseudochactidae*.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

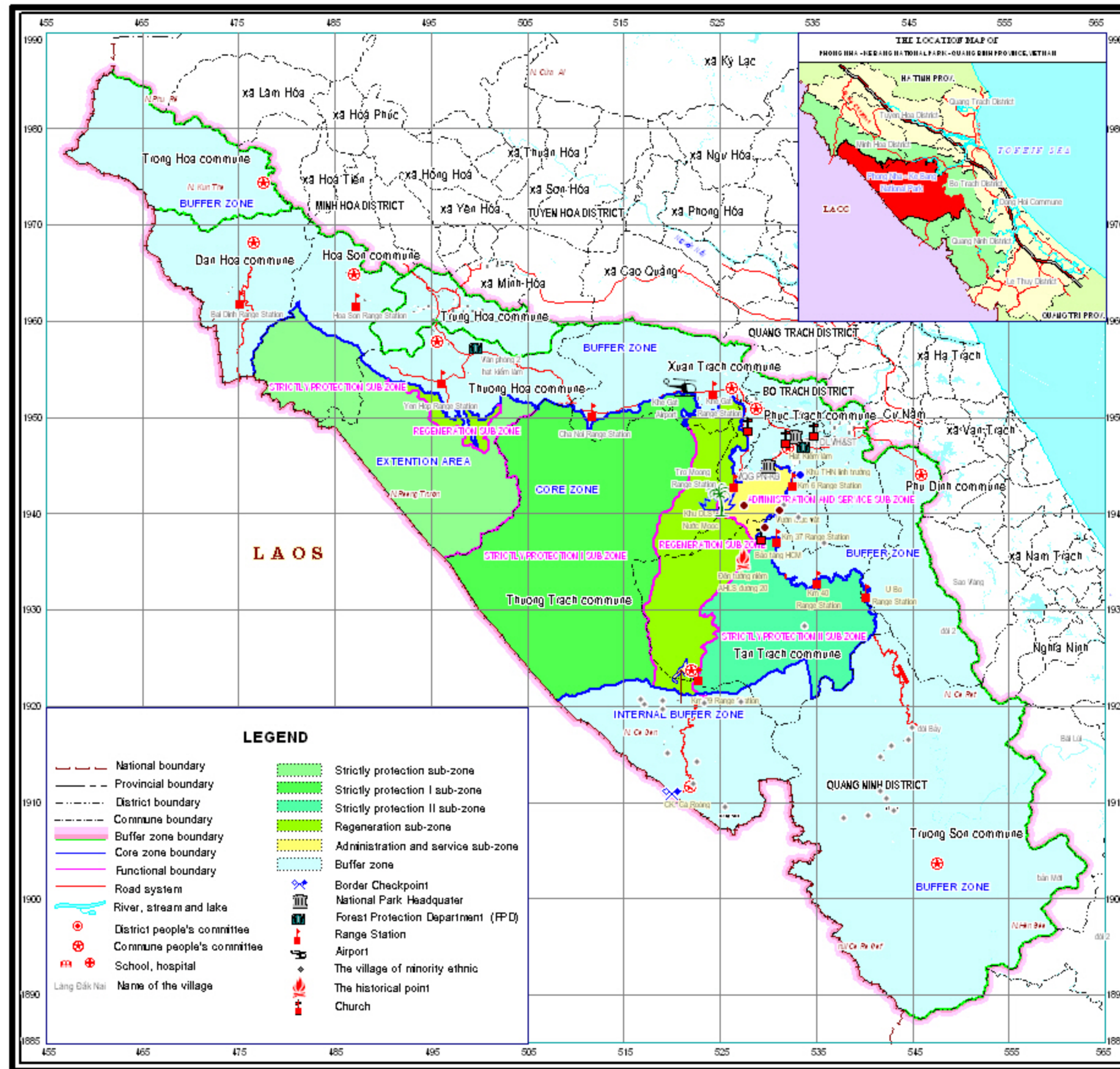
Acknowledgements

We are most grateful to Bernard Duhem (MNHN, Paris) for preparing the illustrations; to Elise-Anne Leguin (MNHN, Paris) for the preparation of the plates; and to Mark Judson (MNHN, Paris) for corrections to the manuscript. The second author wishes to thank Dang Ngoc Kien, Phung Thi Hong Luong, Dang Van An, Le Quang Tuan, and Ho Khanh for their help during the field survey; the Nature Conservation and Sustainable Natural Resource Management of the Phong Nha-Ke Bang National Park Region Project for logistic support during field studies and funds from the Vietnam-Germany Development Cooperation.

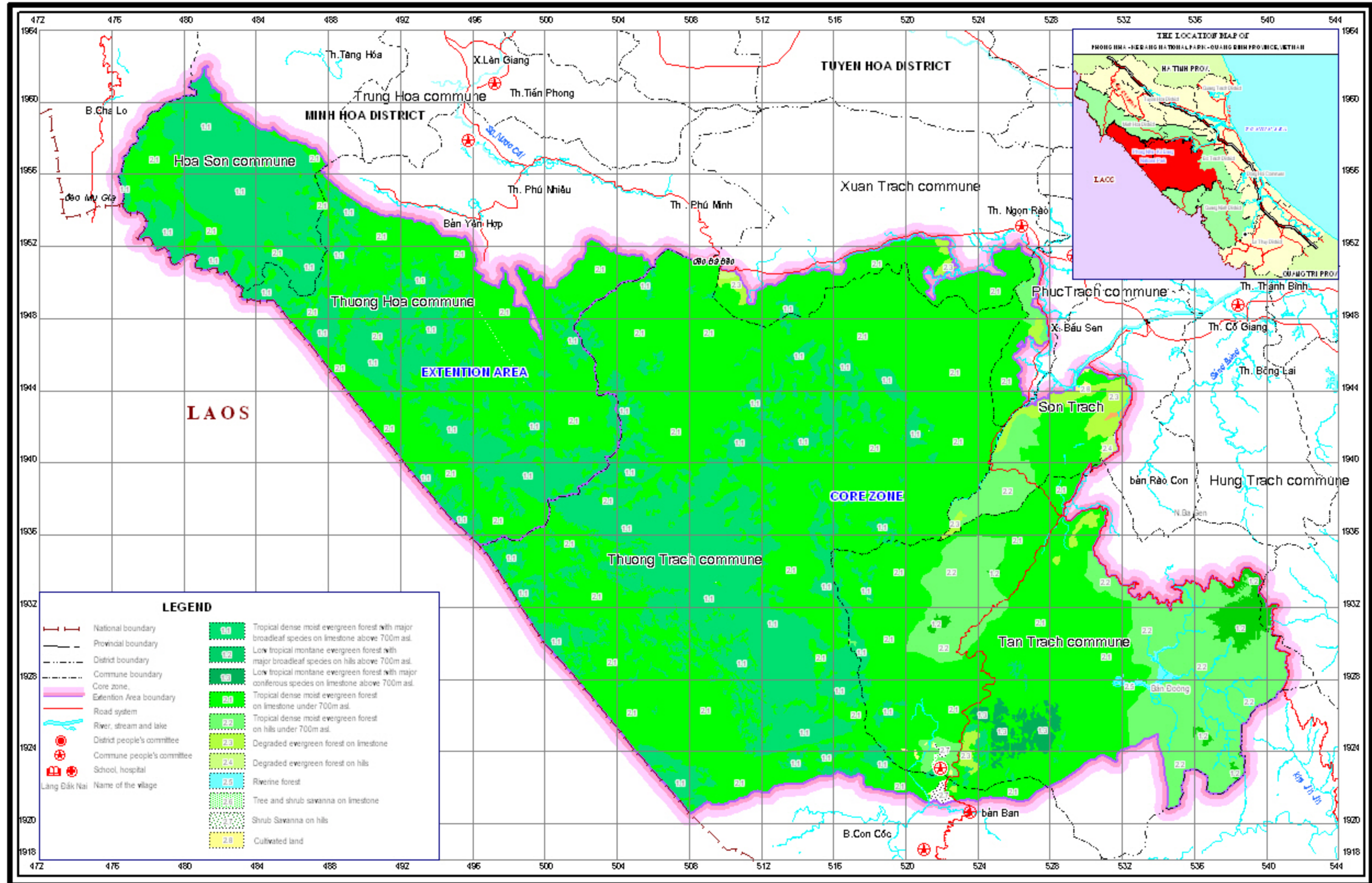
References

- [1] A.V. Gromov, A new family, genus and species of scorpions (Arachnida, Scorpiones) from southern Central Asia, *Zool. Zhurnal.* 77 (1998) 1003–1008 (in Russian, English summary) (English translation, *Russ. J. Zool.* 2 (1998) 409–413)..
- [2] W.R. Lourenço, First record of the family Pseudochactidae Gromov (Chelicerata, Scorpiones) from Laos and new biogeographic evidence of a Pangaeian palaeodistribution, *C. R. Biologies* 330 (2007) 770–777.
- [3] W.R. Lourenço, D.S. Pham, A remarkable new cave scorpion of the family Pseudochactidae Gromov (Chelicerata, Scorpiones) from Vietnam, *Zoo Keys* 71 (2010) 1–13.
- [4] UNEP-WCMC, Phong Nha-Ke Bang National park, Pdf file (2006) 1–6. <http://www.unep-wcmc.org>.
- [5] T. Nghi, T.H. Phuong, V.V. Phai, D.X. Thanh, N.T. Lan, N.D. Thai, N.T. Hong, Adventurous tourism—a potential realm of world natural heritage—National Park Phong Nha-Ke Bang, *J. Sci., Earth Sci.* 27 (2011) 77–88.
- [6] H.L. Stahnke, Scorpion nomenclature and mensuration, *Entom. News* 81 (1970) 297–316.
- [7] M.E. Sologlad, V. Fet, Evolution of scorpion orthobothriotaxy: a cladistic approach, *Euscorpius* 1 (2001) 1–38.
- [8] J.T. Hjelle, Anatomy and morphology, in : G.A. Polis (Ed.), *The biology of scorpions*, Stanford Univ. Press, 1990, p. 9–63.
- [9] W.R. Lourenço, Complements to the morphology of *Troglokhammouanus steineri* Lourenço, 2007 (Scorpiones: Pseudochactidae) based on scanning electron microscopy, *Euscorpius* 59 (2007) 1–6.
- [10] M.E. Sologlad, V. Fet, High-level systematics and phylogeny of the extant scorpions (Scorpiones: Orthosterni), *Euscorpius* 11 (2003) 1–175.
- [11] M.E. Sologlad, V. Fet, The scorpion sternum: structure and phylogeny (Scorpiones: Orthosterni), *Euscorpius* 5 (2003) 1–34.

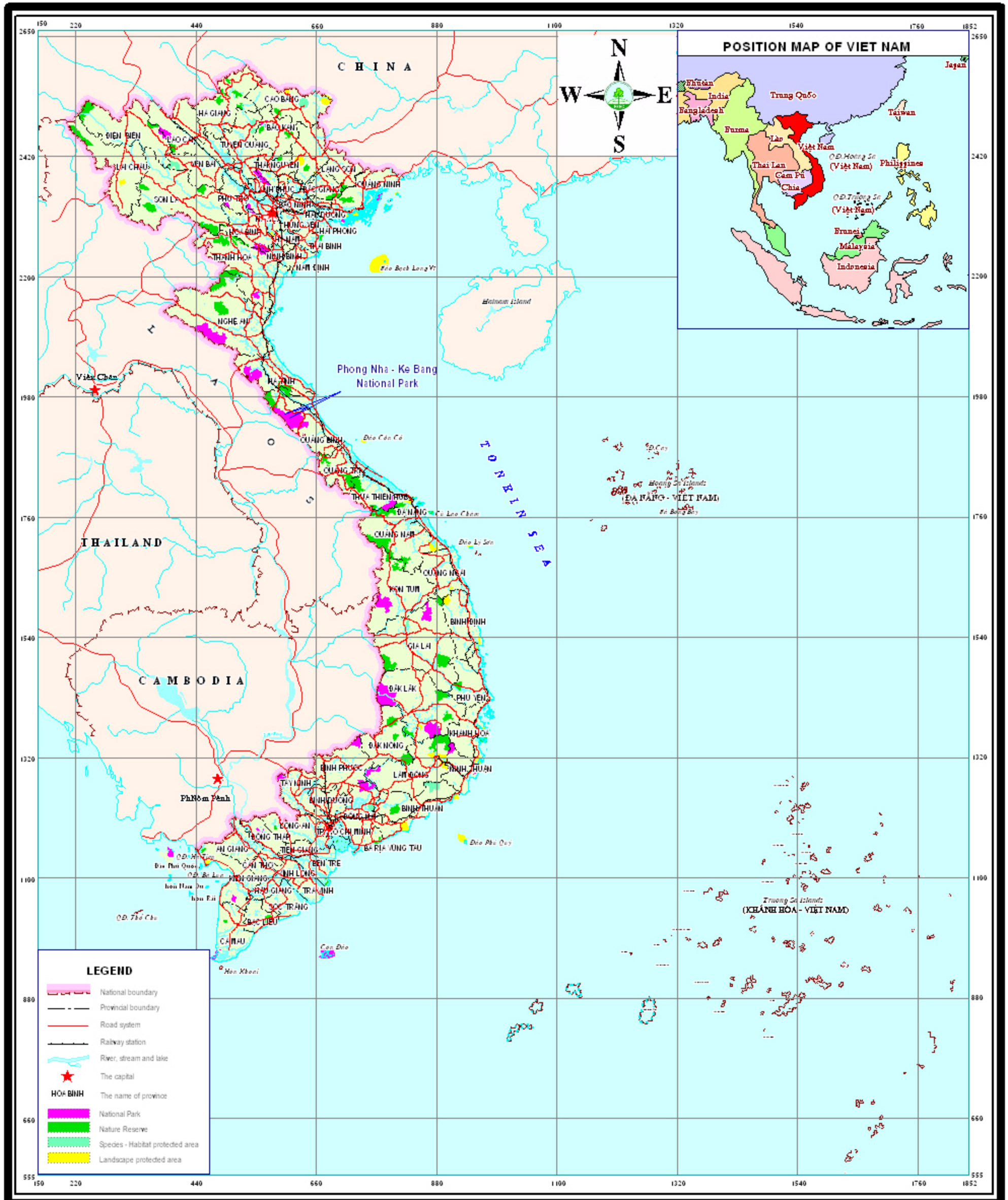
PLANNING MAP OF PHONG NHA - KE BANG NATIONAL PARK, QUANG BINH, VIET NAM



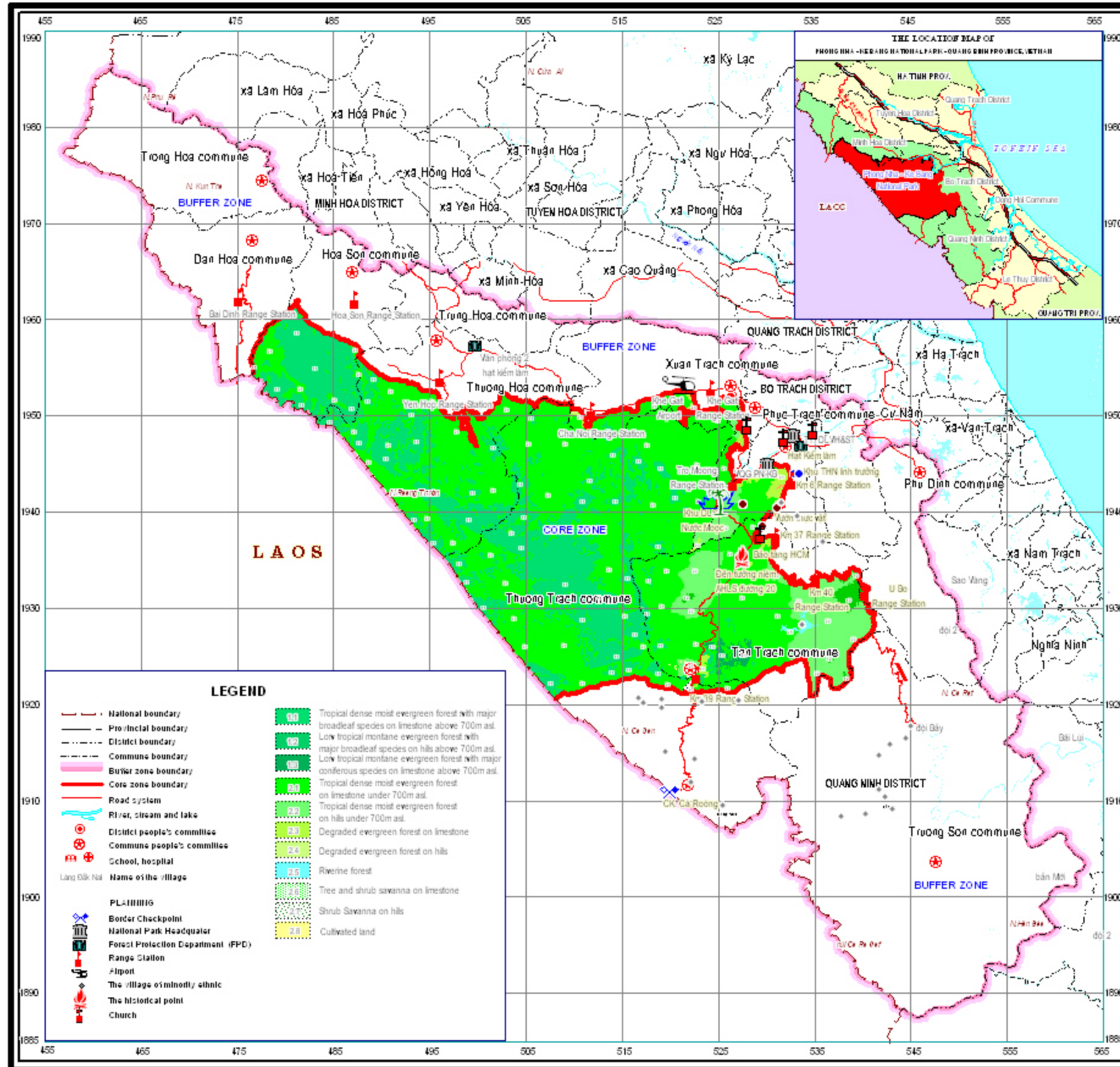
VEGETATION MAP OF PHONG NHA - KE BANG NATIONAL PARK, QUANG BINH, VIET NAM



SPECIAL USE FOREST SYSTEM IN VIETNAM



ZONING MAP OF PHONG NHA - KE BANG NATIONAL PARK, QUANG BINH, VIET NAM



SCALE 1 : 480.000

**PRELIMINARY SURVEY OF ORCHIDS
(ORCHIDACEAE)
IN
PHONG NHA – KE BANG NATIONAL PARK**

**Leonid V. Averyanov, Phan Ke Loc, Nguyen Tien Hiep,
Anna L. Averyanova, Pham Van The, Nguyen Tien Vinh**



**FAUNA & FLORA
INTERNATIONAL**

and

COUNTERPART INTERNATIONAL

2005

**PRELIMINARY SURVEY OF ORCHIDS
(ORCHIDACEAE)
IN
PHONG NHA – KE BANG NATIONAL PARK**

**Leonid V. Averyanov, Phan Ke Loc, Nguyen Tien Hiep,
Anna L. Averyanova, Pham Van The, Nguyen Tien Vinh**

Summary: Preliminary inventory of orchid flora in PNKB NP were fulfilled during 20 days (15 Jan. - 05 Feb. 2005). Reconnaissance field studies included 4 sites of NP, both in limestone rocky areas and in mountains composed with silicate rocks. During investigations were collected 558 numbers of herbarium and living specimens collecting numbers, among them about 355 numbers of orchids (all living specimens), which belong to about 208 orchid species and 69 genera. All voucher living specimens of orchids are housed now exclusively in nursery of Phong Nha – Ke Bang National Park. Report includes checklist with full inventory of this collection and indicates groups of orchid more perspective for commercial propagation. Kinds of landscapes, main forest dominants, discovered species of orchids and other ornamental plants perspective for propagation are illustrated with photographs of high resolution (presented separately in JPG and TIF formats). Briefly main recommendations include follow items:

- Collecting of new living orchid specimens.
- Secure, careful and qualified care of living collection.
- Observations of development and growth of collected living specimens.
- Regular inventory of living collection and careful fixation of specimen death.
- Careful observations of specimen flowering and gathering materials for species determination.
- Appropriate documentation of collected scientific materials.
- Appropriate keeping of collected scientific documentation.
- Primary coniferous limestone forests of PNKB NP represent unique formation of global importance. Their studies and protection is goal of highest priority.
- Organization of ecotourism system in PNKB NP may give very high economic and commercial effect and provide additional employment for many people.

Content:

**I. Background, objectives, terms of reference and schedule of field work
(dates and efforts)**

II. Methods and equipment

**III. Brief notices on vegetation and main plant communities observed in
the studied area**

**IV. Preliminary checklist of orchids (Orchidaceae) documented in Phong
Nha - Ke Bang National Park**

V. Brief notes, comments and recommendations

VI. Cited and related literature

VII. Illustrations

Notes for illustrations:

Maps:

Map 1.

Figures:

Landforms and main vegetation types. Fig. 1-12.

**Main dominants of primary coniferous forests in Phong Nha – Ke Bang National Park most
rich in orchids.** Fig. 13-19.

**Some orchid species (Orchidaceae) observed and documented in Phong Nha – Ke Bang
National Park.** Fig. 20-87.

**Some plant species of Phong Nha – Ke Bang National Park desirable for conservation,
propagation and ornamental cultivation.** Fig. 88-93.

Field works. Fig. 94-98.

**Possible diversity of some orchid species of Phong Nha – Ke Bang National Park collected in
fruits (for which correct determinations needs flowers).** Fig. 99-101.

Documentation of field studies. Tables 13, 14.

**PRELIMINARY SURVEY OF ORCHIDS
(ORCHIDACEAE)
IN
PHONG NHA – KE BANG NATIONAL PARK**

**I. Background, objectives, terms of reference and schedule of field work
(dates and efforts)**

Background.

The Phong Nha – Ke Bang National Park (PNKB NP) Forest Garden Project is implemented in six communities in the buffer zone of PNKB NP. The Forest Garden concept is based on the principles of Analog Forestry and community based Ecosystem Management, offers capacity building and appropriate, sustainable technologies that are designed to improve local livelihoods, biodiversity conservation and sustainable management of natural resources.

