Convention Concerning the Protection of the World Cultural and Natural Heritage

Natural Heritage：China

South China Karst

Shilin Karst (Yunnan)

Libo Karst (Guizhou)

Wulong Karst (Chongqing)

Ministry of Construction of People's Republic of China

CONTENTS

A more detailed description is now provided for each of the Nominated Areas separately for the sake of clarity
Shilin Karst, Yunnan (24-46) Nominated as meeting the following criteria: **viii** be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features **vii** contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
Libo Karst, Guizhou (47-77) Nominated as meeting the following criteria: **viii** be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features **ix** be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals **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

Wulong Karst, Chongqing (78-102)
Nominated as meeting the following criteria:

viii be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features

Executive Summary

State Party	**People's Republic of China**	
Name of Property	**South China Karst**	
State, Province or Region	Shilin Karst	Shilin Yi Nationality Autonomous County, Kunming City, Yunnan Province
	Libo Karst	Libo County, Southern Guizhou Buyi and Miao Nationalities Autonomous Prefecture, Guizhou Province
	Wulong Karst	Wulong County, Chongqing City
Geographical coordinates to the nearest second	Nominated Sites	Coordinate (Central)
	Shilin Karst	N 24° 47' 30" E 103° 16' 30"
	Libo Karst	N 25° 13' 15" E 107° 58' 30"
	Wulong Karst	N 29° 13' 48" E 107° 54' 12"
Textual description of the boundary(ies) of the nominated property	The South China Karst is the title of this serial World Heritage nomination by the Chinese Government. The nominated property (Phase 1) comprises three internationally acclaimed karst areas in Yunnan, Guizhou and Chongqing in South China. The South China Karst (Phase 1) is being serially nominated for World Heritage listing because, although not contiguous, the nominated areas are located in the same geological-geomorphological region, unified by their karst topography, and because the nominated areas incorporate a range of features within a single geographical region (karst region of South China). The South China Karst serial nomination will be submitted progressively, starting with the Shilin karst, Libo karst and Wulong karst areas. Each respectively meets the requirement for outstanding universal value, satisfying World Heritage Criterion N (viii), with Shilin karst and Libo karst also respectively satisfying criterion N (vii) and criteria N (ix), (x), thus demonstrating the universal significance of the "South China Karst". The boundary of nominated areas and proposed buffer zone of each site of the South China Karst is clearly labeled on the maps and	

	actual spots. In the boundary of nominated areas, they mainly remain the integrities of natural geomorphology and ecosystem, and prohibit all human activities with negative impacts on the nominated areas in exception of scientific researches. In buffer zone, the contents and patterns of human activities are also controlled in some extent. 1. The delimitation of boundary for the Shilin Karst Nominated Sites mainly take the integrality of Shilin geomorphology development and distributing to consideration, and in accordance with areas of Shilin national scenic and historical area and Shilin National Geological Park. The delimitation of boundary for buffer zone mainly accord to the protection of Shilin scene. 2. The delimitation of boundary for the Libo Karst Nominated Sites mainly accord to the integrality of cone karst geomorphology development and distributing, karst forest ecosystem and habitat of rare and endangered species. The boundary keeps coherence with the boundary of Maolan National Nature Reserve and Daqikong and Xiaoqikong Scenic Spot in Libo Zhangjiang National Scenic and Historical Area. The delimitation of boundary for buffer zone not only accord to the integrality of cone geomorphology development and distributing, but also according to the factors of protection of nominated site, such as avoiding the influence of human activities. But because the southern nominated site is located in the joint areas of Guizhou and Guangxi, the natural conditions also are relatively better; the region is planned to become further extending nominated sites, so there is no buffer zones in the southern nominated sites. 3. The delimitation of boundary of the Wulong Karst is mainly accord to the integrality of cave karst, gorge karst and doline scenes. The nominated sites are coincident with Furongjiang Scenic and Historical Area and National Geological Park of Wulong. The delimitation of boundary of buffer zone mainly accord to the integrality of karst drainage area, especially the boundary of Furong Cave buffer zone adequately according to the integrality of Furongjiang drainage area.
A4 (or "letter") size map of the nominated property, showing boundaries and buffer zone (if present)	Attached behind
Justification Statement of Outstanding Universal Value	China has more than 1,250,000km^2 of carbonate rock outcrop that occupies 13% of the total country. Thus it has one of the highest proportions of karst in the World. The South China Karst is 55% of the total and comprehensively reflects the geological history of a major region of China and its particular physical geography. It embodies

special karst landforms, karst ecosystems, biodiversity, natural landscape beauty and evolutionary processes, many of them of World significance.

The South China Karst covers nearly 500,000km^2 and lies mainly in Yunnan, Guizhou and Guangxi, but extends into parts of Chongqing, Sichuan, Hunan, Hubei and Guangdong.

The geological stages span for the carbonate outcropped in the South China Karst Area is wide (Cambrian to Permian Period), in which the carbonate can accumulate to the thickness of several kilometers, with rock type-diversity and global significance. Because of crust movement from the late stage of Triassic, especially Himalayan Movement from the late stage of Tertiary, these broad karst areas were tilted uplifted to form gigantic slope areas with the elevation difference of 2000m, high in northwest and low in southeast.

In addition to various familiar surface karst landforms, plentiful caves and abundant speleothem, a wide variety of typical landform types with global significance occurred in the South China Karst Nominated Property.

The Shilin Karst Nominated Sites (Yunnan): The nominated sites lie in Shilin Yi Nationality Autonomous County, east Yunnan Province. They are typical sites of plateau karst, outstanding for the high limestone pinnacles decorated with deep, sharp karren, which is the result of subjacent karst process under the cover of Tertiary red sandstone and Permian basalt. Both sites contain outstanding examples of “stone forest” karst landscapes. They have been selected so that they are representative of the immense variety of stone forests that are found within the South China Karst. The Shilin stone forests illustrate the episodic nature of the evolution of these karst features, which in this case span 270 million years. They are known throughout the world as being one of the finest examples of the natural beauty that karst processes give to rock. Adding to this beauty is a special plateau karst ecosystem that has developed in the subtropical monsoon climate of the continental interior. Yi people and their valuable culture are also very important.

The Libo Karst Nominated Sites (Guizhou): The nominated sites lie in Libo County, south Guizhou Province. They are typical sites of Fengcong karst on the transitional zone between Guizhou plateau and Guangxi lowland, outstanding for their full spectra of gradual change from plateau karst to the lowland karst, with a combination of numerous tall karst peaks, deep dolines, sinking streams and long river caves.The

	cone karst landscape constitute superlative examples of *fengcong* and *fenglin* karst landscapes including fengcong-depression (polje), fengcong-valley (polje), fengcong-gorge, fenglin-depression, fenglin-valley and fenglin-plain (basin). In addition, within them there is an impressive array of major karst features. These sites illustrate the geomorphological exchange and evolution between fengcong landscapes and fenglin landscapes. The cone karst landscape supports immense biodiversity and this special karst forest ecosystem is the habitat of many endemic species and endangered fauna. As field study areas they have great potential to extend the current knowledge of ecosystems developed in fengcong landscapes. The Libo nominated sites, where 90% of their populations are minorities, are rich in culture. The exotic local minority culture is the colorful and unique ethnic groups of Shui, Yao and Buyi. **The Wulong Karst Nominated Sites (Chongqing):** The nominated sites lie in Wulong County, south Chongqing. They are classic sites of deep gorge karst, unique for their rich information about the long history of geological evolution kept in the Furong Cave, as well as the changes from peneplains on different altitude above knickpoints to the deeply dissected gorge nearby, and its relevant special karst forms such as karst collapse dolines several hundred meters deep and natural bridges. The sites are an outstanding example of a karst landscape that has evolved in areas where thick sequences of pure carbonate rocks have been subjected to tectonic uplift. The result is a fengcong karst landscape dissected by gorges, caves and *tiankengs*. The sites selected all show fine examples of this process; the natural bridges site shows a series of tiankengs joined by natural bridges and gorges, the cave site illustrates how such down cutting creates large caverns that subsequently become infilled by decoration leading to an environment of great aesthetic value; the final site in this area exhibits the manner in which caves, tiankengs and underground rivers combine in such a landscape from streamsink to spring. In the broad domain of from 300m hills to 2000m plateau and 700km width from east to west, various karst geomorphology in the South China Karst Nominated Property exemplifies geological evolutionary history and geological process of geomorphology development in these regions, and they annotate intrinsic genetic relation of various karst geomorphology development under the integrated process of tectonic movement, climate and hydrology, etc, as well as some formation mechanism of special geomorphology. So the South China Karst Nominated Property is proved to be best Textbook of continental tropical-subtropical karst evolution in the Northern Hemisphere. Beside *Keichousaurus Hui* formed in Triassic limestone,

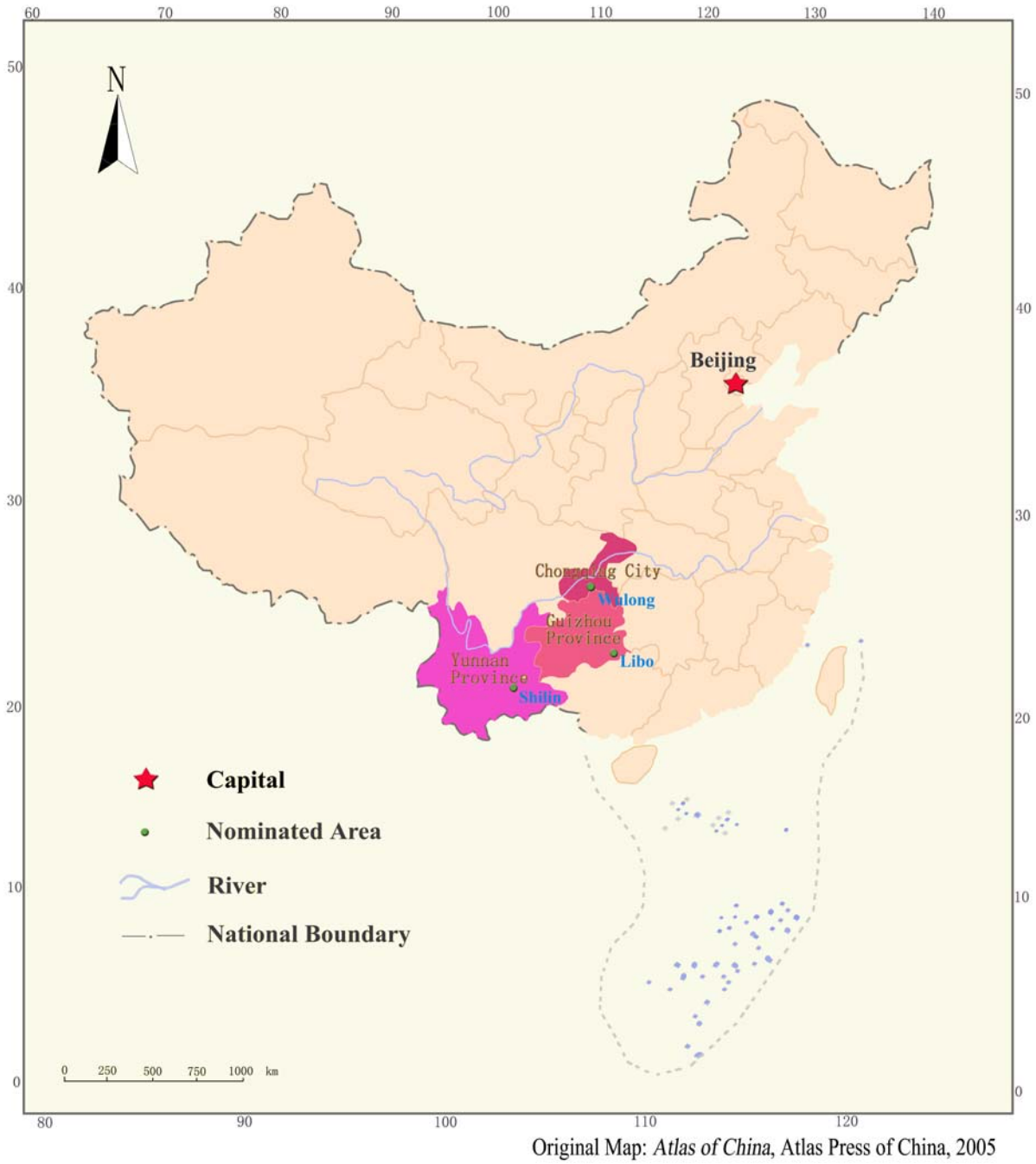
	the middle Permian from which the nominated areas developed contains exceptional rich marine fossils such as branchiopod, coral, foram and fusulina, etc. They are of great regional stratigraphic correlation significance and of important record of earth life. The South China Karst Nominated Property displays a significant and on-going karst biological and ecological evolutionary process. Libo Karst is a representative case, conserves virgin karst forest ecosystem with the top natural succession stages, covering the areas of $3.35 \cdot 10^4 hm^2$, mainly including karst ever-green broad-leaved forest (*Castanopsis*, *Cyclobalanopsis*, etc), karst ever-green mixed broadleaf-conifer forest (*Platycarya longipes*, *Pinus kwangtungensis*, etc.). It is proved to be the intactest and most representative subtropical karst forest ecosystem at the same latitude in the world. So it turns to be the natural background to study karst forest vegetation in bare cone karst regions, and be an ideal place and natural experimentation base to study the configuration, function and equilibrium of forest ecosystem, and is reputed as green diamond and the lattest karst forest at the same latitude of the North Hemisphere. Therefore it plays an important role in forest vegetation in the world for its uniqueness and rarity. Because the nominated sites are located on the joint areas of several biogeographical provinces, vegetation system embody typical transition and uniqueness, besides variety of biological features like typical xerophyte, lithophyte and calciphile in short-soil, short-water, high-calcium ecosystem. Therefore the forest system not only is a typical and special ecosystem, but also displays the on-going biological ecological process under the conditions of this soil and climate. The South China Karst Nominated Property possesses prominent biodiversities and contains abundant endangered, endemic and rare propagation. The Libo Karst Nominated Sites in Guizhou is the presentative example with 1532 species advanced plant and 112 species of protected plants of national importance, which occupy 10% of plant species in total. In addition, there are plenty of endemic species including *Cycas guizhouensis*, *Kmeria septentrionalis*, *Handeliodendron bodinieri* and *Mussaenda anomala*. In the case of animal, the nominated site enriched abundant mammal, bird, amphibian, fish, cave animal, etc. including many endangered and endemic species, such as *Presbytis francoisi*, *Neofelis nebulosa*, *Moschus berezovskit*, etc. Therefore the nominated sites provide habitats and refuges for many endangered and endemic propagation.
Criteria under which property is nominated (itemize criteria)	**(vii)** contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;

	(viii) 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; **(ix)** be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals; **(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.
Name and contact information of official local institution/agency	**Name**：Ministry of Construction of People's Republic of China **Address**：No.9, Sanlihe Road, Beijing, the People's Republic of China **Post Code**：100835 **Tel**：+86-010-68393014 **Fax**：+86-010-68393014 **E-mail：** zuoxp@mail.cin.gov.cn npo@mail.cin.gov.cn **Name**：Construction Department of Yunnan Province **Address**：No.129, Xichang Road, Kunming City, Yunnan Province, the People's Republic of China **Post Code**：650032 **Tel**：+86-871-4113446 **Fax**：+86-871-4113447 **E-mail**：sjbl2000@21cn.com **Name:** Construction Department of Guizhou Province **Address：** Guiyang City, Guizhou Province, the People's Republic of

	China **Post Code**：550002 **Tel：**+86-851-5954664 **Fax**：+86-851-5952862 **E-mail：**gzxgl2002@163.com **Name**：Garden Bureau of Chongqing City **Address：**No.179, Eling Street, Yuzhong Region, Chongqing City, the People's Republic of China **Post Code**：400014 **Tel：**+86-023-63858381 **Fax：**+86-023-63624871 **E-mail：**cqylwangwendi@sina.com **Name：**World Heritage Management Committee of Yunnan Province **Address**：No.129, Xichang Road, Kunming City, Yunnan Province, the People's Republic of China **Post Code**：650032 **Tel**：+86-871-4113446 **Fax：**+86-871-4113447 **E-mail：**sjbl2000@21cn.com **Name：**Office of World Heritage Application and Management of Guizhou Province **Address：**Guiyang City, Guizhou Province, the People's Republic of China

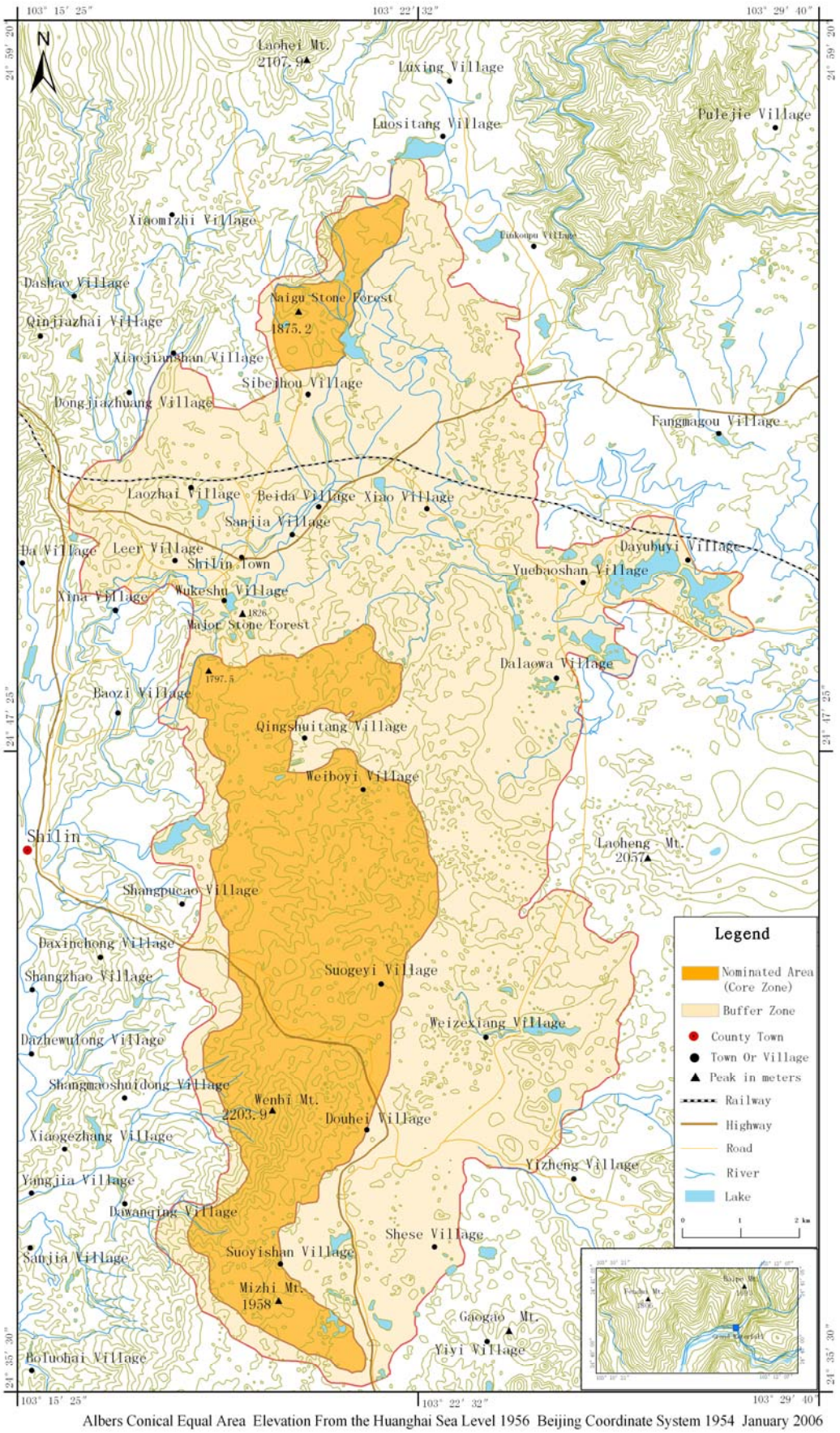
	Post Code：550001 **Tel**：+86-851-5954664 **Fax**：+86-851-5952862 **E-mail**：gzxgl2002@163.com **Name：**World Heritage Management Committee of Chongqing City **Address**：No.179, Eling Street, Yuzhong Region, Chongqing City, the People's Republic of China **Post Code**：400014 **Tel**：+86-023-89068667 **Fax**：+86-023-89068666

Locations of the Nominated South China Karst Sites (Phase 1) in China



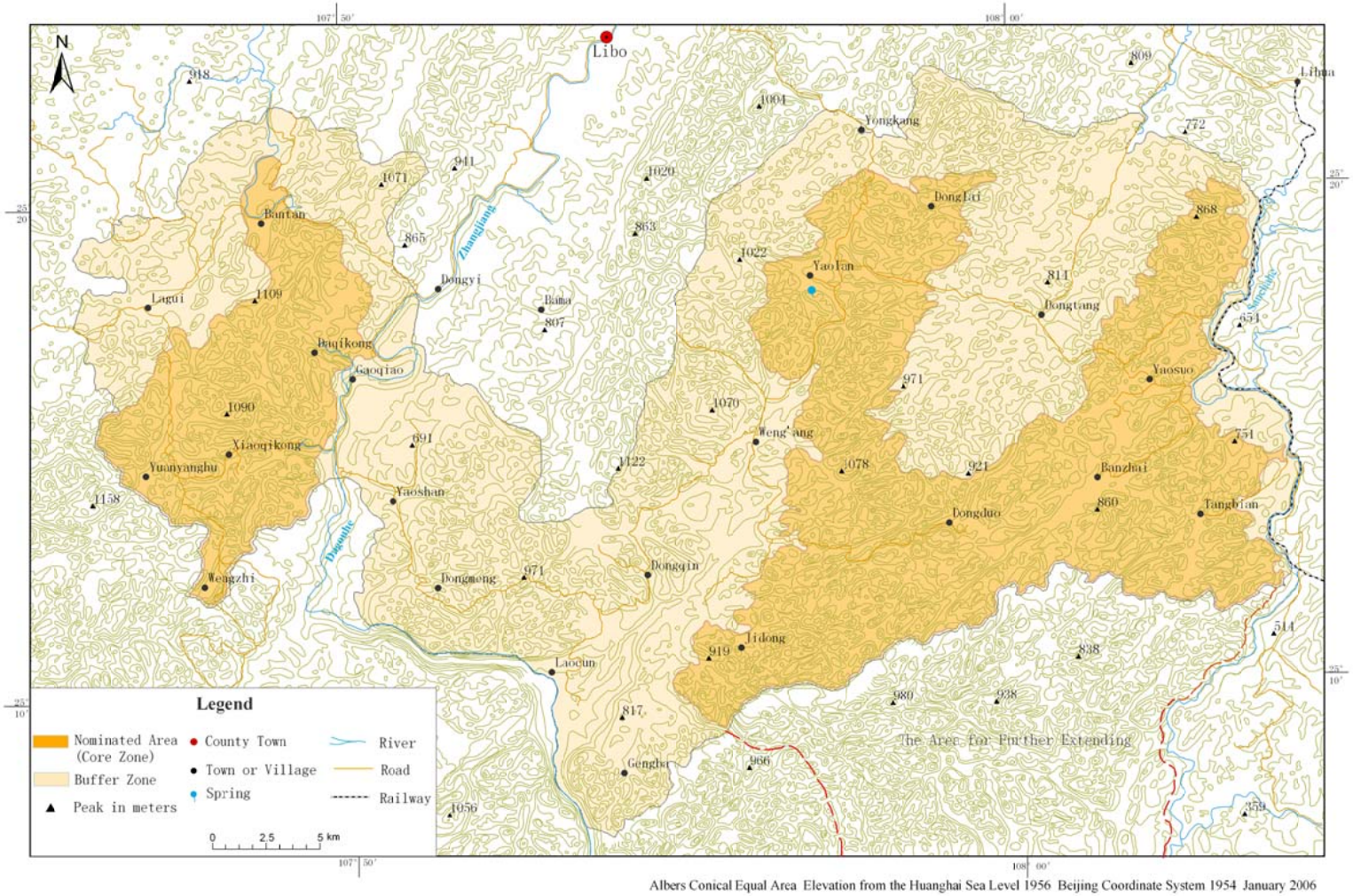
Original Map: *Atlas of China*, Atlas Press of China, 2005

Details of the Nominated Shilin Karst Sites

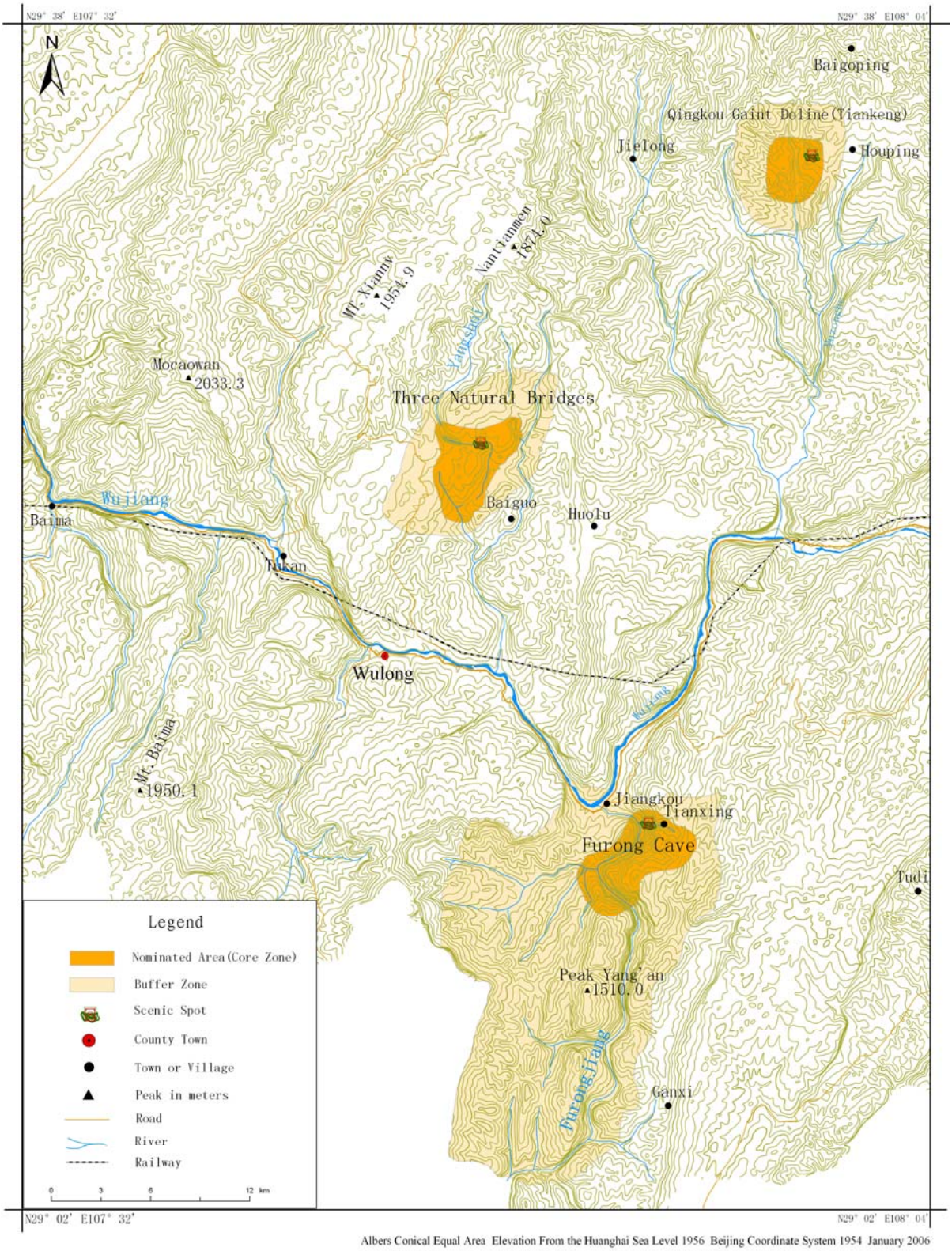


Albers Conical Equal Area Elevation From the Huanghai Sea Level 1956 Beijing Coordinate System 1954 January 2006

Details of the Nominated Libo Karst Sites



Details of the Nominated Wulong Karst Sites



Albers Conical Equal Area Elevation From the Huanghai Sea Level 1956 Beijing Coordinate System 1954 January 2006

1. Identification of the Property

1.a Country

People's Republic of China

1.b County and Province (City)

Shilin Yi Nationality Autonomous County, Kunming City, Yunnan Province

Libo County, South Guizhou Buyi and Miao Nationalities Autonomous Prefecture, Guizhou Province

Wulong County, Chongqing City[①]

1.c Name of Property

South China Karst

1.d Geographical Coordinates

Table 1-1 Geographical Coordinates of the South China Karst (Phase 1) Nominated Properties

Nominated Sites	Coordinate (Central)	Region (County and Province/City)
Shilin Karst	N 24° 47' 30" E 103° 16' 30"	Shilin Yi Nationality Autonomous County, Kunming City, Yunnan Province
Libo Karst	N 25° 13' 15" E 107° 58' 30"	Libo County, Southern Guizhou Buyi and Miao Nationalities Autonomous Prefecture, Guizhou Province
Wulong Karst	N 29° 13' 48" E 107° 54' 12"	Wulong County, Chongqing City

1.e Maps and Plans, Showing the Boundaries of the Nominated Property and Buffer Zone

Fig.1-1 Locations of the Nominated South China Karst Sites (Phase1) in China

Fig.1-2 Details of the Nominated Shilin Karst Sites

Fig.1-3 Relationship of the Nominated Shilin Karst Sites to Other Reserves

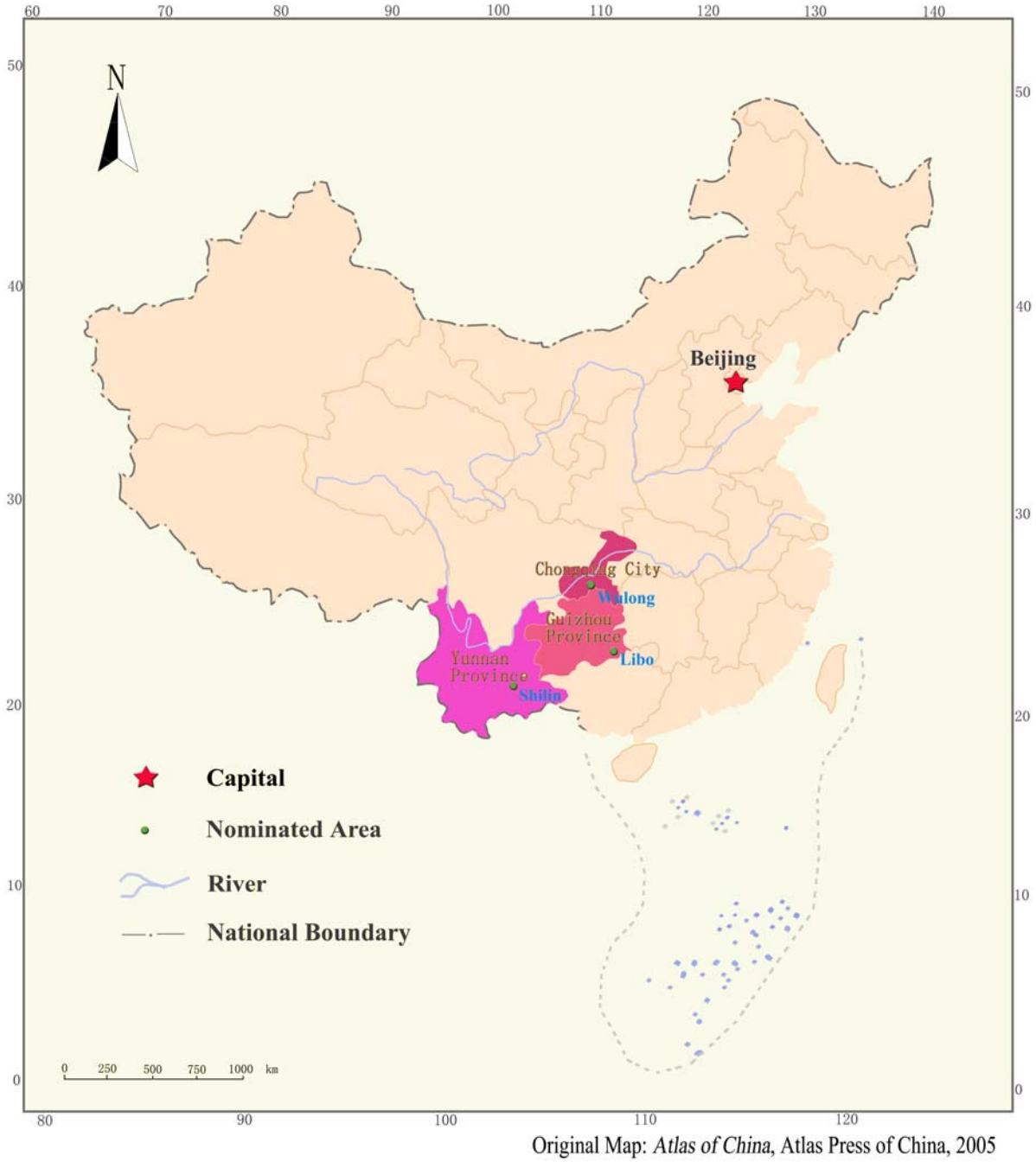
① Chongqing City is at the same administrative level as Yunnan Province and Guizhou Province