The Orchid Propagation sub-project aims to protect orchid species in the PNKB NP area through in-situ and ex-situ conservation methods. The project will help to generate an environmentally sustainable cash income for targeted local community members as well as plants for home-based ornamental purposes. These orchid propagation activities, will also aim to increase both the interests of local community in nature conservation and improve home garden development.

Objective of orchid survey.

The objective of this assignment is to conduct an orchid survey in PNKB NP that will provide the basic information for the establishment of an orchid propagation project in PNKB NP and surrounding vicinities including, but not limited Minh Hoa, Quang Ninh and Bo Trach Districts.

Terms of reference.

Names: Dr. Nguyen Tien Hiep (team leader)
Prof. Phan Ke Loc (deputy team leader)
Prof. Leonid V. Averyanov (orchid expert)
Anna L. Averyanova (junior botanical expert)
Pham Van The (assistant)
Nguyen Tien Vinh (assistant)

Position: Orchid Survey Experts

Location: Phong Nha – Ke Bang National Park (PNKB NP), Quang Binh Province, Vietnam

Duration: From 15/01/2005 to 05/02/2005

Reports to: Trinh Thang Long – PNKB NP Forest Garden Project Team Leader (Contract Manager)
Mark Infield – Fauna & Flora International, Vietnam Conservation Support Programme Director (Co-supervising Manager)
Victor Pinga – Counterpart International Vietnam, Food for Progress Program Manager (Co-supervising Manager)

Schedule of field work (dates and efforts)

Table 1. Field studies of orchid flora in area of Phong Nha – Ke Bang National Park

Dates	Itinerary and camps	Kind of works	Collected numbers of specimens	Studied kinds of vegetation
15-17 Jan, 2005	Hanoi - Quang Binh - Thuong Hoa - Ban On - field camp (Map 1)	Identifying 24 collecting numbers of orchids in PN-KB NP old orchid nursery		
18 -22 Jan 2005	Working around Ban On (17°40'21" N 105°58'00" E) and vicinities (Ca Xach mt, Yen Hop mt., etc.), 340-800 m a.s.l. (Map 1)	Collecting specimens (living and herbarium)	228 numbers (HAL 5827-6054)	Lowland and submontane primary and secondary forests and scrubs on limestone mountains
23 Jan, 2005	Back to PN-KB NP HQ. Leaving for new camp at A Rem (Map 1)	Handed living orchid specimens to PN-KB NP orchid nursery		
24-27 Jan 2005	Working around A Rem (17°23'32"N 106°12'46"E) and vicinities, 650-900 m a.s.l. (Map 1)	Collecting specimens (living and herbarium)	158 numbers (HAL 6055-6212)	Mostly submontane primary coniferous forests on tops of ridges of limestone mountains
28 Jan, 2005	Back to PN-KB NP HQ. Leaving for new camp at U Bo pass (Map 1)	Handed living orchid specimens to PN-KB NP orchid nursery		

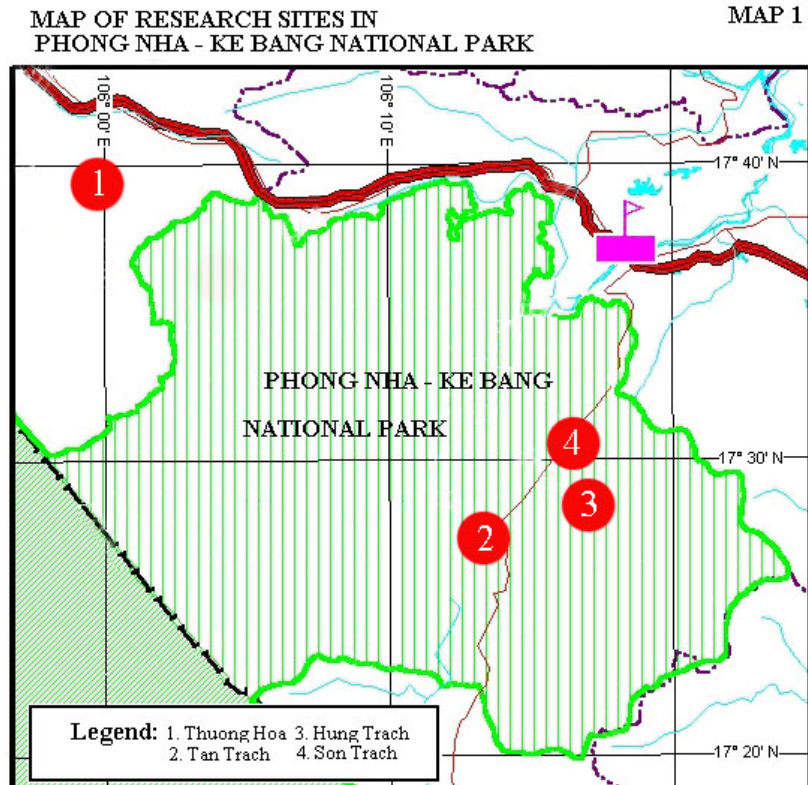
29 Jan- 01 Feb, 2005	Working at U Bo pass (around point 17°27'51"N 106°22'46"E) and vicinities, 600-1000 m a.s.l. (Map 1)	Collecting specimens (living and herbarium)	117 numbers (HAL 6213-6329)	Submontane primary broad-leaved forests on shale and sandstone mountains
02 Feb, 2005	Working at km 27 of west branch of Ho Chi Minh road (17°30'32"N 106°17'45"E, 300-400 m) (Map 1)	Collecting of specimens (living and herbarium)	31 numbers (HAL 6330-6360)	Mostly lowland secondary forests and scrubs on top ridges of limestone mountains
03 Feb. 2005	Working at km 22 of west branch of Ho Chi Minh road (17°31'02"N 106°16'48"E, 200-250 m) (Map 1)	Collecting of specimens (living and herbarium)	25 numbers HAL 6361-6385	Mostly lowland secondary scrubs on top ridges of limestone mountains
04 Feb. 2005	Working at PN-KB NP	Handed living orchid specimens to PN-KB NP orchid nursery. Preliminary inform about results of expedition		
05 Feb. 2005	Leaving PN-KB NP for Hanoi			

Field works of the program were fulfilled by project participants – Prof. Leonid V. Averyanov, Prof. Phan Ke Loc, Pham Van The, Anna L. Averyanova, Nguyen Tien Vinh, Nguyen Quang Vinh and Nguyen Tien Binh.

All observations and studies are certified by voucher living specimens, which are housed at Phong Nha – Ke Bang orchid nursery.

This report continues botanical surveys of country-protected areas supported financially by Fauna and Flora International (Averyanov et al., 2001, 2002; 2003, 2004). Presented investigation has preliminary character. Considerable part of plant names needs verifications by studies of flowering material.

Map 1. Approximate locations of sites of field studies of orchid flora in area of Phong Nha – Ke Bang National Park



II. Methods and equipment

For inventory of orchid flora were visited all kinds of primary and secondary woody plant communities on slopes and tops of rocky karst limestone mountains at elevations from 200 up to 900 m a.s.l., as well as alluvial river valleys and river canyons at elevation 200-500 m a.s.l. Also were visited primary and secondary plant communities on slopes and tops of shale, sandstone and granite mountains at elevations 800-1000 m a.s.l., as well as rocky canyons and river valleys at elevations 600-800 m a.s.l. For orchid collecting, observations and inventory were visited all typical plant communities occurring in studied area. For studies were chosen preferably intact (among accessible) habitats where preservation of plant diversity is maximal. During field works were studied next main types of woods:

- Primary and secondary closed evergreen seasonal tropical lowland broad-leaved forest on lower part of slopes and along streams of rocky limestone mountains (marked in accepted classification as 1.1.1.1.1).
- Primary and secondary closed evergreen seasonal tropical lowland stunted and gnarled coniferous forest on rocky limestone mountains *Dacrydium elatum* (marked in accepted classification as 1.1.1.2.1).
- Secondary semi-open evergreen seasonal tropical lowland stunted and gnarled mixed and broad-leaved woodlands and scrubs on rocky limestone mountains (marked in accepted classification as 1.1.1.2.2).
- Secondary semi-open evergreen seasonal tropical lowland broad-leaved woodlands and scrubs on rocky ridges and upper part of rocky limestone mountains (marked in accepted classification as 1.1.1.2.3).
- Primary closed evergreen seasonal tropical submontane stunted and gnarled coniferous forest on rocky ridges and upper part of rocky limestone mountains with *Calocedrus rupestris* (marked in accepted classification as 1.2.1.1.1).
- Secondary semi-open evergreen seasonal tropical submontane stunted and gnarled broad-leaved woodland on rocky ridges and upper part of rocky limestone mountains (marked in accepted classification as 1.2.1.1.2).
- Primary closed evergreen seasonal tropical submontane forest on upper part of slopes of shaly, sandstone and granite mountains (marked in accepted classification as 1.2.2.1.1).
- Primary closed evergreen seasonal tropical submontane forest on valley- along streamlets and lower part of slopes of shale, sandstone and granite mountains (marked in accepted classification as 1.2.2.2.1).

Main attention in exploration was focused on studies of primary coniferous and broadleaved primary forests on tops and along edges of rocky limestone ridges as most rich in orchid species.

For inventory of orchid flora in studied area were collected regularly 3 living specimens as the voucher specimens. Occurrence of the same species in other habitats and localities was fixed on the base of visual observations. All voucher specimens were housed in nursery of PNKB NP for cultivation, propagation and further study.

Description of vegetation were based on field observations along landscape transects and detailed descriptions of structure and species composition in typical plant communities, as well as on the base of collected voucher herbarium specimens as necessary material for studies and confirmation of scientific names. For each collection number and each place of observations were determined geographical position (coordinates), landscape elevation above sea level (used abbreviation - a.s.l.), slope/cliff exposition and inclination. In this work were used standard GPS satellite system, altimeter, compass and available maps.

Labels of each collection numbers includes geographic position, scientific name, short data on ecology and species occurrence on studied territory. Status according to classification IUCN Red

List Categories was preliminary estimated for all each orchid species according to observation of all habitats in studied area.

Totally during field works were collected 558 numbers of herbarium and living specimens collecting numbers, among them about 355 numbers of orchids (all living specimens), which belong to about 208 species and 69 genera. Living specimens of orchids represent main scientific documentation of fulfilled field studies. All these specimens are housed now in nursery of Phong Nha – Ke Bang National Park.

All materials of field studies are illustrated with photographs of high resolution (presented separately in JPG and TIF formats). They include images of different kinds of landscapes, main forest dominants, discovered species of orchids and other ornamental plants perspective for propagation as well as pictures of field exploration and examples of digital herbarium sheets.

Further explorations of orchids for more full inventory of the orchid flora in the area should include first of all studies of orchids in coniferous forests on highest tops of rocky limestone mountains (particularly along the border with Laos) and collecting of orchids in places of logged forests (in and in nearest places outside national park) for collecting of canopy epiphytic species on fallen trees that give no more damage for natural populations). Exploration of mentioned sites is most perspective for fast increasing of living collection in more rare and diverse orchid species. Total number of orchids in the area according to approximate estimation may be about 350-400 species.

Plants, habitats and landscapes photography was made by “*Canon Rebel*” and “*Canon d-Rebel*” photo-cameras with “*Canon*”, “*Nikon*”, “*Cosina*” and “*Sigma*” lenses of various focus distance. For artificial lighting were used straight flash National “*PE-201M*” and ring flash “*Starblitz 1000 AUTO MACRO-LITE*”.

III. Brief notices on vegetation and main plant communities observed in the studied area

PLANT COMMUNITIES OF STUDIED AREAS (ARRANGED IN SERIES OF SUCCESSION) AND THEIR DOMINANT SPECIES

1. Closed evergreen seasonal tropical forest

1.1. Closed evergreen seasonal tropical lowland (usually lower than 600-700 m a.s.l.) forest

1.1.1. Closed evergreen seasonal tropical lowland forest on limestone mts

1.1.1.1. Closed evergreen seasonal tropical lowland forest on lower part of slopes and along atreams of limestone mts

1.1.1.1.1. Slightly and heavily logged primary closed evergreen seasonal tropical lowland broad-leaved forest on lower part of slopes and along atreams of limestone mts. Co-dominants tree species are *Bischofia javanica*, *Lagerstroemia* sp., *Dracontomelon duperreanum*, *Anogeissus acuminata*, *Pometia pinnata*, *Ficus* sp., *Allospondias lakonensis*, *Pterospermum* spp., *Aglaia* sp., *Chisocheton paniculatus* and some others (for example at ca 0.5-1 km, 340-400 m a.s.l., to N of Ban On vill., 17⁰40'21" N, 105⁰58'00" E, Thuong Hoa mun., Minh Hoa distr., Quang Binh Prov., 19 Jan 2005).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(as most usual host trees for epiphytic species are such forest dominants as *Bischofia javanica*, *Lagerstroemia* sp., *Dracontomelon duperreanum*, *Anogeissus acuminata*, *Pometia pinnata*, *Ficus* sp., *Allospondias lakonensis*, *Pterospermum* spp., *Aglaia* sp., *Chisocheton paniculatus*)

<i>Acampe rigida</i> ,	<i>D. loddigesii</i> ,	<i>Ornithochilus difformis</i> ?,
<i>Biermannia calcarata</i> ?,	<i>D. terminale</i> ,	<i>Parapteroceras elobe</i> ,
<i>Bulbophyllum ambrosia</i> ,	<i>D. thyrsiflorum</i> ,	<i>Phalaenopsis gibbosa</i> ,
<i>B. longiflorum</i> ?,	<i>D. truncatum</i> ,	<i>Pholidota articulata</i> ,
<i>B. retusiusculum</i> ?,	<i>Eria corneri</i> ,	<i>Pteroceras simondianum</i> ?,
<i>Calanthe alismifolia</i> ,	<i>E. lasiopetala</i> ?,	<i>Robiquetia spathulata</i> ,
<i>Callostylis rigida</i> ,	<i>E. thao</i> ,	<i>Schoenorchis gemmata</i> ,
<i>Chiloschista trudelii</i> ?,	<i>Gastrochilus acutifolius</i> ?,	<i>Thecostele alata</i> ,
<i>Cleisostoma paniculatum</i> ?,	<i>G. hainanensis</i> ?,	<i>Thelasis khasiana</i> ,
<i>C. rostratum</i> ,	<i>Habenaria ciliolaris</i> ,	<i>Th. pygmaea</i> ,
<i>C. striatum</i> ,	<i>Kingidium deliciosum</i> ,	<i>Thrixspermum calceolus</i> ?,
<i>C. williamsonii</i> ?,	<i>Liparis pumila</i> ?,	<i>Th. centipeda</i> ,
<i>Corymborkis veratrifolia</i> ,	<i>L. stricklandiana</i> ?,	<i>Tropidia angulosa</i> ,
<i>Cymbidium aloifolium</i> ,	<i>Ludisia discolor</i> ,	<i>T. curculigoides</i> ,
<i>C. lancifolium</i> ,	<i>Malleola seidenfadenii</i> ?,	<i>Vanilla</i> sp.
<i>Dendrobium hercoglossum</i> ?,	<i>Nervilia aragoana</i> ?,	

1.1.1.2. Closed evergreen seasonal tropical lowland forest on top ridges and upper part of limestone mts

1.1.1.2.1. Slightly logged primary closed evergreen seasonal tropical lowland stunted and gnarled coniferous forest on rocky ridges and upper part of mts., composed with solid and stratified marble-like highly eroded crystalline limestone. Monodominant is *Dacrydium elatum* (for example at Yen Hop mt., Yen Hop vill., ca. 550-650 m a.s.l., 17⁰040'25" N, 105⁰57'46" N, NW of Ban On vill., Thuong Hoa mun., Minh Hoa distr., Quang Binh Prov., 21 Jan 2005).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(most usual host tree for most of observed epiphytic species is *Dacrydium elatum*)

<i>Acampe rigida</i> ,	<i>D. thyrsoflorum</i> ,	<i>Neuwiedia balansae</i> ?,
<i>Ae. odorata</i> ?,	<i>D. truncatum</i> ,	<i>Oberonia cavaleriei</i> ,
<i>Ae. rosea</i> ?,	<i>Epigeneium labuanum</i> ,	<i>O. kwangsiensis</i> ?,
<i>Anoectochilus calcareus</i> ,	<i>Eria corneri</i> ,	<i>Odontochilus elwesii</i> ,
<i>Apostasia odorata</i> ?,	<i>E. gagnepainii</i> ,	<i>Ornithochilus difformis</i> ?,
<i>A. hexandra</i> ?,	<i>E. globulifera</i> ?,	<i>Panisea albiflora</i> ?,
<i>Biermannia calcarata</i> ?,	<i>E. lasiopetala</i> ?,	<i>P. tricallosa</i> ?,
<i>Bulbophyllum ambrosia</i> ,	<i>E. paniculata</i> ,	<i>Paphiopedilum concolor</i> ,
<i>B. arcuatilabium</i> ?,	<i>E. pusilla</i> ,	<i>P. malipoense</i> ,
<i>B. insulsum</i> ?,	<i>E. spirodela</i> ,	<i>Parapteroceras elobe</i> ,
<i>B. longiflorum</i> ?,	<i>E. thao</i> ,	<i>Phalaenopsis gibbosa</i> ,
<i>B. macraei</i> ?,	<i>Flickingeria angustifolia</i> ?,	<i>Pholidota articulata</i> ,
<i>B. retusiusculum</i> ?,	<i>F. fimbriata</i> ?,	<i>Ph. imbricata</i> ?,
<i>Calanthe alismifolia</i> ,	<i>Gastrochilus acutifolius</i> ?,	<i>Ph. rubra</i> ,
<i>C. triplicate</i> ,	<i>G. calceolaris</i> ,	<i>Phreatia plantaginifolia</i> ?,
<i>Callostylis rigida</i> ,	<i>G. viridiflora</i> ,	<i>Podochilus khasianus</i> ,
<i>Ceratostylis subulata</i> ,	<i>Habenaria ciliolaris</i> ,	<i>Pomatocalpa spicata</i> Breda,
<i>Cheirostylis yunnanensis</i> ,	<i>Hygrochilus parishii</i> ,	<i>Pteroceras simondianum</i> ?,
<i>Chiloschista trudelii</i> ?,	<i>Kingidium deliciosum</i> ,	<i>Renanthera coccinea</i> Lour.,
<i>Cleisostoma birmanicum</i> ,	<i>Liparis averyanoviana</i> ?,	<i>Rhomboda petelotii</i> ,
<i>C. melanorachis</i> ?,	<i>L. dendrochiloides</i> ?,	<i>Robiquetia spathulata</i> ,
<i>C. paniculatum</i> ?	<i>L. distans</i> ?,	<i>Schoenorchis gemmata</i> ,
<i>C. rostratum</i> ,	<i>L. elliptica</i> ?	<i>Tainia hongkongensis</i> ?,
<i>C. striatum</i> ,	<i>L. latilabris</i> ,	<i>Thelasis khasiana</i> ,
<i>Corymborkis veratrifolia</i> ,	<i>L. manni</i> ,	<i>Th. pygmaea</i> ,
<i>Cymbidium aloifolium</i> ,	<i>L. petraea</i> ,	<i>Thrixspermum calceolus</i> ?,
<i>C. ensifolium</i> ,	<i>L. pumila</i> ?,	<i>Th. centipeda</i> ,
<i>C. lancifolium</i> ,	<i>L. stricklandiana</i> ?,	<i>Th. formosanum</i> ,
<i>Dendrobium anosmum</i> ?,	<i>L. viridiflora</i> ,	<i>Trichotosia pulvinata</i> ,
<i>D. cariniferum</i> ?,	<i>Ludisia discolor</i> ,	<i>Tropidia angulosa</i> ,
<i>D. hercoglossum</i> ?,	<i>Malaxis ophridis</i> ,	<i>T. curculigoides</i> ,
<i>D. nobile</i> ?,	<i>Malleola seidenfadenii</i> ?,	<i>Vanda pumila</i> ?,
<i>D. salaccense</i> ,	<i>Micropera poilanei</i> ,	<i>Vanilla</i> sp.,
<i>D. spatella</i> ,	<i>Mischobulbum</i>	<i>Vrydagzyne albida</i> ,
<i>D. terminale</i> ,	<i>longiscapum</i> ,	<i>Zeuxine nervosa</i> .

1.1.1.2.2. Heavily logged and suffered from forest fire secondary semi-open evergreen seasonal tropical lowland stunted and gnarled mixte and broad-leaved woodlands and scrubs on rocky ridges and upper part of mts., composed with solid and stratified marble-like highly eroded crystalline limestone. Co-dominants are *Pistacia cucphuongensis*, *Phyllanthus* spp., *Memecylon* sp., *Alstonia quangxiensis*, *Quercus* sp., *Pittosporum* sp., scandent shrubs Apocynaceae, and some others (for example at ca 540-640 m a.s.l., ca 1-2 km N of Ban On vill., 17⁰40'21" N, 105⁰58'00" E, Thuong Hoa mun., Minh Hoa distr., Quang Binh Prov., 18 Jan 2005).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(most usual host trees for epiphytic species are observed such forest dominants as *Pistacia cucphuongensis*, *Phyllanthus* spp., *Memecylon* sp., *Alstonia quangxiensis*, *Quercus* sp., *Pittosporum* sp.)