1.f Area of Nominated Property (ha) and Proposed Buffer Zone (ha)

Table 1-2 Area of the Nominated Property and Proposed Buffer Zones

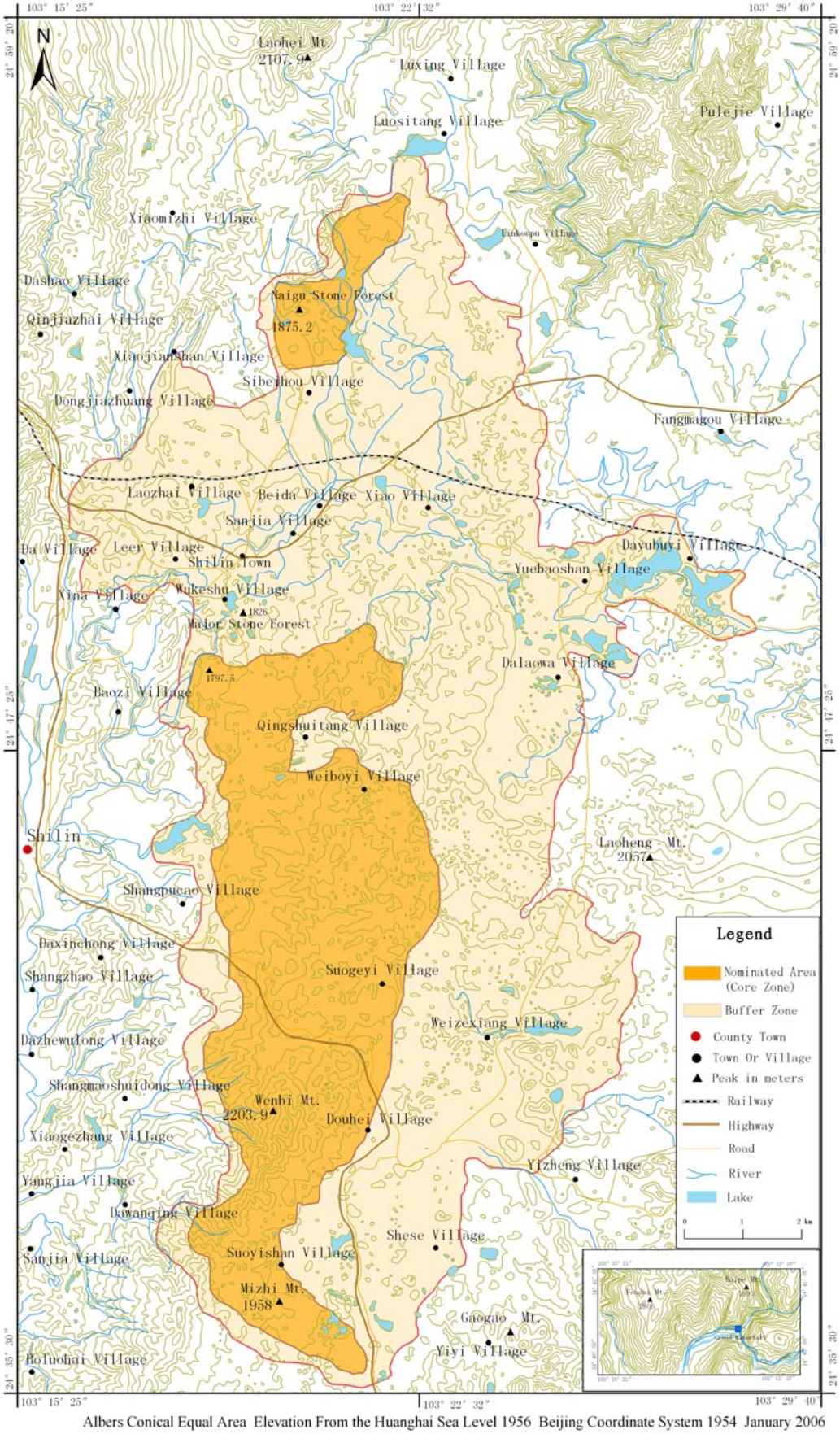
Nominated Sites	Area (ha)	Region (County and Province/City)
Shilin Karst	Area of nominated properties: 12,070 Buffer zone: 22,930 Total: 35,000	Shilin Yi Nationalities Autonomous County, Kunming City, Yunnan Province
Libo Karst	Area of nominated properties: 29,518 Buffer zone: 43,498 Total: 73,016	Libo County, South Guizhou Buyi and Miao Nationalities Autonomous Prefecture, Guizhou Province
Wulong Karst	Area of nominated properties: 6,000 Buffer zone: 32,000 Total: 38,000	Wulong County, Chongqing City
Total area of nominated properties: 47,588 ha Total buffer zone: 98,428 ha Grand Total: 146,016 ha		

Fig.1-1 Locations of the Nominated South China Karst Sites (Phase 1) in China



Original Map: *Atlas of China*, Atlas Press of China, 2005

Fig.1-2 Details of the Nominated Shilin Karst Sites



Albers Conical Equal Area Elevation From the Huanghai Sea Level 1956 Beijing Coordinate System 1954 January 2006

Fig.1-3 Relationship of the Nominated Shilin Karst Sites to Other Reserves

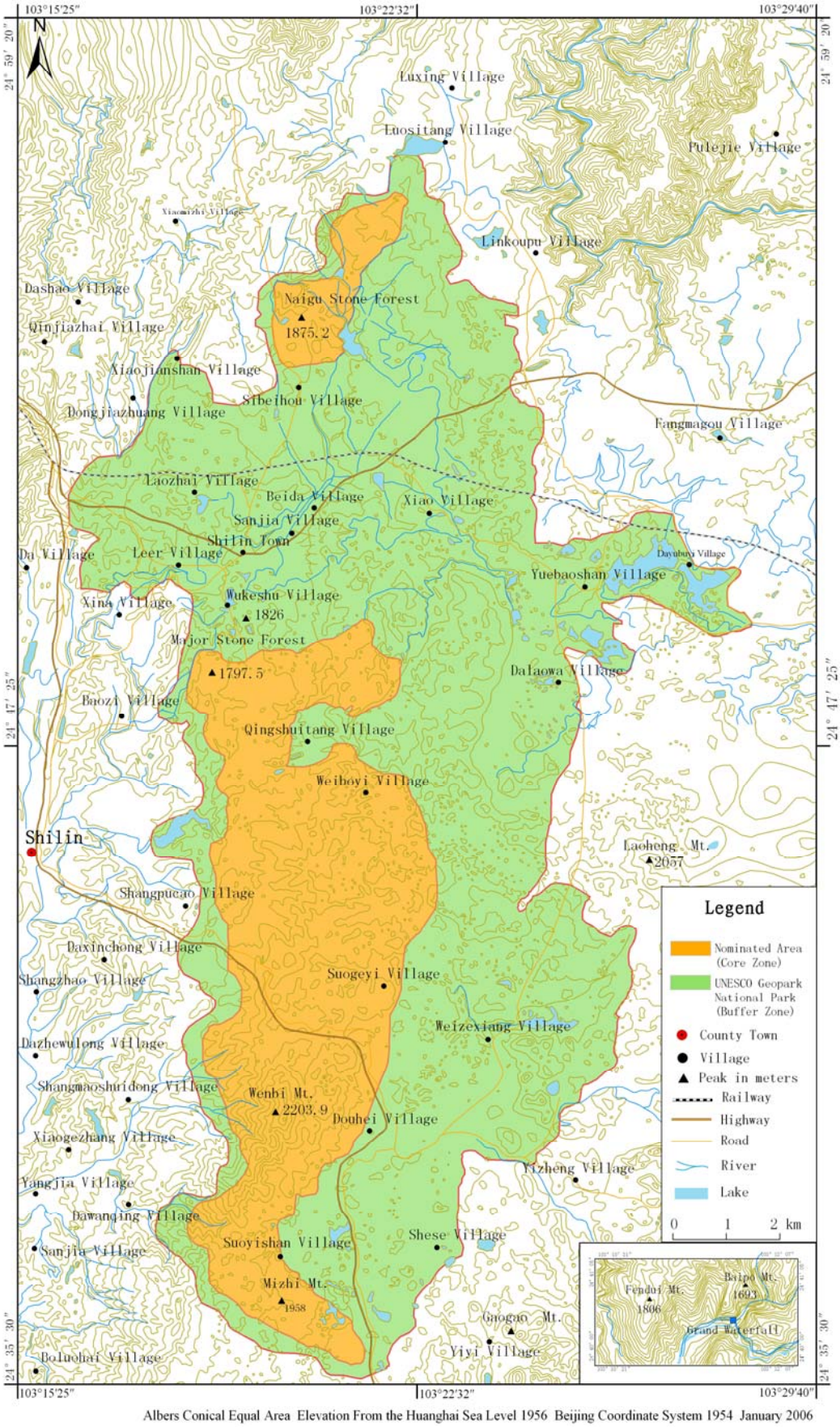


Fig.1-4 Details of the Nominated Libo Karst Sites

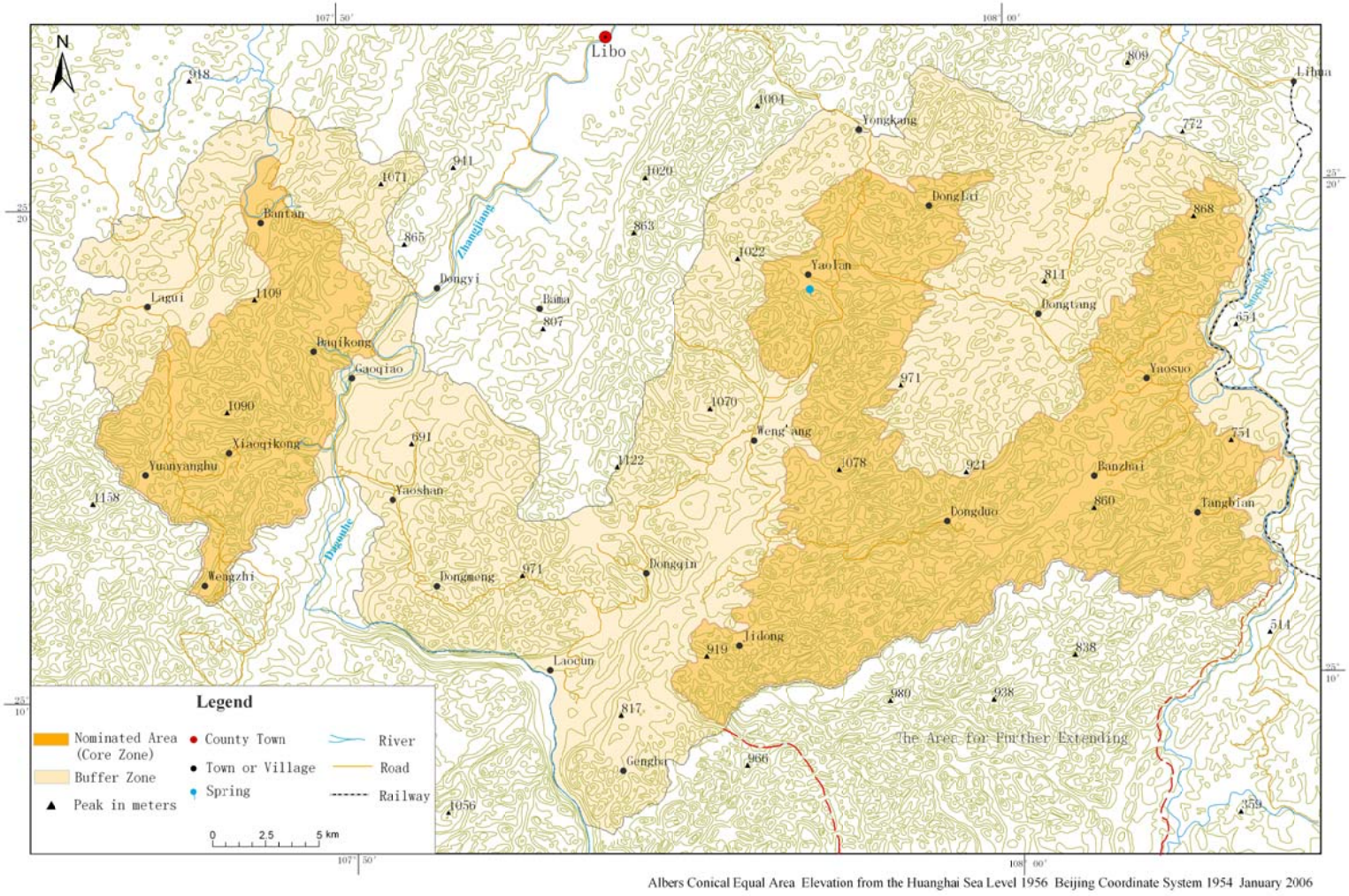


Fig.1-5 Relationship of the Nominated Libo Karst Sites to Other Reserves

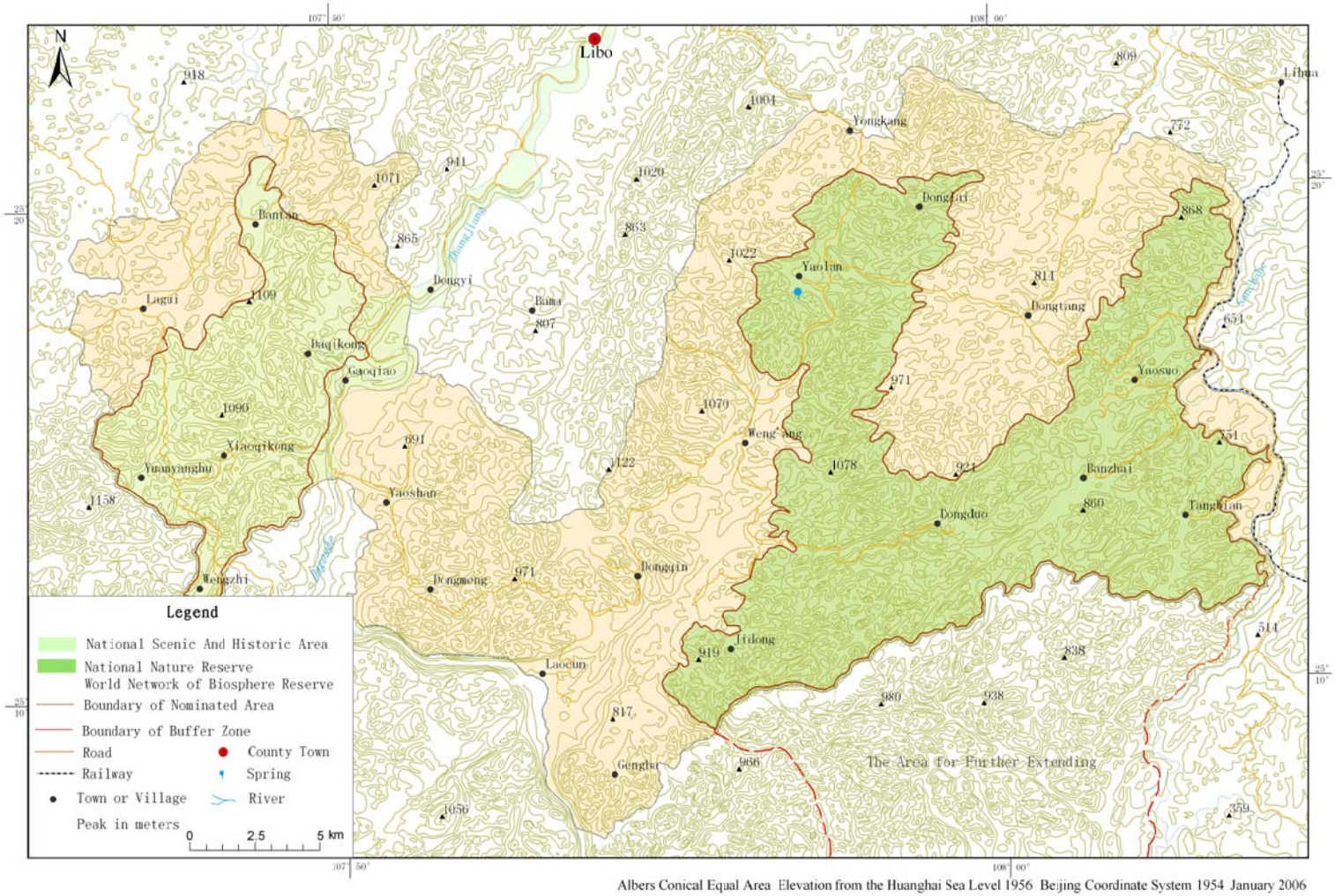


Fig.1-6 Details of the Nominated Wulong Karst Sites

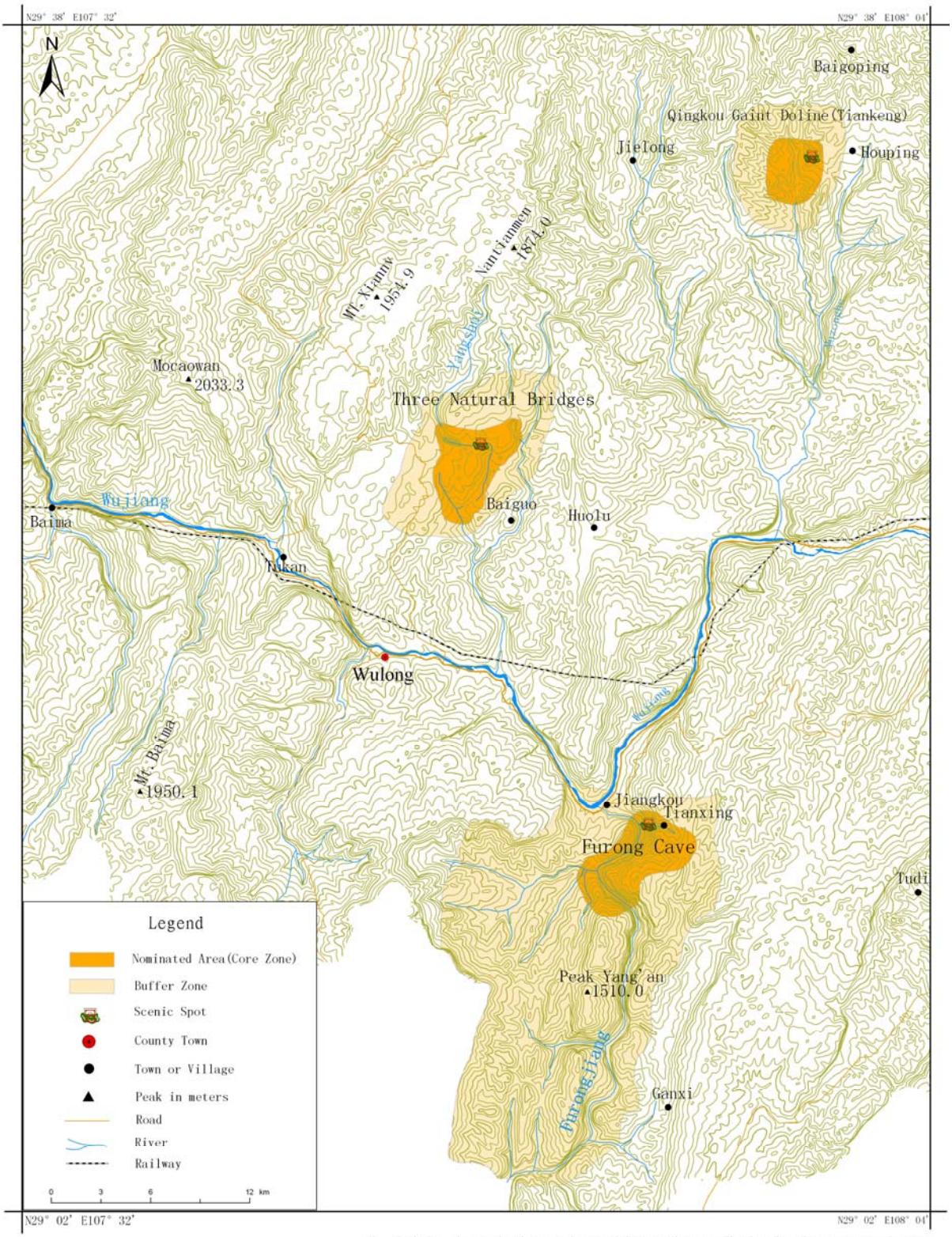
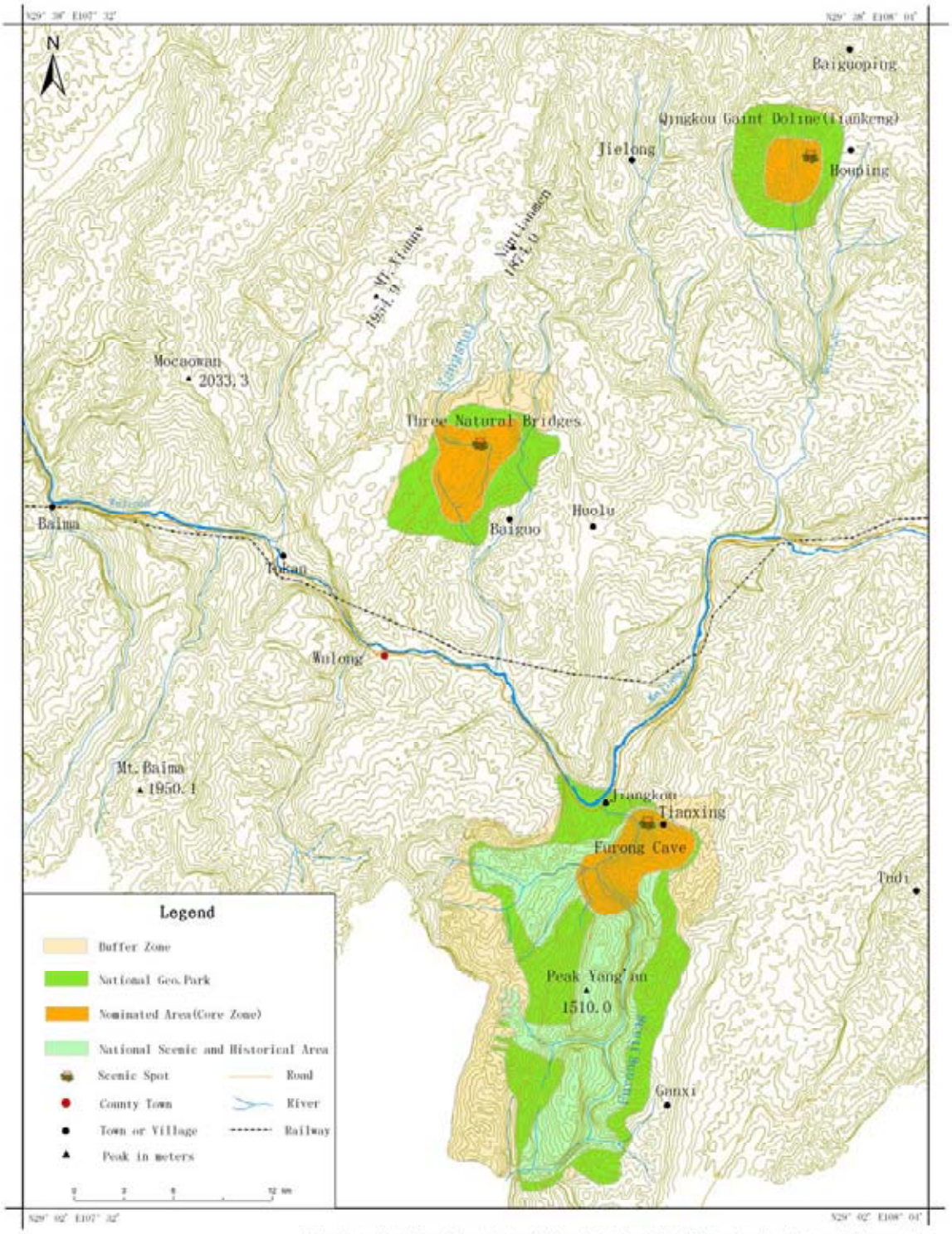


Fig.1-7 Relationship of the Nominated Wulong Karst Sites to Other Reserves



Albers Conical Equal Area Elevation From the Huanghai Sea Level 1956 Beijing Coordinate System 1954 January 2006

2. Description

2.a Overview of the Total Property

2.a-1 Context of the Nomination

Two dimensions of this nomination demand special recognition, and so are highlighted here.

The Geological History of China Karst:

The China karst has particularly unusual, probably unique characteristics. It arose from within the unique synergy of the strong and intermittent Cenozoic uplifts of the Himalayan Orogeny and the hot-moist Asian monsoon. Moreover, it is mostly developed on the Pre-Triassic hard, compact carbonate rocks and did not suffer the scouring and denuding processes of the last glaciations. These rocks have relatively thin soil development and are also more deeply bedded than similar rocks of other continents. They are unusually impervious to water and have great physical hardness.

These factors have provided for the exceptional development of landforms of pinnacle karst, cone karst and tower karst, and immense caves. The very hardness of the rock has provided for exceptional preservation of micro-karst surface features, such as deep and sharp karren, evaporation pans, notches and scallops. Although landscape features may be superficially comparable with those of China, closer assessment generally establishes that they are not, and so genuinely comparable landscapes are indeed rare.

Chinese policies on minority peoples:

The rights of cultural minorities to retain control over their traditional lands and to maintain their own cultural traditions and languages are fully recognized and upheld. Minority people comprise the majority of residents in both many karst areas included here (Shilin, Libo) and others which may be nominated in the future. The people will be given support, if necessary, in their adjustment to the inevitable continuing social change. However, they are also seen as making a very special contribution to the value of protected areas. This is especially the case in the two areas nominated here.

The Shui people, already granted special recognition in the creation of the Maolan Biosphere

Reserve, have in fact managed their lands as a protected area for at least a thousand years. Moreover, they provide a long-standing demonstration of exemplary forest management based in totally sustainable harvesting and utilization of non-timber forest products.

During a long period of historical involvement, the Yi people have developed close ties with the Shilin Stone Forests, establishing lifestyles adapted to the karst environment and a culture relating intimately with the Stone Forest landscapes. Stone forests have entered every aspect of the Yi peoples' life, including religion, celebrations, dance and architecture. The Yi have painted and engraved some stone pillars. This relationship with the environment continues to the present day and is indeed visible to all visitors. Thus the Stone Forest in fact celebrates the culture of the Yi people. They provide park staff of absolutely outstanding quality who provide a truly welcoming presence for visitors and so their contribution to the daily management of the park is one of its great distinguishing characteristics.

In the buffer zone surrounding Libo sites, the Yao people constitute the dominant population. Their love of music and dance, athletic games, and their attractive costumes provide a valuable and joyful cultural experience for visitors.

2.a-2 Outline

China, with more than 1,250,000km^2 of carbonate rock outcrop (*China karst research group*, 1979), which occupies 13% of the total country, has one of the highest proportions of carbonate rocks in the World. The South China Karst, covering nearly 500,000km^2, lies mainly in Yunnan, Guizhou and Guangxi, but extends into parts of Chongqing, Sichuan, Hunan, Hubei and Guangdong. It contains an outstanding series of karst landforms - from humid to semi-humid and from tropical to subtropical - plains, hills, mountains and plateaux.

This karst has a distinctive character, which arises from both its geological and climatic history. It spans virtually all eras of geological history and so many areas are very ancient. The accumulated sequential depositions of limestone mean that as well as covering a large surface area, the limestone is of great thickness. While some areas remain virtually as they were first deposited, others have been subject to extensive tectonic change. There is a range of discontinuities resulting from sequences of denudation, interspersed with further deposition.

The limestone primarily comprises early hard and compact rocks of low porosity with extensive uplift during the Cenozoic. It has not been subject to the extensive Pleistocene glaciations which characterises many other limestone areas of the world. Finally, it has long been subject to humid climates in both sub-tropical and temperate latitudes.

The result is a remarkable diversity of surface landscape features with well-preserved historical evidence of the evolution of landscape. Similarly, the structural integrity of the limestone provides for large and relatively stable caves and other subsurface forms. Thus, many features of the Chinese karst only occur in China and are not truly comparable with landforms of somewhat similar superficial appearance in other countries (Yuan Daoxian, Li Bin and Liu Zaihua, 1998).

More comprehensive discussion of this context can be found in appendix 2.

2.a-2 Shilin Karst (Yunnan)

The Shilin Karst Nominated Sites for the World Natural Heritage are nominated as fulfilling the following criteria:

(viii) be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;

(vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

2.a-2-1 Physical Geography

Terrain：The Shilin Karst Nominated Sites are located in Shilin County in Kunming City, Yunnan Province. The terrain rises from 1720m in the southwest to 2203m in the northeast; the highest peak is Mt.Wenbi (2203m). The sites are situated on the Yunnan Karst Plateau of the western Yunnan-Guizhou Plateau which lies in the second geomorphological altitude zone (GAZ) of China (Fig. 2-1).

Climate：The Shilin Karst Nominated Sites have a low latitude subtropical plateau monsoon climate characterized by warm winters and cool summers. The mean temperate is 20.8°C in July (the hottest month), 8.2°C in January (the coldest month). The highest temperature recorded was 33.6°C. The wet season is from May to October. The range of the mean annual rainfall across the sites is from 800mm to 850mm and the range of mean annual potential evaporation from 1800mm to 2500mm.

Hydrology：The site is positioned in the Nanpanjiang catchment on the upper reaches of the Pearl River (Group of Stone Forest Study, 1997; Peng Jian, Yang Mingde and Liang Hong, 2000; Liang Hong, 2001). Water resources in the Shilin area consist of both surface water and groundwater. The Bajiang river rises in the north on Mt. Shanshenmiao from where it flows from NE to SW through the Naigu Stone Forest, Beidacun Village, Lumeiyi, Lupu Town and finally into the Nanpanjiang at the Grand Waterfall on the border of Yiliang County.

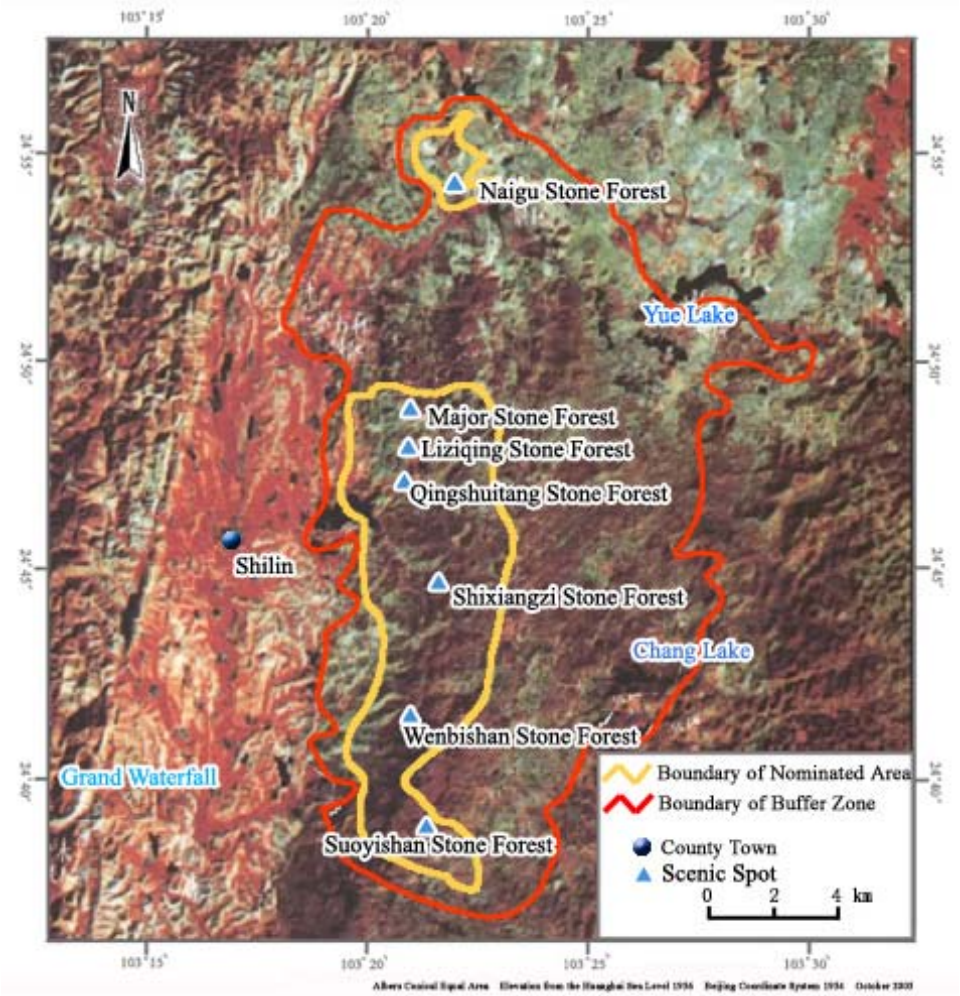


Fig. 2-1 Satellite image of the Shilin Karst Nominated Sites

Soil and Vegetation：There are two soil types in the Shilin karst (Wang Wenfu, 1996; Group of Stone Forest Study, 1997), one being red earth and the other calcareous soils. Zonal vegetation is represented by the semi-humid evergreen broad-leaved forests that include the forests of *Cyclobanopsis glancoides*, *Cyclobalanopsis delavayi*, *Castanopsis delavayi*, *Quercus cocciferoides* and *Quercus franchetii* (Group of Stone Forest Study, 1997; Jin Zhenzhou, 1998; Tian Youping, 2001; Tian Youping, 2001). Also, the present vegetation includes warm coniferous forest (*Pinus yunnanedsis*) and the karst lake plant community is represented by *Ottelia acuminatea* (Li Heng, 1988).