<i>Acampe rigida</i> ,	<i>B. insulsum</i> ?,	<i>Chiloschista trudelii</i> ?,
<i>Aerides. odorata</i> ?,	<i>B. longiflorum</i> ?,	<i>Cleisostoma birmanicum</i> ,
<i>Ae. rosea</i> ?,	<i>B. macraei</i> ?,	<i>C. melanorachis</i> ?,
<i>Anoectochilus calcareus</i> ,	<i>B. retusiusculum</i> ?,	<i>C. paniculatum</i> ?,
<i>Apostasia odorata</i> ?,	<i>Calanthe alismifolia</i> ,	<i>C. rostratum</i> ,
<i>Appendicula hexandra</i> ?,	<i>C. triplicate</i> ,	<i>C. striatum</i> ,
<i>Biermannia calcarata</i> ?,	<i>Callostylis rigida</i> ,	<i>Corymborkis veratrifolia</i> ,
<i>Bulbophyllum ambrosia</i> ,	<i>Ceratostylis subulata</i> ,	<i>Cymbidium aloifolium</i> ,
<i>B. arcuatilabium</i> ?,	<i>Cheirostylis yunnanensis</i> ,	<i>C. dayanum</i> ,

<i>C. ensifolium,</i>	<i>Habenaria ciliolaris,</i>	<i>Parapteroceras elobe,</i>
<i>C. lancifolium,</i>	<i>Hygrochilus parishii,</i>	<i>Phalaenopsis gibbosa,</i>
<i>Dendrobium anosmum ?,</i>	<i>Kingidium deliciosum,</i>	<i>Pholidota articulata,</i>
<i>D. cariniferum ?,</i>	<i>Liparis averyanoviana ?,</i>	<i>Ph. imbricata ?,</i>
<i>D. hercoglossum ?,</i>	<i>L. dendrochiloides ?,</i>	<i>Ph. rubra,</i>
<i>D. nobile ?,</i>	<i>L. distans ?,</i>	<i>Podochilus khasianus,</i>
<i>D. salaccense,</i>	<i>L. elliptica ?,</i>	<i>Polystachya concreta,</i>
<i>D. spatella,</i>	<i>L. latilabris,</i>	<i>Pomatocalpa spicata,</i>
<i>D. terminale,</i>	<i>L. manni,</i>	<i>Pteroceras simondianum ?,</i>
<i>D. thyrsiflorum,</i>	<i>L. pumila ?,</i>	<i>Renanthera coccinea,</i>
<i>D. truncatum,</i>	<i>L. stricklandiana ?,</i>	<i>Rhomboda petelotii,</i>
<i>Epigeneium labuanum,</i>	<i>L. viridiflora,</i>	<i>Robiquetia spathulata,</i>
<i>Eria corneri,</i>	<i>Ludisia discolor,</i>	<i>Schoenorchis gemmata,</i>
<i>E. gagnepainii,</i>	<i>Malaxis ophridis,</i>	<i>Thelasis khasiana,</i>
<i>E. globulifera ?,</i>	<i>Malleola seidenfadenii ?,</i>	<i>Th. pygmaea,</i>
<i>E. lasiopetala ?,</i>	<i>Micropera poilanei,</i>	<i>Thrixspermum calceolus ?,</i>
<i>E. paniculata,</i>	<i>Mischobulbum</i>	<i>Th. centipeda,</i>
<i>E. pusilla,</i>	<i>longiscapum,</i>	<i>Trichotomia pulvinata,</i>
<i>E. spirodela,</i>	<i>Oberonia cavaleriei,</i>	<i>Tropidia angulosa,</i>
<i>E. thao,</i>	<i>O. kwangsiensis ?,</i>	<i>T. curculigoides,</i>
<i>Flickingeria angustifolia ?,</i>	<i>Odontochilus elwesii,</i>	<i>Vanda pumila ?,</i>
<i>F. fimbriata ?,</i>	<i>Ornithochilus difformis ?,</i>	<i>Vanilla sp.,</i>
<i>Gastrochilus acutifolius ?,</i>	<i>Panisea albiflora ?,</i>	<i>Vrydagzynea albida,</i>
<i>G. calceolaris,</i>	<i>Paphiopedilum concolor,</i>	<i>Zeuxine nervosa.</i>
<i>G. viridiflora,</i>	<i>P. malipoense,</i>	

1.1.1.2.3. Regenerated from heavily and repeatedly destroyed by war bombs and fire secondary semi-open evergreen seasonal tropical lowland broad-leaved woodlands and scrubs on rocky ridges and upper part of mts., composed with solid and stratified marble-like highly eroded crystalline limestone. Co-dominants are *Streblus ilicifolius*, *Streblus macrophyllus*, *Randia* sp., *Canthium* sp., *Rutaceae*, *Gleditsia* sp., and some others (for example at near Tra Ang bridge, west branch of Ho Chi Minh road, 17°31'02" N, 106°16'48" E, ca 200-250 m a.s.l., Son Trach mun., Bo Trach distr., Quang Binh Prov., 03 Feb 2005 and at km 27 of west branch of Ho Chi Minh road, 17°30'32" N, 106°17'45" E, ca 300-400 m a.s.l., Son Trach mun., Bo Trach distr., Quang Binh Prov., 02 Feb 2005).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(most usual host trees for epiphytic species are observed such forest dominants as *Streblus ilicifolius*, *Streblus macrophyllus*, *Randia* sp., *Canthium* sp., *Rutaceae*, *Gleditsia* sp.)

<i>Acampe rigida,</i>	<i>C. lancifolium,</i>	<i>Robiquetia spathulata,</i>
<i>Biermannia calcarata ?,</i>	<i>Dendrobium loddigesii,</i>	<i>Thrixspermum centipeda,</i>
<i>Bulbophyllum ambrosia,</i>	<i>D. truncatum,</i>	<i>Tropidia angulosa,</i>
<i>Calanthe alismifolia,</i>	<i>Eria boniana,</i>	<i>T. curculigoides,</i>
<i>Cleisostoma rostratum,</i>	<i>E. corneri,</i>	<i>Vanilla sp.</i>
<i>C. williamsonii ?,</i>	<i>Ludisia discolor,</i>	
<i>Cymbidium aloifolium,</i>	<i>Nervilia aragoana ?,</i>	

1.2. Closed evergreen seasonal tropical submontane (usually higher than 600-700 m a.s.l.) forest

1.2.1. Closed evergreen seasonal tropical submontane forest on limestone mts

1.2.1.1. Closed evergreen seasonal tropical submontane forest on top ridges and upper part of slopes of limestone mts

1.2.1.1.1. Pristine and slightly logged primary closed evergreen seasonal tropical submontane usually stunted and gnarled coniferous forest on rocky ridges and upper part of mts., composed with solid and stratified marble-like highly eroded crystalline limestone. *Calocedrus*

rupestris is monodominant (for example at km 38 mt., ca 750-900 m a.s.l., ca 1.5 km SE of A Rem vill., 17^o23'32" N, 106^o12'46" E, Tan Trach mun., Bo Trach distr., Quang Binh Prov., 25 Jan 2005 and vicinities).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(most usual host tree for most of observed epiphytic species is *Calocedrus rupestris*)

<i>Aerides crassifolia</i> ?,	<i>Eria gagnepainii</i> ,	<i>Nephelaphyllum</i>
<i>Ae. odorata</i> ?,	<i>E. globulifera</i> ?,	<i>tenuiflorum</i> ,
<i>Ae. rosea</i> ?,	<i>E. lasiopetala</i> ?	<i>Nervilia macroglossa</i> ?,
<i>Anoectochilus calcareus</i> ,	<i>E. paniculata</i> ,	<i>Neuwiedia balansae</i> ?,
<i>A. roxburghii</i> ,	<i>E. pannea</i> ,	<i>Oberonia cavaleriei</i> ,
<i>Appendicula hexandra</i> ?,	<i>E. pusilla</i> ,	<i>O. kwangsiensis</i> ?,
<i>Bulbophyllum ambrosia</i> ,	<i>E. siamensis</i> ,	<i>Odontochilus elwesii</i> ,
<i>B. arcuatilabium</i> ?,	<i>E. spirodela</i> ,	<i>Ornithochilus difformis</i> ?,
<i>B. insulsum</i> ?,	<i>E. thao</i> ,	<i>Panisea albiflora</i> ?,
<i>B. macraei</i> ?,	<i>Flickingeria angustifolia</i> ?,	<i>P. tricallosa</i> ?,
<i>B. macranthum</i> ?,	<i>Flickingeria fimbriata</i> ?	<i>Paphiopedilum concolor</i> ,
<i>B. retusiusculum</i> ?,	<i>Gastrochilus acutifolius</i> ?,	<i>P. dianthum</i> ,
<i>Callostylis rigida</i> ,	<i>G. calceolaris</i> ,	<i>P. malipoense</i> ,
<i>Ceratostylis subulata</i> ,	<i>Goodyera foliosa</i> ?,	<i>Parapteroceras elobe</i> ,
<i>Cheirostylis yunnanensis</i> ,	<i>G. hispida</i> ,	<i>Phaius flavus</i> ,
<i>Cleisostoma birmanicum</i> ,	<i>G. viridiflora</i> ,	<i>Pholidota articulata</i> ,
<i>C. melanorachis</i> ?,	<i>Hetaeria anomala</i> ,	<i>Ph. imbricata</i> ?,
<i>C. paniculatum</i> ?,	<i>Hygrochilus parishii</i> ,	<i>Ph. rubra</i> ,
<i>C. rostratum</i> ,	<i>Liparis aurita</i> ?,	<i>Phreatia plantaginifolia</i> ?,
<i>C. simondii</i> ?,	<i>L. averyanoviana</i> ?,	<i>Podochilus khasianus</i> ,
<i>C. striatum</i> ,	<i>L. dendrochiloides</i> ?,	<i>Renanthera coccinea</i> ,
<i>Cymbidium ensifolium</i> ,	<i>L. distans</i> ?,	<i>Rhomboda petelotii</i> ,
<i>C. lancifolium</i> ,	<i>L. elliptica</i> ?,	<i>Rhynchostylis gigantea</i> ,
<i>Dendrobium anosmum</i> ?,	<i>L. latilabris</i> ,	<i>Schoenorchis gemmata</i> ,
<i>D. cariniferum</i> ?,	<i>L. manni</i> ,	<i>Staurochilus fasciatus</i> ?,
<i>D. hercoglossum</i> ?,	<i>L. nervosa</i> ,	<i>Taeniophyllum</i> sp.,
<i>D. nobile</i> ?,	<i>L. petelotii</i> ?,	<i>Tainia hongkongensis</i> ?,
<i>D. salaccense</i> ,	<i>L. petraea</i> ,	<i>Thelasis khasiana</i> ,
<i>D. spatella</i> ,	<i>L. pumila</i> ?,	<i>Thrixspermum calceolus</i> ?,
<i>D. terminale</i> ,	<i>L. stricklandiana</i> ?,	<i>Th. fleuryi</i> ?,
<i>D. thyrsiflorum</i> ,	<i>L. viridiflora</i> ,	<i>Trichotomia pulvinata</i> ,
<i>D. truncatum</i> ,	<i>Mischobulbum</i>	<i>Vanda pumila</i> ?,
<i>Epigeneium labuanum</i> ,	<i>longiscapum</i> ,	<i>Vrydagzynea albida</i> .

1.2.1.1.2. Heavily logged and suffered from forest fire secondary semi-open evergreen seasonal tropical submontane stunted and gnarled broad-leaved woodland on rocky ridges and upper part of mts., composed with solid and stratified marble-like highly eroded crystalline limestone. Co-dominants are *Phyllanthus* sp., *Nageia fleuryi*, *Alstonia quangxiensis*, *Garcinia* sp., *Quercus* sp., *Memecylon* sp., and some others (for example at Ca Xach mountain, 17^o39'20" N, 105^o57'42" E, SW of Ban On vill., Thuong Hoa mun., Minh Hoa distr., Quang Binh Prov., 20 Jan 2005, ca 700-800 m a.s.l.).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(as most usual host trees for epiphytic species are observed such forest dominants as *Phyllanthus* sp., *Alstonia quangxiensis*, *Garcinia* sp. and *Quercus* sp.)

<i>Aerides odorata</i> ?,	<i>Anoectochilus calcareus</i> ,	<i>Bulbophyllum ambrosia</i> ,
<i>Ae. rosea</i> ?,	<i>Appendicula hexandra</i> ?,	<i>B. arcuatilabium</i> ?,

<i>B. insulsum</i> ?,	<i>E. pannea</i> ,	<i>Oberonia cavaleriei</i> ,
<i>B. macraei</i> ?,	<i>E. pusilla</i> ,	<i>O. kwangsiensis</i> ?,
<i>B. macranthum</i> ?,	<i>E. spirodela</i> ,	<i>Odontochilus elwesii</i> ,
<i>B. retusiusculum</i> ?,	<i>E. thao</i> ,	<i>Ornithochilus difformis</i> ?,
<i>Callostylis rigida</i> ,	<i>Flickingeria angustifolia</i> ?,	<i>Panisea albiflora</i> ?,
<i>Ceratostylis subulata</i> ,	<i>F. fimbriata</i> ?,	<i>P. tricallosa</i> ?,
<i>Cheirostylis yunnanensis</i> ,	<i>Gastrochilus acutifolius</i> ?,	<i>Paphiopedilum concolor</i> ,
<i>Cleisostoma birmanicum</i> ,	<i>G. calceolaris</i> ,	<i>P. malipoense</i> ,
<i>C. melanorachis</i> ?,	<i>Goodyera foliosa</i> ?,	<i>Parapteroceras elobe</i> ,
<i>C. paniculatum</i> ?,	<i>G. hispida</i> ,	<i>Phaius flavus</i> ,
<i>C. rostratum</i> ,	<i>G. viridiflora</i> ,	<i>Pholidota articulata</i> ,
<i>C. simondii</i> ?,	<i>Hetaeria anomala</i> ,	<i>Ph. imbricata</i> ?,
<i>C. striatum</i> ,	<i>Hygrochilus parishii</i> ,	<i>Ph. rubra</i> ,
<i>Cymbidium ensifolium</i> ,	<i>Liparis averyanoviana</i> ?,	<i>Phreatia plantaginifolia</i> ?,
<i>C. lancifolium</i> ,	<i>L. dendrochiloides</i> ?,	<i>Podochilus khasianus</i> ,
<i>Dendrobium anosmum</i> ?,	<i>L. distans</i> ?,	<i>Polystachya concreta</i> ,
<i>D. cariniferum</i> ?,	<i>L. elliptica</i> ?,	<i>Renanthera coccinea</i> ,
<i>D. hercoglossum</i> ?,	<i>L. latilabris</i> ,	<i>Rhomboda petelotii</i> ,
<i>D. nobile</i> ?,	<i>L. mannii</i> ,	<i>Schoenorchis gemmata</i> ,
<i>D. salaccense</i> ,	<i>L. petelotii</i> ?,	<i>Taeniophyllum</i> sp.,
<i>D. spatella</i> ,	<i>L. petraea</i> ,	<i>Tainia hongkongensis</i> ?,
<i>D. terminale</i> ,	<i>L. pumila</i> ?,	<i>Thelasis khasiana</i> ,
<i>D. thyrsiflorum</i> ,	<i>L. stricklandiana</i> ?,	<i>Thrixspermum calceolus</i> ?,
<i>D. truncatum</i> ,	<i>L. viridiflora</i> ,	<i>Trichotosia pulvinata</i> ,
<i>Epigeneium labuanum</i> ,	<i>Mischobulbum</i>	<i>Vanda pumila</i> ?,
<i>Eria gagnepainii</i> ,	<i>longiscapum</i> ,	<i>Vrydagzynea albida</i> .
<i>E. globulifera</i> ?,	<i>Nephelaphyllum</i>	
<i>E. lasiopetala</i> ?,	<i>tenuiflorum</i> ,	
<i>E. paniculata</i> ,	<i>Neuwiedia balansae</i> ?,	

1.2.2. Closed evergreen seasonal tropical submontane forest on shaly and sandstone mts

1.2.2.1. Closed evergreen seasonal tropical submontane forest on upper part of slopes of shaly and sandstone mts

1.2.2.1.1. Slightly logged primary closed evergreen seasonal tropical submontane forest on upper part of slopes of shaly and sandstone mts. Dominants are *Hopea mollissima*, *Schima wallichii*, *Diplopanax vietnamensis*, *Choerospondias axillaris*, *Podocarpus nerifolius*, *Dacrycarpus imbricatus*, *Engelhardia roxburghiana* and some others (for example at Khe Me loc., Hung Trach mun., Bo Trach distr., Quang Binh Prov., 29 Jan 2005, ca. 900-1000 a.s.l., 17⁰27'51" N, 106⁰22'46" E and vicinities).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(as most usual host trees for epiphytic species are observed such forest dominants as *Hopea mollissima*, *Schima wallichii*, *Diplopanax vietnamensis*, *Choerospondias axillaris*, *Podocarpus nerifolius*, *Dacrycarpus imbricatus* and *Engelhardia roxburghiana*)

<i>Appendicula hexandra</i> ?,	<i>C. striatum</i> ,	<i>E. paniculata</i> ,
<i>Bulbophyllum ambrosia</i> ,	<i>Collabium chinense</i> ,	<i>E. thao</i> ,
<i>B. astelidum</i> ?,	<i>Cymbidium atropurpureum</i> ?,	<i>Flickingeria angustifolia</i> ?,
<i>B. clandestinum</i> ,	<i>C. dayanum</i> ,	<i>Galeola nudifolia</i> ,
<i>B. insulsum</i> ?,	<i>Dendrobium cariniferum</i> ?,	<i>Hetaeria anomala</i> ,
<i>B. macranthum</i> ?,	<i>D. hercoglossum</i> ?,	<i>Liparis bootanensis</i> ?,
<i>B. retusiusculum</i> ?,	<i>D. salaccense</i> ,	<i>L. dendrochiloides</i> ?,
<i>Calanthe lyroglossa</i> ,	<i>D. spatella</i> ,	<i>L. elliptica</i> ?,
<i>Callostylis rigida</i> ,	<i>D. terminale</i> ,	<i>L. stricklandiana</i> ?,
<i>Ceratostylis subulata</i> ,	<i>D. thyrsiflorum</i> ,	<i>L. tixieri</i> ,
<i>Cleisostoma birmanicum</i> ,	<i>D. truncatum</i> ,	<i>Nephelaphyllum tenuiflorum</i> ,
<i>C. paniculatum</i> ?,	<i>Eria gagnepainii</i> ,	<i>Phaius mishmensis</i> ,
<i>C. rostratum</i> ,	<i>E. lasiopetala</i> ?,	<i>Pholidota articulata</i> ,

Ph. chinensis,
Ph. rubra,
Rhomboda tokioi ?,
Schoenorchis gemmata,

Tainia latifolia ?,
T. pauciflora ?,
Thrixspermum formosanum,
Th. fragrans ?,

Th. pauciflora ?,
Trichotosia pulvinata,
Vrydagzynea albida,
Zeuxine nervosa.

1.2.2.2. Closed evergreen seasonal tropical submontane forest on valley of shale and sandstone mts

1.2.2.2.1. Slightly logged primary closed evergreen seasonal tropical submontane forest on valley- along streamlets and lower part of slopes of shale and sandstone mts. Co-dominants are *Dracontomelon duperreanum*, *Bischofia javanica*, *Michelia* sp., *Chisocheton paniculatus*, *Cinnamomum* sp., *Pometia pinnata*, 2 species of *Pterospermum*, *Duabanga grandiflora*, and some others (for example at Khe Ba Tanh loc., Hung Trach mun., Bo Trach distr., Quang Binh Prov., 30 Jan 2005, ca. 600-700 a.s.l., 17⁰27'24" N, 106⁰23'14" E).

Orchid species most typical for this kind of habitat in Phong Nha – Ke Bang National Park

(as most usual host trees for epiphytic species are observed such forest dominants as *Dracontomelon duperreanum*, *Bischofia javanica*, *Michelia* sp., *Chisocheton paniculatus*, *Cinnamomum* sp., *Pometia pinnata*, of *Pterospermum* spp. (2 species) and *Duabanga grandiflora*)

Acriopsis indica ?,
Apostasia odorata ?,
Appendicula cornuta,
A. hexandra ?,
Bulbophyllum ambrosia,
B. astelidum ?,
B. clandestinum,
B. insulsum ?,
B. macranthum ?,
B. retusiusculum ?,
B. tixieri ?,
Calanthe lyroglossa,
Callostylis rigida,
Ceratostylis subulata,
Cheirostylis yunnanensis,
Cleisostoma birmanicum,
C. paniculatum ?,
C. rostratum,
C. striatum,
Collabium chinense,
Cymbidium atropurpureum ?,

C. dayanum,
C. sinense,
Dendrobium cariniferum ?,
D. hercoglossum ?,
D. salaccense,
D. spatella,
D. terminale,
D. thyrsiflorum,
D. truncatum,
Eria corneri,
E. gagnepainii,
E. globulifera ?,
E. lasiopetala ?,
E. paniculata,
E. thao,
Flickingeria angustifolia ?,
Galeola nudifolia,
Goodyera fumata,
G. procera,
Kingidium deliciosum,
Liparis bootanensis ?,

L. dendrochiloides ?,
L. elliptica ?,
L. stricklandiana ?,
L. tixieri,
Nephelaphyllum tenuiflorum,
Neuwiedia balansae ?,
Phaius mishmensis,
Pholidota articulata,
Ph. chinensis,
Ph. rubra,
Rhomboda tokioi ?,
Schoenorchis gemmata,
Tainia latifolia ?,
T. pauciflora ?,
Thecopus maingayi ?,
Thrixspermum formosanum,
Th. fragrans ?,
Th. pauciflora ?,
Trichotosia pulvinata,
Vrydagzynea albida,
Zeuxine nervosa.

All available data on details of orchid species habitats are available on labels for voucher specimens presented for each collected number.

Occurrence of documented orchid species in studied habitats of Phong Nha – Ke Bang National Park are presented on tab 2.

Table 2. Occurrence of documented orchid species in studied habitats in Phong Nha – Ke Bang National Park.

Kinds of habitat:

- 1 – kind of forest marked in classification as 1.1.1.1.1.
- 2 - kind of forest marked in classification as 1.1.1.2.1.
- 3 - kind of forest marked in classification as 1.1.1.2.2.
- 4 - kind of forest marked in classification as 1.1.1.2.3.
- 5 - kind of forest marked in classification as 1.2.1.1.1.
- 6 - kind of forest marked in classification as 1.2.1.1.2.
- 7 - kind of forest marked in classification as 1.2.2.1.1.
- 8 - kind of forest marked in classification as 1.2.2.2.1.