2.a-2-2 Regional Geology

Tectonics and Structures：The Shilin Karst Nominated Sites are located in southwestern Yangtze Platform, and regional tectonics are controlled by the N-E Shizong-Mile Fault and S-N Xiaojiang Fault,

these together with the Niutoushan Base, control landform development, basin evolution and sediment deposition (Yunnan Bureau of Geology and Mineral, 1990; Group of Stone Forest Study, 1997; Li Yuhui, Liang Yongning and Geng Hong, 1998; Peng Jian, Yang Mingde and Liang Hong, 2000). The Shilin region reemerged from the ocean in the late stage of the early Permian and then was sequentially uplifted (Yu Jinbiao, Wang Xueyu and Wang Zhonghan, 1985; Wang Xueyu. 1985; Luo Zhili, Jin Yizhong, Zhu Bianyu, etc, 1988; Li Yuhui, Yang Yiguang, Liang Yongning, etc, 2001). In the early Eocene the altitude of the Shilin area varied from 700m to 800m, however since the late Pleistocene it has been uplifted to nearly 2000m as a result of the Himalayan Movement (Lin Junshu, 1997). During this long uplift, the limestone formations developed two joint sets at 40-50° and 280- 300° in the Devonian carbonates, 320-330°, 10-20° in the Carboniferous carbonates and 300-340° and 40-70° in Permian carbonates. Stone teeth and stone forest were formed associated with some of the deeper and wider joints. The density and intensity of joints controlled the morphology of the karst landscape. Generally speaking, if the fissure frequency was low, karst hills formed. If the fissure frequency was high, stone forest formed. If one of the joint sets had a high frequency and the other had a low frequency then razor ridges developed in the paleokarst (Fig. 2-2).

Strata and Lithology： In the 350km^2 Stone Forest Park the strata are composed of Paleozoic carbonates, late Permian basalts and early Tertiary lake sediments (Group of Stone Forest Study, 1997; Zheng Jiajian, 1978). The older early Paleozoic and Proterozoic strata occur outside the park (Ma Xirong, 1936; Yang Zhongjian, etc, 1939; Zhou Mingzhen, 1995; Xu Yuxuan and Qiu Zhanxiang, 1962; Zhou Mingzhen, 1962; Tang Xin and Zhou Mingzhen, 1964). The karst landforms are mainly developed on the Paleozoic carbonates; however, the stone forests have developed only on Permian limestones and dolomitic limestones (Zhang Shouyue, 1984).

Hydrogeology： Hydrology is a key controller in the development and distribution of stone forest landscape (D.Ford and P.Williams, 1989). All forms of water (rainfall, surface water and groundwater) can cause corrosion. The Bajiang located in the west of the Stone Forest Park controls the groundwater levels in the Stone Forest Park and hence controls the present depth of karstification of the limestone (Ma Xirong, 1936; Group of Stone Forest Study, 1997; Peng Jian, Yang Mingde and Liang Hong, 2000; Liang Hong, 2001). The Bajiang flows through the Lunan Basin from north to south and joins the Nanpanjiang at the Grand Waterfall. The waterfall has inhibited the headward erosion of the Nanpanjiang; thus the karst

drainage in the Stone Forest Park has remained at a constant level since the late Neocene. Before in the early Neocene, an ancient lake controlled the karst drainage. At present in the Shilin County there are six distinct groundwater drainage systems.

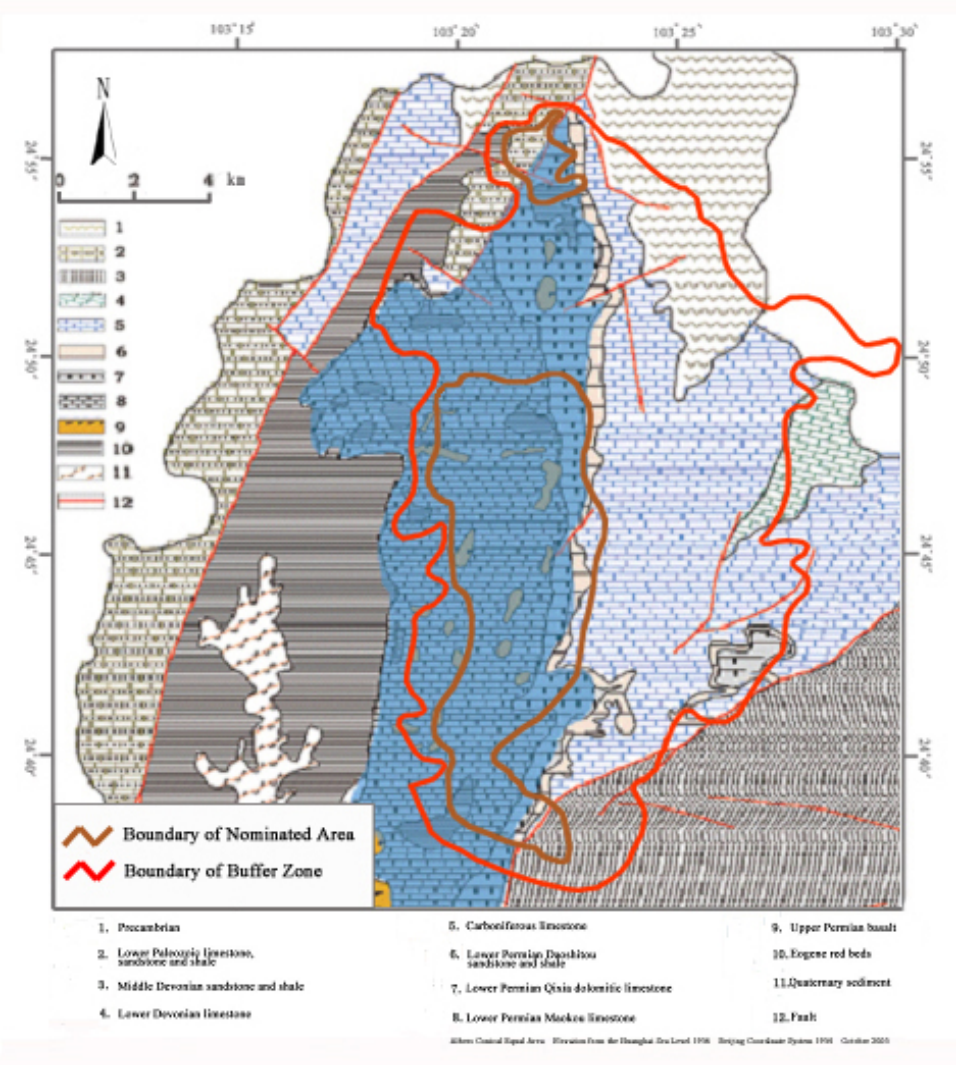


Fig. 2-2 Geology of the Shilin Karst Nominated Sites

2.a-2-3 Karst Geomorphology

The Stone Forest Karst is located on the gently undulating surface of the eastern Yunnan Plateau. The altitude of the karst varies from 1700m to 1950m except for several peaks of more than 2200m. Where the thick late Paleozoic carbonates outcrop in Shilin County a great variety of karst landforms have developed covering more than an area of 900km^2. Within the nominated sites, stone forest is the major karst landform and its evolution has lead to varieties of this karst landform not known elsewhere in the World. The stone pillars of the stone forests are developed in the Qixia Formations and Maokou Formations of the Permian

carbonates. Within the stone forests there are other associated karst landforms such as stone teeth and caves. The stone pillars are covered in minor karst features such as rillenkarren and rundkarren and extensive micro karst (Fig. 2-3).

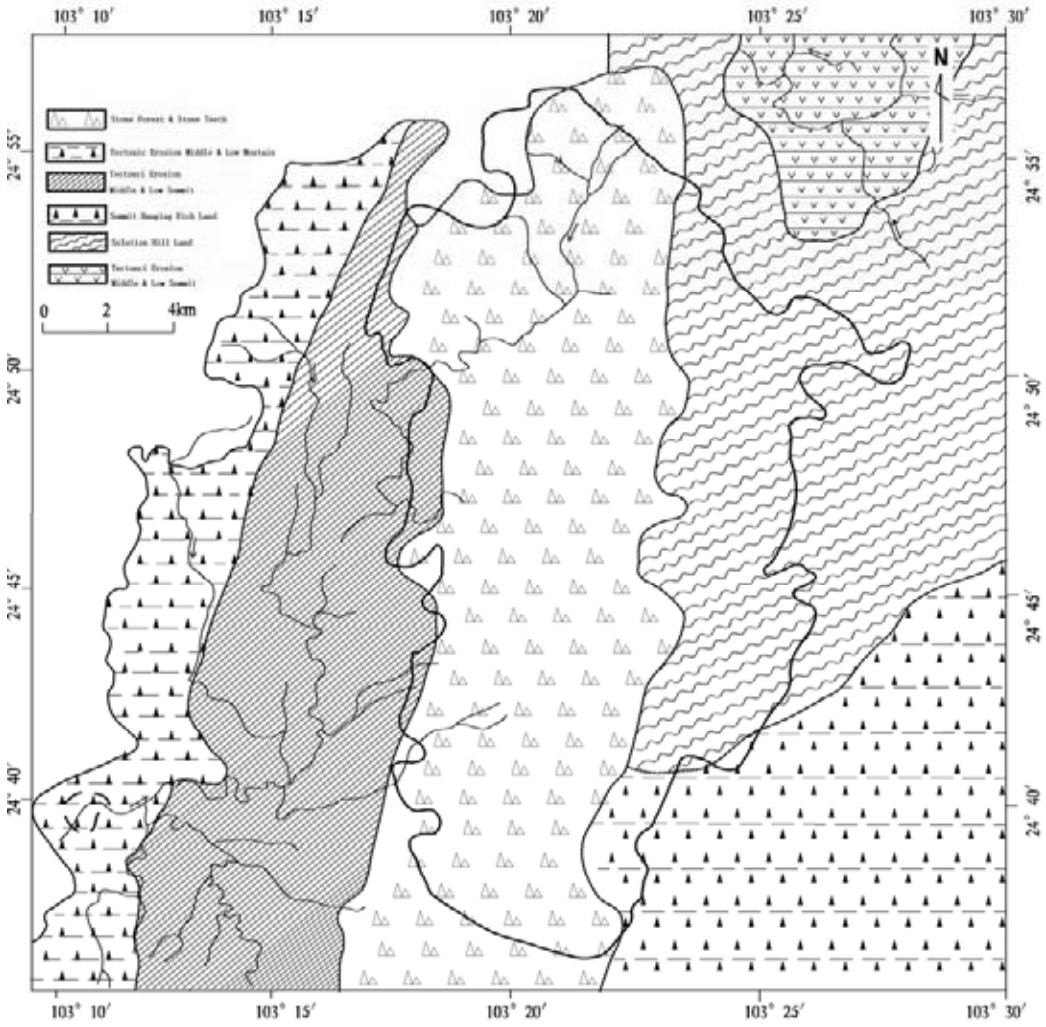


Fig. 2-3 Types of karst landscape in the Shilin Region

2.a-2-3a Distribution of features in the nominated Stone Forests

In the Shillin Geological Park there are a number of named stone forests including peak, ridge, slope and valley, etc. each of which has special characteristics.

The Major Stone Forest and liziyuanqing Stone Forest: The Major Stone Forest is the highlight of the park, where we may appreciate the traditional stone forest. The Maokou gray and pure limestone of middle Permian are eroded to develop the most representative pinnacle karst like sharp swords to the sky, having striking difference from Naigu Stone Forest for lithology difference (photo 2-1 and photo 2-2).

Naigu Stone Forest: “Naigu” means “black” in the Yi language. Naigu Stone Forest is located in the north of the nominated site, and is developed in the most part on the dolomitic limestone of the Qixia Formation. Because dolomitic limestone is less prone to corrosion, the sharp pinnacle karst of the Major Stone Forest is not common here. The Naigu Stone Forest is special because it is one of the few areas in the World where stone forest has formed on a dolomitic limestone. Its stone pillars of dark gray rock are tall and robust and thus form a karst landscape of exceptional beauty (Photo 2-3).

Qingshuitang-Shixiangzi Stone Forests: These are in a valley in the centre of the southern nominated site. There are stone forest clusters scattered on a plateau whilst others stand on hilltops, ridges and hill slopes and some stand in lakes. Different evolutionary stages of stone forests are found to outcrop in the same area. Some of these are Permian stone forests now exposed after being covered by basalt; some are Eocene stone forests exposed after being covered by Tertiary sediments. The ascending tiers of stone forest clusters show which generation they belong to; those on the highest positions are the oldest and those in the groundwater lakes, the youngest.

Photo 2-1 The Major Stone Forest landscape

Photo 2-2 Liziyuangqing Stone Forest

Photo 2-3 Naigu Stone Forest

Suyishan-Wenbishan Stone Forests: Found in the southern nominated site, these forests exhibit the greatest variety in their karst features. Many of them are found on the flanks of Mt.Wenbishan (2200m) and are now covered by forest; others are found in water-filled deep depressions and show the vertical bedding in the limestone. The Suyishan Stone Forest, standing in a lake, has pillars that exhibit 18 to 20 vertical beds of limestone. This is in contrast to the other stone forests where near horizontal bedding is predominant.

2.a-2-3b Morphology of the Isolated Stone Outcrops

Some of the isolated stone outcrops can be grouped into four major types based on their morphology. Others are so individually bizarre so that it is impossible to group them.

Pinnacles: The Major Stone Forest and Naigu Stone Forest are two areas where there is pinnacle karst (photo 2-4). The height of pinnacles in the Major Stone Forest ranges from several metres to 40m. The pinnacles are fluted spires with razor-shape edges and often have other sub-aerial karren and micro-karren forms on them. The height of the Naigu Stone Forest pinnacles ranges from 10m to 30m, with numerous 1m to 3m needle sharp karren and fissure karren on their tops. In places the metamorphosed rock of the

Naigu pinnacles is a patchwork of black and white.

Photo 2-4 Pinnacles

Pillars: Again these are distributed throughout the stone forest karst. Their heights vary from several metres to 20m with a nearly uniform cross section from top to bottom. The pillars, like the pinnacles, are covered with many minor and micro karren forms (Photo 2-5).

Towers: Larger than the pillars and isolated on the plateau surface or on hills and ridges, the towers rise to a height of 20m and are smaller at the top than at the bottom. The pillars can have 10 bases that exhibit rundkarren and remnants of caves.

Mushrooms: Occur as isolated limestone blocks throughout the stone forests, especially at basin margins. The mushrooms, up to 10m high, have massive tops perched on thin columns. There are minor sub-aerial karren features on the tops and on the stalks there is micro-karren. This type of stone outcrop is rare (Photo 2-6).

Irregular stone forest: The Stone forest landform is difficult to classify.

Photo 2-5 Pillars

2.a-2-3c Evolution Model of Shilin Karst

Sub aerial solution, subsoil erosion and bio-karst: The outcropping height of a stone forest is a combination of the past persistent uplift, sub-aerial solution and sub-soil solution. Two examples of stone forest formation are presented here: one is soil corrosion in rock crevices, which both widens and deepens them and finally isolates the rock into stone teeth and pillars. These create favorable conditions for the second form of development: corrosion by invading of ground water. This rapidly corrodes the limestone, facilitating the formation of stone forest and stone teeth. Rain and microorganisms are other agents modifying the pinnacles, pillars and teeth sub-aerially; together they lower the height of the rock outcrops. The microorganisms also colour the rock surface and may burrow into it, forcing the crystal grains apart and fragmenting it.

Geomorphological evolution model: The Shilin Karst landform evolution model is presented in figure 2-4. In the early Permian, 270 million years ago, a carbonate deposit several hundreds of metres thick formed in the ocean that covered the Shilin region. Then 250 million years ago, the Shilin region emerged from the ocean. At this time in the humid and warm climate of the new coastal environment, the first stone forests and teeth developed on the now exposed fractured limestone. In the late Permian, rifting

within the Yangtze landmass lead to the production of copious quantities of lava in western Sichuan, western Guizhou and eastern Yunnan. These basaltic lavas flowed onto the Shilin region covering the karst landforms and metamorphosed the limestone that formed the early stone forests and teeth. Finally these stone forests and teeth were buried beneath hundreds of metres of basalt.

Photo 2-6 A mushroom amongst pillars and towers

During the Mesozoic the basalt-covered Shilin region was slowly uplifted. With time the thickness of the basalt cover was reduced by erosion.

In the late Mesozoic and the early Cenozoic the basalt cover was totally stripped from sections of the Shilin area exposing the underlying limestone with its earlier stone forests and teeth. In addition, in parts the exposed limestone began to develop a new generation of stone forest and teeth (photo 2-7).

Photo 2-7 Stone teeth exposed by erosion of the basalts

In the Eocene, some 50 million years ago, regional uplift, especially the Himalayan Movement, led to the formation of a large intra-montane paleo-lake, Lunan Lake, namely the Lunan Basin of today. The red beds formed in the bottom of the lake and the stone forests within its confines were buried. The lake only covered some parts of the stone forest and the areas not submerged continued to develop as stone forests. Because of the very favourable conditions at this time the stone pillars that formed then are unrivalled in height and beauty.

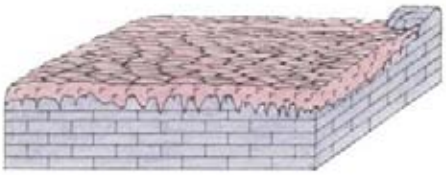
In association with the Tibetan Plateau uplift in the late Tertiary, the Shilin Stone Forest region continued to be intermittently uplifted, establishing the present Bajiang erosion/corrosion base level.

A

In the Shilin region, 260 million years ago, a fractured carbonate rock mass emerged from the ocean a result of tectonic uplift.

B

Between 260 and 250 million years ago, the first stone forest was developed on the carbonate rocks in a coastal environment.



C

250 million years ago, basaltic lavas flowed into the karst covering and metamorphosing the stone forests and teeth there. Finally they entire stone forest landscape was buried beneath hundreds of metres of basalt.

D

By 65 million years ago, in the late Mesozoic, in some areas of the Shilin Stone Forests the basalts had been stripped and the underlying Permian limestone karst surface started to emerge.

E

Between 50 and 20 million years ago, in the Eocene and Oligocene, regional uplifts led to the formation of a large intramontane lake. Stone forests and teeth within the lake drowned and stone forests were created around the lake. The stone forests and teeth in the lake were later

F

20 million years ago, in the Miocene, the lake drained and where the red beds and basalts were eroded older generations of stone forests and teeth were uncovered. In addition, new stone forests started to develop in the plateau basins.

Fig. 2-4 Evolution model for the Stone Forest

The paleo-lake in Lunan only existed for 30 millions years (from Eocene to Oligocene). In the late Oligocene, uplift moved the lake centre south and reduced its area. Finally the lake drained through a fault and disappeared in the vicinity of the Grand Waterfall.

Stone forest karst is unrivalled in the multi-phase complexity of its evolution with its many different generations of landscape. Some stone forests are just emerging from beneath the basalt cover and the stone forest evolution, which had been interrupted for 200 millions years in the early Permian, has commenced again. Other early Eocene stone forests are still emerging from the red beds. These are different from the stone forests that were developed at the same time on the Lunan Lake shores which were never covered by paleo-lake sediments. Sections of these early stone forests are still covered by basalts and red beds (photo 2-8).

Photo 2-8 Stone teeth exposed by erosion of the red beds

In summary, the Shilin Stone Forests were formed in four stages. Remnants of all of them can be found today. This is a magnificent record of a long period of the earth's history. Stone Forest formation occurred:

1) in the late stage of the early Permian;
2) from the late Mesozoic to the Eocene;
3) from the Eocene to the Oligocene;
4) from the Miocene to the present.

The stone forest of today is a result of constant change in the landscape, in that the Shilin region has

experienced changes from ocean to land, from lowland to plateau, from lake basin to plateau basin. With the accompanying increase in latitude and altitude, the climate of the Shilin Area has also changed with time from a warm and humid tropical to the present plateau monsoon subtropical climate. No other area of stone forest in the World has had such a complex history.

2.a-2-3d The Natural Beauty of the Shilin Stone Forest

The Shilin Stone Forest is a place of colour. It changes with the seasons whether in sunlight or under cloud cover. When dry, the pinnacles in the Major Stone Forest are light gray; when wet they are black. All of China has benefited from the beauty of the Shilin Stone Forests, which have lent their forms to classical Chinese gardening. For centuries the Stone Forests, due to their exceptional beauty, have served as the natural model for some traditional Chinese gardeners and have been a treasure house for their inspiration and design. For artists of all callings the Shilin Stone Forests provide everlasting natural models.

The Shilin Stone Forests have unrivalled natural beauty. The indigenous Sani people have recognized this. The Sani have an intimate and inseparable relationship with stone forests and especially their most scenic sites. As part of this relationship they have named numerous stone pinnacles, pillars and towers. For example, the tower immortalises “A Shi-Ma”, a legendary Sani heroine. She is depicted wearing a head cloth and shouldering a pack basket (Photo 2-9). An unusual pinnacle is called “The Lotus Flower” (Photo 2-10), a flower that has featured prominently in Chinese culture. There are also more than hundreds of area named as Sani people.

Besides macro-karst shapes, a wide various of beautiful micro-solution forms occurred on the rock surfaces such as karren, solution grooves, solution holes, solution slots, etc. Individually, the stone forest developed on pure limestone (Dikou Formation) take the shape of uniform and flat pinnacle; the stone forest developed on dolomitic limestone (Qixia Formation) is rough and disordered. Collectively, stone forest clusters may present as sculpturing pictures (photo 2-11).

The beauty of the Shilin Stone Forest is not only represented by spectacular stones, but also in scenes where their beauty is integrated with other karst landforms and vegetation. Together stone teeth clustering in a basin and the stone forest on the ridge (Photo 2-12) presents a landscape that is recognised for its beauty throughout the World.

Photo 2-9 “A Shi-Ma”

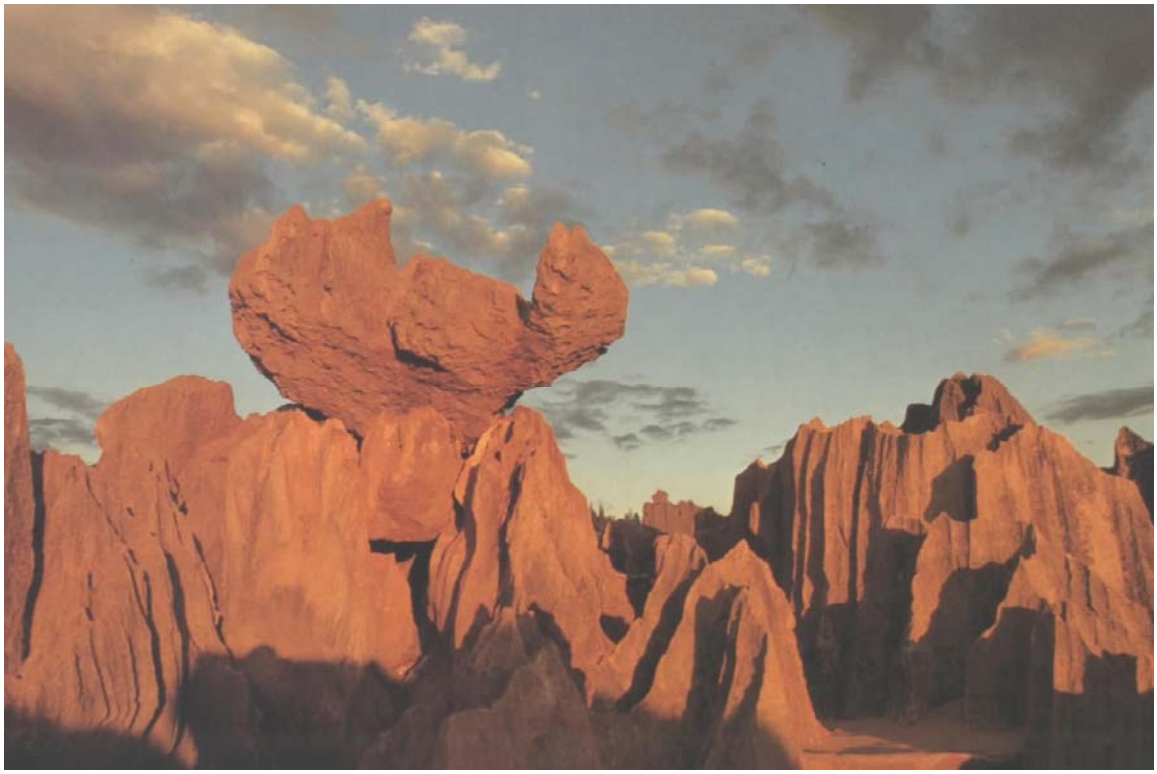


Photo 2-10 Lotus Flower (Major Stone Forest)

Photo 2-11 The Major Stone Forest in autumn

Photo2-12 Stone Teeth and Stone Forest

Along with the weather change, Stone Forest may appear different color, such as in sun, the Major Stone Forest appears light gray; In rain, it suddenly turns to heavy black; After rain, the color suddenly begin to turn to white from sword edge to whole, the people are inevitably both shocked and enchanted by unrivaled natural beauty.

2.a-2-4 Biotic Community and Biology Species

2.a-2-4a Plant Community and Flora Element Features

The Shilin Karst Nominated Sites belong to the Pan-Arctic biogeographic flora category. The nominated sites have subtropical plateau ecosystems. The forest covers 32% of the karst and four kinds of karst forest are found in the area (Photo 2-13). They are: Evergreen broad-leaved forest composed of *Cyclobanopsis glancoides*, *Cyclobalanopsis delavayi* and *Castanopsis delavayi* species. These are all partially drought resistant species of the evergreen broad-leaved forest. *Castanopsis* forest is endemic to karst areas in Southwest China (Photo 2-14). Sclerophyllous evergreen broad-leaved forests contain *Quercus cocciferoides* and *Quercus francheti. Quercus franchetii* is paleo-epibiotic having been derived

from the “Tethys” vegetation. Deciduous broad-leaved and subtropical needle-leaved forests containing *Pinus yunnanensis* are found here and throughout the needle-leaved forests of west China.

Other vegetation types are those found in the shrublands and grasslands with occasional trees and in the meadows. The only other significant karst vegetation is that found in the lakes, that is, the *Ottelia acuminata* community.

The Shilin Karst Nominated Sites contain 889 species of vascular plants, belonging to 533 genera and 147 families; 43 species of Pteridophytes, belonging to 25 genera, 14 families; 13 species of gymnosperm, belonging to 9 genera, 3 families and 833 species of angiosperm, belonging to 499 genera, 130 families. Their flora consists of the elements of the Sino-Himalayan forest subregion, Sino-Japan forest subregion and the East-Asian Realm. The Sino-Himalayan subregion species include *Colquhounia*, *Corallodiscus*, *Docynia*, *Lysiontus*, *Physospermopsis*, *Prinsepia*, *Sinocrassula* and *Siphonostegia*; the Sino-Japan forest subrealm includes: *Akebia*, *Conandron*, *Sinomennium* and *Platycladus*; the East-Asian Realm includes: *Ainsliaea*, *Bletilla*, *Codonopsis*, *Dendrobenthamia*, *Eriobotrya*, *Leptodermis*, *Lycoris*, *Ophiopogon*, *Patrinia* and *Reineckea*.

Photo 2-13 Vegetation in the Shilin Stone Forest

Photo 2-14 *Cyclobalanopsis glaucoides*

In this area, there are eight species of nationally protected plants, for example: *Psammosilene tunicoides*, *Paeonia delavayi franch* var. *lutrea* and *Ottelia acuminata*; and twenty species protected by Yunnan province, for example: *Gleditsia delavayi*, *Zizyphus mairei* and *Hymenodictyon flaccidum*. There are almost 100 species of Shilin and Kunming endemic and rare plants in Yunnan province, for example: *Impatiens loulanensis* var. *intermedia* and *Salvia breviconnetcivata*. Based on the Chinese Species Red List for Vegetation there are 30 species in the Shilin area requiring protection.

2.a-2-4b Animal

Animals: Animals in the nominated sites belong to the Oriental Realm of Southwest China Region and the Central Yunnan Plateau subregion. There are 185 species comprising 42 species of mammal, 87 species of birds, 32 species of reptiles, 12 species of amphibians and 12 species of fish. Of these 7 mammal and 8 bird species are protected in the Chinese Red List.

Birds: Found in the nominated sites are: *Chrysolophus amherstiae*, *Streptopelia chinensis*, *Dendrocopos cathpharius*, *D. major*, *Certhia himalayana*, *Garrulax elliotii*, *G .albogularis ruficeps*, *G. sannis*, *Alcippe chrysotis*, *Alcippe morrisonia*, *Yuhima flavicollis*, *Yuhima diademata*, *Phylloscopus inornatus*, *Parus monticolus*, *Aegithalos coninnus*, *Aegithalos iouschistos*, *Paradoxornis webbianus*

yunnanensis, *Carpodacus rhodopeplus*, *Culicicapa ceylanensis*, *Eumyias thalassina*, *Carpodacus plucherrimus* and *Dicrurus macrocercus*.

Mammals: *Soriculus caudatus, Crocidura Dracula, Phinolophus lepidus, Dremomys rufihenis, Rupestes forresti* and *Callosciurus finlaysoni* are found in the nominated sites (photo 2-15).

Photo 2-15 *Manis pentadectyla aurita*

Amphibians: In the nominated sites amphibians include: *Cynops wolterstorffi*, *C. chenggongensis*, *C. cyanurus yunnanensis*, *Amolops mantzonum*, *Bufo andrewsi*, *Jyla annetcans*, *Rana pleuraden*, *R . grahami*, *R. shuchinae*, *Paa yunnanensis* and *Caluella yunnanensis*.

Reptiles: In the nominated sites reptiles include: *Calotes jerdorii*, *Japalura varcoae*, *J. yunnanensis*, *Hemiphyllosactylus y·yunnanensis*, *Scincella doriae*, *Ophisaurus gracilis*, *Atretium yunnanensis*, *Zaocys nigromarginatus*, *Bungarus multicinctus wanghaotingii*, *Trimeresurus stejnegeri yunnanensis* and *Dinodon septentrionalis*.

Animals of Palearctic Realm: In the nominated sites birds include: *Ptyonopyogne rupestris*, *Emberiza cia*, *Tichodroma muraria*, *Turdus mupinensis*, *Turdus feae*, *Motacila grandis*, *Anthus hodgsoni*, *Phylloscopus fuscatus*, *P. armandii*. Mammals include: *Apodemus uralensis*, *Apodemus latronum*, *Mustela*

sibirica, *Microtus arvalis*, *Micromys minutus* and *Volermys millicens*. Reptiles include: *Gekko scabridus*, *Japalura flaviceps* and *J. splendida*. Many of these species are drought tolerant .

Cave Animals: *Triplophysa shilinensis* was discovered in the river in Weiboyi Cave in 1991. It is one of 11 cave fish and the fourth member of the Nemacheilinae. Only five of this small species of fish have been found. *Triplophysa shilinensis* is closely related to *T. gejiuensis* and *T. nanpanjiangensis*; they may have had the same ancestor.

Bats include *Rhinolophus ferrumequinum tragatus* weighing 10 to 20g and *Hipposideros armiger armiger* weighing 60 to 65g. These bats are found both individually and as groups in the caves.

2. a-2-5 Human Activities

Humans have resided in the Shilin region from as long ago as the Paleolithic. There were many social groups and the people of these clans and tribes were the ancestors of the Shilin Yi people. In 2004, 961 people live within the Shilin Nominated Sites and 4632 in the buffer zone. The population density of the nominated sites and the buffer zone respectively are 8 people / km^2 and 20 people / km^2. The minorities, mainly the Yi people, including the Sani, Axi and Azhe branches, are dominant in these areas.

In the Shilin Area, the natural environment has been influenced by a long history of exploitation of soil, forest, stone and mineral resources. Mining and harvesting in the 18th and 19th centuries destroyed some of the local vegetation and stone forests. The Stone Forest endemic vegetation has been allowed to recover since the Stone Forest Park was established in 1931 to protect and develop the area. Recovery of the vegetation is now well advanced and most of the park is in excellent condition (Photo 2-16).

During indeed a long period of historical involvement, the Yi people have developed close ties with the Shilin Stone Forests, establishing lifestyles adapted to the karst environment and a culture relating intimately with the Stone Forest landscapes. Stone forests have entered every aspect of the Yi peoples' life, including religion, celebrations, dance and architecture. The Yi have painted and engraved some stone pillars. They wear their traditional costume with grace and beauty and so the visibility of their culture is a delight to visitors (Photo 2-17).

This relationship with the environment continues to the present day and is indeed visible to all visitors. Thus the Stone Forest in fact celebrates the culture of the Yi people. As park staff, they provide visitor services and other park management functions of absolutely outstanding quality. That as a truly welcoming presence for visitors, their contribution to the daily management of the park is one of its great distinguishing characteristics.

Photo 2-16 Stone Forest in 1930 before being designated as a park

Photo 2-17 Show with singing of the Minority People

2.a-3 Libo Karst (Guizhou)

The Libo Karst Nominated Sites for the World Natural Heritage are nominated as fulfilling the following criteria:

(viii) be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;

(ix) be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;

(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.

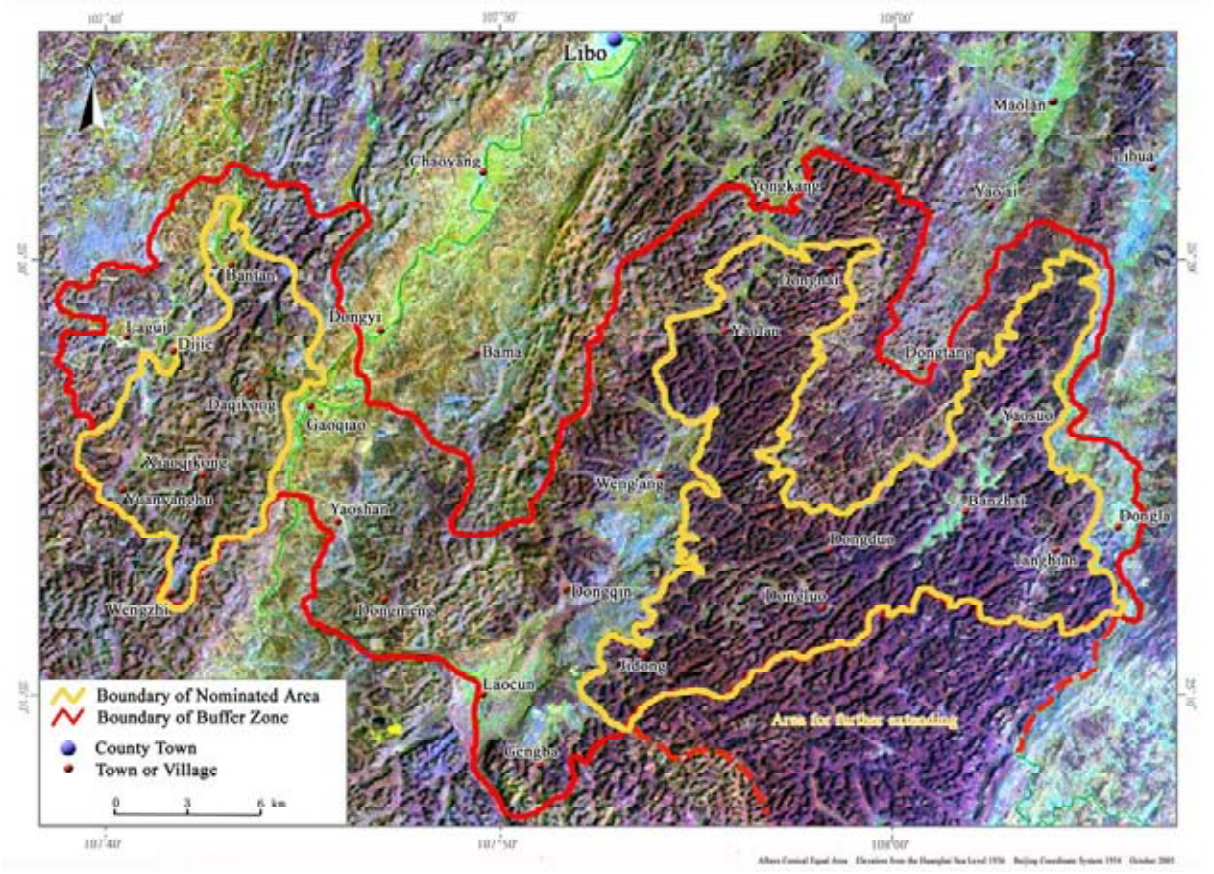


Fig. 2-5 Satellite image of the Libo Karst Nominated Sites

2.a-3-1 Physical Geography

Terrain: The Libo Karst Nominated Sites are located in Libo County, Guizhou Province, China. The terrain is high in the west and low in the east, and slopes north-south to Guangxi Basin (Fig. 2-5). The mean altitude is 747m, with a range from 385m to 1109m. The area comprises a subtropical karst plateau characterized by major changes in relief and deeply incised drainage.

Climate: The Libo Karst Nominated Sites are located in a humid subtropical monsoon climatic zone characterized by mild temperatures and plentiful rainfall. The mean annual temperature is about 15 ºC. The annual temperature range is only 18 ºC, with a mean temperature of 5 ºC in the coldest month, January, and 23 ºC in the hottest, July. The mean annual rainfall is 1752mm, mostly concentrated in the period April to October. There are 1272 hours of sunshine annually, with sunshine on 29% of the days and 632,898 kw/m^2 annual solar radiation.

Hydrology: The Libo Karst Nominated Sites are located on the middle reaches of the Dagouhe and the Hongshuihe in the Pearl River System. The regional erosion-corrosion base level of karst development is controlled in the west by the Zhangjiang and the Fangcunhe, both are tributary rivers of the Dagouhe, and in the southeast by the Sanchahe and its tributaries.

Soil and Vegetation: In the nominated sites, soils are represented by neutral to alkaline limestone soils, with rendzina ever-present, developed under the forests of fenglin karst, fengcong karst and valley slopes. There are some yellow soils in depressions, basins and on valley bottoms. There is a range of vegetation types and the climax communities are mainly evergreen deciduous broad-leaved mixed forests comprising different dominant species. The fengcong karst and fenglin karst evergreen deciduous broad-leaved mixed forests are distributed widely, occupying 335 km^2. This forest type is extremely rare at this altitude and has exceptionally high scientific potential. There is also a local bamboo forest on the karst, the *Dendrocalamus tsiangii* forest.

2.a-3-2 Regional Geology

Tectonics and structure: The Libo Karst Nominated Sites are located in the Qiannan (south Guizhou) ancient fault-fold zone of the Yangtze Massif. There are many unconformities in the stratigraphic record,

for instance, between the middle Devonian and its underlying strata, between the upper Cretaceous strata and the underlying Permian and Triassic strata. There are partial red beds from the Mesozoic in the tectonic basin, but upper Triassic and Jurassic strata are absent. Within the nominated sites, the tectonic activity mostly trended north-south during tectonic movements. This resulted in a “trough” fold system, made up of parallel and gigantic box-like anticlines with a width of 30-50km and tight synclines. In the central parts of the anticlines, the Carboniferous and Permian carbonates outcrop widely, and middle Triassic clastic rocks outcrop in the axes of the synclines (Fig. 2-6). On the surface, fold flanks are steep, even vertical, and orderly aligned towards the west (Gao Daode and Zhang Shicong, etc., 1986; Guizhou Regional Geology Investigation Group, 1982).

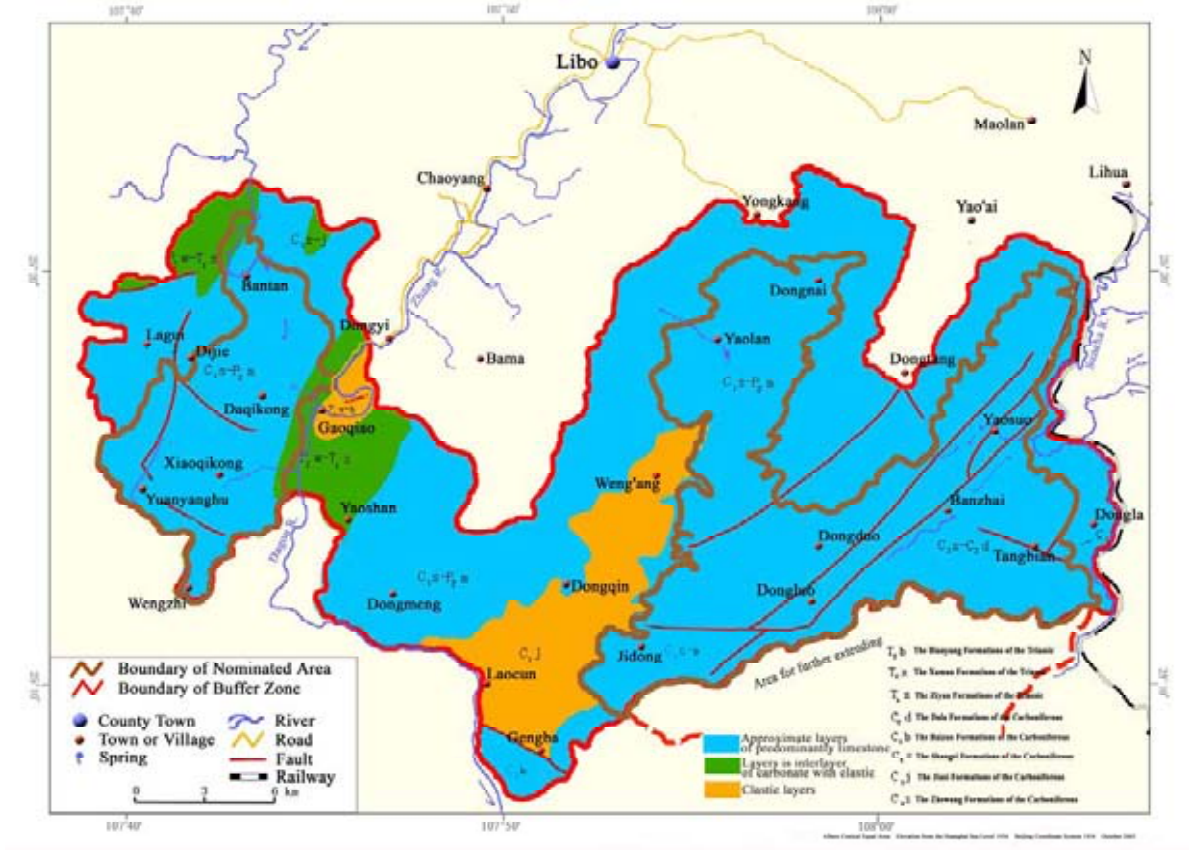


Fig. 2-6 Geology of the Libo Karst Nominated Sites

Strata and lithology: In the nominated sites, carbonates some 8600m thick were deposited between the Sinian (late Precambrian) and Triassic, however they are lacking strata from the Ordovician and Silurian. The karst has developed on the strata of the Datang Formation (C_1d), Baizuo Formation (C_1b), Huanglong Formation (C_2hn) and Maping Formation (C_3mp) of the Carboniferous and Qixia (P_2q) and Maokou (P_2m) Formations of the Permian. The karst developed in different ways, on the limestones,

dolomites and dolomitic limestones.

Hydrogeology: The surface rivers of the Sites are tributaries of the Zhangjiang, and are mainly fed by springs and subterranean rivers. The groundwater exists in a distinct dual structure. Epikarst fissure water, which contains decomposing litter, and underlying groundwater exist simultaneously; the former being characterized by small flow and stable dynamic conditions, the latter characterized by much larger flow and greater variations. Hydrological phenomena are best developed beneath the karst forests. The water retained by the forest is classified as forest retained spring and forest retained swamp water. The former is widespread across the nominated area on the slopes covered by dense karst forest, in dolines and on saddles; the latter is seen in the lower and more subdued terrain forests, and usually accumulates, to form pools or swamp land. Because of these special hydrological conditions in the Maolan karst forest, not only is the replenishment of groundwater and drainage significantly improved, but also the interchange between rainfall, surface water and groundwater is facilitated. They combine to create an environment that favors the karst forest succession and its constituent fauna.

2.a-3-3 Karst Geomorphology

Karst geomorphological types: According to the succession of humid tropical karst hill base, early Chinese geomorphologists have provided up two modes, namely fengcong connecting their base and fenglin isolating on the carbonate surface (Xiong K.N., 1992; Xiong Kangning, 1996). Among humid tropical karst landscapes, cone karst and tower karst are two most typical and representative types. In the Libo Karst, cone karst dominates the landscape as both fengcong and fenglin karst (Fig. 2-7 and 2-8). The cones are symmetrical about their slopes, with an average angle of 45°; their heights range from tens of metres to more than a hundred metres.

Fengcong karst: Fengcong karst is a combination of conical hills and depressions, valleys and gorges, with the proportion of positive landforms being greater than that of negative landforms. Cones are connected at their bases and are of different heights. They have elevation differences that range from 100m to 250m, lowering in the direction of the regional landform slope. This fengcong landscape generates a highly unusual hydrogeology and an abundant forest ecosystem because of its available epikarstic water.

The fengcong-depression karst is characterized by enclosed depressions, which may take any

polygonal shape and have cylinder, v-shaped or basin-shaped sections. The bases of the depressions are at different heights, gradually lowering in the regional landform slope direction, and in some of them dolines have developed. The difference in elevation between cone summits and their associated depressions is from 180 to 300m, while that between saddles and their associated depression bottoms is 50 to 150m (Photo 2-18).

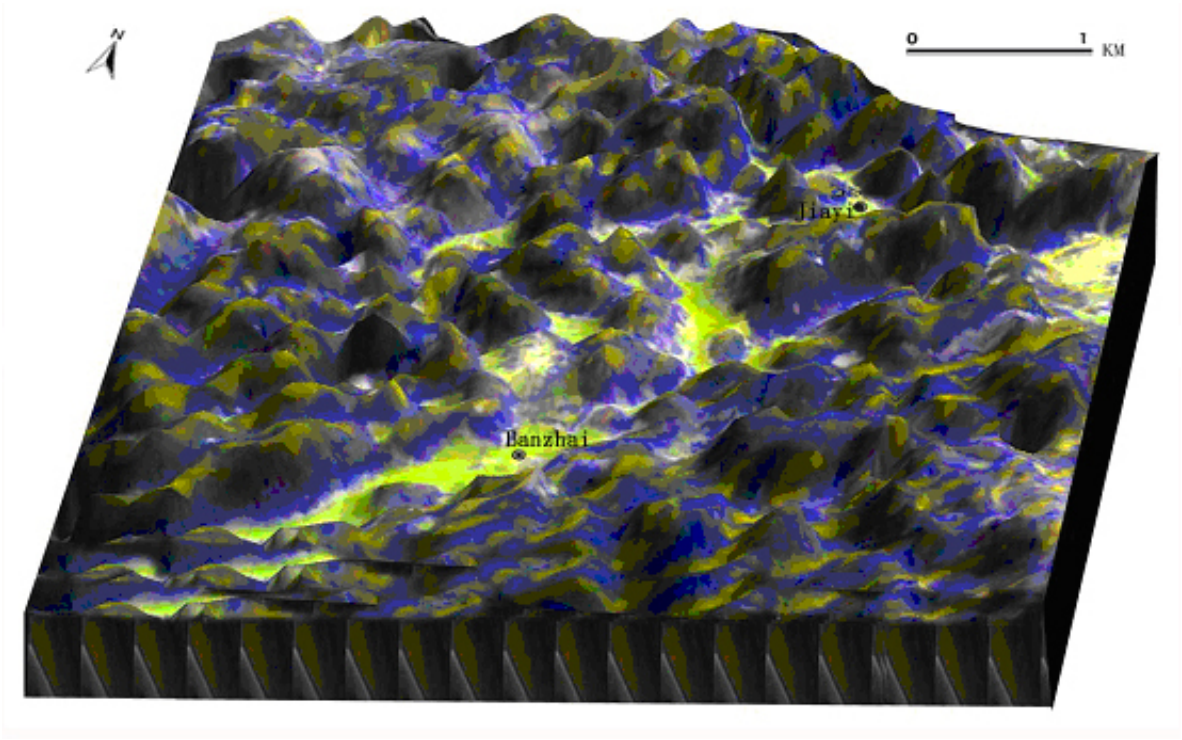


Fig. 2-7 3D image of fengcong karst in the Libo Karst Nominated Sites

The fengcong-valley karst has narrow, flat dry valleys that have evolved from the merging of a series of strike-controlled depressions or from the paleochannels of earlier allogenic watercourses. A few are covered by regolith and slope wash, although most are bare (Photo 2-19).

The fengcong-gorge karst contains fast-flowing rivers in narrow beds, which often have steep gradients. The gorges are the result of plateau uplift and river incision. As a result, alluvial deposits have not developed and the gorges have a “V” shape or vertical sides. At the same time surrounding the depressions on the plateau above the gorges are rejuvenated (Photo 2-20).

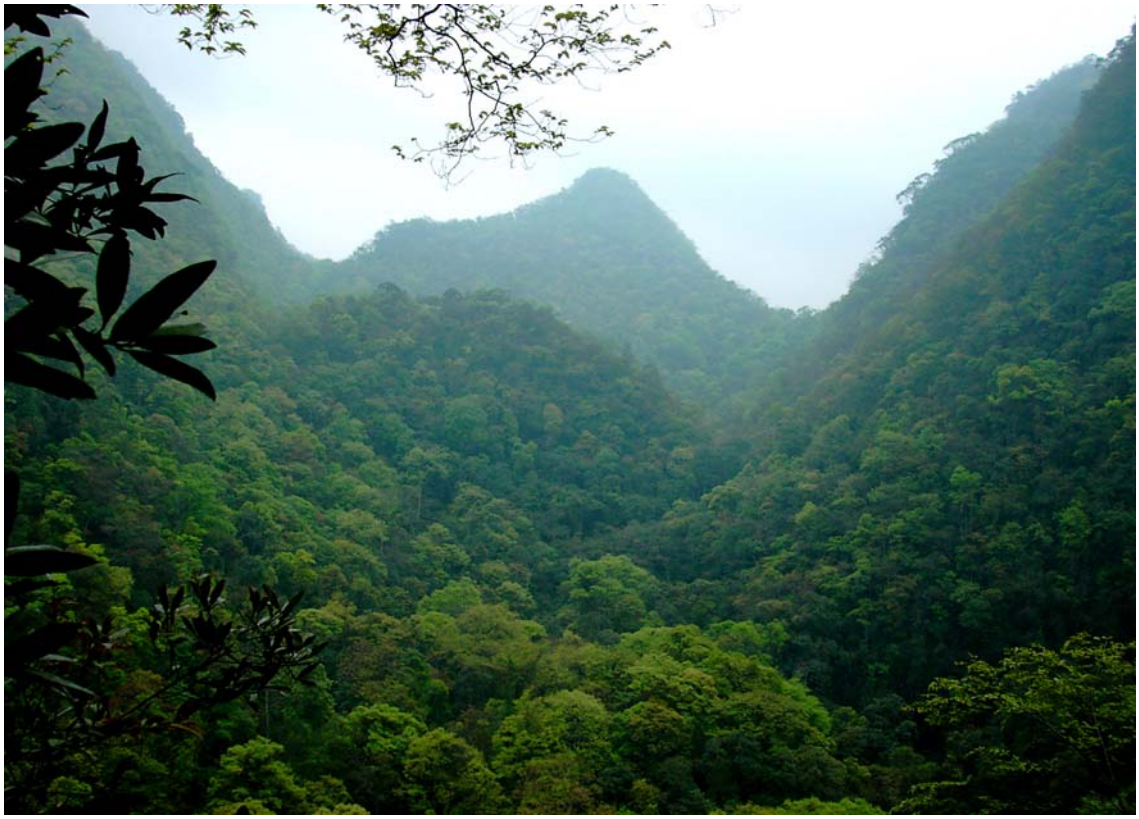


Photo 2-18 Fengcong-depression karst

Photo 2-19 Fengcong-valley karst

Photo 2-20 Fengcong-gorge karst

Fenglin karst: Fenglin karst consists of isolated cones on broad and flat karst peneplains. Here the proportion of positive landforms is much less than the proportion of negative landforms. Isolated cones exist on flat carbonate rock surfaces. They do not have any preferred slope direction and their heights above the plain range between 50 and 150 m. The plains are covered by thin regolith. The transition from vadose underground drainage to surface rivers and streams take places here. In this karst are found many surface rivers and lakes, and river caves are well developed in the base of the cones.

Fenglin-depression karst is differentiated by large and shallow-irregular depressions that have level and broad bottoms, the floors of which are covered by thin regoliths. In a number of these depressions dolines have developed (Photo 2-21).

Fenglin-valley karst is characterized by valleys that extend longitudinally. Where these valleys are closed, they can be classed as base level polje. They have formed either by the combination of depressions along the strike, or as river valleys that have resulted from lateral planation, or both. The valley bottoms are wide and flat, and as they approach the hydrogeologic base level have alluvial deposits aroud their margins. Wall springs are abundant these areas (Photo 2-22).

Photo 2-21 Fenglin-depression karst

Photo 2-22 Fenglin-valley karst

Cave systems: In the nominated sites, on the interior plateau and far from the main rivers where there

has not been recent geomorphological rejuvenation, caves formed in the past have often been truncated by the erosion of the karst surface. They have entrances in the cone tops, slopes and bases, are horizontal with numerous branches, and contain extensive speleothem deposits and sediment beds (Fig.2-8). Near the main rivers where the terrain is steep, subterranean rivers have formed caves that are deep, long and large. There are also multi-level caves with entrances on the gorge walls and in the deep depressions. Where the caves intersect the karst watertable, they can be long, large and horizontal (Zhang Yingjun, Miu Zhongling, etc., 1985). The highest and intermediate caves are widespread in both fenglin and fengcong karst, and are associated with two old rest levels of the watertable at 1100m and 800m. The caves below 800m were formed on the slopes in the upper parts of depressions, and in some have stream sink entrances. Within the caves, the colour of the speleothems gives guide to the period in which they were deposited, with red speleothems being formed in the Cretaceous, grayish brown-tawny speleothems being formed from the Tertiary to the early Quaternary, while grayish white-grey formations have been formed since. Two of the long caves are described in the following paragraphs.

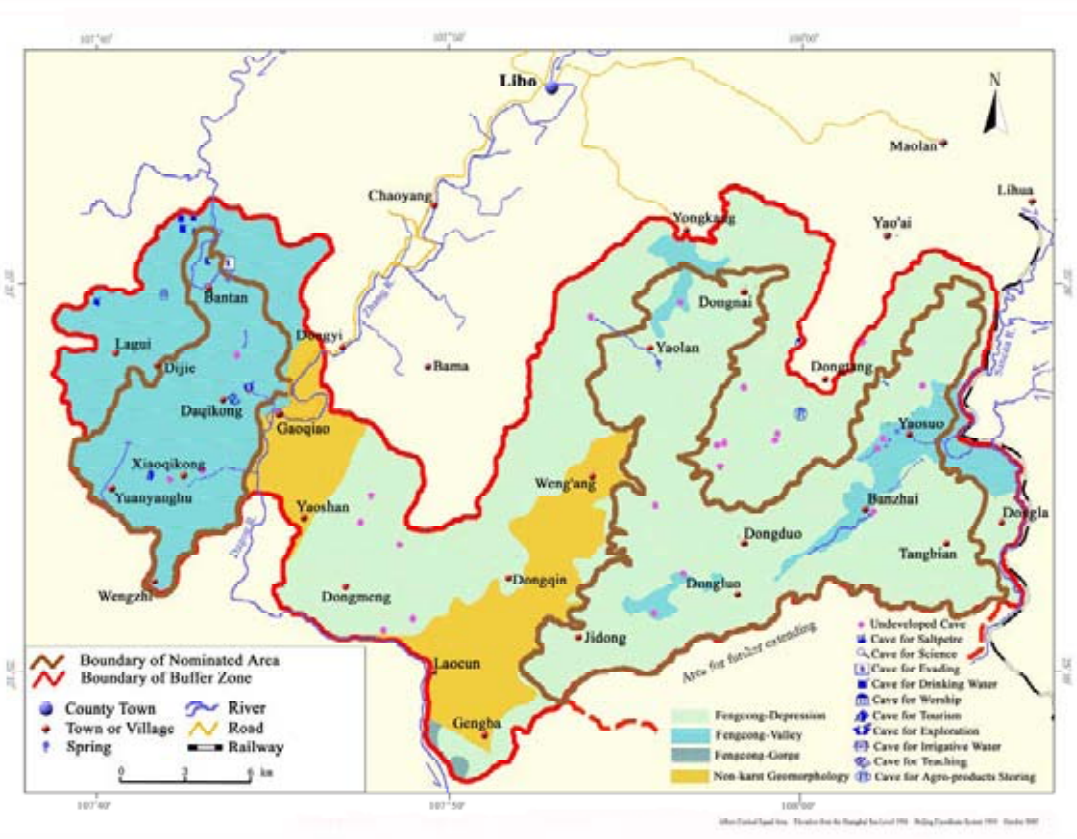


Fig. 2-8 Karst landform and cave distribution of the Libo Karst Nominated Sites

Daqikong Cave, the length of which is 11.2km, forms part of the combined surface and underground

watercourse of the Fangcunhe. In the nominated area, the Fangcunhe has developed a meandering fengcong-gorge 100m deep and 10-20m wide with forests on its banks; the river then sinks into the Daqikong Cave (Fig. 2-9). In the first 1.5km of the cave, there are four waterfalls, then the river flows into a cavern 700m long, 70-80m wide and 50-70m high containing a lake. Above the lake are karst windows and there are a number of passages leading from the lake. The cavern walls and ceiling are decorated with colorful displays of speleothems. After the cavern, the Fangcunhe again flows on the surface to form an attractive gorge containing a series of lakes with primary subtropical forests on their shores. In its lower reaches, the valley floor broadens, the riverbanks are covered in dense forest, and the river sinks and resurges several times. In the caves formed by the river, there are waterfalls and lakes. Finally, the Fangcunhe joins the Zhangjiang as a waterfall. At this location, the Zhangjiang flows in a deep gorge and through a 60m high natural bridge.

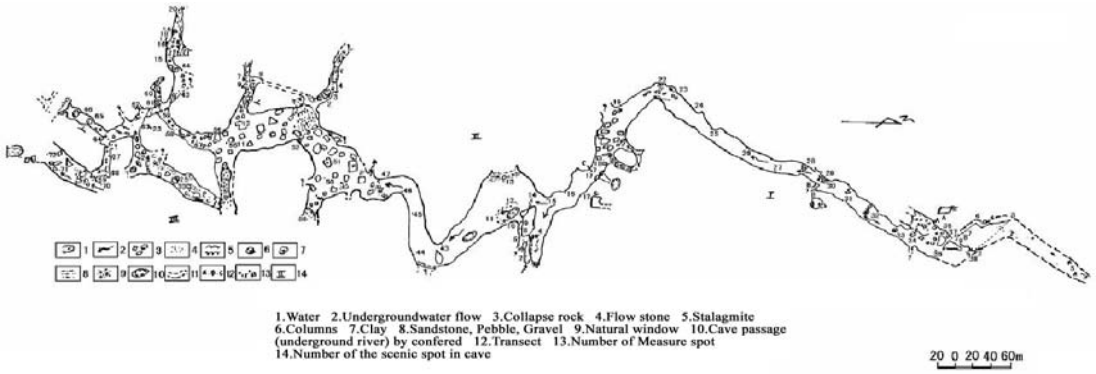


Fig. 2-9 Plan of Daqikong Cave of the Libo Karst Nominated Sites

Dongge Cave entrance is located in a fengcong karst depression at an altitude of 680m. The surveyed cave length of the cave passages is 1107m. Its passages are 3-55m wide, 2.5-30m high and descend relatively steeply (slope angle of 5-7°). There are several short drops in the cave passages. The cave has developed on two levels, at 650-660m and 560-570m. The floors of the section above 650m are flat and the southwest trending passage from the entrance branches. From here the northwest branch is steep and descends in short drops to the lower passage. The southwest branch is steep with smaller passages also leading to the lower passage. The floor of the lower passage contains breakdown material that is covered in calcite decorations such as flowstone and dripstone. Both ends of this passage are blocked. Throughout the cave intermittent seepage waters have coated the floors with flowstone covered with micro-rimstone dams; occasionally amongst the flowstone are found nests of cave pearls (Ran Jingcheng and Lin Yushi, 2005) (Fig. 2-10).

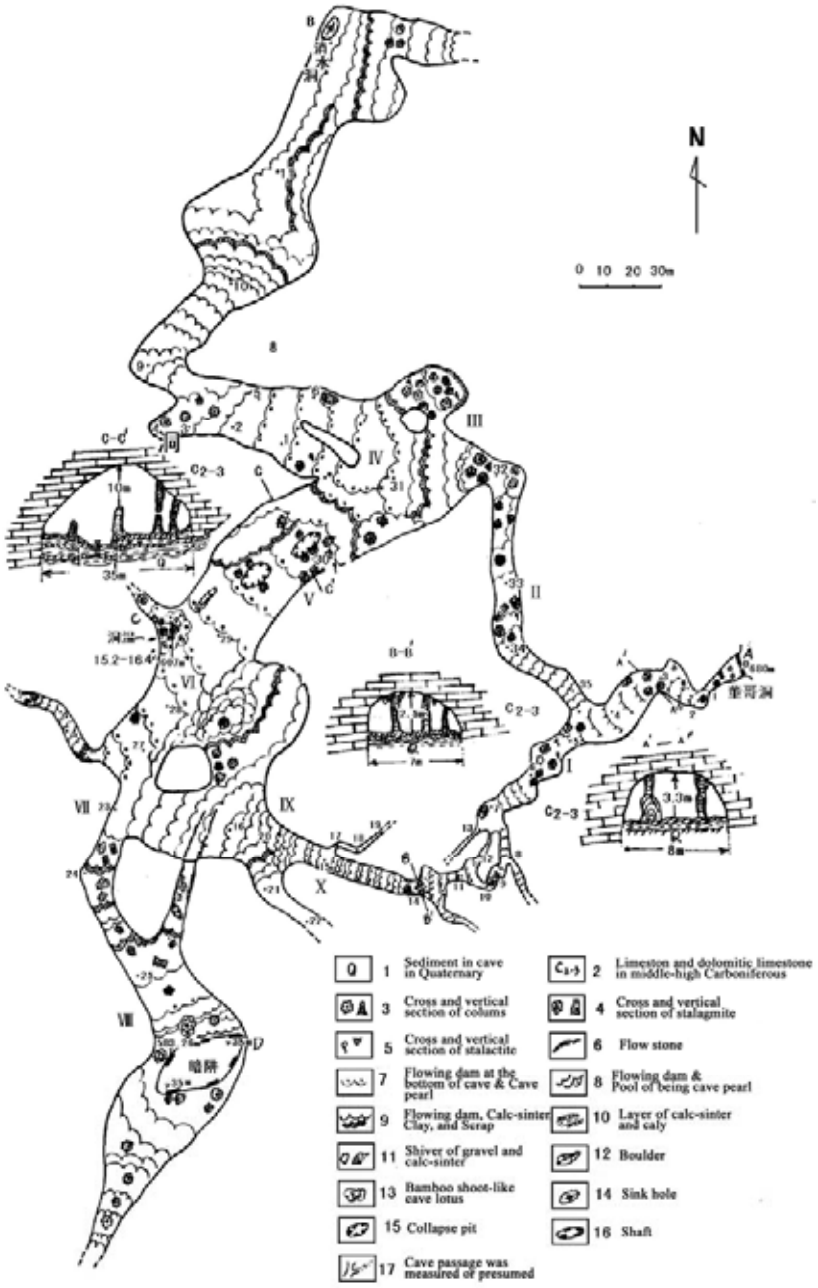


Fig. 2-10 Passage plan of the Dongge Cave (Ran Jingcheng and Lin Yushi, 2005)

The information of abrupt monsoon change 120-110 Ka ago kept in speleothems of Dongge Cave has made Libo nominated sites well known to the world. Studies published in *Science* established the geological chronology of a cave stalagmite from Dongge Cave that commenced growth just after Dali Glacial Period. The stalagmite deposition layers showed rhythmic variations over 160,000 years and provide a continuous climatic record. The oxygen isotope record from this stalagmite (5-year-resolution) has also provided a history of variations in the Asian monsoon over the past 9000 years. The cave also has great biological significance, with more than 20 new species of cave-adapted fauna being collected in it (Daoxian Yuan, Hai Cheng, R.lawrence Edwards, etc., 2004).

The caves of the Libo nominated sites, their locations in the karst sequence and the secondary mineral deposits they contain have added significantly to the understanding of the evolution of this complex karst landscape.

Karst distribution: The karst development on the west and east banks Zhangjiang provides different examples of cone karst development. In both cases, regular changes from uplift in the Quaternary show the changes that take place in karst landscape from watershed to the erosion/corrosion base level that is at major river levels.

The cone karst in the west bank of Zhangjiang is distributed on the S-N Dushan “box” anticline; extending from the watershed near Mawei in the east to the Zhangjiang valley in the west, the linear distance and landform elevation difference are approximately 50km and 720m respectively. Trending eastwards from the plateau around Mawei, the cone karst has undergone rejuvenation from fenglin-valley to fengcong-valley to fengcong-depression to fengcong-gorge. Xiaoqikong subterranean river runs beneath the whole area, descending in a series of short drops; a knickpoint in its lower reaches forms a huge waterfall. The plateau surface is preserved in the upstream catchment, where cone summits of less than 100m are isolated in wide and flat valleys and basins. The early planation surface has been subjected to erosion by shallow groundwater, slope runoff and weathering denudation. The side slopes of the cones have retreated in parallel, the result being gradual erosive lowering of the cones so that the slopes have been reduced to 42°-48°. To the southeast, around the middle and lower reaches of the Xiaoqikong river (from Huanghou to Yanyang Lake), the karst has changed to fengcong-valley and fengcong-depression. Here the groundwater level suddenly drops 80m. The consequent increase in vertical seepage from groundwater input and from the karst surface has resulted in the depressions and dolines that become progressively deeper. The cones here are mostly clustered, and exhibit an increased height and slope gradient (52°-58°). From Yuanyang Lake to the lower reaches of the Xiaoqikong river, the fengcong-depression karst has deeper depressions and fengcong-gorge karst. Along with the increase of the subterranean river flow, its gradient and even greater seepage distance from the karst surface, dolines and sink holes have developed in the depressions. The height difference here between cone tops and depression bottoms increases to 300m-450m, and the breakdown of some cone slopes has produced cliffs (Fig. 2-11).