Occurrence orchid species are marks in the table with blue shading

Orchid name:	Kind of habitat:							
	1	2	3	4	5	6	7	8
1. <i>Acampe rigida</i>								
2. <i>Acriopsis indica</i> ?								
3. <i>Aerides crassifolia</i> ?								
4. <i>Ae. odorata</i> ?								
5. <i>Ae. rosea</i> ?								
6. <i>Anoectochilus calcareus</i>								
7. <i>A. roxburghii</i>								
8. <i>Apostasia odorata</i> ?								
9. <i>Appendicula cornuta</i>	1	2	3	4	5	6	7	8
10. <i>A. hexandra</i> ?								
11. <i>Biermannia calcarata</i> ?								
12. <i>Bulbophyllum ambrosia</i>								
13. <i>B. arcuatilabium</i> ?								
14. <i>B. astelidum</i> ?								
15. <i>B. clandestinum</i>								
16. <i>B. insulsum</i> ?								
17. <i>B. longiflorum</i> ?								
18. <i>B. macraei</i> ?	1	2	3	4	5	6	7	8
19. <i>B. macranthum</i> ?								
20. <i>B. retusiusculum</i> ?								
21. <i>B. tixieri</i> ?								
22. <i>Calanthe alismifolia</i>								
23. <i>C. lyroglossa</i>								
24. <i>C. triplicata</i>								
25. <i>Callostylis rigida</i>								
26. <i>Ceratostylis subulata</i>								
27. <i>Cheirostylis yunnanensis</i>	1	2	3	4	5	6	7	8
28. <i>Chiloschista trudelii</i> ?								
29. <i>Cleisostoma birmanicum</i>								
30. <i>C. melanorachis</i> ?								
31. <i>C. paniculatum</i> ?								
32. <i>C. rostratum</i>								
33. <i>C. simondii</i> ?								
34. <i>C. striatum</i>								
35. <i>C. williamsonii</i> ?								

36. <i>Collabium chinense</i>	1	2	3	4	5	6	7	8
37. <i>Corymborkis veratrifolia</i>								
38. <i>Cymbidium aloifolium</i>								
39. <i>C. atropurpureum</i> ?								
40. <i>C. dayanum</i>								
41. <i>C. ensifolium</i>								
42. <i>C. lancifolium</i>								
43. <i>C. sinense</i>								
44. <i>Dendrobium anosmum</i> ?								
45. <i>D. cariniferum</i> ?	1	2	3	4	5	6	7	8
46. <i>D. hercoglossum</i> ?								
47. <i>D. loddigesii</i>								
48. <i>D. nobile</i> ?								
49. <i>D. salaccense</i>								
50. <i>D. spatella</i>								
51. <i>D. terminale</i>								
52. <i>D. thyrsiflorum</i>								
53. <i>D. truncatum</i>								
54. <i>Epigeneium labuanum</i>	1	2	3	4	5	6	7	8
55. <i>Eria boniana</i>								
56. <i>E. corneri</i>								
57. <i>E. gagnepainii</i>								
58. <i>E. globulifera</i> ?								
59. <i>E. lasiopetala</i> ?								
60. <i>E. paniculata</i>								
61. <i>E. pannea</i>								
62. <i>E. pusilla</i>								
63. <i>E. siamensis</i>	1	2	3	4	5	6	7	8
64. <i>E. spirodela</i>								
65. <i>E. thao</i>								
66. <i>Flickingeria angustifolia</i> ?								
67. <i>F. fimbriata</i> ?								
68. <i>Galeola nudifolia</i>								
69. <i>Gastrochilus acutifolius</i> ?								
70. <i>G. calceolaris</i>								
71. <i>G. hainanensis</i> ?								
72. <i>Goodyera foliosa</i> ?	1	2	3	4	5	6	7	8
73. <i>G. fumata</i>								
74. <i>G. hispida</i>								
75. <i>G. procera</i>								
76. <i>G. viridiflora</i>								
77. <i>Habenaria ciliolaris</i>								
78. <i>Hetaeria anomala</i>								
79. <i>Hygrochilus parishii</i>								
80. <i>Kingidium deliciosum</i>								
81. <i>Liparis aurita</i> ?	1	2	3	4	5	6	7	8
82. <i>L. averyanoviana</i> ?								
83. <i>L. bootanensis</i> ?								
84. <i>L. dendrochiloides</i> ?								
85. <i>L. distans</i> ?								

86. <i>L. elliptica</i> ?								
87. <i>L. latilabris</i>								
88. <i>L. mannii</i>								
89. <i>L. nervosa</i>								
90. <i>L. petelotii</i> ?	1	2	3	4	5	6	7	8
91. <i>L. petraea</i>								
92. <i>L. pumila</i> ?								
93. <i>L. stricklandiana</i> ?								
94. <i>L. tixieri</i>								
95. <i>L. viridiflora</i>								
96. <i>Ludisia discolor</i>								
97. <i>Malaxis ophridis</i>								
98. <i>Malleola seidenfadenii</i> ?								
99. <i>Micropera poilanei</i>	1	2	3	4	5	6	7	8
100. <i>Mischobulbum longiscapum</i>								
101. <i>Nephelaphyllum tenuiflorum</i>								
102. <i>Nervilia aragoana</i> ?								
103. <i>N. macroglossa</i> ?								
104. <i>Neuwiedia balansae</i> ?								
105. <i>Oberonia cavaleriei</i>								
106. <i>O. kwangsiensis</i> ?								
107. <i>Odontochilus elwesii</i>								
108. <i>Ornithochilus difformis</i> ?	1	2	3	4	5	6	7	8
109. <i>Panisea albiflora</i> ?								
110. <i>P. tricallosa</i> ?								
111. <i>Paphiopedilum concolor</i>								
112. <i>P. dianthum</i>								
113. <i>P. malipoense</i>								
114. <i>Parapteroceras elobe</i>								
115. <i>Phaius flavus</i>								
116. <i>P. mishmensis</i>								
117. <i>Phalaenopsis gibbosa</i>	1	2	3	4	5	6	7	8
118. <i>Pholidota articulata</i>								
119. <i>Ph. chinensis</i>								
120. <i>Ph. imbricata</i> ?								
121. <i>Ph. rubra</i>								
122. <i>Ph. yunnanensis</i> ?								
123. <i>Phreatia plantaginifolia</i> ?								
124. <i>Podochilus khasianus</i>								
125. <i>Polystachya concreta</i>								
126. <i>Pomatocalpa spicata</i>	1	2	3	4	5	6	7	8
127. <i>Pteroceras simondianum</i> ?								
128. <i>Renanthera coccinea</i>								
129. <i>Rhomboda petelotii</i>								
130. <i>Rh. tokioi</i> ?								
131. <i>Rhynchosstylis gigantea</i>								
132. <i>Robiquetia spathulata</i>								
133. <i>Schoenorchis gemmata</i>								
134. <i>Staurochilus fasciatus</i> ?								
135. <i>Taeniophyllum sp.</i>								

136. <i>Tainia hongkongensis</i> ?	1	2	3	4	5	6	7	8
137. <i>T. latifolia</i> ?								
138. <i>T. pauciflora</i> ?								
139. <i>Thecopus maingayi</i> ?								
140. <i>Thecostele alata</i>								
141. <i>Thelasis khasiana</i>								
142. <i>Th. pygmaea</i>								
143. <i>Thrixspermum calceolus</i> ?								
144. <i>Th. centipeda</i>								
145. <i>Th. fleuryi</i> ?	1	2	3	4	5	6	7	8
146. <i>Th. formosanum</i>								
147. <i>Th. fragrans</i> ?								
148. <i>Th. pauciflora</i> ?								
149. <i>Trichotosia pulvinata</i>								
150. <i>Tropidia angulosa</i>								
151. <i>T. curculigoides</i>								
152. <i>Vanda pumila</i> ?								
153. <i>Vanilla sp.</i>								
154. <i>Vrydagzynea albida</i>								
155. <i>Zeuxine nervosa</i>	1	2	3	4	5	6	7	8

IV. Preliminary checklist of orchids (Orchidaceae) documented in Phong Nha - Ke Bang National Park

PRELIMINARY CHECKLIST OF ORCHIDS (ORCHIDACEAE) DOCUMENTED IN PHONG NHA – KE BANG NATIONAL PARK

Checklist includes:

- Orchid names (names of all orchids documented for studied area during fulfilled field works are given in alphabetic order)
- Short data on ecology of all orchid species discovered in studied area
- Species occurrence, and IUCN Red List Categories (IUCN, 2001, version 3.1) estimated for species in studied area; species, which are included in the Red Data Book of Vietnam (1996), are marked with special references.
- Species distribution (all localities discovered in studied area)
- Numbers of species voucher specimens collected during field work studies

1. *Acampe* Lindl.

1.1. *A. rigida* (J.E.Smith) P.F.Hunt

Living form. Lithophytic or occasionally epiphytic herb or undershrub up to 1 m tall.

Ecology. Primary and secondary evergreen broad-leaved lowland forests and scrub on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded crystalline limestone commonly at elevations 200-620 m a.s.l. Usually on high vertical cliffs.

Occurrence and IUCN status. Occasional. LR.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Son Trach Municipality, around point (17°30'32"N, 106°17'45"E); Bo Trach Distr., Son Trach Municipality, around point (17°31'02"N, 106°16'48"E).

Collections. No HAL 6036 22 January 2005; No HAL 6344 2 February 2005; No HAL 6365 3 February 2005.

2. *Acriopsis* Blume

2.2. *A. indica* Wight ?

Living form. Epiphyte.

Ecology. Primary broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and granite, commonly at elevations 600-700 m a.s.l. Commonly grows on high trees on shady steep slopes, usually along stream valleys.

Occurrence and IUCN status. Not common. VU.

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E

Collections. No HAL 6275 30 January 2005.

3. *Aerides* Lour.

3.3. *Ae. crassifolia* Burbridges ?

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (commonly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Commonly on tops of ridges.

Occurrence and IUCN status. Very rare. EN.

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6174 26 January 2005.

3.4. *Ae. odorata* Lour. ?

Living form. Epiphyte on high trees.

Ecology. Primary closed evergreen broad-leaved gnarled stunted forests on mountain tops and occasionally secondary broad-leaved evergreen forests and scrub on tops of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 300-800 m a.s.l. Commonly on steep rocky slopes near mountain tops.

Occurrence and IUCN status. Not common. VU.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E at elevations 300-400 m a.s.l.

Collections. No HAL 5965 20 January 2005; No HAL 6343 2 February 2005.

3.5. *Ae. rosea* Lindl. & Paxt. ?

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (commonly with *Calocedrus rupestris*) and secondary evergreen broad-leaved forests and scrub on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 550-850 m a.s.l.

Occurrence and IUCN status. Not common. VU.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5833 18 January 2005; No HAL 6173 26 January 2005.

4. *Anoectochilus* Blume

4.6. *A. calcareus* Aver.

Living form. Lithophytic and terrestrial creeping herb, leaves deep green to nearly black, with heavy net of fine white nerves.

Ecology. Primary and secondary closed evergreen coniferous (particularly with *Calocedrus rupestris* and *Dacrydium elatum*) forests, as well as broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-900 m a.s.l. Grows commonly on shady rocky slopes.

Occurrence and IUCN status. Rare. VU.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 5866 18 January 2005, **photo 20**; No HAL 5984 21 January 2005; No HAL 6055 24 January 2005.

4.7. *A. roxburghii* (Wall.) Lindl.

Living form. Lithophytic and terrestrial creeping herb, leaves deep green, with heavy net of fine light yellowish nerves.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep rocky slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows commonly on shady rocky slopes.

Occurrence and IUCN status. Rare. VU. **Species is included in Red Data Book of Vietnam as EN** (under the name *A. setaceus*).

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6203a 26 January 2005, **photo 21**.

5. *Apostasia* Blume

5.8. *A. odorata* Blume ?

Living form. Terrestrial erect herb up to 0.4 m tall.

Ecology. Primary and secondary closed coniferous forests (particularly with *Dacrydium elatum*) and evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l. Grows commonly on rocky slopes.

Occurrence and IUCN status. Occasional. LR.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5878 18 January 2005; No HAL 5987 21 January 2005.

6. *Appendicula* Blume

6.9. *A. cornuta* Blume

Living form. Lithophytic herb, flowers including lip white.

Ecology. Primary closed broad-leaved evergreen forests on steep slopes of mountains composed with shale and sandstone along stream canyons. Particularly in shady places along streams.

Occurrence and IUCN status. Locally common. LR.

Distribution. Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6315 1 February 2005, **photo 22**.

6.10. *A. hexandra* (Koenig) J.J.Smith ?

Living form. Epiphytic and lithophytic herb.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) and primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-

like highly eroded crystalline limestone at elevations 550-900 m a.s.l. Grows commonly on shady rocky mossy vertical cliffs.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5848 18 January 2005; No HAL 6134 25 January 2005, **photo 23.**

6.11. *Appendicula* sp.

Living form. Epiphytic herb.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-1000 m a.s.l. Grows commonly on shady steep slopes of stream valleys.

Occurrence and IUCN status. Locally very common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6234 29 January 2005; No HAL 6278 30 January 2005.

7. *Biermannia* King et Pantl.

7.12. *B. calcarata* Aver. ?

Living form. Small canopy epiphytic herb.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone as well as primary closed evergreen broad-leaved lowland forests along streams and foothills of limestone ridges at elevations 340-650 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5875 18 January 2005; No HAL 5923 19 January 2005.

7.13. *Biermannia* sp.?

Living form. Small canopy epiphytic herb.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6011 22 January 2005.

8. *Bulbophyllum* Thouars

8.14. *B. ambrosia* (Hance) Schltr.

Living form. Creeping epiphytic herb, flowers with *Amygdalus* fragrance, whitish, with pink tint and purple veins on tepals.

Ecology. All kinds of forests at elevations 300-700 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5853 18 January 2005, **photo 24, 25**; No HAL 5994 21 January 2005; No HAL 6027 22 January 2005; No HAL 6120 25 January 2005; No HAL 6292 30 January 2005; No HAL 6332 2 February 2005.

8.15. *B. arcuatilabium* Aver. ?

Living form. Small creeping epiphyte.

Ecology. Primary closed evergreen broad-leaved gnarled stunted forests along rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 600-800 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5961 20 January 2005.

8.16. *B. astelidum* Aver. ?

Living form. Small creeping epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l. Grows in canopies of tall trees.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6305 31 January 2005.

8.17. *B. clandestinum* Lindl.

Living form. Small epiphyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows in shady places, particularly on tops of ridges.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6168 26 January 2005.

8.18. *B. insulsum* (Gagnep.) Seidenf. ?

Living form. Small creeping epiphyte.

Ecology. All kinds of forests at elevations 500-1000 m a.s.l. Grows particularly in deep shade, commonly along stream valleys.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5963 20 January 2005; No HAL 6023 22 January 2005; No HAL 6226 29 January 2005.

8.19. *B. longiflorum* Thouars ?

Living form. Creeping lithophyte and epiphyte.

Ecology. Primary closed evergreen broad-leaved forests on steep slopes of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone, as well as lowland forests along atreams and foothills of limestone mountains at elevations 340-750 m a.s.l. Grows commonly on shady vertical cliffs or in canopies of tall trees.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5914 19 January 2005; No HAL 6083 24 January 2005.

8.20. *B. macraei* (Lindl.) Rchb.f. ?

Living form. Creeping epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6029 22 January 2005.

8.21. *B. macranthum* Lindl. ?

(vel *B. hiepii* Aver. **Species is included in Red Data Book of Vietnam as R).**

Living form. Creeping epiphyte.

Ecology. Primary closed coniferous and broad-leaved evergreen forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone, as well as on mountains composed with shale, sandstone and occasionally granite at elevations 600-1000 m a.s.l. Grows commonly in canopies of tall trees, particularly along stream valleys.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6132 25 January 2005; No HAL 6222 29 January 2005; No HAL 6261 30 January 2005, **photo 26**; No HAL 6313 1 February 2005.

8.22. *B. retusiusculum* Rchb.f. ?

Living form. Epiphyte, leaves below with violet tint.

Ecology. All kind of forests at elevations 600-850 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6186 26 January 2005; No HAL 6312 1 February 2005.

8.23. *B. tixieri* Seidenf. ?

Living form. Creeping lithophytic herb.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Commonly grows on open mossy granite rocks along stream valley.

Occurrence and IUCN status. Occasional. **VU. Species is included in Red Data Book of Vietnam as R.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6280 30 January 2005.

8.24. *Bulbophyllum* sp. 1.

(*B. arcuatilabium* Aver. aff.).

Living form. Small creeping epiphyte

Ecology. Primary closed evergreen broad-leaved and coniferous (particularly with *Calocedrus rupestris*) forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-850 m a.s.l. Grows commonly on tops of ridges.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6034 22 January 2005; No HAL 6190 26 January 2005.

8.25. *Bulbophyllum* sp. 2.

(*B. xylophyllum* aff.).

Living form. Creeping epiphyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6129 25 January 2005.

8.26. *Bulbophyllum* sp. 3.

(*Bulbophyllum* sp. Sect. *Desmosanthes*).

Living form. Creeping epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5854 18 January 2005.

8.27. *Bulbophyllum* sp. 4.

(*Bulbophyllum* sp. Sect. *Desmosanthes*).

Living form. Creeping epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-620 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6022 22 January 2005.

8.28. *Bulbophyllum* sp. 5.

(*Bulbophyllum* sp. Sect. *Desmosanthes*).

Living form. Creeping epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6235 29 January 2005.

8.29. *Bulbophyllum* sp. 6.

(*Bulbophyllum* sp. Sect. *Desmosanthes*).

Living form. Creeping epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6237 29 January 2005.

8.30. *Bulbophyllum* sp. 7.

Living form. Epiphyte.

Ecology. Primary closed evergreen coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l.

Occurrence and IUCN status. Occasional. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6071 24 January 2005.

8.31. *Bulbophyllum* sp. 8.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved forests on steep slopes of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 650-750 m a.s.l.

Occurrence and IUCN status. Occasional. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6089 24 January 2005.

8.32. *Bulbophyllum* sp. 9.

Living form. Lithophytic and occasionally epiphytic herb.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on shady vertical cliffs.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6115 25 January 2005.

8.33. *Bulbophyllum* sp. 10.

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6188 26 January 2005.

8.34. *Bulbophyllum* sp. 11.

Living form. Epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6302 31 January 2005.

8.35. *Bulbophyllum* sp. 12.

Living form. Creeping epiphyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline gray limestone at elevations 200-250 m a.s.l. Grows commonly on steep rocky slopes near tops of ridges.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 6368 3 February 2005.

8.36. *Bulbophyllum* sp. 13.

Living form. Epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5874 18 January 2005.

8.37. *Bulbophyllum* sp. 14.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests along atreams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-400 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5907 19 January 2005.

8.38. *Bulbophyllum* sp. 15.

Living form. Creeping epiphyte.

Ecology. Primary closed evergreen broad-leaved gnarled stunted forests along rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 600-800 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5962 20 January 2005.

8.39. *Bulbophyllum* sp. 16.

Living form. Creeping epiphyte and lithophyte.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests (particularly with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6006 21 January 2005.

8.40. *Bulbophyllum* sp. 17.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6052 22 January 2005.

8.41. *Bulbophyllum* sp. 18.

Living form. Epiphyte.

Ecology.

Primary closed broad-leaved evergreen forests on steep slopes of mountains composed with shale and sandstone along stream canyon at elevations 600 m a.s.l. Commonly grows in canopies of tall trees.

Occurrence and IUCN status. Common. **LR.**

Distribution. Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6312 1 February 2005.

9. *Calanthe* R.Br.

9.42. *C. alismifolia* Lindl.

Living form. Erect terrestrial herb.

Ecology. Primary coniferous and evergreen broad-leaved forests on steep slopes of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 650-900 m a.s.l. Grows commonly in humid shady slopes.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6079 24 January 2005; No HAL 6112 25 January 2005.

9.43. *C. lyroglossa* Rech.f.

Living form. Erect terrestrial herb.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-1000 m a.s.l. Grows commonly on humid shady slopes of stream valleys.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6215 29 January 2005, **photo 27, 28**; No HAL 6269 30 January 2005.

9.44. *C. triplicata* (Willem.) Ames

Living form. Erect terrestrial herb, leaves uniform green.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-750 m a.s.l. Grows commonly in deep shade.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5852 18 January 2005; No HAL 6080 24 January 2005.

9.45. *Calanthe* sp.

Living form. Erect terrestrial herb.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on shady rocky slopes.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6137 25 January 2005.

10. *Callostylis* Blume

10.46. *C. rigida* Blume

Living form. Creeping epiphytic vine up to 3 m long.

Ecology. All kind of forests at elevations 340-1000 m a.s.l. Grows commonly in canopies of tall trees, flowers dull orange, lip with violet-purple-brown spot.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5917 19 January 2005; No HAL 6217 29 January 2005, **photo, 29**.

11. *Ceratostylis* Blume

11.47. *C. subulata* Blume

Living form. Epiphyte, flowers dull purple, lip yellowish.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved gnarled stunted forests along rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 600-900 m a.s.l. Grows commonly on old mossy trees in deep shade.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 5950 20 January 2005, **photo, 30**; No HAL 6065 24 January 2005.

12. *Cheirostylis* Blume

12.48. *Ch. yunnanensis* Rolfe

Living form. Small terrestrial and lithophytic creeping herb, flowers white, lip with two green spots on mesochile, leaves dull uniform green or pale green with whitish broad median stripe.

Ecology. All kind of forests at elevations 600-850 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E at elevations about 600 m a.s.l. near U Bo forestry protection station.

Collections. No HAL 6197 26 January 2005, **photo 31, 32**; No HAL 6307 1 February 2005.

12.49. *Cheirostylis* sp. 1.

Living form. Terrestrial and lithophytic creeping herb, flowers white, lip with two green spots on mesochile, leaves dull light to deep uniform green or with whitish broad central stripe.

Ecology. Primary and secondary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 300-900 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E

Collections. No HAL 5869 18 January 2005; No HAL 6056 24 January 2005; No HAL 6092 24 January 2005; No HAL 6196 26 January 2005, **photo, 33, 34**; No HAL 6352 2 February 2005.

12.50. *Cheirostylis* sp. 2.

Living form. Lithophytic and epiphytic creeping herb, Tepals green, lip white with light yellow-green center, leaves bright uniform green.

Ecology. Primary closed evergreen broad-leaved forests on steep slopes of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 650-750 m a.s.l.

Occurrence and IUCN status. Very rare. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6092 24 January 2005, **photo, 35**.

13. *Chiloschista* Lindl.

13.51. *Ch. trudelii* Seidenf. ?

Living form. Leafless canopy epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone as well as evergreen broad-leaved lowland forests along streams at foothills of limestone mountains at elevations 340-650 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5879 18 January 2005; No HAL 5925 19 January 2005.

14. *Cleisostoma* Blume

14.52. *C. birmanicum* (Schltr.) Garay

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 550-1000 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5956 20 January 2005; No HAL 5982 21 January 2005; No HAL 6172 26 January 2005; No HAL 6218 29 January 2005.

14.53. *C. melanorachis* Aver. et Averyanova ?

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests (particularly with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5998 21 January 2005.

14.54. *C. paniculatum* (Ker-Gawl.) Garay ?

(vel *C. racemiferum* (Lindl.) Garay).

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 550-1000 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5951 20 January 2005; No HAL 5981 21 January 2005; No HAL 6121 25 January 2005; No HAL 6170 26 January 2005; No HAL 6219 29 January 2005.

14.55. *C. rostratum* (Lodd.) Seidenf.

Living form. Epiphyte and lithophyte.

Ecology. All kinds of forests at elevations 340-750 m a.s.l.

Occurrence and IUCN status. Very common, particularly on limestone. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5844 18 January 2005; No HAL 5913 19 January 2005; No HAL 6021 22 January 2005; No HAL 6085 24 January 2005; No HAL 6347 2 February 2005.

14.56. *C. simondii* (Gagnep.) Seidenf. ?

Living form. Epiphyte.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 650-850 m a.s.l. Commonly grows in canopies of tall trees.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6090 24 January 2005; No HAL 6167 26 January 2005.

14.57. *C. striatum* (Rchb.f.) Garay

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 340-1000 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 5843 18 January 2005; No HAL 5912 19 January 2005; No HAL 6084 24 January 2005; No HAL 6236 29 January 2005; No HAL 6273 30 January 2005.

14.58. *C. williamsonii* (Rchb.f.) Garay ?

Living form. Epiphyte.

Ecology. Primary and secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l.

Occurrence and IUCN status. Occasional. **VU.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6341 2 February 2005.

14.59. *Cleisostoma* sp. 1.

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6125 25 January 2005.

14.60. *Cleisostoma* sp. 2.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6010 22 January 2005.

15. *Collabium* Blume

15.61. *C. chinense* (Rolfe) Tang & F.T.Wang

Living form. Terrestrial creeping herb, tepals light green, lip white with purple marks, leaves dull green with deep green spots.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 600-1000 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6225 29 January 2005; No HAL 6320 1 February 2005, **photo, 36, 37.**

16. *Corymborkis* Thouars

16.62. *C. veratrifolia* (Reinw.) Blume

Living form. Erect terrestrial herb up to 2 m tall.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-750 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5870 18 January 2005; No HAL 6101 24 January 2005.

17. *Cymbidium* Sw.

17.63. *C. aloifolium* (L.) Sw.

Living form. Epiphyte and lithophyte.

Ecology. All kinds of forests at elevations 200-400 m a.s.l., more often on rocky open slopes.

Occurrence and IUCN status. Common, particularly on limestone. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E; Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 5918 19 January 2005; No HAL 6337 2 February 2005; No HAL 6366 3 February 2005.

17.64. *C. atropurpureum* (Lindl.) Rolfe ?

Living form. Epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. commonly in canopies of tall trees.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6263 30 January 2005.

17.65. *C. dayanum* Rchb.f.

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 600-700 m a.s.l. Grows commonly as a humus epiphyte on tall trees.

Occurrence and IUCN status. Locally common. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6211 27 January 2005; No HAL 6262 30 January 2005; No HAL 6314 1 February 2005.

17.66. *C. ensifolium* (L.) Sw.

Living form. Terrestrial herb.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests (commonly with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-650 m a.s.l. Grows commonly on steep rocky slopes.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5850 18 January 2005; No HAL 5988 21 January 2005.

17.67. *C. lancifolium* Hook.f.

Living form. Terrestrial herb, flowers light green, tepals with purple-brown stripes, lip white with purple marks.

Ecology. All kinds of forests on limestone at elevations 500-650 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5855 18 January 2005, **photo, 38, 39**; No HAL 6017 22 January 2005.

17.68. *C. sinense* (Jacks.) Willd.

Living form. Terrestrial herb.

Ecology. Slightly logged primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6264 30 January 2005.

17.69. *Cymbidium* sp. 1.

Living form. Epiphyte.

Ecology. Primary closed evergreen coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l.

Occurrence and IUCN status. Locally common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6073 24 January 2005.

17.70. *Cymbidium* sp. 2.

Living form. Epiphyte.

Ecology. Primary and secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6336 2 February 2005.

18. *Dendrobium* Sw.

18.71. *D. anosmum* Lindl. ?

(vel *D. parishii* Rchb.f.)

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests (with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-650 m a.s.l. Grows commonly as humus epiphyte on tall trees.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5990 21 January 2005; No HAL 6025 22 January 2005.

18.72. *D. cariniferum* Rchb.f. ?

(*Dendrobium* sect. *Nigrohirsutae*: vel *D. ochraceum* De Wild. or *D. kontumense* Gagnep. **Species is included in Red Data Book of Vietnam as R** under the name *D. virgineum* Rchb.f.).

Living form. Epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l. and in primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l. Grows commonly as humus epiphyte on tall trees.

Occurrence and IUCN status. Occasional. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5860 18 January 2005; No HAL 6227 29 January 2005, **photo, 40.**

18.73. *D. hercoglossum* Rchb.f. ?

Living form. Epiphyte and occasionally lithophyte.

Ecology. All kinds of forests at elevations 200-1000 m a.s.l. Grows commonly as humus epiphyte on tall trees.

Occurrence and IUCN status. Locally very common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E; Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 5908 19 January 2005; No HAL 5991 21 January 2005; No HAL 6028 22 January 2005; No HAL 6111 24 January 2005; No HAL 6143 25 January 2005; No HAL 6259 30 January 2005; No HAL 6308 1 February 2005; No HAL 6363 3 February 2005.

18.74. *D. loddigesii* Rolfe

Living form. Lithophyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l. Grows commonly on vertical shady cliffs.

Occurrence and IUCN status. Rare. **VU.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6335 2 February 2005.

18.75. *D. nobile* Lindl. ?

Living form. Epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 300-650 m a.s.l. Grows commonly as a humus epiphyte.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5861 18 January 2005; No HAL 6030 22 January 2005; No HAL 6342 2 February 2005.

18.76. *D. salaccense* (Blume) Lindl.

Living form. Lithophyte and occasionally epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5856 18 January 2005, **photo, 41.**

18.77. *D. spatella* Rchb.f.

(= *D. acinaciforme* Roxb. auct.).

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 500-800 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 5955 20 January 2005; No HAL 5989 21 January 2005; No HAL 6026 22 January 2005; No HAL 6293 30 January 2005.

18.78. *D. terminale* Par. & Rchb.f.

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 550-1000 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5849 18 January 2005; No HAL 6086 24 January 2005; No HAL 6238 29 January 2005.

18.79. *D. thyrsiflorum* Rchb.f.

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 300-800 m a.s.l. Grows commonly as a humus epiphyte on tall trees.

Occurrence and IUCN status. Very common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5827 18 January 2005; No HAL 5947 20 January 2005; No HAL 6020 22 January 2005; No HAL 6072 24 January 2005; No HAL 6124 25 January 2005; No HAL 6257 30 January 2005; No HAL 6331 2 February 2005.

18.80. *D. truncatum* Lindl.

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 200-650 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E; Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 5857 18 January 2005; No HAL 5911 19 January 2005; No HAL 6334 2 February 2005; No HAL 6361 3 February 2005.

18.81. *Dendrobium* sp. 1.

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6126 25 January 2005.

18.82. *Dendrobium* sp. 2.

Living form. Epiphyte and lithophyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6338 2 February 2005.

18.83. *Dendrobium* sp. 3.

Living form. Epiphyte and lithophyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6339 2 February 2005.

18.84. *Dendrobium* sp. 4.

Living form. Epiphyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline gray limestone at elevations 200-250 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Common. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 6362 3 February 2005.

19. *Epigeneium* Gagnep.

19.85. *E. labuanum* (Lindl.) Summerh.

Living form. Lithophytic and epiphytic creeping herb, flowers white, lip with reddish-purple keels.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-900 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5829 18 January 2005; No HAL 5960 20 January 2005, **photo, 42, 43**; No HAL 6123 25 January 2005.

20. *Eria* Lindl.

20.86. *E. boniana* (Gagnep.) Tang & F.T.Wang

Living form. Lithophytic creeping herb.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows commonly on vertical shady cliffs.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6183 26 January 2005.

20.87. *E. corneri* Rchb.f.

Living form. Epiphyte and occasionally lithophyte.

Ecology. All kinds of forests at elevations 340-600 m a.s.l. Grows commonly along streams in shade.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 5916 19 January 2005; No HAL 6309 1 February 2005.

20.88. *E. gagnepainii* Hawkes & Heller

Living form. Epiphyte and lithophyte, flower buds light green with dull purple-brown marks, flowers dull greenish, sepals outside with dirty purple-brown marks.

Ecology. All kinds of forests at elevations 500-1000 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6013 22 January 2005; No HAL 6074 24 January 2005; No HAL 6216 29 January 2005, **photo 44, 45**.

20.89. *E. globulifera* Seidenf. ?

Living form. Lithophyte and epiphyte.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved gnarled stunted forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 600-900 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5958 20 January 2005; No HAL 6127 25 January 2005.

20.90. *E. lasiopetala* (Willd.) Ormerod ?

Living form. Creeping epiphyte.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved gnarled stunted forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 300-850 m a.s.l. Grows commonly on open rocky slopes.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5828 18 January 2005; No HAL 6180 26 January 2005; No HAL 6345 2 February 2005.

20.91. *E. paniculata* Lindl.

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 600-1000 m a.s.l. Grows commonly as a humus epiphyte on tall trees.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5943 20 January 2005; No HAL 6081 24 January 2005; No HAL 6224 29 January 2005.

20.92. *E. pannea* Lindl.

Living form. Creeping epiphyte.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved gnarled stunted forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 600-900 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5952 20 January 2005; No HAL 6118 25 January 2005.

20.93. *E. pusilla* (Griff.) Lindl.

Living form. Small creeping epiphyte and lithophyte, flowers white.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved gnarled stunted forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 600-900 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5970 20 January 2005, **photo 46**; No HAL 6157 25 January 2005.

20.94. *E. siamensis* Schltr.

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6179 26 January 2005.

20.95. *E. spirodela* Aver.

Living form. Lithophyte and epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved and coniferous forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5862 18 January 2005, **photo 47**.

20.96. *E. thao* Gagnep.

Living form. Creeping epiphyte, flowers yellow-orange.

Ecology. All kinds of forests at elevations 340-850 m a.s.l.

Occurrence and IUCN status. Very common, particularly in limestone forests. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5834 18 January 2005, **photo 48, 49**; No HAL 5919 19 January 2005; No HAL 5964 20 January 2005; No HAL 5985 21 January 2005.

20.97. *Eria* sp.

Living form. Lithophyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5877 18 January 2005.

21. Flickingeria Hawkes

21.98. F. angustifolia (Blume) Hawkes ?

Living form. Epiphyte and lithophyte.

Ecology. Primary closed evergreen broad-leaved and coniferous forests (particularly with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-800 m a.s.l. Commonly on tall trees.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5864 18 January 2005; No HAL 5968 20 January 2005; No HAL 5992 21 January 2005; No HAL 6024 22 January 2005.

21.99. F. fimbriata (Blume) Hawkes ?

Living form. Epiphyte and lithophyte.

Ecology. All kinds of forests at elevations 550-700 m a.s.l., particularly along streams.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 5863 18 January 2005; No HAL 6277 30 January 2005.

22. Galeola Lour.

22.100. G. nudifolia Lour.

Living form. Achlorophyllous mycotrophic vine 2-3 m.

Ecology. Primary and secondary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Occasional. **DD.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6240 29 January 2005.

23. Gastrochilus D. Don

23.101. G. acutifolius (Lindl.) Kuentze ?

Living form. Epiphyte.

Ecology. All kinds of forests on limestone at elevations 300-900 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5847 18 January 2005; No HAL 6076 24 January 2005; No HAL 6340 2 February 2005.

23.102. G. calceolaris (J.E. Smith) D. Don ?

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved gnarled stunted forests along rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 600-800 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5944 20 January 2005.

23.103. G. hainanensis Tsi ?

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests along atreams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-400 m a.s.l. Commonly along streams in deep shade.

Occurrence and IUCN status. Occasional. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5909 19 January 2005.

24. *Goodyera* R.Br.

24.104. *G. foliosa* (Lindl.) C.B. Clarke ?

Living form. Terrestrial creeping herb, leaves deep uniform green.

Ecology. Primary closed evergreen coniferous (particularly with *Calocedrus rupestris*) and evergreen broad-leaved gnarled stunted forests on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l. Commonly in humid shady places.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 5959 20 January 2005; No HAL 6061 24 January 2005.

24.105. *G. fumata* Thwaites

Living form. Terrestrial and lithophytic creeping herb, leaves deep uniform green.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Usually in wet, humid and shady places along streams.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6267 30 January 2005.

24.106. *G. hispida* Lindl.

Living form. Creeping terrestrial and lithophytic herb, leaves deep green with whitish network of nerves.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6189 26 January 2005, **photo 50.**

24.107. *G. procera* (Ker-Gawl.) Hook.

Living form. Terrestrial and lithophytic herb.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Commonly on wet rocks and on open sandy places along streams and rivers

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Bo Trach Distr., Hung Trach Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6270 30 January 2005; No HAL 6319 1 February 2005.

24.108. *G. viridiflora* (Blume) Dietrich

Living form. Terrestrial and lithophytic creeping herb, leaves uniform green.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-900 m a.s.l. Commonly on steep rocky slopes.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 5980 21 January 2005; No HAL 6014 22 January 2005; No HAL 6057 24 January 2005, **photo 51, 52.**

25. *Habenaria* Willd.

25.109. *H. ciliolaris* Kraenzl.

Living form. Terrestrial ephemeroïd tuberiferous herb.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 300-800 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5873 18 January 2005; No HAL 5942 20 January 2005; No HAL 6353 2 February 2005.

25.110. *Habenaria* sp.

Living form. Terrestrial ephemeroïd tuberiferous herb.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6135 25 January 2005.

26. Hetaeria Blume

26.111. *H. anomala* (Lindl.) Hook.f.

Living form. Terrestrial and lithophytic creeping herb, lateral sepals whitish with brown spots, lip white, leaves uniform green.

Ecology. Primary closed evergreen coniferous (with *Calocedrus rupestris*) and broad-leaved evergreen forests on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-1000 m a.s.l.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6060 24 January 2005; No HAL 6241 29 January 2005, **photo 53, 54.**

27. Hygrochilus Pfitzer

27.112. *H. parishii* (Rchb.f.) Pfitzer

Living form. Epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Rare. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5831 18 January 2005.

28. Kingidium P.Hunt

28.113. *K. deliciosum* (Rchb.f.) Sweet

Living form. Epiphyte and occasionally lithophyte.

Ecology. All kinds of forests at elevations 340-900 m a.s.l. Commonly in humid shady places along streams.

Occurrence and IUCN status. Common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 5906 19 January 2005; No HAL 6016 22 January 2005; No HAL 6077 24 January 2005; No HAL 6276 30 January 2005.

29. Liparis Rich.

29.114. *L. aurita* Ridl. ?

Living form. Small epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6136 25 January 2005.

29.115. *L. averyanoviana* Szlach. ?

Living form. Lithophyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5842 18 January 2005.

29.116. *L. bootanensis* Griff. ?

Living form. Lithophyte, flowers dull orange.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6214 29 January 2005, **photo 55.**

29.117. *L. dendrochiloides* Aver. ?

Living form. Epiphyte and lithophyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Commonly on shady steep stream valley slopes.

Occurrence and IUCN status. Locally very common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6274 30 January 2005.

29.118. *L. distans* C.B. Clarke ?

Living form. Lithophytic herb.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-800 m a.s.l. Commonly on shady cliffs.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5841 18 January 2005; No HAL 5948 20 January 2005.

29.119. *L. elliptica* Wight ?

Living form. Epiphyte.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and broad-leaved evergreen forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-1000 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6131 25 January 2005; No HAL 6304 31 January 2005.

29.120. *L. latilabris* Rolfe

Living form. Lithophyte, flowers olive-green, later dull orange.

Ecology. Primary closed evergreen coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Commonly on shady vertical cliffs.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6070 24 January 2005; No HAL 6161 25 January 2005, **photo 56, 57.**

29.121. *L. mannii* Rchb.f.

Living form. Lithophyte.

Ecology. Primary closed evergreen coniferous forests (with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6069 24 January 2005.

29.122. *L. nervosa* (Thunb.) Lindl.

Living form. Terrestrial herb.

Ecology. Primary closed evergreen coniferous forests (with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l. Commonly in shady places along stream.

Occurrence and IUCN status. Not rare. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6066 24 January 2005.

29.123. *L. petelotii* Gagnep. ?

Living form. Lithophyte.

Ecology. Primary closed evergreen coniferous forests (with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l.

Occurrence and IUCN status. Common. **LR. Species is included in Red Data Book of Vietnam as R.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6075 24 January 2005.

29.124. *L. petraea* Aver. et Averyanova ?

Living form. Lithophyte.

Ecology. Primary closed evergreen broad-leaved gnarled stunted forests along rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 600-800 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5954 20 January 2005.

29.125. *L. pumila* Aver ?

Living form. Lithophytic and epiphytic clustering herb.

Ecology. Primary closed coniferous (mainly with *Calocedrus rupestris*) and broad-leaved evergreen forests and scrub on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 340-850 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5922 19 January 2005; No HAL 6185 26 January 2005; No HAL 6359 2 February 2005.

29.126. *L. stricklandiana* Rchb.f. ?

Living form. Lithophyte.

Ecology. Primary closed evergreen broad-leaved lowland forests along atreams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-400 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5920 19 January 2005.

29.127. *L. tixieri* Guillaum.

(= *L. flava* (Aver.) Aver.).

Living form. Lithophytic herb, flowers deep green to yellow-green.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-1000 m a.s.l. Usually on shady wet rocks along streams.

Occurrence and IUCN status. Locally very common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17° 27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6230 29 January 2005, **photo 58, 59**; No HAL 6265 30 January 2005.

29.128. *L. viridiflora* (Blume) Lindl.

Living form. Lithophyte and epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6140 25 January 2005.

29.129. *Liparis* sp. 1.

Living form. Lithophyte.

Ecology. Primary closed evergreen coniferous forests (with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6067 24 January 2005.

29.130. *Liparis* sp. 2.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved forests on steep slopes of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 650-750 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6088 24 January 2005.

29.131. *Liparis* sp. 3.

Living form. Lithophyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly shady vertical cliffs.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6116 25 January 2005.

29.132. *Liparis* sp. 4.

Living form. Creeping lithophyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6158 25 January 2005.

29.133. *Liparis* sp. 5.

Living form. Epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6303 31 January 2005.

29.134. *Liparis* sp. 6.

Living form. Epiphyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l. Grows commonly on steep rocky slopes near tops of mountain.

Occurrence and IUCN status. Not rare. **LR.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6348 2 February 2005.

29.135. *Liparis* sp. 7.

Living form. Lithophyte and epiphyte.

Ecology. Secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline gray limestone at elevations 200-250 m a.s.l. Grows commonly on steep rocky slopes near tops of ridges.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 6369 3 February 2005.

29.136. *Liparis* sp. 8.

Living form. Lithophytic herb.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Occasional. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5841a 18 January 2005.

29.137. *Liparis* sp. 9.

Living form. Lithophyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l.

Occurrence and IUCN status. Occasional. **DD.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5842a 18 January 2005.

29.138. *Liparis* sp. 10.

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6192 26 January 2005.

30. *Ludisia* A.Rich.

30.139. *L. discolor* (Ker-Gawl.) A.Rich.

Living form. Creeping lithophytic herb, flowers white, anther yellow, leaves deep green to green-brown, with 3-7 white, yellowish-pink to pink longitudinal nerves.

Ecology. All kinds of forests at elevations 300-750 m a.s.l. Grows commonly on shady mossy rocks.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E; Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E; Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5865 18 January 2005, **photo 60-62, 78**; No HAL 5926 19 January 2005; No HAL 5983 21 January 2005; No HAL 6078 24 January 2005; No HAL 6279 30 January 2005; No HAL 6310 1 February 2005; No HAL 6350 2 February 2005; No HAL 6351 2 February 2005.

31. *Malaxis* Sw.

31.140. *M. ophridis* (Koenig) Ormerod

Living form. Terrestrial and lithophytic herb.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l. Grows commonly on steep shady rocky slopes.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6018 22 January 2005.

32. *Malleola* J.J.Smith & Schltr.

32.141. *M. seidenfadenii* Christenson ?

Living form. Small canopy epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub as well as lowland forests along streams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-650 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5845 18 January 2005; No HAL 5924 19 January 2005.

33. *Micropera* Lindl.

33.142. *M. poilanei* (Guillaum.) Garay

Living form. Epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 500-650 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5871 18 January 2005; No HAL 6019 22 January 2005.

34. *Mischobulbum* Schltr.

34.143. *M. longiscapum* Seidenf.

Living form. Lithophytic and occasionally terrestrial herb, leaves deep green above, deep purple to dull violet below beneath.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 200-800 m a.s.l. Grows commonly on steep shady rocky slopes near tops of ridges.

Occurrence and IUCN status. Occasional. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5837 18 January 2005; No HAL 5969 20 January 2005; No HAL 6033 22 January 2005; No HAL 6370 3 February 2005.

35. *Nephelaphyllum* Blume

35.144. *N. tenuiflorum* Blume

Living form. Lithophytic and terrestrial creeping herb, leaves brightly green with deep green spots above, dull green with violet tint below.

Ecology. All kinds of forests at elevations 750-1000 m a.s.l. Grows commonly on steep shady rocky slopes.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6063 24 January 2005; No HAL 6182 26 January 2005; No HAL 6233 29 January 2005; No HAL 6317 1 February 2005.