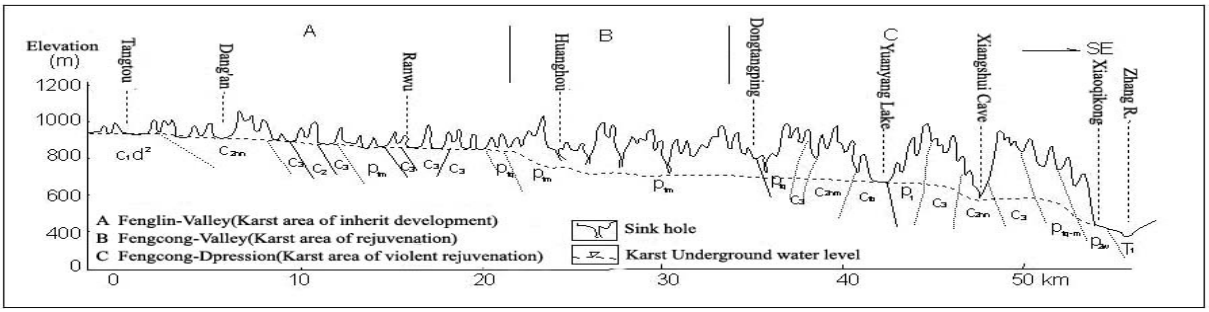


Fig. 2-11 Geomorphological section in the Libo Karst Nominated Sites
(Xiaoqikong Scenic Spot, western part of Zhangjiang River)

Cone karst evolution on the eastern bank of the Zhangjiang is different. The fragmentary rocks of the Jiusi Formation (lower Carboniferous) are largely bare, only occasionally covered with shallow soil. The Sanchahe, although deeply incised into the fragmentary rocks, has not lowered the karst groundwater level. The groundwater profile is concave from the western catchment to the eastern Sanchahe valley; the ancient planation surface of the upper reaches of the western catchment has been eroded to develop rugged fengcong-depression karst. The groundwater lies deep below this surface. Vertical infiltration on the karst surface has deepened the depressions; the height difference is 250-400m from cone tops to depression bottoms, with a slope angle of 55°-58°. In the middle and lower reaches (Yaosuo Areas), some areas of the karst belong to the fengcong-valley form, while other areas belong to fenglin-valley, with cone heights of 150-250m and average slope angles of 42°-48°. Within the nominated areas, caves are found at four levels in the cones, testimony to cone karst evolution and change since the Neogene. From the base of the cones, the caves are found between15 and 20m, 50 and70m, 100 and 130m the highest caves are found between 220-240m. In these, there are violet-red travertine and grit deposits in the highest caves, which are the peneplain sediments from the late stage of the Pliocene (Fig 2-12).

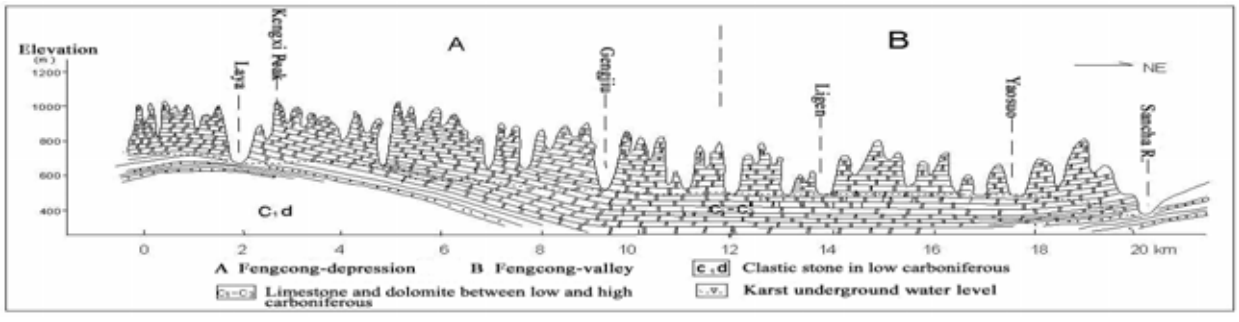


Fig. 2-12 Geomorphological section of the Libo Karst Nominated Sites
(Maolan Nature Reserve, eastern part of Zhangjiang River)

History of karst development: About 570 million years ago the Xuefeng Movement uplifted the Jiangnan paleocontinent and started the first development phase of geomorphological significance for karst

development in Guizhou. The Jialidong Movement occurred 400 millions years ago, after the Cambrian, uplifting the centre of Guizhou and resulting in intense karstification of the earlier middle and upper Cambrian strata. Consequently, the lower and middle Palaeozoic sedimentary strata are lacking, and the Carboniferous and Permian strata rest unconformably on the middle and upper Cambrian strata. The above stratigraphic evidence shows that associated with the Jialidong Movement was an extensive karstification phase. During the Triassic (190 millions years ago), Guizhou was uplifted by the Indo-China Movement and the periods of marine invasion ended. Finally, the Yanshan Movement (65 million years ago) not only uplifted Guizhou further but also produced a period of folding and faulting which began a new phase of karst development. After experiencing this great length and intensity of intermittent karst development, the framework of the present karst landform had been established (Guizhou Regional Geology Investigation Group, 1982; Yang Mingde, 1993).

The next phase to follow was one of fold-fault block mountain-basin formation. As the Pacific plate converged with the China plate during the late stages of the Cretaceous through to the middle stage of the Tertiary, western compressive forces predominated; this was the Yanshan Movement. Later during the late Cretaceous-Oligocene, block movement resulted (the Himalayan Movement). As a result, of these activities, tectonic basins were broadly developed, further creating a hilly geomorphology. In that time, the Tropic of Cancer was located further north, the Tibetan Plateau had not been uplifted and the Guizhou climate was controlled by the subtropical anticyclones. Thus, corrosion-erosion processes were strong and the Libo highlands were gradually eroded, and the resulting sediment accumulated in the lower tectonic basins, creating a terrain that was planate. In the first “Planation-Daloushan Phase”, the present highest-level planation surface was developed and this is shown by the relict planation at 1000-1100m and its associated residual hills.

Then a phase of fengcong-fenglin karst development followed in the Miocene during which the Libo highlands were again uplifted, faulted and planated. In the Pleistocene, the compression force of the Pacific Plate converging with the China Plate remained consistent so Guizhou stayed relatively stable. Although block movements were greatly reduced, the on-going planation processes were widespread. After a long period of planation, broad and undulating karst peneplains were formed. At this time, because of the disappearance of the subtropical anticyclone and intensification of a monsoon temperate-humid climate,

karstification was again active, so many complex caves developed. This phase was the most active karstification phase of the middle Cenozoic, forming the “Shanpen Phase” land surface that is characterized by giant fengcong depressions, poljes and fenglin-valleys. Many karst surfaces were covered by a red regolith formed by the extensive planation processes in the low altitude and humid-hot climatic conditions.

The final phase of the historic karst development was the plateau-gorge formation that has taken place since the Quaternary and which continues today. The northwestern compression forces of the Pacific Plate as it converged with the China Plate led to major intermittent uplifts from west to east of 760 to 600m, accompanied by some up and down fault block movement. Against this tectonic background, rivers incised deeply and rapidly to form gorges. Many rivers were characterized by knickpoints and the deeply incised gorges were found below these. While some planate plateau surface landscapes remained in the upper river catchments, other land surfaces were incised to form hilly plains. The present majestic plateau-gorge landscapes of Libo are features of this phase.

The cone karst evolution model: The evolution of the nominated sites’ landscape follows the basic pattern of all humid tropical-subtropical cone karst evolution. The model reflects the whole spectrum of the complex geological-climatic environmental changes with time.

Where the karst watertable is deep and there is flow in the deep conduits, a hydrodynamic system exists where water movements are relatively confined, especially in the vertical movement of water (Fig 2-13 A, B and C). At this time, dolines start to develop on the surface and between them low flat-topped cones. As the landscape develops further, the dolines become depressions and the cones loose their flat tops, adopting their traditional shape; eventually the depressions develop their characteristic polygonal shapes. Although erosion continues and overall the terrain is lowered, if there is a long relatively stable phase in climate and tectonic activity, the fengcong-depression karst will exhibit a state of dynamic equilibrium (Fig 2-13 C). That is, depression area, cone volume and slope, and the height difference between cone tops and depression bottoms, also remains relatively stable. During this phase, the weathering residuals from the cones accumulate in the depressions. Thus regardless of its location, the karst surface is lowered almost uniformly.

Where the karst watertable is shallow, such as on the plateau surfaces where there is either no surface water, or where surface waters are confined in rivers and isolated from the limestone, for example, in valleys and poljes (Fig 2-13 D). The hydrodynamic environment will be diffuse. In this situation, the watertable fluctuates with rainfall and the vadose zone decreases or increases accordingly. In this case, it is difficult for all the runoff to penetrate the karst due to the low hydrodynamic gradient that results in low flows and diffuse replenishment routes. In this environment the cave development, the spatial distribution of karst aquifer and its water capacity are relatively uniform. Under these circumstances slope wash and other soil movements become the most active karst processes. Because there is poor but relatively uniform vertical infiltration on the cone slopes, the vadose zone becomes the main guide for karst development. By the end of this stage, a fengcong-depression karst has started to become a fenglin-depression karst.

Where the karst watertable is extremely shallow there is erosion by surface water, as in poljes, and a converging hydrodynamic environment is formed (Fig 2-13E). The fluctuating vadose zone is largely replaced by a fluctuating surface water zone. This zone is less active in karst development than the fluctuating vadose zone. Variations in an extremely shallow watertable can be large, in the rainy season the watertable can rise to the surface after only one or two heavy rains since all surface water rapidly enters the aquifer. Therefore, when compared with the input of endogenic and allogenic water, slope wash and other soil movements that cause karst development may be negligible; lateral erosion at the saturated surface zone thus becomes the main agent in karst landscape development. Alluvial and lake deposits accumulate more rapidly, which not only prevent eroding infiltration of surface water, but also provide a powerful processes for lateral mechanical erosion. This hydrodynamic environment leads to undermining of the cone slopes, which collapse and lead in time to the transformation of cones to towers. A final stage of these karst processes is the development of a flat bedrock surface around the cone or tower and flat, broad alluvial plains covered by thin regolith. The earlier fenglin-depression karst has arrived at its final stage a fenglin-plain karst.

To the right of fig. 2-13 E the watertable is show dropping – a situation that occurs as the land is uplifted and the major rivers incise deeply. This produces a very aggressive hydrodynamic environment with the formation of fengcong–gorges, deepened depressions adjacent to the gorge and deep wet caves.

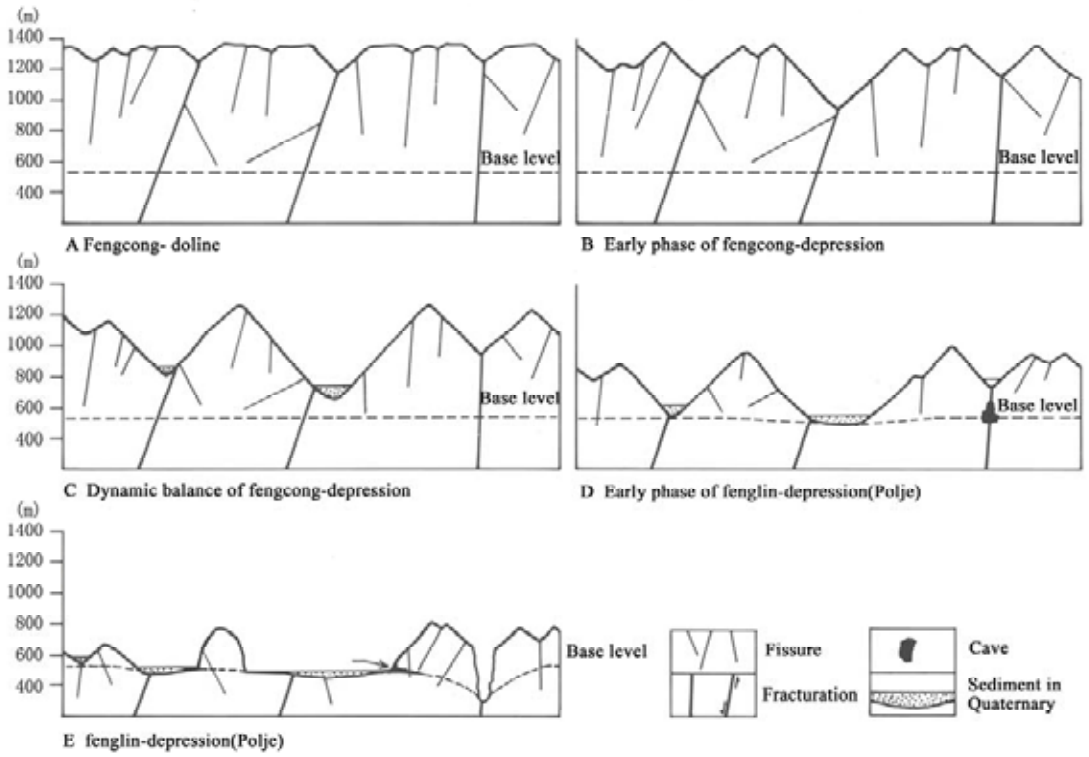


Fig. 2-13 Evolution of the cone karst in Libo Karst

2.a-3-4 Ecosystem

Within the nominated Sites, plants are drought hardy, lithophilous and calciphilous. These combine with a complex array of fauna and significant local peculiarity, to develop a typical subtropical plateau karst ecologic succession (Guizhou Forestry Bureau, 1987). There are 11 species belonging to climax community, not only ancient and relict of plant environment is reserved, but also the endemic local species and communities also are developed and evolved (Table 2-1, Photo 2-23 and Fig. 2-14).

The primary karst forest as Libo is not found elsewhere at the same latitude and altitude. It is located in large reserves such as the Maolin Virgin Forest, listed by UNESCO in 1996 into the World Man and Biosphere Protected Area Network.

Table 2-1 Forest Classification in the Libo Karst Nominated Sites

Group	Vegetation type	Formation
Coniferous forest	Warm coniferous forest	*Pinus keangtungensis* forest
Needle and broad-leaved mixed forest	Warm needle and broad-leaved mixed forest	*Pseudotsuga sinensis*, *Platycarya longipes* mixed forest *Pseudotsuga sinensis*, *Pinus keangtungensis*, *Quercus phillyraeoides* mixed forest
Broad-leaved forest	Evergreen and	*Cyclobalanopsis glauca*, *Platycarya longipes* mixed

	deciduous broad-leaved mixed forest	forest *Platycarya longipes*,*Phellodendron amurense* mixed forest *Platycarya longipes*, *Vinurnum* mixed forest *Handeliodendron bodinieri*, *Acer* mixed forest *Vinurnum*, *Schefflera octophylla* mixed forest *Sterculiaceae*, *Cyclobalanopsis glauca* mixed forest *Taxus cuspidata*, *Lindera* mixed forest *Koelrenteria paniculata*, *Aceraceae* mixed forest *Castanopsis fargesii*, *Elaeocarpaceae* mixed forest
Bamboo forest	Big-cluster bamboo forest	*Dendrocalamus tsiangii* forest

Photo2-23 Libo Karst forest climax community——evergreen-deciduous broad-leaved mixed forest mainly presented by *Cyclobalanopsis glauca*

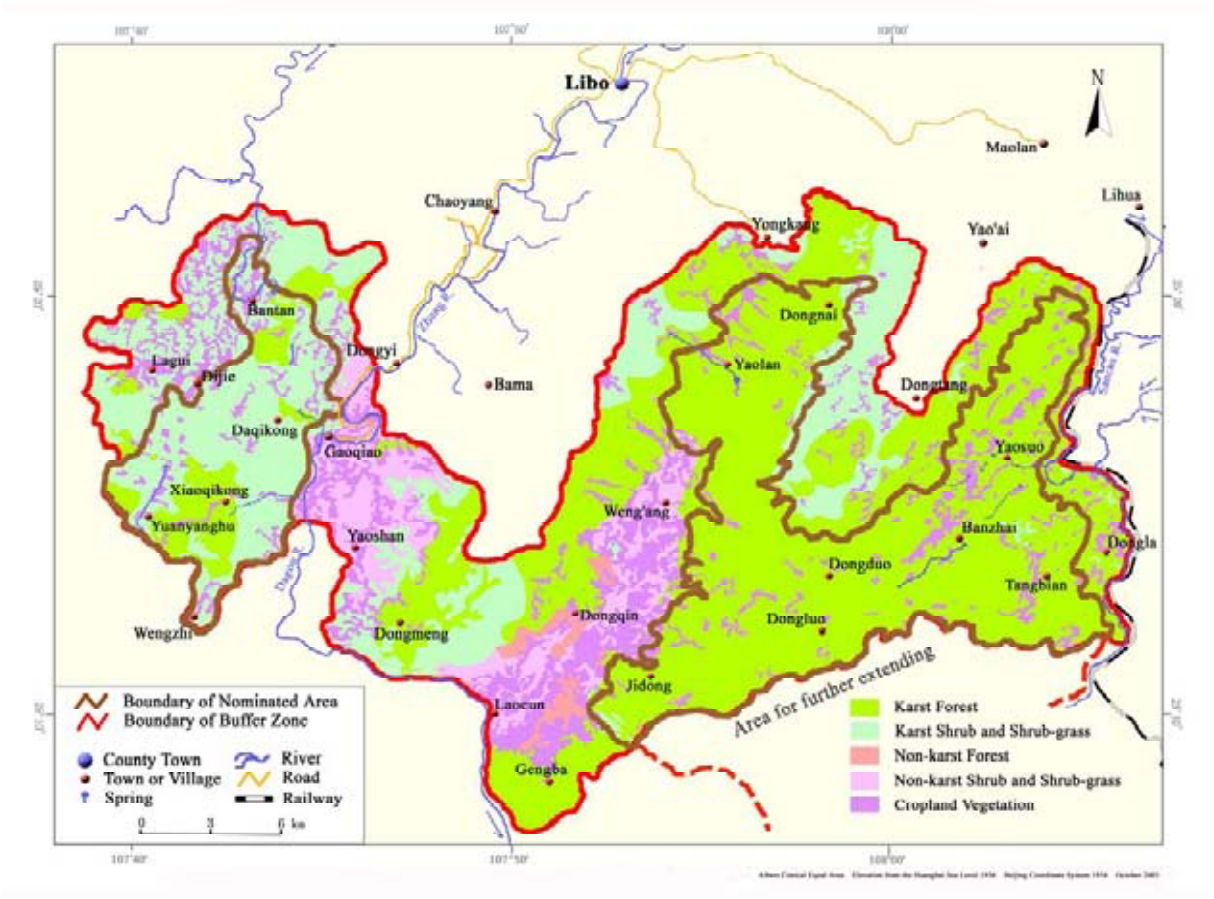


Fig. 2-14 Vegetation of the Libo Karst Nominated Sites

2.a-3-4a Biodiversity

The sites nominated for World Natural Heritage listing have an extremely rich biodiversity that incorporates a total of 1532 species of advanced plants (687 genera and 225 families); as well 314 species of vertebrate fauna, including 59 species of mammal (24 families, 8 orders), 137 species of birds (40 families, 15 orders), 43 species of reptiles (10 families, 3 orders), 32 species of amphibians (8 families, 2 orders) and 43 species of fish (10 families, 5 orders). There are also 1282 species of insects (Li Zizhong and Jin Daochao, 2002), 140 species of land snails, 146 species of arachnids and 10 species of myriapods. Among the plants, there are 144 species of bryophytes (94 genera, 45 families), 212 species of pteridophytes (84 genera, 37 families), 17 species of gymnosperms (12 genera, 6 families) and 1159 species of angiosperms (497 genera, 137 families) (photo 2-24).

Flora: Tropical angiosperms make up 60.6% (284 genera) of all angiosperms in the Libo nominated sites (table 2-2). Among them the subtropical genera are the most numerous, comprising nearly 20.5% of the total, including such species as *Beilschumiedia* and *Cryptocarya* of Lauraceae, *Casearia* and

Diospeyrus of Samydaceae, *Pittosporum* of Pittosporaceae. Temperate angiosperms make up 35.4% (166 genera) of the total, of which the northern temperate genera are the most numerous among them, the north temperate genera are most numerous, comprising nearly 11.7% of the total number of genera, including *Acer* of Aceraceae, *Carpinus* of Betulaceae, *Ulmus* of Ulmaceae, *Viburnum* of Caprifoliaceae and *Prunus* and *Rosa* of Rosaceae.

Photo 2-24 Libo fengcong karst forest ecosystem

Table 2-2 Area Distribution at Genus Level of Spermatophytes of the Libo Sites

Zone	Number of genera	%	Areal distribution of genera	Number of genera	%
Cosmopolitan	28	--	Worldwide	28	--
Tropics and Subtropical	284	60.6	Pantropic	96	20.5
			Tropical Asia to America	13	2.8
			Old World Tropics	45	9.6
			Tropical Asia to Oceania	20	4.3
			Tropical Asia to Africa	23	4.9
			Tropical Asia	87	18.6
Temperate	166	35.4	North Temperate	55	11.7
			East Asia and North America	35	7.5
			Old World Temperate	14	3.0
			Temperate Asia	3	0.6
			East Asia	59	12.6
Mediterranean	2	0.4	Mediterranean, West Asia to Central Asia	2	0.4
			Central Asia	0	0
Endemic to China	17	3.6	Endemic to China	17	3.6
Total	497	100		497	100

Ancient and relict plants, like the ancient Cymnospermae, are represented by 17 species belonging to

12 genera and 6 families. Among them *Pinus keangtungensis*, *Pseudotsuga brevifolia*, *Calocedrus macrolepis* and *Keteleeria davidiana* var. *calcarea* are not only plentiful, but also widely spread on each cone summit and are thus regarded as the dominant species of cone summit karst forest. In addition, some ancient pre-Paleogene species are found in the nominated sites, including *Podocarpus* of Podocarpaceae, *Cephalotaxus* of Cephalotaxaceae, *Amentotaxus* of Taxaceae and *Tetrathyrium* of Hamamelidaceae. *Tetrathyrium* in such large quantities is extremely rare in China, and even in East Asia, thus Libo is deemed the center of its distribution.

Fauna: The fauna found in the nominated sites belongs largely to the Oriental and Palearctic realms (Huang Weilian, Tu Yulin and Yang Long, 1988). There are 248 species of terrestrial vertebrates (not including the 23 species of birds breeding here), representing 34.4% of the total fauna species (719) found in Guizhou province. Among the terrestrial vertebrates there are 202 Oriental species (81.4%), 18 Paleartic species (7.2%), 3 Oriental-Paleartic species (1.2%) and 25 common species (10.1%), thus clearly indicating the predominance of Oriental species.

Of the 201 species of fish found in Guizhou province, 43 species (21.3%) are found within the nominated sites. Not only are the common Chinese species found but also species endemic to the Pearl River drainage system of which the drainage in the nominated sites is a part. These include *Yaoshanicus arcu*, *Crossocheilus bamaensis* and *Parasinilabeo assimilis.*

Among the 1282 species of insects found within the nominated sites, among them are 690 (53.9%), 525 (41%) Oriental-Palearctic species, 9 (0.7%) Oriental species, 5 (0.4%) Oriental-African species, 20 (1.6%) Oriental-Palearctic-Australian species, with the remainder belonging to other transregional species.

Together these encapsulate not only the complexity of the fauna of the region, but also show the endemic nature of some of the ancient and new species.

Within the nominated sites, 121 species of flora (from 67 genera and 27 families) are listed in *IUCN Species Red List* and *China Species Red List*, including 7 CR species, 26 EN species, 50 VU species, 32 NT species, 6 LC species (Fig. 2-15). The 83 seriously endangered plant species endangered are characterized by obvious endemicity, such as *Carya Kweichowensis*, *Michelia angustioblonga*, *Camellia rubimuricata* and *Paphiopedium emersonii.* Of these endangered species, 18 are listed in the World Species

Red List, including the CR species (*Dipentodon sinicus*), 9 VU species, 7 NT species and 1 DD species. There are also 45 species of fauna are listed in *China Species Red List*, including 3 CR species, 4 EN species and 38 VU species. Therefore, the Libo nominated sites possess the richest assemblage of nationally protected species and endangered species (China Imports and Exports Administer Office of Endangered Species, 2001).

Endangered species on Red Lists:

Key to IUCN categories:
CR – critical EN – endangered VU – vulnerable LC – lower risk conservation
NT – not threatened DD – data deficient

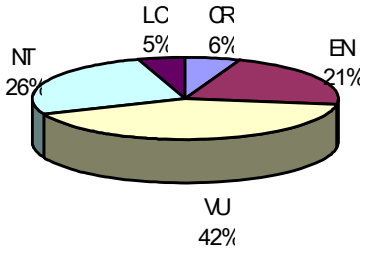


Fig. 2-15 IUCN categories for plant species in the nominated sites that are on Red Lists

Protected Plants: Within the Libo nominated sites there are 112 protected plant species of national importance, amounting to about 43% of the flora of the province (Guizhou Forestry Bureau, 2000). Among them, there are 8 species of class I national protected plant including *Handeliodendron bodinieri*, *Mussaenda anomala*, *Taxus chinensis* var. *mairei*, *Taxus chinensis*, *Orchidaceae Paphiopedilum emersonii*, *Paphiopedilum barbigerum* and *Paphiopedilum micranthum*. There are a total 104 species of class II national protected plants, such as *Pinus kwangtungensis*, *Pseudotsuga sinensis*, *P. brevifolia*, *Calocedrus macrolepis*, *Tetrathyrium subcordatum*, *Trachycarous nana*, *Emmenopterys henryi*, *Liridendron chinense*. Libo is therefore one of China's karst areas with the greatest number of national protected plants and the highest biodiversity, and with high conservation values (Photo 2-25, 26,27,28,29,30,31,32,33,34).

Endemic Plants: There are 8 endemic genera in the nominated sites, namely *Fokienia*, *Handeliodendron*, *Emmenoperys*, *Pteroceltis*, *Eurycorymbus*, *Tetrathyrium*, *Eucommia* and *Zenia* as well as 5 endemic genera having several species, namely *Amentotaxus*, *Calocedrus*, *Ampelocalamus*, *Sargentodaxa* and *Loxocalyx*. All of the above are endemic to China; many of them are nationally protected plants with extremely high conservation value. To date, 41 endemic local species (that is, endemic to Libo karst) belonging to 33 genera and 25 families have been discovered they include 14

species of tree, 12 species of brush, 7 species of liane and 8 species of herb. Some species are representative, namely: *Carpinus liboensis*, *Indosasa liboensis*, *Chirita liboensis*, *Camellia rubimuricata*, *Amentotaxus argotaenia* var. *brevifolia*, *Cryptecarya austro-kweichowensis*, *Zanthoxylum liboensis* and *Rubus liboensis* (Photo 2-35, 36, 37, 38, 39, 40).

Photo 2-25 *Handeliodendron bodinieri* (fruit)
EN of China Red List

Photo 2-26 *Handeliodendron bodinieri* (flower)
Class National Protected Plant

Photo 2-27 *Taxus chinensis* var. *mairei*
VU in China Red List
Class National Protected Plant

Photo 2-28 *Taxus chinensis*
VU in China Red List
Class National Protected Plant

Photo 2-29 *Paphiopedium emersonii*
CR in China Red List

Photo 2-30 *Cymbidium goeringi*
VU in China Red List

Photo 2-31 *Paphiopedium barbigerum*: EN in China Red List

Photo 2-32 *Pseudotsuga brevifolia*
VU in China Red List and World Red List and Class National Protected Plant

Photo 2-33 *Tetrathyrium subcordatum*
EN in China Red List
Class National Protected Plant

Photo 2-34 *Emmenopterys henryi*
NT in China Red List
Class National Protected Plant

Photo 2-35 *Dipentodon sinicus*
CR in World Red List, VU in China Red List

Photo 2-36 *Keteleeria davidiana* var. *calcarea*
VU in China Red List

Photo 2-37 *Carpinus lipoensis*: Endemic Species to the Libo Area

Photo 2-38 *Chirita liboensis*: Endemic Species to Libo Area

Photo 2-39 *Paphiopedium malipoense*
CR in China Red List

Photo 2-40 *Dendrobium moniliforme*
EN in China Red List

2.a-3-4b Animals

Animal species protection: In the nominated sites fauna is extremely diverse. There are 243 species of vertebrates, including 63 species of mammal (24 families), 103 species of birds (28 families), 40 species of reptiles (9 families), 20 species of amphibians (7 families), 17 species of fish (7 families). There are

1282 species of insects, including 125 species of spiders (26 families) 67 species of land snails (10 families) and 53 species of mites (17 families). Among these 35 species are listed in the nationally protected fauna, including 3 species of class I national protected animals, namely *Panthera pardus*, *Python molurus* and *Symaticus ellioti* and 32 species of class II national protected animals, some of which are endemic to Libo such as *Sinocyclocheilus longibarbatus and Sinocyclocheilus marcrolepis.* Additionally, there are 3 CR species, 4 EN species and 38 VU species. There are 48 species endemic to the region, many of which are found only in China. For instance, there are 3 endemic species of bats, namely *Myotis altariu m*, *Myotis daubentoni* and *Ia io*. In recent years, 124 new species have been discovered, such as *Concaveplana maolana*, *Carabus liboicus* and *Pachyprotarsis libona*. Some 13 type species have been found in Libo, such as *Rhopatopsote sinensis*, *Onukia flaoopunctata* and *Conwentzia yunguiana*. The richness in endemic species makes the Libo nominated sites vital to the study of regional flora and fauna, and especially for the study of development, formation and evolution of flora and fauna in karst ecosystems. The outstanding biological endemicity demonstrates the special significance of biodiversity in the Libo Karst (Li Daohong, Luo Rong and Chen Hu, 2001).

Cave fauna: There are 174 species of cave fauna, including 13 species of bats (5 families), 37 species of fish (9 families), 58 species of land snails (12 families), 42 species of spiders (21 families) 10 species of myriapods (6 families) and 14 other species of invertebrates (8 families). It has been shown that cave fauna in the nominated area mainly include land snails, spiders, fish and bats, respectively amounting to 33.3%, 24.1%, 21.3% and 7.5% of the cave species. There are 3 endemic genera, *Sinaphaenops*, *Libotrechus* and *Uniclavellus*, and 17 endemic species, for example *Chamalycaeus libonensis* (Feng Tianjie, Wang Deyi, Li Dongyi, etc. 1999) (Photo 2-41,42,43).

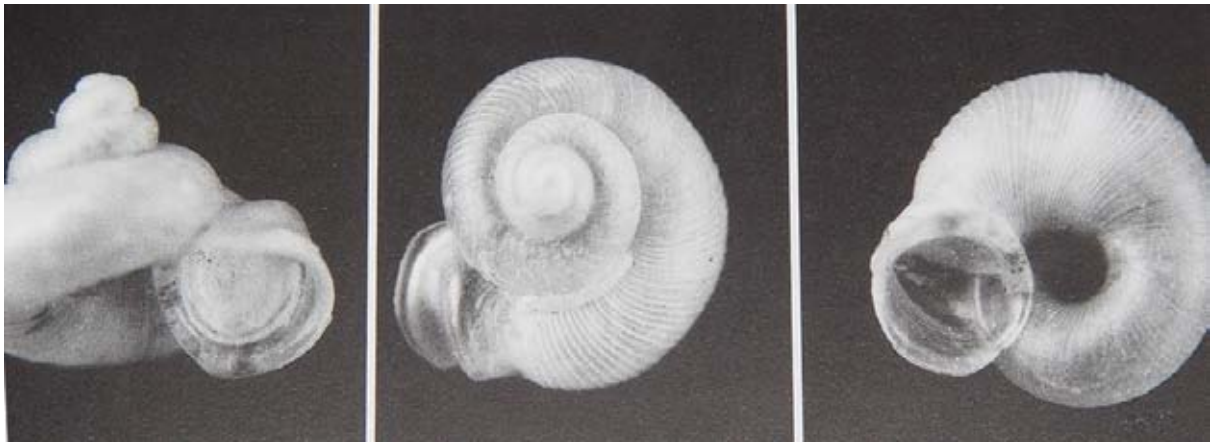


Photo 2-41 *Chamalycaeus libonensis*, a new species: Endemic to the Libo Area

Habitat of protected animals: The extensive primary karst forests within the Libo nominated sites are one of the most important and endemic karst forest ecosystems at this latitude. There are 45 protected animal species here. the number in each IUCN category is 3 CR, 4 EN and 38 VU. There are 38 species endemic to China. Many new species are likely to be discovered, especially amongst the cave fauna. The Libo area provides significant habitat for rare, precious and endemic animals (Fig.2-16).