36. *Nervilia* Gaudich.

36.145. *N. aragoana* Gaudich. ?

Living form. Terrestrial ephemeroïd tuberiferous herb, leaves uniform green.

Ecology. Primary closed evergreen broad-leaved lowland forests along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-650 m a.s.l. Grows commonly in alluvial lowers part of mountain slopes, in open places.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5995 21 January 2005.

36.146. *N. macroglossa* (Hook.f.) Schltr. ?

Living form. Terrestrial ephemeroïd tuberiferous herb, leaves deep uniform green.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6191 26 January 2005.

37. *Neuwiedia* Blume

37.147. *N. balansae* Gagnep. ?

Living form. Erect terrestrial herb up to 0.5 m tall.

Ecology. All kinds of forests at elevations 600-900 m a.s.l. Grows commonly in leveled shady places of middle part of mountain slopes.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6149 25 January 2005; No HAL 6254 30 January 2005.

38. *Oberonia* Lindl.

38.148. *O. cavaleriei* Finet

Living form. Lithophyte

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and broad-leaved gnarled stunted forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 600-900 m a.s.l. Grows commonly on shady vertical cliffs.

Occurrence and IUCN status. Locally common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5949 20 January 2005; No HAL 6160 25 January 2005.

38.149. *O. kwangsiensis* Seidenf. ?

Living form. Lithophyte and epiphyte.

Ecology. Primary closed coniferous (particularly with *Calocedrus rupestris*) and broad-leaved gnarled stunted forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 600-900 m a.s.l. Grows commonly on steep open rocky slopes near top of ridges.

Occurrence and IUCN status. Locally very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5946 20 January 2005; No HAL 6142 25 January 2005.

38.150. *Oberonia* sp. 1.

Living form. Small canopy epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6220 29 January 2005.

38.151. *Oberonia* sp. 2.

Living form. Small canopy epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6221 29 January 2005.

38.152. *Oberonia* sp. 3.

Living form. Small canopy epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6301 31 January 2005.

38.153. *Oberonia* sp. 4.

Living form. Small canopy epiphyte.

Ecology. Primary closed evergreen broad-leaved gnarled stunted forests along rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 600-800 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5953 20 January 2005.

39. *Odontochilus* Blume

39.154. *O. elwesii* C.B. Clarke ex Hook.f.

Living form. Creeping terrestrial and lithophytic herb.

Ecology. Primary closed coniferous and evergreen broad-leaved forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 600-900 m a.s.l. Grows commonly on shady steep rocky slopes.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E); Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5957 20 January 2005, **photo 63**; No HAL 6113 25 January 2005.

40. *Ornithochilus* (Lindl.) Benth.

40.155. *O. difformis* (Lindl.) Schltr. ?

Living form. Canopy epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 500-650 m a.s.l.

Occurrence and IUCN status. Occasional. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5832 18 January 2005; No HAL 6015 22 January 2005.

41. *Panisea* Lindl.

41.156. *P. albiflora* (Ridl.) Seidenf. ?

Living form. Epiphyte and occasionally lithophyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on *Calocedrus rupestris*.

Occurrence and IUCN status. Very common particularly on *Calocedrus rupestris*. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6122 25 January 2005; No HAL 6187 26 January 2005, **photo 64**.

41.157. *P. tricallosa* Rolfe ?

Living form. Lithophyte and occasionally epiphyte on *Calocedrus rupestris*, flowers light dull yellow, lip dull orange.

Ecology. Primary closed evergreen coniferous forests (with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6068 24 January 2005; No HAL 6114 25 January 2005, **photo 65, 66**.

42. *Paphiopedilum* Pfitzer

42.158. *P. concolor* (Batem.) Pfitzer

Living form. Lithophytic herb, flower buds and leaves of typical coloration.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges and mountain tops composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 500-650 m a.s.l. Grows commonly on very steep rocky slopes and cliffs.

Occurrence and IUCN status. Common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5840 18 January 2005, **photo 67-69**; No HAL 6037 22 January 2005.

42.159. *P. dianthum* Tang & F.T.Wang

Living form. Epiphyte at base of trees and lithophyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Very rare. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6166 26 January 2005.

42.160. *P. malipoense* S.C.Chen & Tsi

Living form. Lithophytic and terrestrial herb, leaves and flowers of typical coloration.

Ecology. Primary closed broad-leaved and coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-900 m a.s.l. Grows commonly on very steep rocky slopes and cliffs.

Occurrence and IUCN status. Common. VU.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5839 18 January 2005, **photo 70-72**; No HAL 5967 20 January 2005; No HAL 6039 22 January 2005; No HAL 6117 25 January 2005; No HAL 6207 26 January 2005.

43. Parapteroceras Aver.

43.161. P. elobe (Seidenf.) Aver.

Living form. Canopy epiphyte, flowers white with yellow tint, lip tip deep purple.

Ecology. Primary closed evergreen broad-leaved and coniferous forests (with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-800 m a.s.l.

Occurrence and IUCN status. Common. VU.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5966 20 January 2005; No HAL 5997 21 January 2005; No HAL 6008 22 January 2005, **photo 73, 74**.

44. Phaius Lour.

44.162. Ph. flavus (Blume) Lindl.

Living form. Large erect terrestrial herb, leaves uniform green.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on rocky mossy slopes in deep shade.

Occurrence and IUCN status. Rare. VU.

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6138 25 January 2005.

44.163. Ph. mishmensis (Lindl. & Paxt.) Rchb.f.

Living form. Large erect terrestrial and lithophytic herb.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Grows commonly on shady wet slopes of stream valleys.

Occurrence and IUCN status. Occasional. LR.

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6271 30 January 2005.

45. Phalaenopsis Blume

45.164. Ph. gibbosa Sweet

Living form. Canopy epiphyte.

Ecology. Primary closed broad-leaved and coniferous forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 550-850 m a.s.l. Grows commonly in humid condition in deep shade.

Occurrence and IUCN status. Rare. VU.

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5876 18 January 2005, **photo 75**; No HAL 6184 26 January 2005.

46. Pholidota Hook.

46.165. *Ph. articulata* Lindl.

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 550-1000 m a.s.l. Grows commonly as humus epiphyte on tall trees.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5851 18 January 2005; No HAL 6130 25 January 2005; No HAL 6231 29 January 2005.

46.166. *Ph. chinensis* Lindl.

Living form. Epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l. Grows commonly in shady places along stream valleys.

Occurrence and IUCN status. Locally common. **VU.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6223 29 January 2005.

46.167. *Ph. imbricata* Hook. ?

(vel *Ph. pallida* Lindl.).

Living form. Epiphyte.

Ecology. Primary closed broad-leaved and coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 500-900 m a.s.l. Grows commonly as humus epiphyte.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6012 22 January 2005; No HAL 6064 24 January 2005; No HAL 6181 26 January 2005.

46.168. *Ph. rubra* Lindl. ?

(vel *Ph. levelleana* Schltr.).

Living form. Creeping lithophyte and epiphyte.

Ecology. Primary closed coniferous and broad-leaved forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-900 m a.s.l. Grows commonly on tops of ridges.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5836 18 January 2005; No HAL 5945 20 January 2005; No HAL 6082 24 January 2005; No HAL 6119 25 January 2005.

46.169. *Ph. yunnanensis* Rolfe ?

Living form. Creeping lithophyte.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l. Grows commonly on tops of ridges.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6031 22 January 2005.

47. *Phreatia* Lindl.

47.170. *Ph. plantaginifolia* (Koen.) Ormerod ?

Living form. Small canopy epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on tops of ridges.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6159 25 January 2005.

48. *Podochilus* Blume

48.171. *P. khasianus* Hook.f.

Living form. Small lithophytic and occasionally epiphytic herb.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on shady humid steep rocky mossy slopes and cliffs.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6133 25 January 2005.

49. *Polystachya* Hook.

49.172. *P. concreta* (Jack.) Garay & Sweet.

Living form. Canopy epiphyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows commonly on tops of ridges.

Occurrence and IUCN status. Rare. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6169 26 January 2005.

50. *Pomatocalpa* Breda, Kuhl & Hasselt

50.173. *P. spicata* Breda

Living form. Epiphyte.

Ecology. Heavily logged primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l. Grows commonly in shady wet places.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5830 18 January 2005.

51. *Pteroceras* Hassk.

51.174. *P. simondianum* (Gagnep.) Aver. ?

Living form. Canopy epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests on mountain slopes, as well as broad-leaved lowland forests along streams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-650 m a.s.l. Grows commonly in shady wet conditions along stream valleys.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Collections. No HAL 5838 18 January 2005; No HAL 5905 19 January 2005; No HAL 5971 20 January 2005.

52. *Renanthera* Lour.

52.175. *R. coccinea* Lour.

Living form. Epiphytic and lithophytic vine up to 2 m long.

Ecology. Primary and secondary closed evergreen broad-leaved and coniferous forests and scrub on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 200-900 m a.s.l. Grows commonly on tops of ridges and rocky hills.

Occurrence and IUCN status. Common. **VU.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo

Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E; Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 5846 18 January 2005; No HAL 6032 22 January 2005; No HAL 6349 2 February 2005; No HAL 6364 3 February 2005.

53. *Rhomboda* Lindl.

53.176. *Rh. petelotii* (Gagnep.) Ormerod

Living form. Terrestrial and lithophytic creeping herb, leaves very deep green to black with 1 (3) white nerves longitudinal.

Ecology. Primary closed evergreen broad-leaved and coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l. Grows commonly on shady mossy steep rocky slopes near top of ridges.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6059 24 January 2005; No HAL 6141 25 January 2005, **photo 76.**

53.177. *Rh. tokioi* (Fukuyama) Ormerod ?

Living form. Creeping terrestrial herb, leaves deep green with median white stripe.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l. Grows commonly in shady places along stream valleys.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6228 29 January 2005.

53.178. *Rhomboda* sp.

(*Rh. petelotii* aff.?).

Living form. Lithophytic and terrestrial creeping herb, leaves above deep green with 3 white nerves, uniform light green below.

Ecology. Primary closed evergreen coniferous forests (with *Calocedrus rupestris*) on steep slopes and tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 800-900 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).

Collections. No HAL 6062 24 January 2005.

54. *Rhynchostylis* Blume

54.179. *Rh. gigantea* (Lindl.) Ridl.

Living form. Epiphyte.

Ecology. Primary closed coniferous forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows as humus epiphyte.

Occurrence and IUCN status. Rare. **EN.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6175 26 January 2005, **photo 77.**

55. *Robiquetia* Gaudich.

55.180. *R. spathulata* (Blume) J.J.Smith

Living form. Epiphyte.

Ecology. Primary and secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline deep gray limestone at elevations 300-400 m a.s.l. Grows commonly in deep shade.

Occurrence and IUCN status. Not rare. **VU.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6333 2 February 2005.

56. *Schoenorchis* Blume

56.181. *Sch. gemmata* (Lindl.) J.J.Smith

Living form. Small canopy epiphyte, tepals purple-violet, lip white.

Ecology. All kinds of forests at elevations 550-1000 m a.s.l. Grows commonly in canopies of tall trees.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5835 18 January 2005, **photo 79, 80**; No HAL 6087 24 January 2005; No HAL 6178 26 January 2005; No HAL 6239 29 January 2005.

57. *Staurochilus* Pfitz.

57.182. *S. fasciatus* (Rchb.f.) Pfitzer ?

Living form. Epiphyte.

Ecology. Primary closed coniferous forests (particularly with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Very rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6176 26 January 2005.

58. *Taeniophyllum* Blume

58.183. *Taeniophyllum* sp.

Living form. Small canopy epiphyte.

Ecology. Primary closed broad-leaved forests on steep slopes of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6209 26 January 2005.

59. *Tainia* Blume

59.184. *T. hongkongensis* Rolfe ?

Living form. Terrestrial herb.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests (with *Dacrydium elatum*) along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 550-650 m a.s.l. Grows commonly in open rocky places with short tall bamboo.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5986 21 January 2005, **photo 81.**

59.185. *T. latifolia* (Lindl.) Rchb.f. ?

Living form. Terrestrial and lithophytic herb, flowers olive-brownish, lip white.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Grows commonly on steep shady slopes of stream valleys.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6266 30 January 2005, **photo 82, 83.**

59.186. *T. pauciflora* (Breda) J.J.Smith ?

Living form. Terrestrial and lithophytic herb, flower buds yellowish-brown.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Grows commonly on shady slopes of stream valleys.

Occurrence and IUCN status. Locally common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Bo Trach Distr., Hung Trach Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6268 30 January 2005; No HAL 6318 1 February 2005.

59.187. *Tainia* sp.

Living form. Terrestrial herb.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 750-900 m a.s.l.

Occurrence and IUCN status. Rare. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6139 25 January 2005.

60. *Thecopus* Seidenf.

60.188. *Th. maingayi* (Hook.f.) Seidenf. ?

Living form. Epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Grows commonly on tall trees along streams.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6260 30 January 2005.

61. *Thecostele* Rchb.f.

61.189. *Th. alata* (Roxb.) Par. & Rchb.f.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests along atreams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-400 m a.s.l. Grows commonly on tall trees along streams.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5915 19 January 2005.

62. *Thelasis* Blume

62.190. *Th. khasiana* Hook.f. ?

Living form. Small canopy epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests along atreams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-400 m a.s.l. Grows commonly on tall trees along streams.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5921 19 January 2005.

62.191. *Th. pygmaea* (Griff.) Blume

Living form. Small canopy epiphyte.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 300-650 m a.s.l. Grows commonly on tops of ridges.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5858 18 January 2005; No HAL 6035 22 January 2005; No HAL 6357 2 February 2005.

63. *Thrixspermum* Lour.

63.192. *Th. calceolus* (Lindl.) Rchb.f. ?

Living form. Epiphyte.

Ecology. Primary closed broad-leaved and coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 300-850 m a.s.l. Grows commonly on tops of ridges and rocky hills.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 6177 26 January 2005; No HAL 6346 2 February 2005.

63.193. *Th. centipeda* Lour.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved and coniferous lowland forests along rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 200-700 m a.s.l. Particularly in shady places along streams.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 5872 18 January 2005; No HAL 5904 19 January 2005, **photo 84**; No HAL 5993 21 January 2005; No HAL 6256 30 January 2005; No HAL 6367 3 February 2005.

63.194. *Th. fleuryi* (Gagnep.) Tang & F.T.Wang ?

Living form. Small canopy epiphyte.

Ecology. Primary closed coniferous forests (with *Calocedrus rupestris*) on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6165 26 January 2005.

63.195. *Th. formosanum* (Hayata) Schltr. s.l.

Living form. Small canopy epiphyte.

Ecology. All kinds of forests at elevations 550-1000 m a.s.l.

Occurrence and IUCN status. Not common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 5996 21 January 2005; No HAL 6213 29 January 2005.

63.196. *Th. fragrans* Ridl. ?

Living form. Canopy epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-1000 m a.s.l. Particularly on shady slopes of stream valleys.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 6232 29 January 2005; No HAL 6258 30 January 2005.

63.197. *Th. pauciflora* (Breda) J.J.Smith ?

Living form. Epiphyte.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale, sandstone and occasionally granite at elevations 600-700 m a.s.l. Particularly on shady slopes of stream valleys.

Occurrence and IUCN status. Common. **LR.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6255 30 January 2005; No HAL 6311 1 February 2005.

63.198. *Thrixspermum* sp. 1.

Living form. Small canopy epiphyte.

Ecology. Primary and secondary closed broad-leaved evergreen forests and scrub on rocky steep slopes of remnant mountains composed with solid highly eroded crystalline gray limestone at elevations 200-250 m a.s.l. Grows commonly on tops of ridges and hills.

Occurrence and IUCN status. Not rare. **DD.**

Distribution. Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E; Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E.

Collections. No HAL 6340a 2 February 2005; No HAL 6371 3 February 2005.

63.199. *Thrixspermum* sp. 2.

Living form. Epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests along atreams and foothills of rocky ridges composed with solid marble-like highly eroded crystalline limestone at elevations 340-400 m a.s.l. Grows on trees along streams in deep shade.

Occurrence and IUCN status. Not rare. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5910 19 January 2005.

63.200. *Thrixspermum* sp. 3.

Living form. Small canopy epiphyte.

Ecology. Primary closed evergreen broad-leaved lowland forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded stratified crystalline limestone at elevations 500-620 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 6009 22 January 2005.

64. *Trichotosia* Blume

64.201. *T. pulvinata* (Lindl.) Kraenzl. ?

(vel *T. velutina* (Lindl.) Kraenzl.).

Living form. Epiphyte.

Ecology. All kinds of forests at elevations 600-900 m a.s.l. Commonly grows as a humus epiphyte on tall trees.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E.

Collections. No HAL 5941 20 January 2005; No HAL 6128 25 January 2005; No HAL 6272 30 January 2005.

65. *Tropidia* Lindl.

65.202. *T. angulosa* (Lindl.) Blume

Living form. Erect terrestrial herb.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l. Grows commonly on alluvial parts of lower part of mountain slopes.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E; Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5859 18 January 2005; No HAL 5867 18 January 2005; No HAL 6326 1 February 2005; No HAL 6358 2 February 2005.

65.203. *T. curculigoides* Lindl.

Living form. Erect terrestrial herb.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-650 m a.s.l. Grows commonly on alluvial parts of lower part of mountain slopes.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Collections. No HAL 5859 18 January 2005.

66. *Vanda* Jones

66.204. *V. pumila* Hook.f. ?

Living form. Epiphyte.

Ecology. Primary closed broad-leaved and coniferous forests on steep slopes and on tops of rocky ridges composed with solid marble-like highly eroded solid crystalline limestone at elevations 750-850 m a.s.l. Grows commonly on tall trees.

Occurrence and IUCN status. Not common. **VU.**

Distribution. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 6171 26 January 2005; No HAL 6210 27 January 2005.

67. *Vanilla* Mill.

67.205. *Vanilla* sp.

Living form. Creeping epiphytic and lithophytic vine up to 10 m long.

Ecology. Primary and secondary closed evergreen broad-leaved and coniferous forests on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 300-900 m a.s.l. Grows often on very steep rocky slopes.

Occurrence and IUCN status. Occasional. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Son Trach Municipality, around point 17°30'32"N, 106°17'45"E.

Collections. No HAL 5880 18 January 2005; No HAL 6144 25 January 2005; No HAL 6330 2 February 2005.

68. *Vrydagzynea* Blume

68.206. *V. albida* (Blume) Blume

Living form. Terrestrial and lithophytic creeping herb, flowers white, later yellowish, with reddish base of sepals, leaves uniform green.

Ecology. All kinds of forests at elevations 600-1000 m a.s.l. Grows commonly in deep shade along river valleys.

Occurrence and IUCN status. Very common. **LR.**

Distribution. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E); Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E); Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E; Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E.

Collections. No HAL 6058 24 January 2005; No HAL 6148 25 January 2005, **photo 85, 86**; No HAL 6229 29 January 2005; No HAL 6316 1 February 2005.

69. *Zeuxine* Lindl.

69.207. *Z. nervosa* (Lindl.) Clarke

Living form. Terrestrial creeping herb, sepals light green-brownish, lip white with brownish median spot, leaves light green with broad median whitish stripe.

Ecology. Primary and secondary closed evergreen broad-leaved forests and scrub on rocky ridges composed with solid and stratified marble-like highly eroded crystalline limestone at elevations 550-750 m a.s.l.

Occurrence and IUCN status. Common. **LR.**

Distribution. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E); Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Collections. No HAL 5868 18 January 2005, **photo 87**; No HAL 6091 24 January 2005.

69.208. *Zeuxine* sp. ?

Living form. Creeping terrestrial herb, leaves uniform deep green.

Ecology. Primary closed broad-leaved evergreen forests on slopes of mountains composed with shale and sandstone at elevations 900-1000 m a.s.l.

Occurrence and IUCN status. Not common. **DD.**

Distribution. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E.

Collections. No HAL 6306 31 January 2005.

V. Brief notes, comments and recommendations.

Phong Nha – Ke Bang National Park (PNKB) is situated on the center of North Indochinese Province of Palaeotropic floristic kingdom (Averyanov, 2002i, 2004c, 2005g,h; Averyanov et al., 2003a,c). Very diverse natural conditions of the PNKB territory and existence of large files of intact primary forest explains very high level of plant species diversity of this region. On the basic estimation flora of this region may include 350-400 orchid species (Averyanov, 1994, 2000c,d, 2004c; Averyanov et al., 2000a,b,f, 2002j, 2003a,b,c,f, 2005c,h) and certainly represent one of the richest orchid floras in Indochina.

Our present reconnaissance botanical exploration here has resulted in the discovery of many distinctive aboriginal (indigenous) orchid species, as well as observations of very rich primary forest communities unique to Vietnam (fig. 1-12). Main dominants in these forests are very rare tree species endemic and sub endemic for Indochinese region (fig. 13-19). During reconnaissance field works (table 1) were collected 397 numbers of living orchids (usually 3 specimens for each number), were found and documented about 208 orchid species, which belong to 69 genera. Living specimens of orchids represent main scientific documentation of fulfilled field studies. All these specimens are housed now in nursery of Phong Nha – Ke Bang National Park.

Largest orchid genera in the flora of PNKB NP are *Bulbophyllum*, *Liparis*, *Dendrobium* and *Eria*, which is typical for the orchid floras of Indochina. Number of documented species for each genus are presented in Table 3.