Photo 2-42 *Hipposideros armiger*

Photo 2-43 *Syrmaticus ellioti*: VU in China Red List, Class National Protected Animal

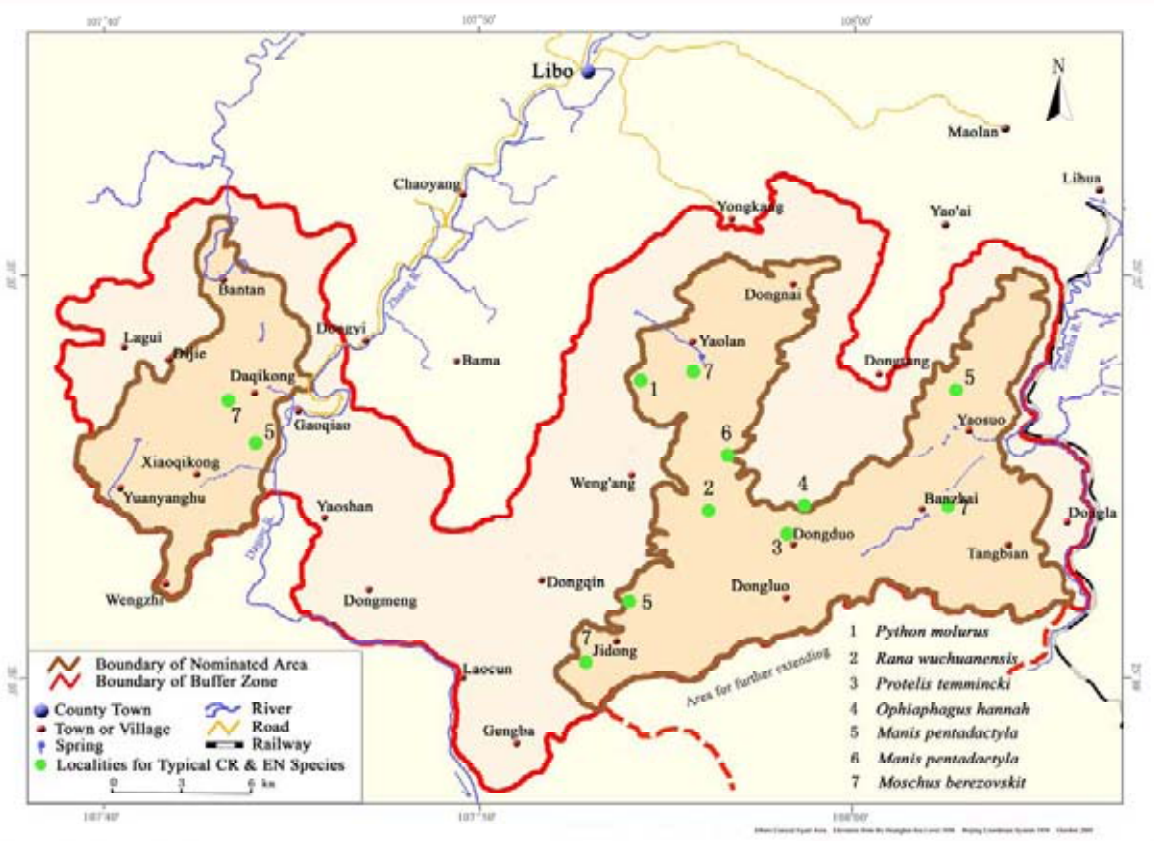


Fig. 2-16 Distribution of typical CR, EN animals of the Libo Karst Nominated Sites

2.a-3-5 Human Activities

The populations in the Libo Karst Nominated Sites and their buffer zone are 5,751 people and 24,747 people respectively. Hence, the population densities in the nominated property and the buffer zone are respectively 19/km^2 and 57/km^2. Aboriginal minorities, such as Buyi People and Shui People, account for 84.2% of the total population. The main activities in the nominated sites are farming, Chinese herbal medicine collecting and hunting. Under the guidance of national laws and regulations and associated policies, these activities have developed along ecologically and culturally sustainable lines. Ecological and folk-cultural tourism have become modern commercial activities for the inhabitants around the nominated sites.

The Shui People of the Maolan Nature Reserve (already recognized as a biosphere reserve) warrant special attention here. They have lived in the Maolan area for a very long time indeed, and have in effect, managed it as a protected area for at least 1,000 years. By focusing on non-timber forest products (foods, medicines, decorative plants and craft materials) they have a long tradition of sustainable forest management. They have an immense pride in their environment, and have given special attention to its

protection. They have a particular concern with prevention of wildfire, constantly display posters and in other ways draw attention to the need for proper fire control (Photo 2-44).

Photo 2-44 Slogans of fire control and forests protection of Shui People in Libo Nominated Sites

They have a unique asset in which they take pride Shui Shu, which is an ancient language passed on for generations. Shui Shu characters are pictographic and similar in form to those ancient characters of the Shang Dynasty (c. 16th century-11th century BC) carved on tortoise shells and animal bones. What is different is that Shui Shu is written on paper. The encyclopedic Shui Shu writings are about divination, local geography, ethics, religion, culture, aesthetics and laws of the ethnic group. Some words are incantations and jargons.

The Yao people in the Libo nominated sites also deserve mention here. Visitors to the Libo area often visit the Yao villages to see their traditional cultural programs of games, dance, music and architectures. They have the highest-profile welcoming ceremony. Dozens of Yao men, dressed in local homespun coarse clothes, stood in a line, each holding a shotgun pointing at the sky. As a leader gave the order, they fired the gun simultaneously. After a short pause and recharge, they held up the gun again, and another bang! Several shots were fired. As such, this adds considerably to the cultural value of the total area.

2.a-4 Wulong Karst (Chongqing)

The Wulong Karst Nominated Sites for the World Natural Heritage are nominated as fulfilling the following criterion to:

(viii) be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

2.a-4-1 Physical Geography

Terrain: The Wulong Karst is located on the lower reaches of the Wujiang in southeastern Chongqing (Fig. 2-17). It is classified as a mid-mountain gorge karst landscape. The Wujiang flows through the central section. The karst terrain slopes down to the Wujiang from south to north. Within the nominated sites, with nearly 2,000m relative elevation difference from the valley bottom to the mountain peaks, a series of stepped landforms can be identified in spite of their deformations by neotectonic movements and modification by river erosion. These landforms are characterized by two planation surfaces, one erosional surface, and multi-layer karst caves in the valley wall which are comparative to the alluvial terraces (Li and Xie, 1999).

Climate: The Wulong Karst has a middle-subtropical humid monsoon climate, which exhibits vertical zonality. Across the nominated sites the mean annual temperature varies from 11.2 to 18.5°C and the mean annual rainfall varies from 870mm to 1215mm. The wet season is from May to October and during it 70% of the precipitation falls, so the annual humidity is 78%.

Hydrology: The rivers that influence karst development at Wulong are the Furongjiang, Yangshuihe and Muzonghe. Furongjiang is the largest tributary of the Wujiang joining it in its lower reaches. The Furongjiang is a deeply incised river; in its length of 160km it drops 1108m; it has an average gradient of 4.8 ‰ and mean flow of 166m^3/s. Within the Wulong karst all surface rivers have deep gorges throughout their courses. This creates a very thick vadose zone in the associated limestone strata, which has a significant role in accelerating multi-level karst development.

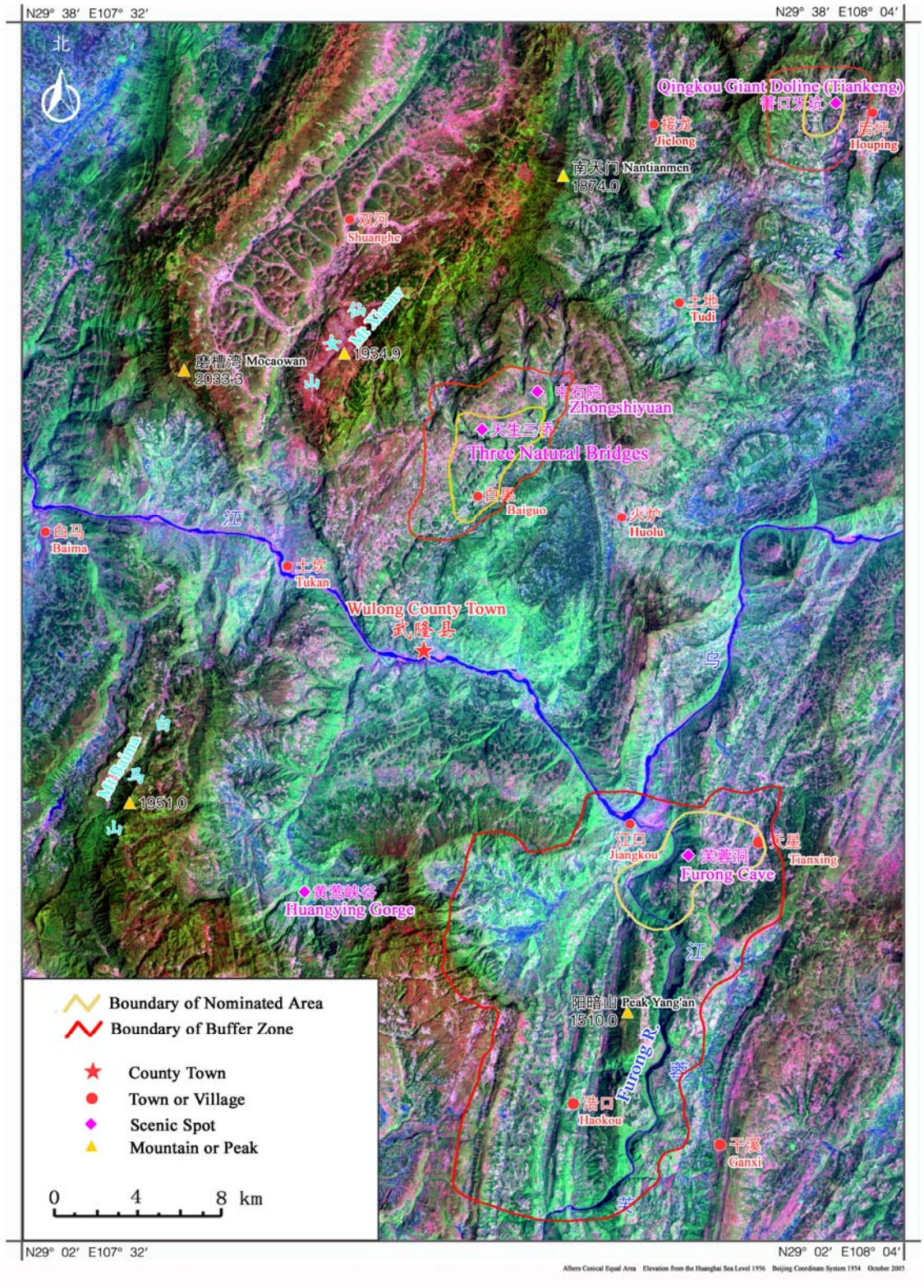


Fig. 2-17 Satellite image of the Wulong Karst Nominated Sites

Soil and Vegetation: Within the nominated sites, are yellow soil, yellow brown soil and alkaline limestone soil. The vegetation is middle-subtropical evergreen broad-leaved forest, deciduous broad-leaved forest, temperate coniferous forest, shrubs and tussock grassland. There are flourish vegetations and

preponderant developmental conditions of zonal karst

2.a-4-2 Regional Geology

Tectonics and Structure: The nominated sites of Wulong Karst are located on the Yangtze Platform, which is tectonically relatively stable. The carbonate rocks were deposited from the Cambrian to the Silurian and then again from the Permian to the Triassic. Because of the Indo-China Movement in the late stage of the middle Triassic, the areas were uplifted. The carbonate rocks were then folded and faulted by the Yanshan Movement of the late Jurassic, which established the basic pattern of joints and faults. The Wulong karst is made up of a series of anticlines and synclines that trend S-N and NE with the Cambrian and Ordovician carbonates outcropping on the anticlines while the Triassic and Jurassic carbonates outcrop on the synclines (Fig. 2-18). The Himalayan Movement since the Cenozoic with its intermittent uplifts, facilitated the formation of multi-level denudation plains, deeply incised gorges and every kinds of typical karst systems.

Strata and Lithology: Cambrian, Ordovician, Silurian, Permian , Triassic and Jurassic in the Paleozoic –Mesozoic carbonate and clastic rocks underlie the nominated sites. The Furong Cave and Houping Tiankeng karst system have developed in the Cambrian and Ordovician carbonates (Fig. 2-19).The Three Natural Bridges have developed in the Triassic carbonates (Fig. 2-20). The total thickness of the carbonate strata is as much as 2000m which provides the karst landform ideal substantial conditions.

Hydrogeology: There are two main aquifer types in the Wulong Karst – one type is in the carbonates and the other in the sand/shale fissures. Their roles are different; the latter contains water, which supplies the former, and provides a dynamic water source for karst development. The carbonate aquifer possesses secondary permeability, so that surface rainfall may permeate and be absorbed. The carbonate aquifer consists of three main zones: epikarst, vadose and phreatic. Between the vadose and phreatic zones exists a zone whose water content changes with the season. The carbonate aquifer can store large quantities of water enabling continuous but variable discharge at the karst springs. The high rainfall, in combination with the thickness of, and steep gradients within, the carbonates, provides the ideal conditions for the development of cave systems containing subterranean rivers.

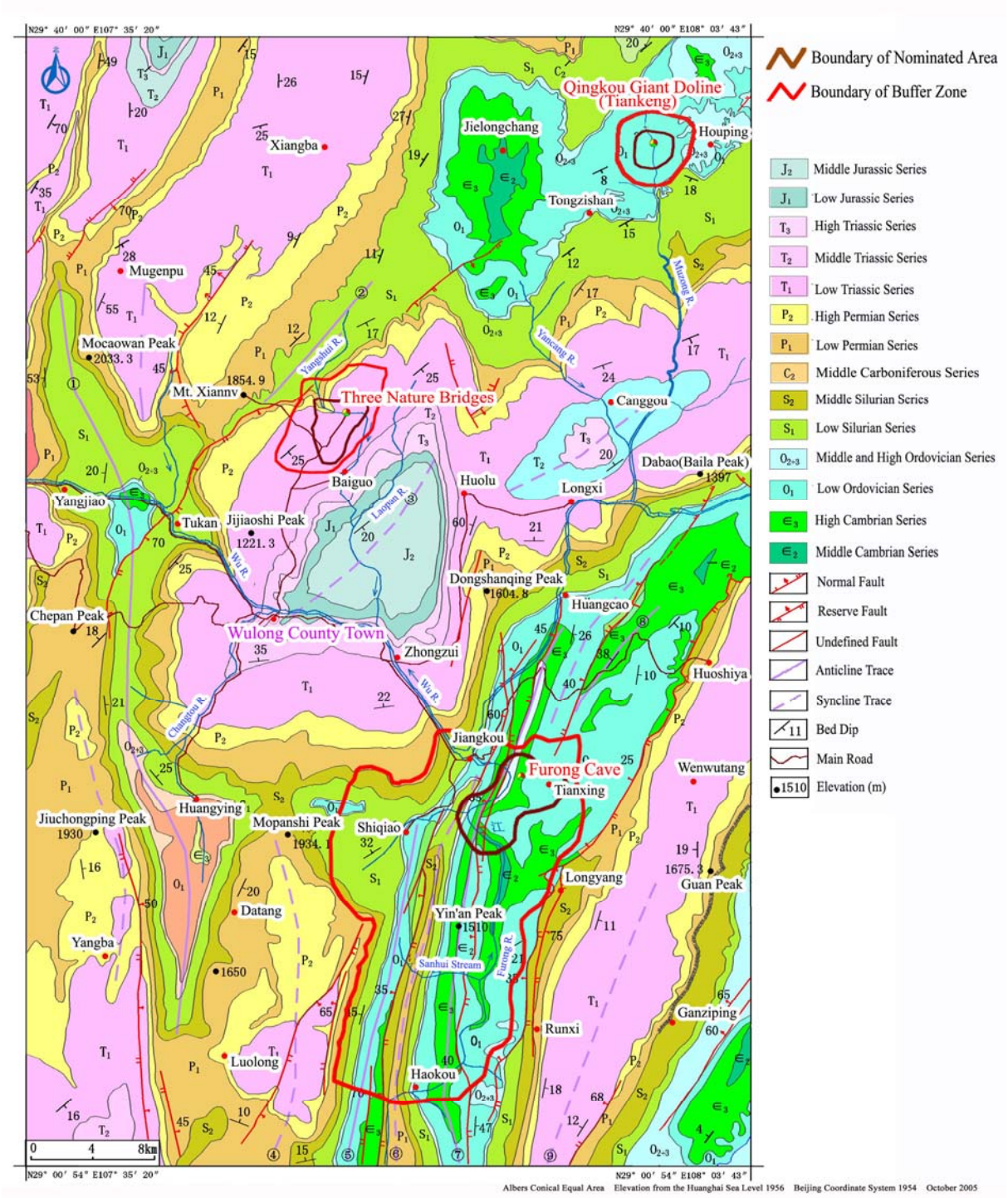


Fig. 2-18 Geology of the Wulong Karst Nominated Sites

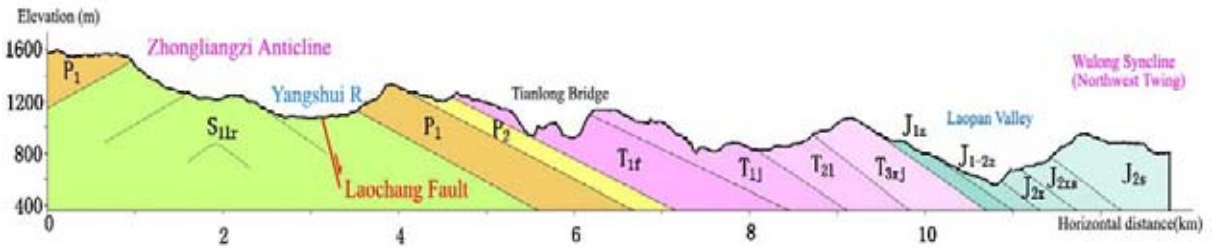


Fig. 2-19 Geological Section of Three Natural Bridges

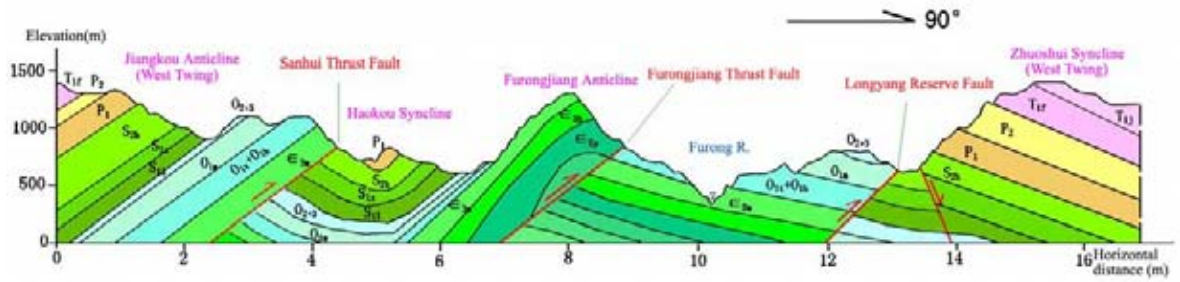


Fig. 2-20 Geological Section of Furongjiang Area

2.a-4-3 Karst Geomorphology

2.a-4-3a Karst Geomorphology Type and Distribution

As a representative of gorge karst in south China, the nominated Wulong Karst sites are characterized by complex surface and underground water systems, thick carbonate strata and a deep vadose zone. In the area, typical subtropical karst landforms are well developed and widely distributed. The multi-level deep gorge karst features are reflected by three impressive karst phenomena.

Furong Cave Karst System: Furong Cave System lies between the left bank of Wujiang and the right bank of Furongjiang (Photo 2-45). The cave system has nine components, with entrances at altitudes between 180m to 1162m (Table 2-3). There are several well-shaped sink holes within an area of 5km^2 of which Furong Cave is the most typical underground karst landform (Photo 2-46, 47).

Table 2-3 Cave Entrance Elevations of Components of Furong Cave System

Name	Qikeng	Shuairen	Weijiangling	Xinlukou	Tongba	Shuilian	Furong	Gangan	Sifang
Entrance elevation (m)	1162	1060	970	900	878	670	480	200	180

Furong Cave: Furong Cave is located in the right bank of Furongjiang and developed in dolomitic limestone and dolomite of the Pingjing Formation of the middle Cambrian ($\in_2 p$). The altitude of the cave entrance is 480m, and at present it is 280m above river level. This will be reduced when the Jiangkou Dam becomes operational. There are 2846m of explored cave passage with huge chambers, whose width and height can both be as much as 80m. The cave is controlled by the strike of the dolomite and NW and NE joints (Fig. 2-21, 22). Due to intermittent techtonic activity in the area there have been many periods of roof

collapse that have modified the cave passages and chambers. At present this process is active in the eastern and western parts of “collapse chamber”. In the western part of the cave the floors are completely covered by giant blocks of rock to a depth of 50m. The catastrophic collapse processes took place in the Paleogene; the present collapses are minor in comparison. The passages up to 20 m diameter that lead to the end of the cave are high in the collapse chamber walls and have elliptical cross sections. There is a shaft at the end of the cave, which connects with another large cavern with depth of 229m and diameter of 10m to 120m that has been modified by collapse (Fig. 2-23).

Photo 2-45 Furongjiang Gorge

Photo 2-46 Doline over the Furong Cave

Photo 2-47 Shaft in Furong Cave

In particular, this section of the cave is rich in dust deposits, sediments and clastic fragments, many of which appear to be of a great age. The tectonic movements and settlement of the floor after massive rock

falls have also cracked or fragmented large speleothem. It is thus a treasure house of evidence that deserves further studies, and which will undoubtedly make a significant contribution to our understanding of regional geo-climatic history. The potential value of this site has obviously been overlooked, and although it has not yet been sampled or fully assessed, its potential research value is probably the most distinctive and important of its multiple values. Of course, this evidence lacks the sheer beauty of the speleothem and these inevitably attract great interest. The speleothem in Furong Cave are varied because it has two very different depositional environments (Table 2-4).

Table 2-4 Speleothem Types and Main Conformation in Furong Cave

Class	Subclass	Main type	Remark
Gravity water precipitation	Drop stone	soda straw, stalactite, stalagmite, columns,	Massive formations
	Flowstone	shield, drapery, curtain, stone waterfall, shawl	giant dimension
	Pool Precipitation	rim stone, flowing dam, cave pearl, raft stalagmite, underwater crystal, dog teeth, crystal cup, cave lotus, coral, finger, raft cone	raft stalagmite and dog teeth are rare
	Splash stone	palm leaf, palm stalagmite, coral, stone grape, stone mushroom	palm stalagmite is famous for greatness.
Fixed water precipitation	Sulphate	gypsum flower, gypsum ear, gypsum coating, gypsum needle, coating	gypsum flower is the most perfect.
	Carbonate	aragonite flower, aragonite needle, calcite crystals, a filiform helictite, a beaded helictite, a vermiform helictite, antler helictite	Dee horn-liked helictite (branch length of 53cm) is the most rare and unique
Associated precipitation		cave lotus, palm stalagmite, raft cone	raft cone and cave lotus are located in the dry pool
Superimposition precipitation		Spindle, stone, lampstand	Early dry pool
Precipitation with same forms and different origin		Coral, stone grape, moonmilk	

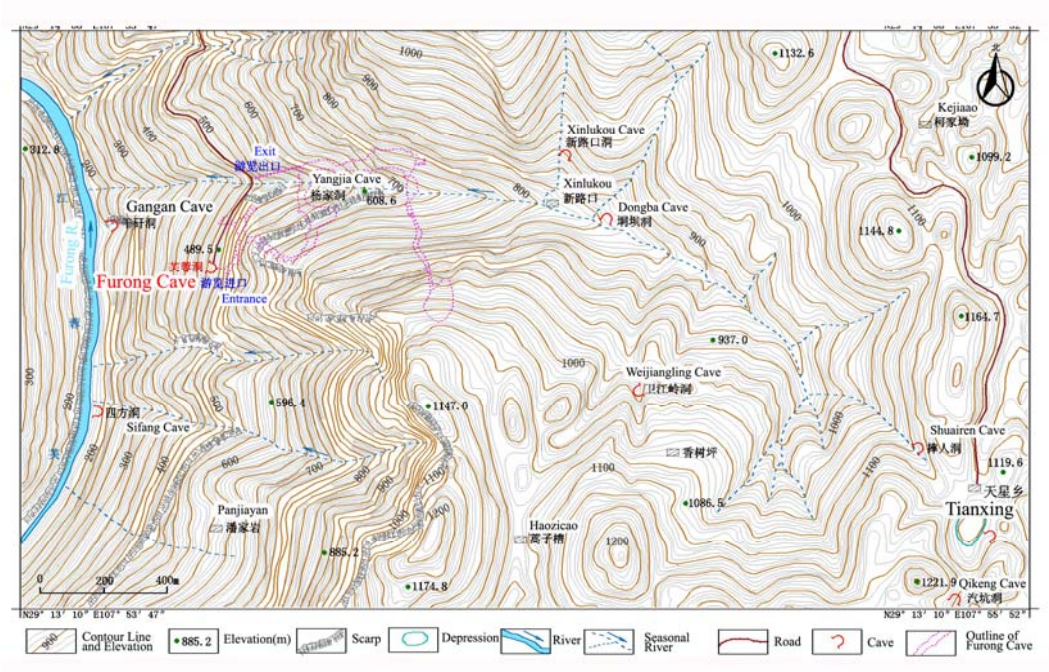


Fig. 2-21 Topography and cave distribution in Furong Cave Area

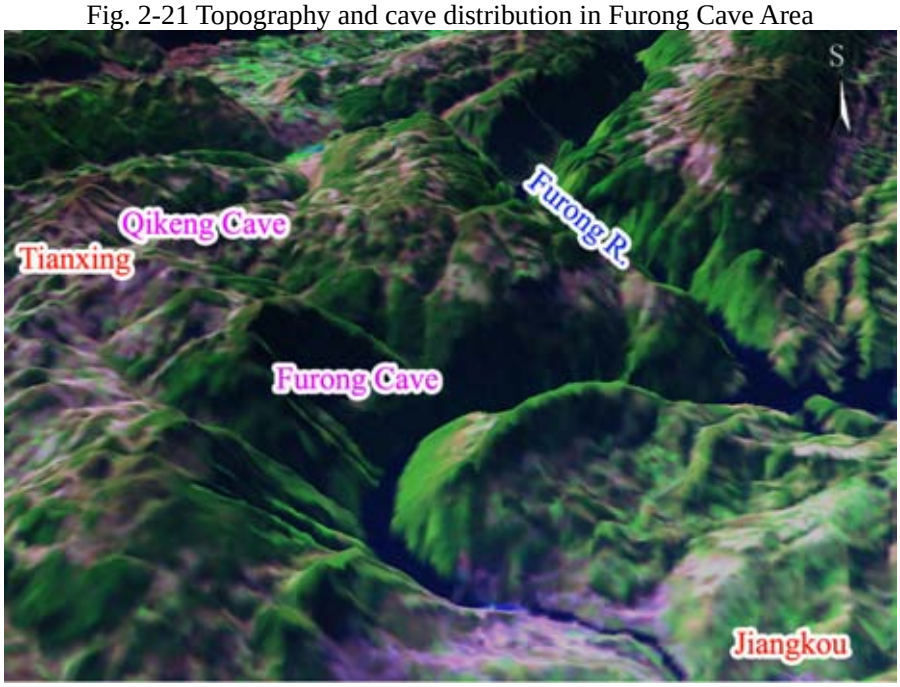


Fig. 2-22 3D Image of karst landform in Furong Cave

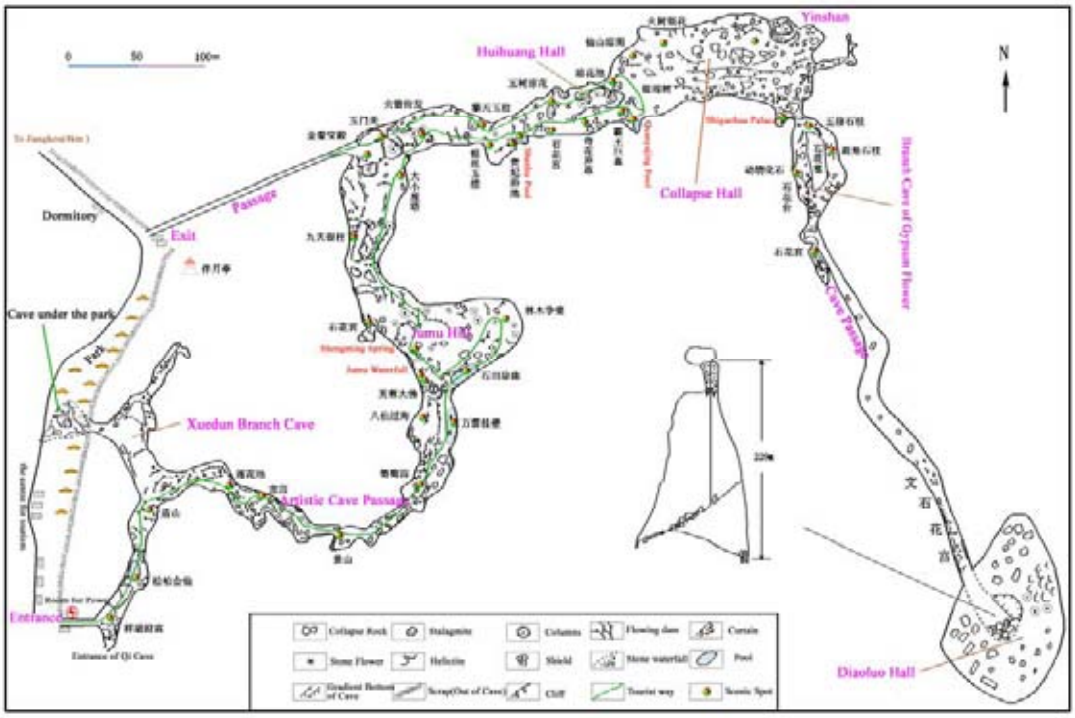


Fig. 2-23 Plan of Furong Cave

From the cave entrance to the huge chambers and passages percolation waters saturated with calcium carbonate have formed immense flowstones, stalactites, stalagmites and columns. In places the saturated percolating waters have collected to form pools, some of which are seasonal. The pools are decorated with a variety of calcite speleothem, for example, spar crystal, cave coral, rafts, lotus flowers and spindles (Photo 2-48). A calcite deposit from one now-dry pool has been dated between 26 and 41 x 10^3 BP. Where the saturated percolating waters have flowed over sloping rocks, shawls and limestone dams have formed. Among the floor deposits are nests of rare cave pearls. Amongst the massive calcite forms many smaller more fragile speleothem are found such as most forms of helictite (Photo 2-49). Deep in the cave 400m from the entrance where there is less exchange with the outside atmosphere there are deposits of the evaporite mineral gypsum (Photo 2-50). In this same section of the cave aragonite anthodites cover the walls. It is extremely rare to find such different depositional environments so close in a subtropical cave.

Photo 2-48 Crystal pool

Photo 2-49 Antler helictite

The pipe cave, parts of Furong Cave are made up of gypsum flower annular branchwork, high passage and Diaoluo Chamber. Within the gypsum flower annular branchwork, the speleothem are typically featured by the following aspects, one is that there is no gravity water precipitation such as stalactite, stalagmite and any flowstone; the second aspect is that aragonite needle scatter on all surface of cave wall; the third aspect is that gypsum is mainly deposited in big fissure and the opening of collapse block; the forth aspect is that large area of antler helictite are discovered in a single cave wall; the latest one is that various and snow-white calcite crystals are discovered in the fissure-shape chamber of the length of about 10m (Photo 2-51). The all above aspects show that this sedimentary environment is characterized by predominating dry fixed water activities.

The higher layer of giant passage is full of various aragonite crystals and calcite crystals. The passage ends are closed by the stalagmite, columns group and drapery as a result gravity water precipitation.

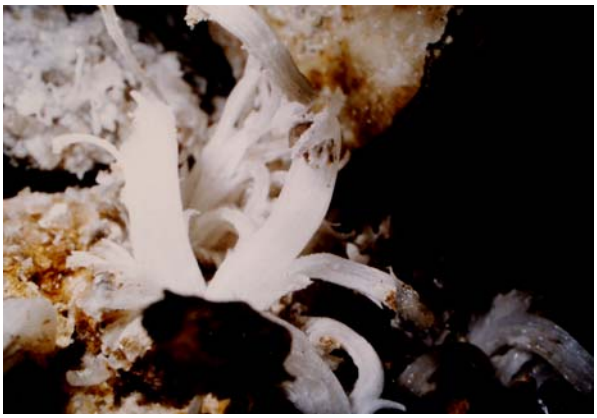


Photo 2-50 Gypsum flower

Photo 2-51 Dog tooth spar

The Three Natural Bridges: This nomination sites include a complete set of natural features, which illustrate the sequence of developments leading to a gorge karst. The Three Natural Bridges are located in the middle reaches of the Yangshuihe. Over a distance of 26km the river drops 1415m producing the step gradient that is required to develop a gorge karst (Photo 2-52). In the process of development of Yangshuihe, the sediments on the top of caves developed Tianlong Bridge, Qinglong Bridge and Heilong Bridge. There are Qinglong Tiankeng and Shenying Tiankeng with huge scale and splendid shape (Table 2-5, Fig. 2-24, 25, 26).