Table 3. Number of documented species in orchid genera in the orchid flora of Phong Nha – Ke Bang National Park

Genus name	Number of documented species:
<i>Bulbophyllum</i> Thouars	28
<i>Liparis</i> Rich.	25
<i>Dendrobium</i> Sw.	14
<i>Eria</i> Lindl.	12
<i>Thrixspermum</i> Lour.	9
<i>Oberonia</i> Lindl.	6
<i>Goodyera</i> R.Br., <i>Pholidota</i> Hook.	5
<i>Calanthe</i> R.Br., <i>Tainia</i> Blume	4
<i>Aerides</i> Lour., <i>Appendicula</i> Blume, <i>Cheirostylis</i> Blume, <i>Gastrochilus</i> D.Don, <i>Paphiopedilum</i> Pfitzer, <i>Rhomboda</i> Lindl.	3
<i>Anoetochilus</i> Blume, <i>Biermannia</i> King et Pantl., <i>Flickingeria</i> Hawkes, <i>Habenaria</i> Willd., <i>Nervilia</i> Gaudich., <i>Panisea</i> Lindl., <i>Phaius</i> Lour., <i>Thelasis</i> Blume, <i>Tropidia</i> Lindl., <i>Zeuxine</i> Lindl.	2
<i>Acampe</i> Lindl., <i>Acriopsis</i> Blume, <i>Apostasia</i> Blume, <i>Callostylis</i> Blume, <i>Ceratostylis</i> Blume, <i>Chiloschista</i> Lindl., <i>Collabium</i> Blume, <i>Corymborkis</i> Thouars, <i>Epigeneium</i> Gagnep., <i>Hetaeria</i> Blume, <i>Galeola</i> Lour., <i>Hygrochilus</i> Pfitzer, <i>Kingidium</i> P.Hunt, <i>Ludisia</i> A.Rich., <i>Malaxis</i> Sw., <i>Malleola</i> J.J.Smith & Schltr., <i>Micropera</i> Lindl., <i>Mischobulbum</i> Schltr., <i>Nephelaphyllum</i> Blume, <i>Neuwiedia</i> Blume, <i>Odontochilus</i> Blume, <i>Ornithochilus</i> (Lindl.)Benth., <i>Parapteroceras</i> Aver., <i>Phalaenopsis</i> Blume, <i>Phreatia</i> Lindl., <i>Podochilus</i> Blume, <i>Polystachya</i> Hook., <i>Pomatocalpa</i> Breda, Kuhl & Hasselt, <i>Pteroceras</i> Hassk., <i>Renanthera</i> Lour., <i>Rhynchostylis</i> Blume, <i>Robiquetia</i> Gaudich., <i>Schoenorchis</i> Blume, <i>Staurochilus</i> Pfitz., <i>Taeniophyllum</i> Blume, <i>Thecopus</i> Seidenf., <i>Thecostele</i> Rchb.f., <i>Trichotisia</i> Blume, <i>Vanda</i> Jones, <i>Vanilla</i> Mill., <i>Vrydagzynea</i> Blume	1

Primary broad-leaved, mixed and coniferous forests on rocky limestone (particularly with dominance of *Calocedrus rupestris*) are most rich in orchids where they reach their maximal abundance and taxonomical diversity. The orchid flora of primary limestone coniferous forests (fig. 3, 4) in Phong Nha – Ke Bang National Park is extraordinarily rich and includes numerous endemic elements of high taxonomic level. Primary broad-leaved forests on high mountains composed with silicate rocks (fig. 11, 12) also rich in orchids and support orchid flora of another species composition. The existence on PKNP territory two different kinds of habitat make total orchid flora very diverse and rich.

Preliminary inventory of orchid flora of PNKB NP reveals on this territory a number of aboriginal (indigenous) orchid species significant for ornamental cultivation. They may be divided into a several specific groups:

1. First group includes orchid species with large, handsome and long lasting flowers. All these species are highly demanded as ornamental plants for horticultural cultivation. This group includes such wild species of PNKB NP as:

<i>Aerides crassifolia,</i>	<i>D. cariniferum,</i>
<i>A. odorata,</i>	<i>D. hercoglossum,</i>
<i>A. rosea,</i>	<i>D. loddigesii,</i>
<i>Bulbophyllum macranthum,</i>	<i>D. nobile,</i>
<i>B. hiepii ?,</i>	<i>D. thyrsiflorum,</i>
<i>Cleisostoma birmanicum,</i>	<i>Dendrobium</i> sp. 1-4,
<i>C. paniculatum</i>	<i>Hygrochilus parishii,</i>
<i>C. racemiferum,</i>	<i>Paphiopedilum concolor,</i>
<i>C. simondii,</i>	<i>P. dianthum,</i>
<i>Cymbidium aloifolium,</i>	<i>P. malipoense,</i>
<i>C. atropurpureum,</i>	<i>Renanthera coccinea,</i>
<i>C. dayanum,</i>	<i>Rhynchostylis gigantea,</i>
<i>Cymbidium</i> sp. 1-2,	<i>Staurochilus fasciatus,</i>
<i>Dendrobium anosmum,</i>	<i>Vanda pumila.</i>
<i>D. parishii,</i>	

Species of this group may be demanded on the market as ornamental plants and particularly in breeding programs for producing of new hybrids, which usually have better characters as wild species and have better prospects in international marketing. It is very important that populations of many such species supported in studied territory by primary forests are numerous and sometimes very large. Their gene pool is still intact and rich. This make possible to discover in the wild and select for propagation unusual plant forms with specific features of leaves and flowers. Such unusual forms may have outstanding prospects in marketing and breeding programs. In many other areas of the world species of this group stand on the verge of extinction and their genetic potentials are miserable.

Endemic and sub endemic species such as *Bulbophyllum hiepii*, *Cleisostoma simondii*, *Cymbidium atropurpureum*, *Paphiopedilum dianthum*, *Paphiopedilum malipoense* represent greatest interest. Many collected plants, which were collected without flowers and did not get appropriate determination belong to this group also. Their correct determinations needs flowering expected to be happen in PNKB nursery.

2. Another group of orchids discovered in PNKB NP includes miniature species, which are popular in cultivation as ornamental plants mainly in home private collections. They also have essential demand in marketing of ornamental plants. This group includes in studied area such species as:

<i>Acriopsis indica,</i>	<i>Biermannia calcarata,</i>
--------------------------	------------------------------

Biermannia sp.,
Bulbophyllum ambrosia,
B. insulsum,
B. longiflorum,
B. macraei,
B. retusiusculum,
B. tixieri,
Bulbophyllum sp. 1-18,
Callostylis rigida,
Chiloschista trudelii,
Cleisostoma melanorachis,
C. rostratum,
C. striatum,
C. williamsonii,
Cleisostoma sp. 1-2,
Dendrobium truncatum,
Epigeneium labuanum,
Eria boniana,
E. corneri,
E. gagnepainii,
E. globulifera,
E. lasiopetala,
E. paniculata,
E. pannea,
E. thao,
Gastrochilus acutifolius,
G. calceolaris,
Gastrochilus hainanensis,
Kingidium deliciosum,
Liparis aurita,
L. averyanoviana,
L. bootanensis,

L. distans,
L. elliptica,
L. latilabris,
L. petelotii,
L. petraea,
L. pumila,
L. stricklandia,
Liparis sp. 1-10,
Malleola seidenfadenii,
Micropera poilanei,
Ornithochilus difformis,
Panisea albiflora,
P. tricallosa,
Parapteroceras elobe,
Phalaenopsis gibbosa,
Pholidota articulata,
Ph. chinensis,
Ph. imbricata,
Ph. pallida,
Polystachya concreta,
Pteroceras simondianum,
Robiquetia spathulata,
Schoenorchis gemmata,
Thecopus maingayi,
Thecostele alata,
Thrixspermum calceolus,
Th. centipeda,
Th. fleuryi,
Th. formosanum,
Th. fragrans,
Th. pauciflora,
Thrixspermum sp. 1-3.

This group includes largest number of endemic species which did not yet introduced into cultivation. They are *Biermannia calcarata*, *Biermannia* sp., *Bulbophyllum insulsum*, *Bulbophyllum macraei*, *Bulbophyllum tixieri* Seidenf., *Bulbophyllum* sp. 1-18, *Chiloschista trudelii*, *Cleisostoma melanorachis*, *Epigeneium labuanum*, *Eria boniana*, *Eria gagnepainii*, *Eria globulifera*, *Eria thao*, *Liparis averyanoviana*, *Liparis petraea*, *Liparis pumila*, *Malleola seidenfadenii*, *Micropera poilanei*, *Panisea albiflora*, *Phalaenopsis gibbosa*, *Pteroceras simondianum* and *Thrixspermum fleuryi*. These species have certain prospects for expected international marketing.

3. Orchids of this group include small creeping herbs with fine coloration of leaves. These so-called **jewel-orchids** are popular as ornamental plants in terrarium home collections or sub aquatic miniature gardens. They have a certain prospects in ornamental plant marketing, particularly unusual forms with specific coloration of leaves. This group includes in studied area such species as:

Anoectochilus calcareus,
A. roxburghii,
Cheirostylis yunnanensis,
Cheirostylis sp. 1-2,
Goodyera foliosa,
G. fumata,
G. hispida,
G. procera,
Goodyera viridiflora,

Hetaeria anomala,
Ludisia discolor,
Mischobulbum longiscapum,
Nephelaphyllum tenuiflorum,
Odontochilus elwesii,
Rhomboda petelotii,
R. tokioi,
Rhomboda sp.,
Vrydagzynea albida,

Zeuxine nervosa,

Zeuxine sp.

It is important to underline that **unusual** forms, which may be selected in the wild for propagation have much brighter prospects for marketing (for example rare or new forms of *Ludisia discolor* with heavy network of pink nerves, or particularly bright network of nerves on leaves of species of *Anoectochilus* or *Rhomboda*). This particularly concerns endemic and sub endemic species not yet known under international cultivation. These species are - *Anoectochilus calcareus*, *Cheirostylis* sp. 1-2, *Mischobulbum longiscapum*, *Rhomboda petelotii*.

4. Orchids of this group include usually large terrestrial and lithophytic species (sometime long vines, like *Vanilla*), which are relatively easy in cultivation and may be very successively used in home ground and rocky gardens (in tropical and subtropical zone). These species also may be demanded on the market of ornamental plants. This group includes in studied area such species as:

Acampe rigida,
Calanthe alismifolia,
C. lyroglossa,
C. triplicata,
Calanthe sp.,
Collabium chinense,
Cymbidium ensifolium,
C. lancifolium,
C. sinense,
Habenaria ciliolaris,
Habenaria sp.,
Liparis nervosa,

L. tixieri,
Nervilia aragoana,
N. macroglossa,
Nervilia sp.,
Phaius flavus,
P. mishmensis,
Tainia hongkongensis,
T. latifolia,
T. pauciflora,
Tainia sp.,
Vanilla sp.

5. Orchids of this group have little ornamental significance, but often demanded by orchid lowers and botanical gardens as unusual exotic plants for their specific unusual, sometimes very interesting morphology and biology. Demands on the international market for these plants are not too high. This group includes such species as:

Bulbophyllum arcuatilabium,
B. astelidum,
Bulbophyllum clandestinum,
Ceratostylis subulate,
Eria pusilla,
E. spirodela,
Flickingeria angustifolia,
F. fimbriata,
Liparis dendrochiloides,
L. mannii,
L. viridiflora,
Malaxis ophridis,
Oberonia cavaleriei,

O. kwangsiensis,
Oberonia sp. 1-4.
Pholidota rubra,
Ph. levelleana,
Ph. yunnanensis,
Phreatia plantaginifolia,
Podochilus khasianus,
Pomatocalpa spicata,
Taeniophyllum sp.,
Thelasis khasiana,
Th. pygmaea,
Trichotosia pulvinata,
.

6. This group of orchids includes achlorophyllous mycotrophic (saprophytic) species and species with specific root system (highly dependent from mycorrhizal fungi) which cannot be cultivated outside their natural habitats. Only few species in studied area belong to this group (but more species of this group will be certainly discovered in PNKB during future explorations).

Apostasia odorata,
Corymborkis veratrifolia,
Galeola nudifolia,

Neuwiedia balansae,
Tropidia angulosa,
T. curculigoides.

Five species of orchids provisionally documented on the territory of PNKB NP are included in Red Data Book of Vietnam (1996). They are *Anoectochilus roxburghii* (Wall.) Lindl., *Bulbophyllum hiepii* Aver.?, *B. tixieri* Seidenf. ?, *Dendrobium kontumense* Gagnep.? and *Liparis petelotii* Gagnep.

There exist data on use of some orchid species discovered on the territory of PNKB NP in traditional oriental medicine (particularly in China). These species are *Anoectochilus roxburghii*, *Cymbidium aloifolium*, *Dendrobium* sp. (all species), *Flickingeria* sp. (all species), *Goodyera hispida*, *Habenaria* sp. (all species) and *Nervilia* sp. (all species). Any ethno botanical data on use of orchid species on the territory of PNKB NP are still not available. Study of this subject may be a matter of special further studies.

It is important to underline, that at least 60% of collected orchid specimens were collected during fieldwork in vegetative state without flowers. These specimens need flowers for appropriate correct determinations. This work may certainly reveal more orchid species significant for horticulture and even new for the flora of Vietnam and for science. Some such plants have yet in presented checklist only hypothetical names (see Plate 12).

For example, exciting plants collected during field works and named preliminarily as *Bulbophyllum macranthum* (fig. 99a) belongs to *Bulbophyllum* group with very large flowers. In vegetative state all species of this group are very similar and can not be determined on species level. This plant may belong to most common *B. macranthum* (fig. 99b) or *B. lobbii* (fig. 99c) widely used in cultivation all over the world, but may belong to *B. smithinandii* (fig.d) – rare sub endemic species, or to *B. hiepii* (fig. 99e) – strict Vietnamese endemic, which prospect for propagation and sale brighter.

Another exciting plant was collected under hypothetical name *Dendrobium cariniferum* (fig. 100a). This plant belongs to *Dendrobium* section *Nigrohirsutae* All species of which have outstanding significance in ornamental cultivation and breeding. This plant may belong to relatively common *D. draconis* (fig. 100b), or *D. cariniferum* (fig. 100c) – both common species in cultivation. On the other hand, this plant may belong to *D. ochraceum* (Fig. 100d), *D. kontumense* (fig. 100e) or *D. suzukii* (fig. 100f), all of which are local Vietnamese endemics having great significance for horticulture in wide sense. Last three species are not yet known in cultivation and were not yet used in breeding programs, which may lead to highest demand for this species in orchid market.

Another species common in coniferous forests in PNKB NP area is plant named provisionally as *Panisea albiflora* (fig. 101a) may belong to *P. albiflora* (fig. 101b) or more rare *P. vinhii* (fig. 101c). Both species did not yet known in cultivation and may certainly have demand in international orchid market.

Similar situation may be now observed with many other collected living specimens, which now are housed in PNKB nursery.

Successful work on propagation and breeding of wild collected orchids may be based on careful inventory of available collection housed and cultivated in the nursery. Up to this moment full available inventory of collected specimens are presented in checklist of this report (with available labels on each collected living specimens). Appropriate cultivation and observation of dynamics of plant growth and development is strongly needed for successful care on this collection. Collecting and preservation of flowers in alcohol for morphological analysis is needed for successful appropriate determination of all living plants and successful further inventory. Scientific work for botanical survey and inventory of plant diversity (including orchid flora) may be based on full documentation of observations and field studies. Herbarium materials housed in Herbaria of responsible scientific organizations are alone kind of scientific documentation for such activity according to regular scientific practice. In this connection, any observations or finding of plant species should be based on herbarium voucher samples available for further studies by any

specialist. This is particularly important for inventory of orchid flora in PNKB NP. Organization of Herbarium collection may create base for scientific botanical works and investigations in PNKB NP. Living cultivated specimens housed in nurseries cannot play role of voucher specimens for scientific studies. Herbarium specimens, which confirm observations and names may be housed in any responsible botanical organization with appropriate conditions of keeping and studies of such materials. It will be excellent if such conditions will be organized as a special Herbarium in PNKB NP.

Observations of all flowering orchids in their natural habitats during their collecting did not detect any insects that may participate as pollinators. Cold misty weather during all days of field works may explain low activity of insects in the studied area. On the other hand, correct investigations of orchid pollination need special studies for round day/night watching during all period of species flowering. It needs much more time and special equipment, particularly for studies of epiphytic orchids growing in canopies of tall trees. A difficulty of such investigations leads to very scarce data on this matter in scientific literature, and no any for Vietnamese orchids. Scientifically correct studies of pollination of selected species may be organized in future as such work did not coincide with extensive collecting orchids and their primary inventory.

For organization of successful and profitable work on orchid propagation, as well as for on basic scientific orchid inventory in PNKB NP one may be provide follow recommendations. It will be necessary:

- Collecting of new living orchid specimens in different parts of the National Park, preferably of different species for cultivation in PNKB NP nursery.
- Secure, careful and qualified care of living collection (cultivation of orchids with necessary conditions for their successful grow and development).
- Observations of development and growth of collected living specimens.
- Regular inventory of living collection (optimally each two month) and careful fixation of specimen death (for further analysis of perspectives of survival and success of cultivation for each species).
- Careful observations of specimen flowering and careful gathering materials for further scientific studies and appropriate determination (collecting of specimens as herbarium sheets, alcohol fixations of flowers, photography or scanning of plants, inflorescences, flowers and details of flowers with necessary level of resolution).
- Appropriate documentation of collected scientific materials (preservation of specimens as herbarium sheets, alcohol fixations of flowers, photography or scanning of plants, inflorescences, flowers and details of flowers with necessary level of resolution).
- Appropriate keeping of collected scientific documentation (herbarium materials, alcohol fixations, photographs or scanned images of plants, inflorescences, flowers and details of flowers) in special appropriate conditions.

As an acceptable variant of scientific documentation of herbarium collections in course of botanical inventory activity in PNKB NP may be advised creation of digital herbaria with high level of resolution. This modern method of scientific documentation is cheaper and gives possibility wide and fast distribution of basic discovered scientific information for all information channels. It makes this information widely available for scientists and students and makes all investigation works much more effective. Examples of such d-herbarium specimens are presented in Tables 13 and 14.

It is very important to underline and understand that very large files of primary coniferous forests on rocky limestone are still remains on the territory of PNKB NP. Such woods represent *most endangered* kind of vegetation in the world, which completely *extinct* in most areas of their

primary distribution (Phan Ke Loc et al., 1999). Limestone coniferous forests in this area composed with sub endemic and endemic species like recently discovered *Calocedrus rupestris* with age of trees sometimes more than 500 years old represent absolutely unique plant formation of global importance (Averyanov et al., 2004d). These intact primary forests support extremely high level of plant diversity very rich in numerous endemic species. Some very rare species of orchids like *Paphiopedilum concolor* and *P. malipoense* occur here in great abundance (fig. 67-72). Their populations in many observed places are still absolutely intact and include very large colonies. Some of orchid species common on the territory of PNKB NP are completely extinct decades ago in all other regions due to commercial collecting and degradation of primary vegetation (Averyanov et al., 2000b, 2003c). For example, recent explorations in China detect nearly complete extinction of *Paphiopedilum malipoense* on the all territory of this country. Primary woods of PNKB NP besides orchids support large populations of plants also very significant and perspective for propagation as ornamental plants highly demanded on internal and international market. They include cycad species (fig. 88, 89), species of Gesneriaceae (fig. 90-92), Araceae (fig. 93) and numerous members of other plant families.

Further studies, conservation and full protection of primary limestone coniferous forests in PNKB NP as unique ancient formations represent goal of highest priority of global importance. These woods with their rich intact species composition are real national treasure, which cannot be observed on such large territory in any other localities of the all-Indochinese region. Very rich pristine aboriginal (indigenous) forests, numerous rare endemic plants along with spectacular rocky landscapes outline many regions of PNKB NP as an ideal place for ecotourism extremely attractive for all people interested in pristine nature of Indochina. Organization of special ecotourism system in PNKB NP with tourism infrastructure, construction of suitable trails and see sites (like it does in Bach Ma NP), along with strong control for nature protection and plant collecting may give very high economic and commercial effect and provide additional employment for local people and NP staff members.

VI. Cited and related materials

Unpublished reports:

- Averyanov Leonid V., Nguyen Tien Hiep, Phan Ke Loc.** 2001. The distribution of *Paphiopedilum vietnamense* and its current status in the wild. Report to FAUNA & FLORA INTERNATIONAL, Administrative Vietnam CITES agency, Scientific Vietnam CITES agency and IUCN Orchid Specialists Group.
- Averyanov Leonid v., Phan Ke Loc, Do Tien Doan.** 2002. Flora and vegetation survey of Van Ban District, Lao Cai Province of northern Viet Nam. Report to FAUNA & FLORA INTERNATIONAL.
- Averyanov Leonid V., Nguyen Tien Hiep, Phan Ke Loc, Do Tien Doan, Jacinto C. Regalado.** 2003. Preliminary botanical survey of primary vegetation in Pu Luong nature reserve. Report to FAUNA & FLORA INTERNATIONAL.
- Averyanov Leonid V., Phan Ke Loc, Nguyen Tien Hiep, Pham Van The, Nguyen Tien Vinh.** 2004. Preliminary survey of orchids and gymnosperms in Trung Khanh district, Cao Bang Province, northern Vietnam in the limita of Ngoc Khe and Phong Nam Municipalities. Report to FAUNA & FLORA INTERNATIONAL and AMERICAN ORCHID SOCIETY.