Photo 2-52 The Upper Gorge on the Yangshuihe River

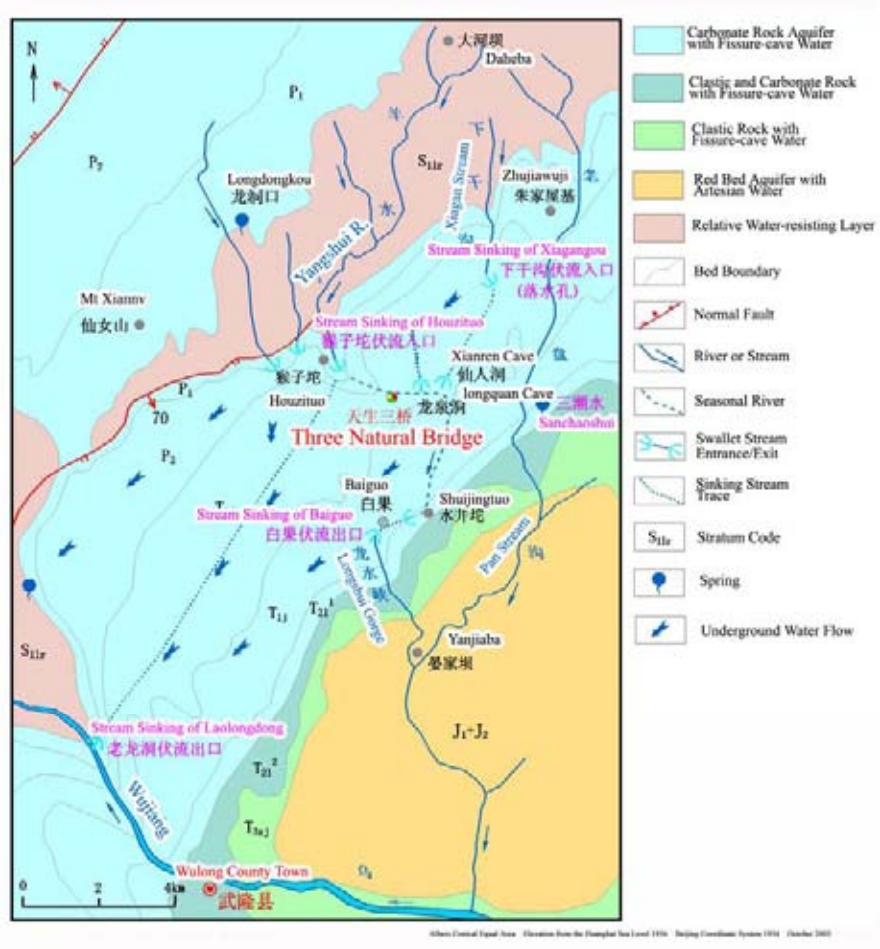


Fig. 2-24 Hydrogeology of the Three Natural Bridges Site

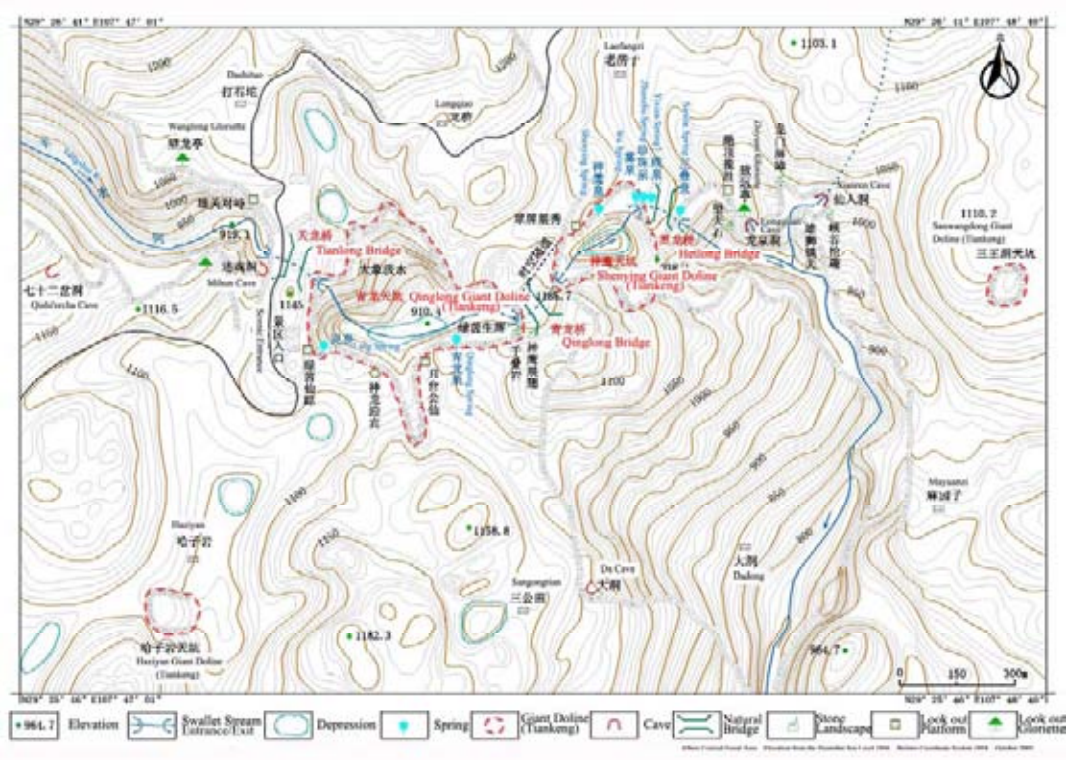


Fig. 2-25 Topography and landforms in the vicinity of the Three Natural Bridges

Fig. 2-26 3D Image of karst landscape at the Three Natural Bridges

Table 2-5 Dimensions of the Wulong and Some Other Chinese Natural Bridges Unit：m

Name	Height	Thick	Width	Average height of arch	Average span
Tianlong Bridge in Wulong, Chongqing	235	150	147	96	34
Qinglong Bridge in Wulong, Chongqing	281	168	124	103	31
Heilong Bridge in Wulong, Chongqing	223	107	193	116	28
Xianren Bridge in Leye, Guangxi	145	78	19	67	177
Xianren Bridge in Jiangzhou, Fengshan, Guangxi	64.5	18.5	38	46	144
Natural Bridge in Zhijin, Guizhou	128	35	55	93	85
Natural Bridge in Shuicheng, Guizhou	136	15	35	121	55
Natural Bridge in Zhongdian, Yunnan	70	--	10	--	200
Natural Bridge in Midu, Yunnan	30	--	17	--	7
Natural Bridge in Lipin, Guizhou	77	40	118	37	138
Xiang Bridge in Luzhai, Liuzhou, Guangxi	55	15	48	40	45

The Tianlong Bridge：The highest altitude of bridge top and lowest altitude of bridge bottom respectively is 1146m and 911m. The bridge is 235m height, 150m thickness, 147m width, 30m～40m bridge span. Tianlong Bridge with giant dimensions is believed as a rare karst natural bridge (Photo 2-53).

The Qinglong Bridge：The highest altitude of bridge top and lowest altitude of bridge bottom respectively is 1186m and 905m, and the bridge height is 281m. The height of eastern arch and western arch respectively is 96m and 110m, so average height is 103m; there are 168m thickness; the bridge span of 13m～58m and average span of 31m. 124m width; there are 800m from Qinglong Bridge to Tianlong Bridge (Photo 2-54).

The Heilong Bridge：The highest point altitude of Heilong Bridge surface is up to 1075m, the bridge bottom altitude is 852m, so the bridge height reaches 223m; the height of the eastern arch and western arch respectively is 141m and 90m, so average height is 107m; bridge span of 16m～49m, and it is wide in the upstream and narrow in the lower reaches, average width is 28m, bridge width of 193m. There are 700m from Heilong Bridge to Qinglong Bridge (Photo 2-55).

Three Natural Bridges not only have grand body, but also remain various water erosion formation such as suspended spring, cave, dissolution pore, etc, which reflect the typical karst genetic background of Three Natural Bridges. The grand Qinglong Tiankeng and Shenying Tiankeng are situated among the three bridges.

The Shenying Tiankeng (Photo 2-56) and Qinglong Tiankeng (Photo 2-57) lie within the Three Natural Bridges nominated site. They are found amongst the natural bridges. Qinglong Tiankeng has the plan dimensions of 522m from east to west and 398m from south to north and hence its maximum area is $19.4 \times 10^4 m^2$. Its maximum depth is 276m giving a volume of $32 \times 10^6 m^3$. Shenying Tiankeng has the plan dimensions of 260m from east to west and 300m from south to north and hence its maximum area is $51.2 \times 10^3 m^2$. Its maximum depth is 285m giving a volume of $7.7 \times 10^6 m^3$. Within The Three Bridges nominated site there is the Xiashiyuan Tiankeng (Photo 2-58). In the same area as the Three Natural Bridges, but not

on the Yangshuihe, lies the Zhongshiyuan Tiankeng (Photo 2-59). It is a broad flat tiankeng covering an area of 28 x $10^4 m^2$, and having a volume 35 x $10^6 m^3$.

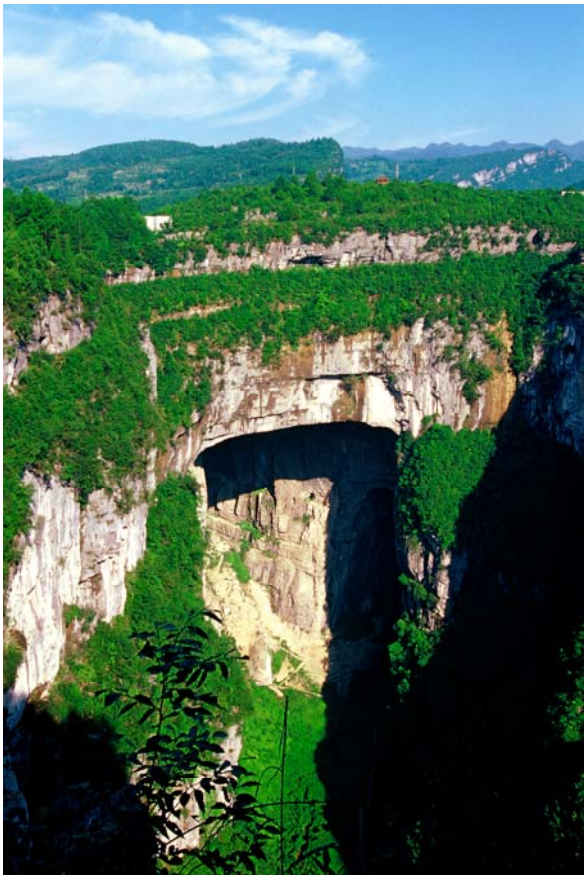


Photo 2-53 Tianlong Bridge

Photo 2-54 Qinglong Bridge

Photo 2-55 Heilong Bridge

Photo 2-56 Shenying Tiankeng

Photo 2-57 Qinglong Tiankeng

Photo 2-58 Xiashiyuan Tiankeng

Photo 2-59 Zhongshiyuan Tiankeng

Houping Tiankeng Karst System: Houping is located on the karst platform of the Wulong Sites catchment at an altitude of 1300m. Because this area has been uplifted collapse landforms have developed on this platform (Fig. 2-27 and Table 2-6). At this site there is a group of tiankengs (giant collapse dolines); associated with them are streamsinks and caves, of which the most typical is Qingkou Tiankeng (Photo 2-60, 61, 62, 63, 64 and 65).

Qingkou Tiankeng: Qingkou Tiankeng has an ellipical cross section with dimensions 250m from east to west and 220m from south to north giving a cross sectional area of 40,754m^2. The highest point of the doline opening of Qingkou Tiankeng is located on the SSW at an altitude of 1100m, the lowest point of the doline opening, on the NW at an altitude of 1000m; the lowest point in the tiankeng bottom is 805m. So the greatest and least depth of the tiankeng are, respectively, 295m and 195m and its volume is 9.2 x 10^{6}m^3 (Fig. 2-28).

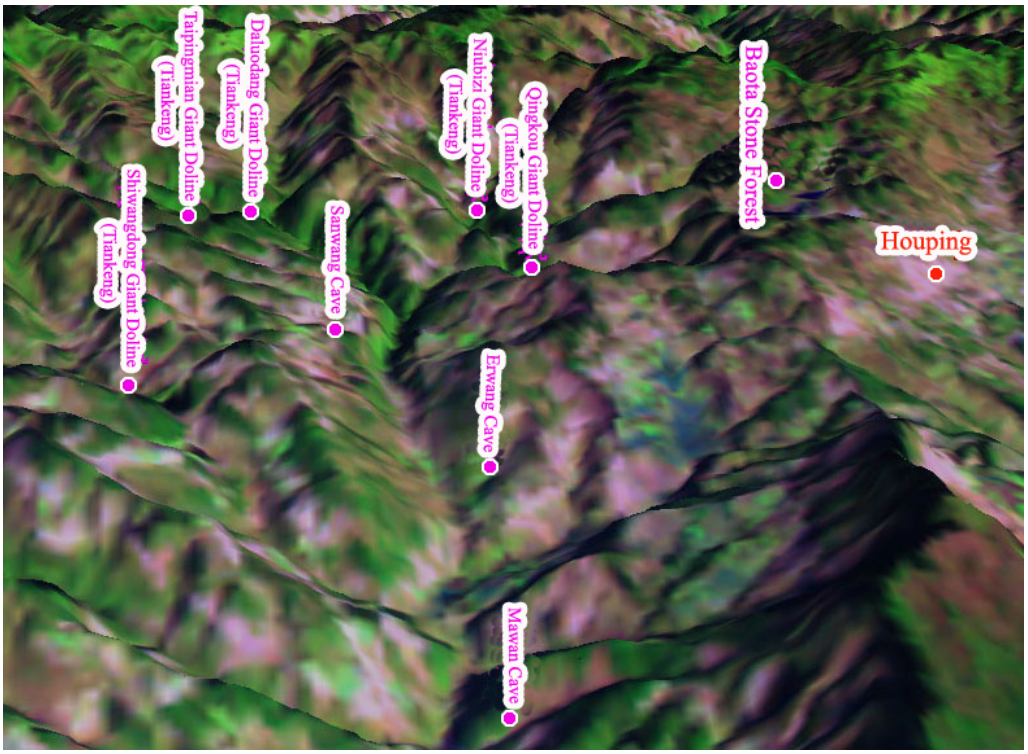


Fig. 2-27 3D Image of karst landscape in Houping tiankeng and caves

Table 2-6 Dimensions of Some Houping Karst Tiankengs

Tiankeng name	Opening Dimension		Depth (m) from highest point on rim	Altitude (m) of lowest point	Volume (Mm^3)
	Diameter (m)	Area (m^2)			
Qingkou	220~250	40,754	295	805	9.21

Shiwang Cave	140~170	25,896	252	848	5.13
Da luodang	220~240	32,405	370	790	10.4
Tianwang	180	26,376	420	800	9.89
Niubizi Cave	80~380	26,670	199	901	3.47

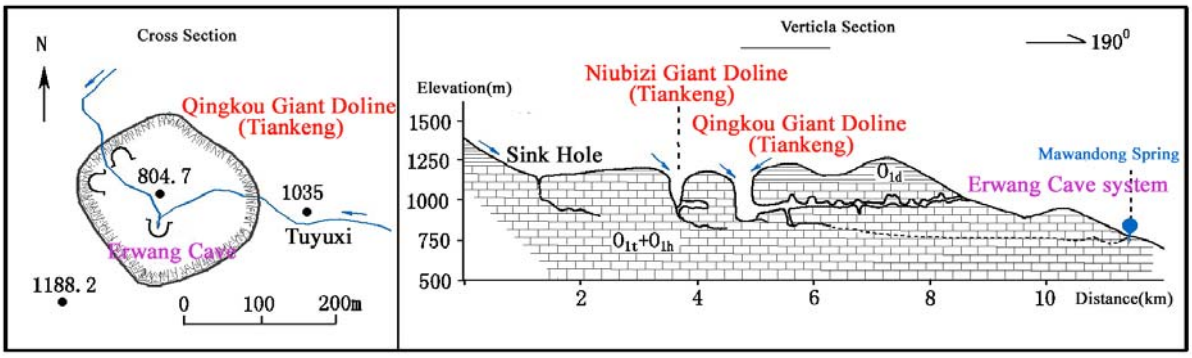


Fig. 2-28 Qingkou Tiankeng and associated caves and landforms

Photo 2-60 Feitian Hanging Waterfall in Longshui Gorge

Photo 2-61 Waterfall on the wall of Qingkou Tiankeng

Photo 2-62 Shiwangdong Tiankeng

Photo 2-63 Tower-shaped stone forest in Houping

2.a-4-3b Geomorphic Evolution

The geomorphologic evidence that well recorded in the nominated Wulong Karst testified the river history, environmental evolution, and local tectonic activity. In general, the landforms of Wulong Karst are characterized by plateau-gorge landscapes, comprising two planation surfaces, one erosional surface, and the deeply incised valleys of Wujiang River and its tributaries.

The upper planation surface occurs at 1800-2000 m, serves as the main drainage divide between the Yangtze River and Wujiang River. Being the highest morphologic unit, this planation surface formed in the late stage of Paleogene or the early Neocene (Shen, 1965; Liu, 1983; Yang,1993), and subsequently was denudated and planed to form today's rolling hilly landscape (Fig. 2-29-1). Represented by Mt. Xiannv, the carbonate rock was reworked by karstification into karst platforms dotted with dolines, hills and depressions.

Photo 2-64 Pepino stone summit in Houping

Photo 2-65 Stalagmite in Sanwang Cave

The lower planation surface was desegregated by the second episode of Himalayan Movement that took place in the early stage of Neocene epoch (Huang, 1980) and the nominated Wulong Karst began its Hilly Plateau Phase**.** Under the warm humid climate, active stream erosion and chemical weathering, the lower planation surface was formed in the Tertiary (3.4-3.6 Ma ago) (Chen and Ma, 1987; Guo et al., 1996). The lower planation surface, at 1200-1500 m, occurs extensively, surrounding the upper one and is also shaped into karst platform whereever limestone crops out (Fig.2-29-2). Though poljes and fengcong-valleys are the predominant landforms, at Houping**,** located on the karst platform at an altitude of 1300m, a group of Tiankengs (giant collapsed dolines) developed, testifying the local tectonic uplift.

The erosional surface below these two planation surfaces is composed of valley basins, intermountain basins, uvulas, and karst platforms, with altitudes ranging from 800 to 1200 m. The chronostratigraphic evidence and diagnostic sediments are generally comparable in time and space, and the age of this surface from the chronological study can be placed between 2.04 and 1.8 Ma ago (Liu et al., 1988; Huang, 1991). This was the time (Late Pliocene to Early Pleistocene) during which the drainage network was restructured to follow the tectonically controlled topography and a tectonic rise accompanied by a rapid down cutting of the river channels crossing the region. Therefore, the development of natural bridges, gorges and tiankengs is closely associated with the deeply incising of the river valley, meanwhile the formation of the multi-layer

karst caves and the alluvial terraces are the results of the intermittent tectonic activity. The present state of the karst surface at Wulong is presented in Fig. 2-29(1-3) (Photo 2-66, 67, 68).

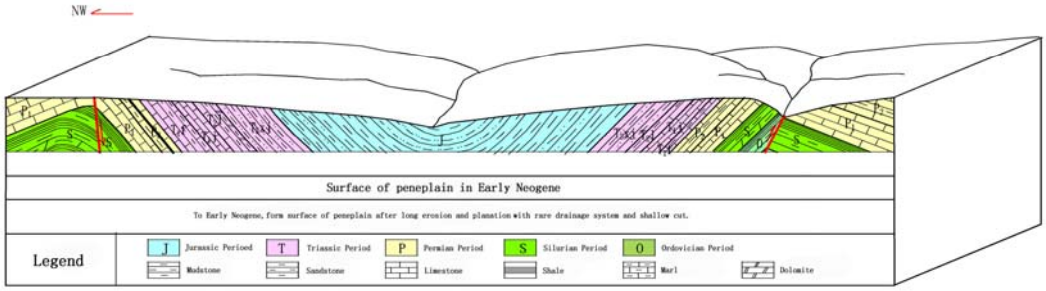


Fig. 2-29-1 Surface of peneplain in Early Neogene of the Wulong Karst Nominated Sites

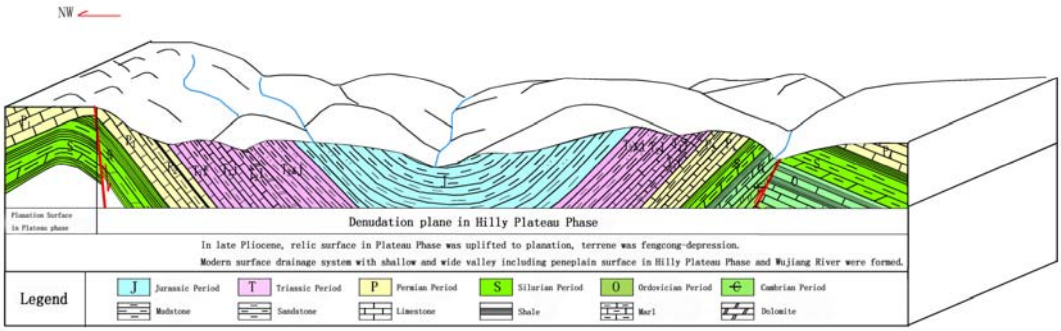


Fig. 2-29-2 Denudation plane in Hilly Plateau Phase and plane surface in Plateau Phase of Pliocene in the Wulong Karst Nominated Sites

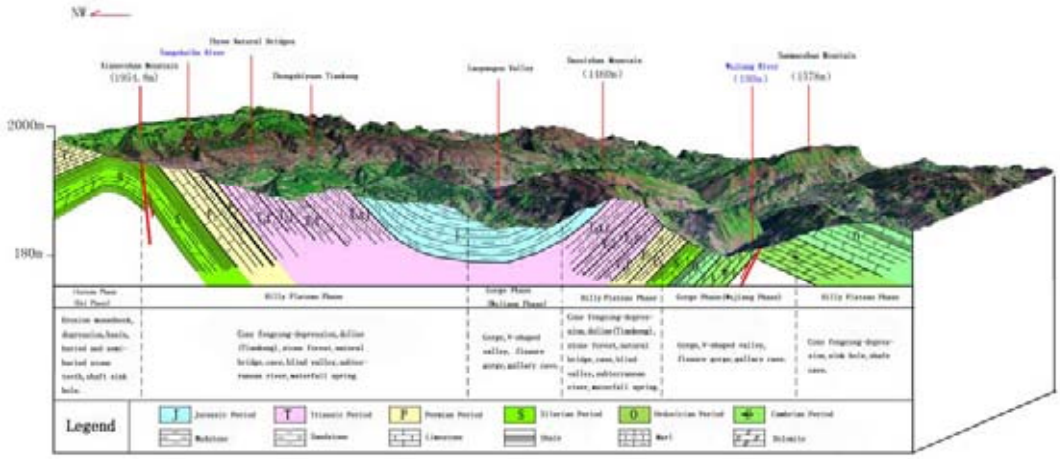


Fig.2-29-3 Modern gorge landscape in the Wulong Karst Nominated Sites

Photo 2-66 Plane surface in Plateau Phase and Hilly Plateau Phase of the Three Natural Bridges Site

Photo 2-67 The Wujiang in a gorge

In the Wulong Karst area, within a quite limited distance from watershed to the river bottom, a wide variety of karst landforms such as fengcong-depression karst, giant karst dolines (tiankeng), natural arches, gorges, and caves are well developed, displaying a typical and whole picture of gorge karst in south China. Wulong Karst, in this sense, not only shows the natural beauty but also provides a complete record of the

area's evolutionary history from Paleogene to the present.

2.a-4-4 Biology

2.a-4-4a Flora

The vegetation around Furong Cave and at the Furongjiang tourist scenic spot is the most important in the Wulong area. Here, where the rivers are deeply incised and climate is warm and moist and there is a special lithology and there are landforms to be displayed care has been taken to retain the endemic vegetation. On both banks of the river canyons the human population has remained low and the vegetation has not been significantly changed and rich vegetation remains, both in variety and rarity, which will be preserved (Photo 2-69).

Photo 2-68 Butterfly Gorge on the Furongjiang

Photo 2-69 Zhuzi Stream habitat on the Furongjiang

In the Wulong Karst there is a rich endemic flora. There are 139 families of vascular plants in 375 genera with 558 species including 19 families, 32 genera and 56 species belonging to the Pteridophytes, 490 species of Angiosperm, belonging to 332 genera in 112 families. Other vegetation types include subtropical needle-leaved forest, composed of Pinus massoniana, Cupressus funebris and mixed Pinus

massoniana and Cupressus funebris; evergreen broad-leaved forest; deciduous broad-leaved forest including Quercus fabric, Quercus acutissima and Lkalopanax ricinifolium; and shrubland containing Pyracantha fortuneana, Vitex negundo and Distylium racemosum shrubs. Evergreen forests include Pinus massoniana, Cupressaceae, Taxodiaceae, Lauraceae, Theaceae, Elaeocarpaceae, Castanopsis and Quercus of Fagaceae. Deciduous trees and shrubs include some species of Fagaceae Quercus, like Liquidambar formosana of Hamamelidaceae, Pyracantha fortuneana of Rosaceae, Vitex negundo of Verbenaceae and Ulmacea. There are also grassland and bamboo forest and bamboo shrubs, including Phyllostachys heteroclada and Sinoca lamusaffinis. The valley region of Furongjiang has vegetation that is characteristic of the subtropical evergreen broad-leaved forests. The seasonal vegetation colour changes are dramatic. In spring and at the beginning of summer, red, yellow and purple flowers are scattered on a jade-green background; in midsummer the vegetation is brown and green; in autumn and winter, red, orange and yellow are mixed amongst the dark blue evergreen leaves. This rainbow of colour change with season is of great beauty.

In the proposed buffer zone of the Three Natural Bridges site, the vegetation is middle subtropical moist evergreen broad-leaved forest. The primary vegetation has been almost destroyed by human activities and the present vegetation is mostly secondary. Despite this the vegetation is diverse, mainly composed of subtropical needle-leaved forest, shrub or coppice forest and shrubland and grassland. Examples of species of protected plants are *Ginkgo biloba*, *Eucommia ulmoides*, *Taxus chinensis*, *Handliodendron bodinieri*, *Liriodendron chinense*, *Juglans regia*, *Phellodendron chinense*, *Fagopyrum dibotrys*, *Cinnamomum camphora*, *Camptotheca acuminata*, *Actinidia chinensis* and *Gynostemma pentaphyllum*.

2.a-4-4b Fauna

In the Wulong Karst Nominated Sites and their buffer zones, especially the valley of the Furongjiang with its steep sides and forest cover, human activities have been limited. Therefore the area has become a native animal refuge. The faunal diversity here is extremely rich, totaling 332 species. They comprise 64 fish species, 174 bird species, 46 mammal species and 20 species of amphibians as well as 28 species of reptiles.

The Furongjiang valley has been protected by the Chinese nation for its biodiversity. It has many rare

and endangered animals, which include four species that have the first level of national protection: *Manis pentadactyla*, *Neofelis nebulosa*, *Trachypithecus francoisi* and *Aquila chrysaetos.* Nineteen species have the second level of national protection: *Macaca mulatta*, *Cuon alpinus*, *Prionodon pardicolor*, *Viverra zibetha*, *Viverricula indica*, *Protelis temmincki*, *Moschus bereaoskii cavbangis*, *Lutra lutra*, *Martes flavigula*, *Aix galericulata*, *Milvus migrans*, *Syrmaticus reevesii*, and *Chrysolophus pictus*. There are eighteen endangered species, which are protected by international trade treaties, for example, *Panthera tigris*, *Manis pentadactyla* and *Trachypithecus francoisi*. Many are attractive animals and thus have commercial value, for example *Trachypithecus francoisi*, *Macaca mulatta*, *Phasianus Colchicus*, *Garrulax canorus* and *Leiothrix* sp. The 64 species of fish found in Furongjiang include 33 endemic species. Local species of bird include *Chrysolophus pictus* (Photo 2-70), *Syrmaticus reevesii*, *Garrulax poecilorhynchus*, *Pycnonotus sinensis*, *Spizixos semitorques*, *Bambusicola thoracica* and *Paradoxornis webbianus.* Exceptionally rare endemic mammals are *Elaphodus cephalophus* and *Sciurotamias davidianus*.

Trachypithecus francoisi —— the black monkey, is both rare and valuable, and enjoy the first level protection of national importance. Two groups have been found in the Furongjiang canyon on the right bank of the Zhuzi tributary and on the Xianbajiang on Nov. 24th, 1993 and Jan. 31st, 1994. Food supply for *Trachypithecus francoisi* is limited as its main food is new folliage this is scarce, forcing this animal to live in small groups of 3 to 5 and large groups of 8 to 10 (Photo 2-71).

Macaca mulatta —— the yellow monkey, has the second level of national protection. There are approximately 300-400 monkeys in the Furongjiang canyon. The largest community size is 90, but they are generally in groups of 30 to 50. The habitat range of *Macaca mulatta* is wider than that for *Trachypithecus francoisi.* Their identified territories are from the Hua Brook power plant to Guanyin Tai to Lao Haokou, Furong Cave to Tianxingqun and Sifang Well to Pangu River. (Photo 2-72)

In the Furongjiang Scenic Spot, 109 species belonging to 14 orders, 33 families and 78 genera have been recorded. *Aquila chrysaetos* has the first level of national protection. Many of them inhabit and breed on the high cliffs around the power plant in Haokou County. When the weather is fine, they soar and take small animals for food.

In the Three Natural Bridges Area, with its steep slopes and forest cover, there are rich animal

resources. There are 7 orders of native mammal in 17 families, comprised of 47 species; reptiles comprise 2 orders of 20 families and 28 species; amphibians, 2 orders, 7 families, 20 species; birds, 15 orders, 39 families, 174 species and fish, 7 orders, 8 families, 34 species.

Cave animals: In Qishiercha Cave of the Three Natural Bridges area there are spiders and butterflies, etc. In Xianren Cave, approximately 5000m from the entrance, bats have been found. In the Longquan Cave and Xianren Cave, where water exists, tadpoles and blind fish occur (Photo 2-73). Their eyes have degenerated and their bodies have reduced pigmentation, allowing their internal organs and skeleton to be seen.

Photo 2-70 *Chrysolophus pictus*

Photo 2-71 *Trachypithecus francoisi*

Photo 2-72 *Macaca mulatta*

Photo 2-73 Blind fish and Tadpole

2.a-4-5 Human Activities

In the Wulong Karst 3940 people reside in the nominated sites and a further 23993 in the buffer zones (Photo 2-74). Population density of the nominated sites and their buffer zones are respectively 66/km^2 and 75/km^2. In the Furongjiang catchments, there are few inhabitants as access is difficult. The remote the Three Natural Bridges Site is one of the eight old scenic landscapes in Wulong area. Within the region next to the buffer zones there is agricultural land, which is both steep and stony and thus is difficult to cultivate. It will revert from farming to forestry. The cliffs of the region are too steep for agriculture and therefore the vegetation on them has not been disturbed.

Photo 2-74 Bamboo dance of the minority people

2.b History and Development of the Total Property

2.b-1 Natural Evolutionary History

South China Karst is situated at the junction of the Indian Plate, the South China Plate (the Yangtze Plate of China) and the Pacific Plate. The main geological tectonic movement phases effecting the karst development include Jialidong Movement Phase of 400 million years ago, Haixi Movement Phase of 400-250 million years ago, Indo-China Movement Phase of 200 million years ago (late Triassic), Yanshan Movement Phase of 200-70 million years ago and Himalayan Movement Phase from 50 million years ago to the present. These tectonic activities affected and controlled the karst development processes of South China.

During the Jialidong Tectonic Movement Phase (Sinian to Silurian), South China Karst formed a combined rock series of fragmentary rocks and carbonate rocks, and developed significant small shell animal fossil and other invertebrate fossil sequences (Photo 2-75). During the Haixi Movement Phase (Devonian to Permian), the South China Karst deposited carbonate over a wide area and of great thickness. These rich invertebrate fossil sequences are vital for the study of Earth's biological, environmental and geological evolution. Concurrently, some areas located in the ancient continental environment produced the early plants—ferns.

Photo 2-75 Coral fossil in the Permian limestone

In the latter part of the Haixi Movement, parts of Guangxi and eastern Yunnan were located in marine and parts in continental environments, and at that time significant events of the South China Karst took place (palaeokarst gives testimony to this, such as the stone teeth and pinnacle karst), then continental basalt erupted and covered the early karst (Photo 2-76). In the early and mid stages of the Triassic, 250-200 million years ago, the mid-west parts of the Yangtze Platform were in a marine environment and the latest suite of carbonate rocks (Triassic carbonate rocks) of the South China Karst were deposited. These contain fossils of the marine reptile – *Keichousaurus hui* – which are of giant significance in the Earth's biological evolution (Photo 2-77). During the Indo-China Movement (late Triassic), 200 million years ago, the South China Karst emerged from the ocean into a continental environment.

Photo 2-76 Stone forest exposed from basalt covering (Yunnan)

In the mid and late stages of the Mesozoic Era, most parts of the South China karst were planed and eroded by weathering, and palaeokarst were bare and continued to develop. The terrain of the South China Karst region was gradually leveled; meanwhile, gymnosperms were flourishing.

The early Himalaya Tectonic Movement from 65 to 25 million years ago, lead to a complex terrain in the South China Karst region and intensive continental fault tectonic activities formed abundant

intermontane basins and inland lakes. As a result of erosion processes, the region developed the earliest landform surface—the High Plateau surface. During 25 to 3 million years ago (Neogene), the long erosion process formed the uniform hill crest surface, grand meta-plain and red soil regions.