Publications:

- Averyanov, Leonid V.** 1994. Identification guide to Vietnamese orchids (Orchidaceae Juss.). S.-Petersburg. World and Family. 432 p. (in Russian).
- Averyanov Leonid. V.** 1997a. *Paphiopedilum hiepii* Aver. New Orchids. Vol. 86. P. 58-60 (in Japan).
- Averyanov Leonid V.** 1997b. *Renanthera citrina* Aver. A new yellow flowering species of the genus from limestone areas of the North Vietnam. Orchids. Mag. Amer. Orch. Soc. Vol. 66. No 12. P. 1284-1290.
- Averyanov, Leonid V., Eric A. Christenson** 1998a. Orchids of Vietnam. *Papilionanthe pedunculata*. A rare Vanda relative under cultivation at an orchid garden in Dalat. Orchids. Mag. Amer. Orch. Soc. Vol. 67. No 2. P. 148-149.
- Averyanov Leonid V., Eric A. Christenson,** 1998b. A new *Vanda* species from Indochina. Orch. Dig. Jan.-Feb.-Mar. 27-29 pp.
- Averyanov Leonid V.** 1998. *Paphiopedilum hiepii*: a new species from Vietnam. Orchids. Mag. Amer. Orch. Soc. Vol. 67. No 3. P. 260-263.
- Averyanov Leonid V., Eric A. Christenson.** 1998c. Orchids of Vietnam. *Cymbidium schroederi*. Expanding the diversity of a classic genus of orchids. Orchids. Mag. Amer. Orch. Soc. Vol. 67. No 7. P. 712-713.
- Averyanov Leonid V., Eric A. Christenson.** 1998d. Orchids of Vietnam. *Dendrobium christyanum*. The requirements of a miniature cool-growing Dendrobium. Orchids. Mag. Amer. Orch. Soc. Vol. 67. No 11. P. 1148-1149.
- Averyanov Leonid V.** 1999. New species of orchids from Vietnam. Lindleyana, Vol. 14. No 4. P. 214-224.
- Averyanov Leonid V., Nguyen Tien Hiep, Phan Ke Loc, Averyanova Anna L.** 2000a. Preliminary orchid checklist of Cao Bang Province (Vietnam). Lindleyana. Vol.15. No 3. P. 130-164.
- Averyanov, L.V., Nguyen Tien Hiep, Phan Ke Loc, Averyanova, A.L.** 2000b. Preliminary orchid checklist of Cao Bang Province. Problems of basic research in biology. Proc. National Conf. Biol. Aug. 2000 (Hanoi). P. 177-180 (in Vietnamese).
- Averyanov Leonid V.** 2000c. Rare species of Orchidaceae in the flora of Vietnam. 1. The genera *Acanthephippium-Didymoplexiopsis*. Bot. Journ. (St.-Petersburg). Vol. 85. No 3. P. 128-138 (in Russian).
- Averyanov Leonid V.** 2000d. Rare species of Orchidaceae in the flora of Vietnam. 2. The genera *Eria-Zeuxine*. Bot. Journ. (St.-Petersburg). Vol. 85. No 4. P. 137-147 (in Russian).
- Averyanov Leonid V.** 2000e. New species of Orchidaceae from northern Vietnam. Lindleyana. Vol. 15. No 2. P. 73-80.
- Averyanov Leonid V., Anna L. Averyanova.** 2000f. Rare species of orchids (Orchidaceae) in the flora of Vietnam. Turczaninowia. Vol. 3. No 2. P. 5-86 (in Russian).
- Averyanov Leonid V.** 2000g. *Stereosandra* Blume and *Yoania* Maxim. (Orchidaceae Juss.) - two additions to the orchid flora of Vietnam. Journ. Science (Hanoi). Vol. 16, N. 2. P. 43-47.
- Averyanov Leonid V.** 2001a. New natural interspecific hybrid - *Paphiopedilum x dalatense* from Vietnam. Orchid Digest. Vol. 65. No 3. P. 133-134.
- Averyanov Leonid V., Phan Ke Loc, Nguyen Tien Hiep.** 2001b. The distribution of *Paphiopedilum vietnamense* and its current status in the wild. Orchid Digest. Vol. 65. N. 4. P. 158-162.
- Averyanov Leonid V.** 2001c. New orchids in the flora of Vietnam 1. Journ. Sci. Nat. Sci. (Hanoi), T. 17, No. 2. 1-6 p.
- Averyanov Leonid V., Nguyen Tien Hiep.** 2002a. *Diplopanax vietnamensis*, a New Species of Nyssaceae from Vietnam - One More Living Representative of the Tertiary Flora of Eurasia. Novon. Vol. 12. N 4. P. 433-436.
- Averyanov Leonid V.** 2002b. *Paphiopedilum barbigerum* var. *lockianum* - new slipper orchid from northern Vietnam. Komarovia. Vol. 2. P. 11-16.
- Averyanov Leonid V.** 2002c. Three new slipper orchids from Vietnam. Komarovia. Vol. 2. P. 17-18.
- Averyanov Leonid V., Rod Rice.** 2002d. *Renanthera vietnamensis*. A new red-flowered species of the genus from the northern Vietnam. Oasis. Vol. 2. Ed. 3. P. 3-6.
- Averyanov Leonid V.** 2002e. Distribution, habitats and natural hybridisation of geographical races of the *Paphiopedilum insigne* complex in Northern Indochina. Orchid Review, 110, Sept.-Oct. P. 280-287.
- Averyanov Leonid V., Phan Ke Loc.** 2002f. *Pleione grandiflora* in the Lao Cai Province of Northern Vietnam. The discovery and remarkable color variation of a showy species new to Vietnam. Orchids. Mag. Amer. Orch. Soc. Vol. 71. No 12. P. 1102-1108.
- Averyanov Leonid V., Phan Ke Loc, Do Tien Doan and Nguyen Tien Hiep.** 2002g. The diversity of the flora of Vietnam 11. Discovery of *Pleione grandiflora* (Rolfe) Rolfe in Lao Cai Province and its natural variations. Journ. Genet. Appl. (Hanoi). 2002. No 2. P. 50-54 (in Vietnamese).
- Averyanov Leonid V.** 2002h. New orchids in the flora of Vietnam 2. The genus *Plocoglottis* Blume. Journ. Sci. (Hanoi). Vol. 18. N. 1. P. 1-6.

- Averyanov Leonid V.** 2002i. Main Centers of Orchid Endemism in Eastern Indochina. International Seidenfaden Orch. Sympos. Orchid Biology and Conservation. Queen Sirikit Bot.Gard. Chiang Mai. P. 31-32.
- Averyanov Leonid V., Anna L. Averyanova.** 2002j. Rare species of orchids (Orchidaceae) in the flora of Vietnam. Turczaniniwia. T. 5. N 4. P. 49-108.
- Averyanov Leonid V, Nguyen Tien Hiep, D.K.Harder, Phan Ke Loc.** 2002k. The history of discovery and natural habitats of *Xanthocyparis vietnamensis* (Cupressaceae). Turczaniniwia. T. 5. N 4. P. 31-39.
- Averyanov Leonid V., Phan Ke Loc, Nguyen Tien Hiep, D.K.Harder.** 2003a. Phytogeographic review of Vietnam and adjacent areas of Eastern Indochina. Komarovia. Vol. 3. pp. 1-83.
- Averyanov Leonid V. and Anna L. Averyanova.** 2003b. Updated checklist of the orchids of Vietnam. Vietnam National University Publishing House, Hanoi. 102 pp. (bilingual, in English and in Vietnamese).
- Averyanov Leonid V., Phillip Cribb, Phan Ke Loc, Nguyen Tien Hiep.** 2003c. Slipper Orchids of Vietnam. With an Introduction to the Flora of Vietnam. Royal Botanic Gardens, Kew. Compass Press Limited. 308 p.
- Averyanov Leonid V., Phan Ke Loc, Nguyen Tien Hiep.** 2003d. On some interesting orchids (Orchidaceae) collected in Rao An watershed, Huong Son Distr., Ha Tinh Province (Vietnam). Genetics and Applications (Hanoi). No. 1 (2003). P. 29-33.
- Averyanov Leonid V., Anna L. Averyanova.** 2003e. *Cleisostoma flavescens* - new orchid species from northern Vietnam. Journ. Sci. (Hanoi). Nat. Sci. and Technology. T. 19. N 1. P. 1-4.
- Averyanov Leonid V., Phan Ke Loc, Nguyen Tien Hiep, Do Tien Doan.** 2003f. Highland vegetation and flora of Van Ban District, Lao Cai Province in Northern Viet Nam. Turczaniniwia. T. 6. N 4. P. 47-86.
- Averyanov Leonid V.** 2004a. *Dendrobium tuananhii* Aver. Another interesting new orchid from Vietnam. Orchids. Mag. Amer. Orch. Soc. Vol. 73. No 2. P. 134-136.
- Averyanov Leonid V. and Averyanova Anna L.** 2004b. *Renanthera vietnamensis*. A red-flowered species from the limestone areas of northern Vietnam. Orchids. Mag. Amer. Orch. Soc. Vol. 73. No 7. P. 532-539.
- Averyanov Leonid V.** 2004c. Orchid biogeography of eastern Indochina. Materials of Asia Pacific Orchid Conference 8. Taiwan. Tainan. 197-214.
- Averyanov Leonid V., Nguyen Tien Hiep, Pham Van The & Phan Ke Loc.** 2004d. *Calocedrus rupestris* sp. nov. (Cupressaceae), new relict coniferous species from limestone areas of northern Vietnam. Basic Research in Life Sciences with emphasis on upland agriculture and forestry. Proceedings of the 2004 National Conference on Life Sciences. Thai Nguyen University, September 23, 2004. Science and Technics Publishing House, Hanoi. Pp 40-44. (in Vietnamese).
- Averyanov Leonid V., Anna L. Averyanova.** 2005a. New orchids from Vietnam. Komarovia. Vol. 5. (in print).
- Averyanov Leonid V., Phan Ke Loc, Do Tien Doan, Nguyen Tien Hiep.** 2005b. *Spatholirion puluogense* (Commelinaceae), a new endemic species from northern Vietnam Komarovia. Vol. 5. (in print).
- Averyanov Leonid V., Anna L. Averyanova.** 2005c. Rare species of orchids (Orchidaceae) in the flora of Vietnam. Turczaniniwia. 2005. (in print).
- Averyanov Leonid V., Nguyen Tien Hiep, Phan Ke Loc.** 2005d. *Paphiopedilum emersonii* and *Paphiopedilum hangianum*. Two relatives of different ecology. Orchids. The magazine of the American Orchid Society.(in print).
- Averyanov Leonid V., Nguyen Tien Hiep & Phan Ke Loc.** 2005e. *Guihaia grossefibrosa* - dragon scale palm, endangered species from ancient rocky limestone mountains of northern Vietnam. Palms. International palm society magazine. (in print).
- Averyanov Leonid V., Nguyen Tien Hiep & Phan Ke Loc.** 2005f. *Rhapis vidalii*, new semi-woody small shrubby papyrus-like palm from Vietnam. Palms. International palm society magazine. (in print).
- Averyanov Leonid V.** 2005g. Biogeography of orchids in Eastern Indochina. Vietnam Nat. Univ. Journal of Sci., Nat. Sci. & Tech. T. 000. No 00 (in print).
- Averyanov Leonid V.** 2005h. Analysis of orchid endemism (Orchidaceae) and phytogeographic division of the eastern part of Indochinese Peninsula. Bot. Journ. (SPb.). (in print).
- Cribb Phillip, Leonid Averyanov, Nguyen T. Hiep.** 2000. *Paphiopedilum henryanum* in North Vietnam. Orchid Review. Vol. 108. No 1232. P. 124-127.
- Farjon, A., Nguyen Tien Hiep, Harder, D.K., Phan Ke Loc & Averyanov, L.** 2002. A New Genus and Species in Cupressaceae (Coniferales) from Northern Vietnam. *Xanthocyparis vietnamensis*. Novon. Vol. 12. No 2. P. 179-189.
- IUCN.** 2001. IUCN Red List Categories: Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN. Gland, Switzerland, and Cambridge, U.K.
- Phan Ke Loc, Nguyen Tien Hiep, L.V. Averyanov.** 1999. Some threatened plant communities and species of the limestone mountains of Caobang province needed to be protected in new proposed protected areas. Vietnam Forestry Rev. (Hanoi). (1999). No 12. P. 35-36 (in Vietnamese).
- Red Data Book of Vietnam. Volume 2. Plants.** 1996. Hanoi. Sci. Techn. Publ. House. 484 p.
- Vu Ngoc Long, Averyanov L.V.** 2002. New species of the genus *Eria* Lindley from Vietnam. Komarovia. Vol. 2. P. 45-50.

VII. Illustrations

Notes for illustrations:

Maps:

Map 1. Map of research sites in Phong Nha – Ke Bang National Park.

Figures:

Landforms and main vegetation types:

- Fig. 1, 2.** Highly eroded ancient rocky limestone hills, mountains and ridges elevated up to 700-900 m a.s.l. is typical kind of landform in Phong Nha – Ke Bang National Park.
- Fig. 3, 4.** Primary coniferous forests (with tree dominants endemic for Indochina) widely presented in rocky limestone areas of Phong Nha – Ke Bang National Park are most endangered kind of vegetation in the World.
- Fig. 5.** Closed primary broad-leaved gnarled stunted forests and scrub on tops of rocky limestone ridges particularly rich in rare orchid species endemic to the studied area.
- Fig. 6.** Old primary broad-leaved forests on slopes of limestone ridges with dominants that reach 25-30 m tall.
- Fig. 7, 8.** Humid lowland forests in limestone canyons along rivers and small streams are specific habitat of some rare warm-losing epiphytic orchid species typical for the studied area.
- Fig. 9, 10.** Typical landscape of montane regions of Phong Nha – Ke Bang National Park composed with sandstone, shale, granite related silicate rocks with elevations 900-1000 m a.s.l.
- Fig. 11, 12.** Primary forests on mountains composed with silicate rocks provide more humid conditions of plant habitats and support orchid flora, which essentially differs in orchid species composition typical for limestone areas.

Main dominants of primary coniferous forests in Phong Nha – Ke Bang National Park most rich in orchids:

- Fig. 13.** *Calocedrus rupestris* Aver., H.T.Nguyen & L.K.Phan (Cupressaceae), HAL 6109. Canopy branch with male cones. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 14.** *Calocedrus rupestris* Aver., H.T.Nguyen & L.K.Phan (Cupressaceae), HAL 6109. Canopy branch with female cones. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 15.** *Dacrydium elatum* Wall. (Podocarpaceae), HAL 5999. Canopy branch with young male cones. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 16.** *Dacrydium elatum* Wall. (Podocarpaceae), HAL 5999. Canopy branch with young female cones. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 17.** *Podocarpus neriifolius* D.Don (Podocarpaceae), HAL 6163. Canopy branch with young ovules. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 18.** *Cephalotaxus mannii* Hook.f. (Cephalotaxaceae), HAL 6202. Canopy branch with male cones. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Fig. 19. *Amentotaxus yunnanensis* Li (Taxaceae), HAL 6203. Canopy branch with young seeds. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Some orchid species (Orchidaceae) observed and documented in Phong Nha – Ke Bang National Park:

Fig. 20. *Anoetochilus calcareus* Aver. HAL 5866. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Fig. 21. *Anoetochilus roxburghii* (Wall.) Lindl. HAL 6203a. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Fig. 22. *Appendicula cornuta* Blume HAL 6315. Quang Ninh Distr., Truong Son Municipality, around point 17°26'50"N, 106°23'41"E at elev. about 600 m a.s.l. near U Bo forestry protection station.

Fig. 23. *Appendicula hexandra* (Koenig) J.J.Smith ? HAL 6134. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Fig. 24, 25. *Bulbophyllum ambrosia* (Hance) Schltr. HAL 5853. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Fig. 26. *Bulbophyllum macranthum* Lindl. (vel *B. hiepii* Aver. ?). HAL 6261. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E at elev. 600-700 m a.s.l.

Fig. 27, 28. *Calanthe lyroglossa* Rchb.f. HAL 6215. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.

Fig. 29. *Callostylis rigida* Blume HAL 6217. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.

Fig. 30. *Ceratostylis subulata* Blume HAL 5950. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).

Fig. 31, 32. *Cheirostylis yunnanensis* Rolfe HAL 6197. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Fig. 33, 34. *Cheirostylis* sp. HAL 6196. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).

Fig. 35. *Cheirostylis* sp. HAL 6092. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'32"N, 106°12'46"E).

Fig. 36, 37. *Collabium chinense* (Rolfe) Tang & F.T.Wang HAL 6320. Bo Trach Distr., Hung Trach Municipality, around point 17°26'50"N, 106°23'41"E at elev. about 600 m a.s.l. near Khe Mua locality.

Fig. 38, 39. *Cymbidium lancifolium* Hook.f. HAL 5855. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Fig. 40. *Dendrobium cariniferum* Rchb.f. ? (vel *D. ochraceum* De Wild., *D. virgineum* Rchb.f.). HAL 6227. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.

Fig. 41. *Dendrobium salaccense* (Blume) Lindl. HAL 5856. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Fig. 42, 43. *Epigeneium labuanum* (Lindl.) Summerh. HAL 5960. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E). Ca Xach mountain (17°39'20"N, 105°57'42"E).

Fig. 44, 45. *Eria gagnepainii* Hawkes & Heller HAL 6216. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.

- Fig. 46.** *Eria pusilla* (Griff.) Lindl. HAL 5970. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E). Ca Xach mountain (17°39'20"N, 105°57'42"E).
- Fig. 47.** *Eria spirodela* Aver. HAL 5862. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 48, 49.** *Eria thao* Gagnep. HAL 5834. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 50.** *Goodyera hispida* Lindl. HAL 6189. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 51, 52.** *Goodyera viridiflora* (Blume) Dietrich HAL 6057. Bo Trach Distr., Tan Trach Municipality, vicinities of A Rem village (17°23'22"N, 106°12'47"E).
- Fig. 53, 54.** *Hetaeria anomala* (Lindl.) Hook.f. HAL 6241. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.
- Fig. 55.** *Liparis bootanensis* Griff. ? HAL 6214. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.
- Fig. 56, 57.** *Liparis latilabris* Rolfe HAL 6161. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 58, 59.** *Liparis tixieri* Guillaum. (= *L. flava* (Aver.) Aver.). HAL 6230. Bo Trach Distr., Hung Trach Municipality, Khe Me locality, around point 17°27'51"N, 106°22'46"E at elev. 900-1000 m a.s.l.
- Fig. 60-62.** *Ludisia discolor* (Ker-Gawl.) A.Rich. HAL 5865. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 63.** *Odontochilus elwesii* Clarke ex Hook.f. HAL 5957. Minh Hoa Distr., Thuong Hoa Municipality, about 1-1.5 km to SW of Ban On village (17°40'21"N, 105°58'00"E), Ca Xach mountain (17°39'20"N, 105°57'42"E).
- Fig. 64.** *Panisea albiflora* (Ridl.) Seidenf. ? HAL 6187. Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 65, 66.** *Panisea tricallosa* Rolfe ? HAL 6114. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 67-69.** *Paphiopedilum concolor* (Batem.) Pfitzer HAL 5840. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 70-72.** *Paphiopedilum malipoense* S.C.Chen & Tsi HAL 5839. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 73, 74.** *Parapteroceras elobe* (Seidenf.) Aver. HAL 6008. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 75.** *Phalaenopsis gibbosa* Sweet HAL 5876. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 76.** *Rhomboda petelotii* (Gagnep.) Ormerod HAL 6141. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 77.** *Rhynchostylis gigantea* (Lindl.) Ridl. HAL 6175. Vietnam, Quang Binh Prov., Bo Trach Distr., Tan Trach Municipality, about 0.5 km to E of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 78.** *Ludisia discolor* (Ker-Gawl.) A.Rich. HAL 5865. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 79, 80.** *Schoenorchis gemmata* (Lindl.) J.J.Smith HAL 5835. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 81.** *Tainia hongkongensis* Rolfe ? HAL 5986. Minh Hoa Distr., Thuong Hoa Municipality, Yen Hop village, about 1 km to NWW of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 82, 83.** *Tainia latifolia* (Lindl.) Rehb.f. ? HAL 6266. Bo Trach Distr., Hung Trach Municipality, Khe Ba Tanh locality, around point 17°27'24"N, 106°23'14"E at elev. 600-700 m a.s.l.

- Fig. 84.** *Thrixspermum centipeda* Lour. HAL 5904. Minh Hoa Distr., Thuong Hoa Municipality, about 1 km to N of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 85, 86.** *Vrydagzynea albida* (Blume) Blume HAL 6148. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 87.** *Zeuxine nervosa* (Lindl.) Clarke HAL 5868. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).

Some plant species of Phong Nha – Ke Bang National Park desirable for conservation, propagation and ornamental cultivation:

- Fig. 88, 89.** *Cycas chevalieri* Leandri (Cycadaceae). HAL 6385. Bo Trach Distr., Son Trach Municipality, around point 17°31'02"N, 106°16'48"E at elev. 200-250 m a.s.l.
- Fig. 90.** *Chirita* sp. (Gesneriaceae). HAL 5889. Minh Hoa Distr., Thuong Hoa Municipality, about 2 km to E of Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 91.** *Bouea* sp. (Gesneriaceae). HAL 6145. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).
- Fig. 92.** *Chirita* sp. (Gesneriaceae). HAL 6047. Minh Hoa Distr., Thuong Hoa Municipality, around Ban On village (17°40'21"N, 105°58'00"E).
- Fig. 93.** *Arisaema* sp. (Araceae). HAL s.n., a.2005. Bo Trach Distr., Tan Trach Municipality, about 1.5 km to SE of A Rem village (17°23'32"N, 106°12'46"E).

Field works:

- Fig. 94.** Collecting of orchid species growing as humus epiphytes.
- Fig. 95.** Collecting small canopy epiphytes.
- Fig. 96.** Collecting epiphytes on fallen died tree boles.
- Fig. 97, 98.** Studies and processing of collected materials.

Possible diversity of some orchid species of Phong Nha – Ke Bang National Park collected in fruits (for which correct determinations needs flowers):

- Fig. 99.** *Bulbophyllum* sp. (*B. macranthum* aff.) HAL 6261 (a), which may represent common species - *B. micranthum* Lindl. (b) or *B. lobbii* Lindl. (c) or much more rare, locally endemic orchid species - *B. smithianii* Seidenf. & Thorut. (d) or *B. hiepii* Aver. (e).
- Fig. 100.** *Dendrobium* sp. (*D. cariniferum* aff.) HAL 6227 (a), which may represent common species - *D. draconis* Rchb.f. (b) or *D. cariniferum* Rchb.f. (c), or much more rare, locally endemic orchid species - *D. ochraceum* De Wild. (d), *D. kontumense* Gagnep. (e) or *D. suzukii* Yukawa (f).
- Fig. 101.** *Panisea albiflora* (Ridl.) Seidenf. ? HAL 6187 (a), which may represent common species - *P. albiflora* (b), or much more rare, locally endemic orchid species - *P. vinhii* Aver. & Averyanova (c).

Documentation of field studies:

- Table 13.** Digital herbarium specimen of *Appendicula cornuta* Blume (Orchidaceae) collected in Phong Nha – Ke Bang National Park during field work (d-EXSICCATES OF VIETNAMESE FLORA 0007/HAL6315 (HN) (c) Nguyen Tien Hiep, L.Averyanov, Phan Ke Loc).
- Table 14.** Digital herbarium specimen of *Ludisia discolor* (Ker-Gawl.) A.Rich. (Orchidaceae) collected in Phong Nha – Ke Bang National Park during field work (d-EXSICCATES OF VIETNAMESE FLORA 0009/HAL6351 (HN) (c) Nguyen Tien Hiep, L.Averyanov, Phan Ke Loc).