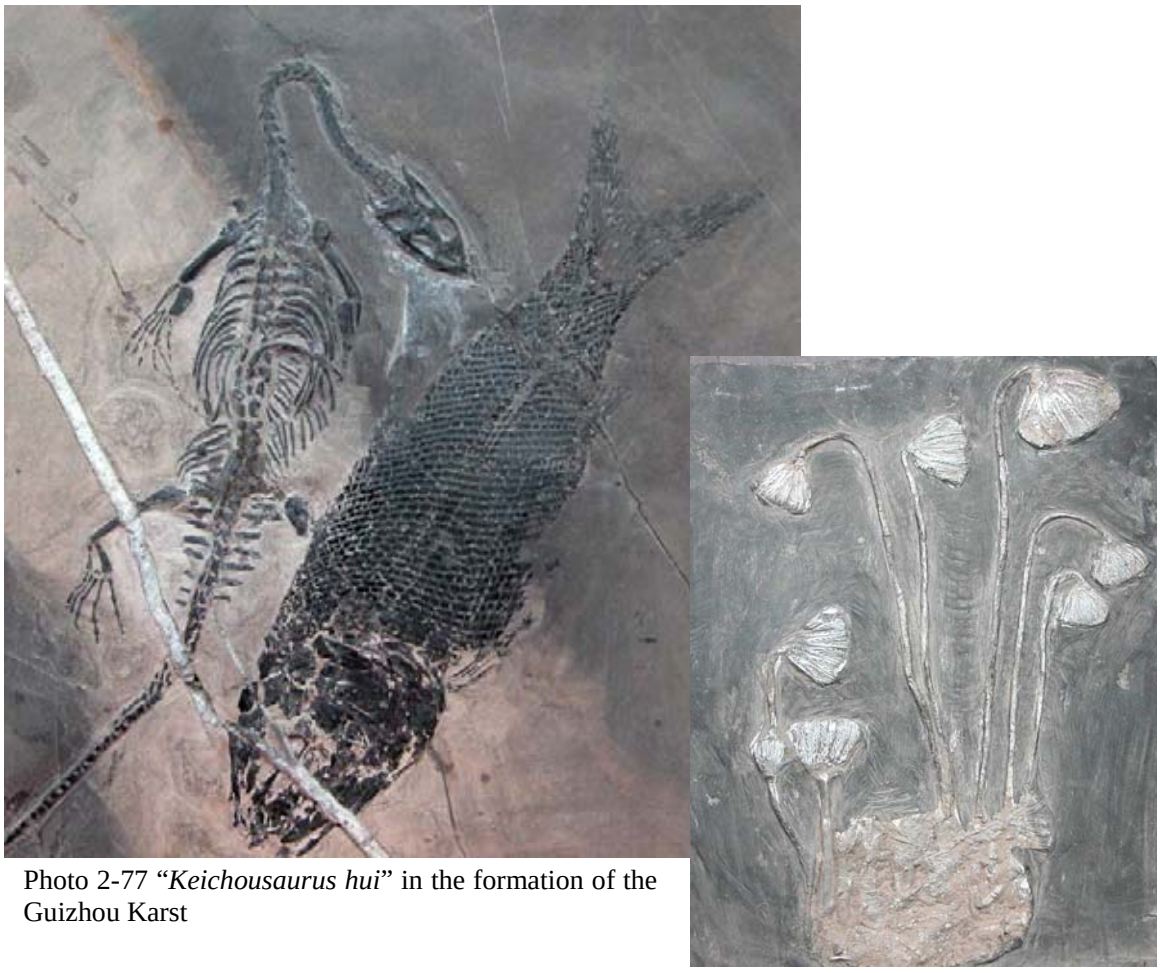


Photo 2-77 "*Keichousaurus hui*" in the formation of the Guizhou Karst

The Himalaya Movement of the middle and late stages 3 million years ago, and the collision of the Indian Plate trending north led to the closure of the new Tethys ocean, to speed the uplift of the Tibetan Plateau with the biggest scope and highest altitude, and to change the planetary wind system pattern of the paleo-subtropical anticyclone, so the patters of South Asian and East Asian Monsoon began to form. The South China Karst moved north to a tropical – subtropical location, and the South China Karst began a variant uplift tectonic phase characterized by tilted uplifts and effected by the Tibetan Plateau uplift. Also the step-shape terrain, high in the west and low in the east, began to form; the western meta-plain (from Shilin in Yunnan to western Guizhou) was uplifted as a plateau, but the eastern parts (Guangxi) still is in the hilly plain condition. Guizhou of the mid-east part is located on the transitionary areas from the former

to the latter. In this phase, the Pearl and Yangtze River systems were originally developed resulting in uplifting the plateau and cutting down the gorges, especially the convergence of the Indo and Asia plates and the uplifts of the Tibetan Plateau in the early and middle Pleistocene. Then the South China Karst underwent a major phase of complex surface and underground karst development. The pinnacle karst, cone karst, gorge karst and tower karst then successively developed from west to east. Because the region was not significantly affected by Quaternary glaciers, the early plants growing in paleo-tropical and subtropical regions and karst geomorphology series were able to continue to develop. At the same time the most extremely tropical and subtropical karst landscapes and associated ecosystems in the world developed. In the western part, the plateau was eroded to Shilin karst (pinnacle karst) and the surface was lowered, but in the middle and mid-east parts, accompanying major leveling, erosion divided the karst to form valley, fengcong, fenglin, various depressions and basins, and erosion plain or polje. Within the tectonic uplift regions, more significant linear erosion resulted in the formation of gorges, surface water drainage systems and large regional rivers—Yangtze River Drainage System and Pearl River Drainage System. Along with geological evolution, constant changes took place in the physical environment; the nominated site experienced a range of karst geomorphological developments from the watersheds to the valley floors, from west to east, from low altitude to high altitude, such as karst plateau, sloping fields, basins (poljes), fenglin and isolated peak plains and blind valleys. The region is thus shown to be an area with a rich variety of landscape types, very unusual surface and underground features and extremely high aesthetic values.

Accompanying the evolution of the karst geomorphology, habitat diversification was occurring. From west to east and from high altitude to low altitude, the vegetation grades from semi-humid to humid-hot and from south to north it grades from humid-hot to warm-hot. The karst ecological environment intensified the endemicity of the biotic community, so this region developed a complex and special karst biotic province surpassing all others at the same latitude.

From depositing carbonate in oceans in the late stage of the Proterozoic to the karst geomorphology at present, South China Karst Region experienced a series of process as below:

(1)The carbonate rocks in South China were entirely formed in the late stage of the Proterozoic Era, and the latest carbonate rocks were developed in the early and middle Triassic. The Indo-China Movement ended the ocean environment when it resulted in major uplift. So the carbonate strata in each phase

preserved significant relics of biotic evolution, including invertebrates, vertebrates and plants, as well as protecting the relics of environmental change.

(2)The multi-phase tectonic movements from the late stage of the Sinian to the Triassic provided the dynamic tectonic conditions for the development of South China Karst and it remains palaeokarst of outstanding significance, such as the palaeokarst of the Permian.

(3)During the phases from 200 million years (the middle and late stages of the Mesozoic Era) to 30 million years ago (Paleogene), terrain evolution was complex for the South China Karst Regions, and they remained the highest altitude erosion surface— the hilly plateau surface.

(4)Between 30 and 3 million years ago, the South China Karst Region was further dissected, the late erosion surface was planed to an almost flat surface and on this plain paleo-red soil and ancient weathering crust accumulated. Subsequent elevation resulted in the red soil being exposed on a hilly plateau surface.

(5)From 3 to 0.7 million years ago (the early and middle Pleistocene), the natural features of South China Karst were subdivided. The major uplifts of the Tibetan Plateau, formed the stepped landform from west to east and north to south and shaped the large river systems of south China and the karst plateau (stone teeth and stone forest karst), cone karst, tower karst and valley karst. Since the late stage of the Cenozoic (middle and late Pleistocene to Holocene), 700 thousand years ago, the subtropical karst geomorphology of south China has continued to develop in humid to semi-humid climate belts, but under the control of the early karst landform development pattern. Vertical erosion and horizontal erosion have gradually further developed the karst landscapes. The South China Karst contains areas which are the best examples of their type, with the richest variety and outstanding karst geomorphological regions containing relics of multi-phase movements. At the same time, the particular bio-physical conditions and outstanding heterogeneity of the karst habitats combine to create a paleo-biological community of unsurpassed significance within this altitude range.

Therefore, South China Karst is proved to be the treasure of heritage on the earth.

2.b-2 Human History

There is a long history of human activities and abundant evidence of early human occupation in the South China Karst area. The history of human activities in the region commences in the Paleolithic, extending through the Ceramic Age, the Bronze Age and the Iron Age to the present. Human activities have impacted on the natural environment and simultaneously that environment has influenced the lifestyles and local culture. Harmonious cultural practices have resulted in the effective reservation of an area of relict Proterozoic karst of international significance.

Relics and sites from the Paleolithic, the Ceramic Age, the Bronze Age and the Iron Age have been discovered in the caves, flood plains, lakes and mountains of the karst region. A mix of aboriginal and immigrant cultures runs through the record of human activities.

Human activities have included periods of nomadism, hunting, cultivation, farming, cutting, mining, scenic protection and tourism. Settlement developed from living in caves, to scattered thatched-roof houses on river banks and basins, and then later to the growth of villages, town and, eventually, cities. Local residents created their national cultures related intimately to the karst environment and scenery, such as the Sani Culture of the Yi People who have woven karst scenic elements through their religion, celebrations, literature, drawing, music, dancing and architecture. Their folk customs include protection of forests around villages and water source areas. In this way parts of the climax forest community have been protected (Photo 2-78).

There are many records of visits to the karst areas between the 17th and 19th Centuries and some records of government protection of the karst in the 20th Century. In the 1980s, a system of protection through laws was established, the boundary of karst reserves was delimited and karst tourism focused on karst scenery and local national cultures developed as the dominant industry. Protection of karst scenery and biodiversity, tree planting and conservation of the natural environment were contributed to by residents, communities and government.

2.b-3 Recent Conservation History

The three nominated sites of South China Karst (Phase 1) have enjoyed protection for a long time. Protection methods have changed from civilian self-protection to legal protection, and the level of protection has been upgraded; the means of protection have been enhanced and the responsible agencies

had been gradually improved.

Photo 2-78 Stone Forest and local minorities in early 20th Century

2.b-3-1 The Shilin Karst Nominated Sites

The Yi People in the Shilin Karst Nominated Sites have the custom of protecting forests and water resources around their villages. Development of the Shilin stone forest for tourism began in 1931 when Shilin Park was built by the People's Government of Yunnan Province.

The Shilin Management Station was established in 1951.

In 1982 Shilin was declared the Central Government as a Key National Scenic Site (one of the first group of such sites).

In 1987 the *Master Plan of Shilin Key National Scenic Site* was ratified. It covered 35,000km^2 and three protective levels were delimited.

The Administering Committee of Shilin Key National Scenic Site was established the following year.

In 1991 the *Protective Regulation of Shilin Key National Scenic Site* was established and in 1992 the Administering Bureau of Shilin Key National Scenic Site was built.

In 1992, the Administering Bureau of Shilin Scenic and Historic Interest was built.

In 2001 Shilin Key National Scenic Site was ratified as a National Geological Park, a China 4A Tourism Scenic Spot and one of the first groups of Demonstration Areas for Organized Tourism.

In 2002 the *Master Plan of Shilin* Key National Scenic Site was modified and edited.

In 2004 Shilin Key National Scenic Site was accepted as a UNESCO Geological Park.

In September 2005 the *Master Plan for Prevention of Karst Rock Desertification in Shilin County (2005-2050)* presented by Yunnan Normal University was ratified.

2.b-3-2 The Libo Karst Nominated Sites

In 1975 the Forestry Bureau of Libo County discovered the unusual Libo karst forest when checking its forest resources.

In 1984 the Forestry Bureau of Guizhou Province arranged an investigation of the Maolan karst forest. The investigation indicated that Maolan karst forest was a unique karst forest ecosystem and contained a gene bank of rare biological resources.

By 1985 a natural resources survey identified the biological and scenic resources and the physical geography of the karst forest area.

In December 1986 the People's Government of Libo County ratified Molao karst forest to be a county level nature reserve and delimited its boundaries. The Forestry Bureau of Libo County took charge of the protective administration and employed 50 villagers to protect the forest.

The Tourism Resource Exploitation Group was established in Libo County in 1987; tourism experts were employed to investigate and prepare a plan. Maolan Nature Reserve was declared a provincial nature reserve by the People's Government of Guizhou Province.

In 1988 the *Master Plan of Zhangjiang County Nature Reserve* in Libo was made by the Institute of Project and Design, Construction Bureau of Guizhou Province. Maolan Nature Reserve was ratified as a national nature reserve and was designated a scientific reserve with the intention of integrated natural ecosystem protection and rare relic protection.

In September 1989 the Administration of Maolan National Nature Reserve of Guizhou Province was established by the People's Government of Guizhou Province to administer and effectively protect Maolan karst forest.

In June 1990, the Zhangjiang County leveled Nature Reserve in Libo was ratified as a provincial scenic area (second group). In July the Construction Bureau of Guizhou Province and the Government convened a meeting of experts to examine the Master Plan for the reserve (Photo 2-79).

Photo 2-79 The Xiaoqikong area of the Maolan National Nature Reserve
and the Zhangjiang River Key National Scenic Site

In November 1991 the People's Government of Libo County determined to establish the management body for Zhangjiang River Scenic Area to protect and effectively administer the site.

In January 1994 Zhangjiang River Scenic Area was ratified to be a Key National Scenic Site by the Central Government.

In April 1996 Maolan Nature Reserve was brought into the international biosphere reserve network by UNESCO and was placed on one of the 22 national ecotourism routes.

August 2005 *The Integrated Management Plan of Libo Karst Rock Desertification (2005-2050)* and *The Integrated Management Proposal of Libo Karst Rock Desertification (2005-2010)* were ratified.

2.b-3-3 The Wulong Karst Nominated Sites

Furong Cave was discovered on 27 March 1993.

In July 1993 The People's Government of Wulong County published a notice on Protection of Furongjiang River Scenic Area.

At the end of 1993 the Wulong Karst Nominated Sites was developed according to the *Tourism Development Plan for Furong Cave* prepared by the Karst Group, Institute of Geology, China Academy of Science.

On 1 March 1994 Furong Cave was formally opened.

On 18 March 1994 the People's Government of Wulong County established the *Report on Protection of Scenery and Facility in Furong Cave.*

In April 1995 the Administration of Furong River Scenic and Historic Interest of Wulong County was established.

In 1995 Furongjiang Scenic and Historic Interest was declared to be a provincial scenic and historic Interest.

In 1995 the *Plan of Tourism Resource in Furongjiang of Sichuan Section* was prepared by Southwest China Normal University.

In 1999 *the Master Plan of Furongjiang Scenic and Historic Interest* was edited and authorized.

In 2002 Furongjiang Scenic and Historic Interest was declared to be a national Scenic and historic Interest by the State Council.

In 2002 the *Master Plan of Furongjiang Scenic and Historic Interest* was edited and evaluated and was adopted by the Ministry of Construction of the People's Republic of China.

In 2002 the People's Government of Wulong County established the *Report on Printing and Distributing the Administering Measure of Hydrotraffic in Furongjiang National Scenic and Historic Interest.*

The protective history of the Three Natural Bridges karst system and Houping karst system.

In 1998 Zhu Xuewen and Chongqing Nanjiang hydrogeology team investigated the Three Natural Bridges.

In 2000 Southwest China Normal University and Garden Bureau of Chongqing City investigated the Three Natural Bridges.

In October 2001 Lu Yaoru, Zhaoxun, Chen Anze, Zhu Xuewen and others investigated in Wulong Karst National Geological Park and its peripheral areas.

Between December 2001 and January 2002 the Institute of Karst Geology, Chinese Academy of Geological Sciences investigated the karst geology, geomorphology, hydrogeology, geological history and tourism resources of Wulong Karst National Geological Park, and published the *Report on Wulong Karst National Geological Park in Chongqing.*

In October 2003 the area was declared to be a national karst geological park.

In September 2005 the *Management Plan on Karst Rock Desertification in Wulong County* edited by Chongqing Normal University was adopted.

3. Justification for Inscription

3.a Criteria under which inscription is proposed (and justification for inscription under these criteria)

If any geomorphologist were asked to nominate a short list of the great landscapes of the world, the celebrated tower karst (including cone karst) of southern China would certainly rank high upon it. This landscape has been an enduring source of inspiration, entrancement and curiosity for travelers, artists and scientists of many dynasties from before Xu Xiake's time in the 17th century right up to the present (Ford and Williams, 1989).

Each nominated site of the South China Karst (Phase 1) independently satisfies World Heritage criteria due to outstanding natural, scientific and esthetic values (Table 3-1). The South China Karst (Phase 1) is a serial World Heritage nomination under natural criteria primarily on the basis of its geological and landscape outstanding characteristics of each nominated site such as karst geomorphology, karst geological evolution, karst ecosystems and, biodiversity and karst landscapes qualities.

Table 3-1 World Heritage Criteria Satisfied by Components of the South China Karst (Phase 1)

Nominated Sites	Province /City	Criteria Satisfied
Shilin Karst	Yunnan	**(viii)** be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features **(vii)** contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
Libo Karst	Guizhou	**(viii)** be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features **(ix)** be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals **(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
Wulong Karst	Chongqing	**(viii)** be outstanding examples representing major stages of the earth evolutionary history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features

3.a-1 World Heritage Criteria (viii)

The nominated South China Karst sites are "outstanding examples representing major stages of the earth evolutionary history, including the records of life…"

In summary, the basic feature of South China Karst evolution are: for the tropical and subtropical karst uplifted development conformation systems and evolutionary succession, although geology is a key base for karst development, exogenic force reshape crust's conformation under special geographical environment, which reflect the evolutionary characters of tropical-subtropical plateau and hill karst. Few areas in the world are characterized by so complex development process not only with succession, but also with multiple generations.

To reflect unique physical geographical characters：The South China Karst (Phase 1) Nominated Property extends over 800km and covers an elevation range of 2000m. The components span a variety of geomorphological regions from the Yunnan-Guizhou Plateau to the gorges of the Yangtze River. In these regions, successive limestone and dolomite rocks present as extreme examples of various karst landforms due to the combined actions of geological tectonic uplifts and solution by surface and underground waters. Under this tropical-subtropical climate, vegetation types and ecosystems have adapted to local karst conditions. The nominated property exhibits the regional karst characters of landform, geomorphology, climate, hydrology, vegetation and ecology. Few areas have similar physical characters in the same latitudes of the northern hemisphere.

To be significant and typical geomorphic features of the Earth: The component parts of the South China Karst Nominated Property (Phase 1) are located in a vast karst region, and conserve and display

striking surface and underground karst landscape features. The Shilin Karst in Yunnan, Libo Karst in Guizhou and Wulong Karst in Chongqing represent particular landform types which developed under a tropical-subtropical climate of the continental interior and, as such, are of international significance and extreme scientific value. The Shilin Karst of Yunnan occurs on an undulating plateau surface at an altitude of 2000m a.s.l. In addition to typical pinnacle karst, each Stone Forest contains features with the shapes of pagodas, mushrooms, pillars and needles. The Shilin Karst contains a richer range of pinnacle shapes than any other area of similar geomorphology in the world (Photo 3-1). The Guizhou cone karst lies in an altitude ranging from 380m to 1300m a.s.l. and features an abundance of pyramid-shaped [or conical] hills. It is believed to be the most well developed example of its type of karst landscape. The nominated sites of Wulong Karst include groups of huge natural bridges, giant dolines, deep incised karst gorges and multilevel caves on the banks of the gorges.

To be outstanding examples of continental humid tropical-subtropical karst geomorphic evolution: In addition to the outstanding examples of Shilin Karst in Yunnan, Cone Karst in Guizhou and Gorge Karst in Chongqing, a wide variety of surface and subsurface karst landforms occur in the nominated sites including fengcong, fenglin, karst hills, stone teeth, depressions, dolines, natural bridges, multi-level caves and plentiful speleothems. The range of sites demonstrates the geological history, evolutionary processes and on-going karst geological processes at different locations, development stages, types and succession. The Stone Forest in Yunnan, for instance, is obviously different from the pinnacle karst of tropical islands. Its development is a result of a combination of fissure and under-soil corrosion; but the cone karst in Guizhou is a rejuvenation development, a renewal of features on the older karst geomorphology. The karst landscapes in the nominated sites of Wulong are the result of tectonic uplifts from the Quarternary. These three groups of sites, jointly display on-going geological processes and reflect karst development and evolutionary processes under different geological conditions. They are also valuable landscape examples in which the formation of present regional drainage nets can be studied, including, in the case of Wulong, the Three Gorges region of the Yangtze River. In view of its extremely richest array of karst features, the South China Karst (Phase 1) Nominated Property provides exceptional “textbook” examples in this field unequalled by continental sites elsewhere.

Photo 3-1 Stone Forest on different platform formed in different geological stages (Shilin, Yunnan)

To be significant and abundant fossils which are important records of life on Earth： The geological span of the carbonate rocks outcropping in the South China Karst is very broad (Sinian, Cambrian to Triassic). Because of the complex paleo-biogeographical environment, the rocks are exceptionally rich in fossils with significance for the study of paleo-biological evolution, such as *Keichousaurus hui* (An area of Triassic limestone in Switzerland was listed as World Heritage in 2003 for the same fossil). The nominated property contains exceptionally rich marine fossils such as branchiopods, corals, foram [inifera] and fusulina. They are not only of great regional stratigraphic correlation significance but also constitute an important record of life on Earth.

3.a-2 World Heritage Criteria (ix)

The Nominated Libo Karst Sites "are outstanding examples representing significant on-going ecological and biological processes in the evolution and development of …"

In botanical terms the South China Karst (Phase 1) spans the tropical-subtropical and transition zones; while zoogeographically it is situated partly in the Oriental realm and partly in the Palaearctic realm. In terms of climate, it lies in convergence regions of the Eastern Asia temperate-humid monsoon and dry-hot

monsoon of subtropical plateaus. Because the South China Karst was not glaciated in the Pleistocene it is an outstanding example of the evolution of continental tropical-subtropical karst region ecosystems over a long period of geological time. (Photo 3-2)

Photo 3-2 The karst forest ecosystem (Libo, Guizhou)

The forest vegetation system with typical transitional and endemic features：In the South China Karst (Phase 1) Nominated Areas, vegetation belongs to the intermediate belt of subtropical humid evergreen broad-leaved forest and semi-humid evergreen broad-leaved forest from tropics to subtropics, from humid realm to semi-humid realm, from low elevation to medium elevation, from karst knoll, valley, basin and plain to plateau. Vegetation types include an intermediate belt from the South Subtropic realm of *Machilus* of limestone fenglin, *Cyclobanopsis* and *Pinus yunnanensis* var. *tenuiformis* of to the Middle Subtropic realm, of *Castanopsis* in Three Rivers region, *Schima superba* forest, limestone forest, *Castanopsis delavayi*, *Castanopsis*, subtropical needle-leaves forest (*Pinus yunnanensis* forest). The vegetation appearance is typical of evergreen-deciduous broad-leaved mixed forest composed of mixed evergreen and deciduous species and the ropencedrymion, endemic suitable vegetation of limestone dry-hot valley region in some place: the sclerophyllous evergreen broad-leaves forest—*Quercus franchetii* forest and *Quercus cocciferoides* forest, etc.

The fossil and relict plants are the record of geographical environmental transition: In the Libo Nominated Sites, there are 17 species of ancient Cymnospermae, belonging to 12 genera, 6 families, especially *Pinus keangtungensis*, *Pseudotsuga brevifolia*, *Calocedrus Macrolepis* and *Keteleeria davidiana* var. *calcarea*. They are widespread, being found on the summit of each karst peak, and are thus the

dominant species. Some ancient genera from before the Paleogene are widespread over the nominated sites, such as *Podocarpus*, *Cephalotaxus*, *Amentotaxus* and *Tetrathyrium*. Because there are many *Tetrathyrium* there (a genus extremely rare in China and East Asia) the Libo Area is considered to be the center of its distribution.

The forest ecosystem adaptation to the habitat changes lead to the horizontal replace of vegetation and plant flora and corresponding phenomenon：In the terms of horizontal replace**,** such as *Cyclobanopsis glancoides* in west Yunnan instead of *Cyclobalanopsis glauca*, which are dominate species of evergreen broad-leaves forest in E.AS; *Castanopsis delavayi* instead of *Castanopsis sclerophylla* in east. In the terms of corresponding phenomenon, *Cinnamomum glanduliferum* corresponds to *Cinnamomum comphora*; *Cyclobalanopsis delavayi* corresponds to *Cyclobalanopsis gilva*, *Pinus yunnanensis* corresponds to *Pinus massoniana* , *Sapindus delavayi* corresponds to *Sapindus mukurosii*, *Ehretia corylifolia* corresponds to *Ehretia diskisonii*, *Albizia mollis* corresponds to *Albizia julibrissin*, corresponds to *Alnus cremastogyne*, *Keteleeria evelyniana* corresponds to *Keteleeria devidiana*.

The typical karst forest ecosystem displays significant and on-going biological and ecological processes: Because the nominated properties lie in karst regions, long geological and biological evolution has developed an environment of thin soils, scarce water and rich calcium. Thus the biota has adapted to exhibit xerophitic, lithophilic and calcicophilic characteristics. The environment displays on-going biological processes, particularly in relation to soils and climate. In the Libo Nominated Sites, plants are characterized by drought hardiness and an affinity for rocky, calcium-rich conditions. Considering also the range of adapted animals produces a typical subtropical plateau karst ecological succession. And it is a single karst primitive forest with unique type, large reserves and succession in the same latitude areas in the world, and plays a significant role in the global forest vegetation. In cone karst and karst valleys, there is abundant lime soil from neutral to alkaline and rendzina; the habitat contains high heterogeneity and develops evergreen-deciduous broad-leaved mixed forest, which is the climax community of karst vegetation in tropical south Asia. among of dominate species, including evergreen species of *Quercus engleriana*, *Cyclobanalopsis glauca*, *Ligustrum lucidum*, *Fraxinus retusa*, etc.; deciduous species of *Platycarya longipes*, *Carpinus pubescens*, *Celtis siinensis*, *Sapium rotundifolium*, *Prunus serulata*, *Kaelreuteria minor*, etc.; some parts are located on the cone summits and hilly ridges. karst conifferous

forest representative include *Pinus kwangtungensis* of dominate species, *Calocedrus macrolepis*, *Pseudotsuga brevifolia*, *Cephalotaxus oliveri*, *Amentoaxus argotaenia* var. *brevifolia*,etc.rare species.

3.a-3 World Heritage Criteria (x)

The Nominated Libo Karst Sites contain "the most significant and prominent natural habitat for in-situ conservation of biodiversities, including …"

Within the South China Karst (Phase 1) Nominated Areas, rich biodiversity and high levels of endemism are embodied in Libo Karst section. Libo karst ever-green broad-leaved and deciduous mixed forests and broad-leaved and needle-leaved mixed forests are representative of South China Karst and, due to their intact climax condition, are better preserved than other same-latitude continental karst vegetation assemblages around the world. This is also one of the most abundant and dense regions with respect to nationally protected species, endangered species and endemic species of plant in Chinese subtropical karst regions. In the Libo Karst Nominated Sites, there are also numerous species of vertebrate and invertebrate animals, many of which are endemic and many are protected; there are also many cave-dwelling animals. The karst landscapes, caves and forests provide significant natural habitat for a range of endangered and endemic flora and fauna (Photo 3-3, 4, 5, 6).

The Libo Area is in the China-Japan Vegetation Subregion of East Asia vegetation region, subtropical broad-leaved forest bioprovince and in karst forest vegetation region in of southern subtropical ever-green broad-leaved forest in china. In the subtropical karst area, ever-green broad-leaved forest, deciduous forest and coniferous forest are well developed to form mixed forest, especially representative ever-green broad-leaved and deciduous mixed forest with 11 formations, such as *Cyclobalanopsis glauca-Platycarya longipes* mixed forest community, *Platycarya longipes- Phellodendron amurense* mixed forest community, *Koelrenteria paniculata-Aceraceae* mixed forest community, *Castanopsis fargesii-Elaeocarpaceae* mixed forest community, *Pinus keangtungensis* forest community, *Pseudotsuga sinensis- Platycarya longipes* mixed forest community, *Pseudotsuga sinensis-Pinus keangtungensis- Quercus phillyraeoides* mixed forest community.

Photo 3-3 *Cymbidium goeringii* (Libo)
VU in China Red List

Photo 3-4 *Paphiopedium malipoense* (Libo)
CR in China Red List

Photo 3-5 *Macaca mulatta* (Libo)

Photo 3-6 *Macaca thibetana* (Libo)
NT in World Red List and VU in China Red List

In Libo, there are 1532 species of advanced plants belonging to 225 families, 687 genera, and 41 endemic species respectively belonging to 25 families, 33 genera, of these species, there are 14 species of arbor, 12 species of shrub, 7 species of liane and 8 species of herbage, such as *Carpinus liboensis, Indosasa liboensis, Chirita liboensis, Camellia rubimuricata, Amentotaxus argotaenia* var. *brevifolia, Cryptecarya austro-kweichowensis, Zanthoxylum liboensis* and *Rubus liboensis*, etc.

Libo is one of the most abundant and concentrated regions with national protective plants in China karst regions, 112 species of wild plants are under the key national protection, such as *Kmeria septentriolata, Handerodendron bodinieri, Mussenda anomala, Pinus kwangtungensis, Tetrathyrium subcordatum.* 121 species of plants belonging to 67 genera, 27 families are listed as IUCN Species Red List and China Red list, of these species, there are 7 CR species, such as *Carya Kweichowensis, Michelia angustioblonga, Camellia rubimuricata* and *Paphiopedium emersonii*, etc.

In the Libo Karst Nominated Sites, there are 266 families, 1768 species and 45 endemic species. Of these species, 243 species belong to vertebrate, including 63 species of mammals belonging to 24 families, 103 species of birds belonging to 28 families, 40 species of amphibians belonging to 9 families, 20 species of fishes belonging to 7 families. Moreover there are 1282 species of insects and 45 species of protected animals including 35 species of protected animals of national importance (3 species of class and 32 species of class Ⅱ). Additional, there are 3 species of VE animals, such as *Python molurus, Rana wuchuanensis, Protelis temmincki*, etc.

Cave animal species are also abundant in Libo karst area. 174 species belonging to 61 families and 17 endemic species have been discovered such as *Gekko liboensis, Nemacheilus liboensis, Diplommatina liboensis and Sinaphuenops mirubilissimus*, etc.

3.a-4 World Heritage Criteria (vii)

The Nominated Slinlin Karst Sites contain "superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance"

The natural beauty of the South China Karst (Phase 1) Nominated Property mainly derives from a wide variety of landscapes such as the spectacular surface karst features (Shilin Karst, Cone Karst, Tower Karst and Gorge Karst, etc.), dense forest vegetation, abundant caves and speleothemes, rivers, waterfalls and subterranean rivers, or from combinations of these.

The Stone Forests of Yunnan are famous for their dense and high pillars of limestone. The Stone Forests not only represent a most unusual karst landscape type, but are also a special landscape feature, displaying exceptional natural beauty. In the Shilin Karst, extending 30km from south to north, numerous Stone Forest clusters are scattered across a range of landscapes. Some stand on hilltops like isolated castles, some lie in depressions and some are reflected in lakes; each displays impressive panoramas. The Shilin Stone Forests are distinguished from similar karst landscapes elsewhere by their rich and colorful features, each patch displaying a range of shapes and various colors. A stone pillar or column may take the shape of a sword, a tower, a mushroom with a large top and smaller base or any of many irregular shapes that are difficult to classify. Numerous pinnacle karst and other karst forms can be seen in the Stone Forest, so it is

truly a museum of karst pinnacle and peak forms. For centuries the Stone Forest has served as the “natural model” for traditional Chinese garden art, therefore it is reputed as the “natural model of garden art”.

The cone karst of Libo displays its own unique beauty and is well known throughout the world for its majesty, rarity and beauty. The fencong depression geomorphology developed on limestone and dolomite in different phases takes various shapes. Together with dense brushwood and shrub, the areas feature panoramic karst landscapes backed by different mountains. In the Maolan National Nature Reserve in Libo, large virgin forest, praised as beryl, well developed with abundant very tall trees on the bare limestone and thin soil, appears like a green ocean. In appearance few areas in the world have such unusual appearance and exceptional beauty. In particular, the Daqikong and Xiaoqikong Scenic and Historic Interest, displays an exceptional hill-and-water landscape formed by two subterranean rivers flowing out in hilly cone karst regions. Beneath dense virgin forests, abundant karst landform features join with water and forest to exhibit natural karst gorge landscapes of mysterious beauty and attractive charm. The combination of hill, stone, water and forest, waterfall, pool and green water interconnect to form the most beautiful natural landscapes, especially around steep cone karst, such as at the Yuanyanghu scenic spots (western Libo).

The nominated sites of Wulong Karst contain spectacular karst landforms such as a cluster of spectacular natural bridges, the gigantic Tiankeng cluster and abundant caves with high esthetic values. The Three Natural Bridges are characterized by not only by their gigantic size, but also by the unusual juxtaposition of three bridges. Combining these with the impressive spectacle of the tiankeng cluster and the exquisite Furongjiang Gorges, the nominated area displays the exceptional natural beauty of karst phenomena on a scale not seen elsewhere. A variety of crystal deposits are seen in abundance in Furong Cave, especially rare raft stalagmite, calcite crystal and dog-tooth crystals in Shanhu Pool. Wulong Karst is truly a region of outstanding natural beauty and significant esthetic values.

On the world scale, because of the singularity and diversity of their dramatic landscapes, the South China Karst (Phase 1) areas demonstrate superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance.

3.b Proposed Statement of Outstanding Universal Value

China is one of widest countries for carbonate outcrop area, successive karst in south China centre on

Guizhou, occupying the areas of $60 \cdot 10^4 km^2$, including eastern Yunnan, the majority of Guizhou, northern Guangxi, southern Sichuan and western Hunan, etc. South China Karst, therefore, is believed to be biggest and most typical areas of continental tropical-subtropical karst physiognomic development.

The geological stages pan for the carbonate outcropped in the South China Karst Area is wide (Cambrian to Permian Period), in which the carbonate can accumulate to the thickness of several kilometers, with rock type-diversity and global significance. Because of crust movement from the late stage of Triassic, especially Himalayan Movement from the late stage of Tertiary, these broad karst areas were tilted uplifted to form gigantic slope areas with the elevation difference of 2000m, high in northwest and low in southeast.

In addition to various familiar surface karst landforms, plentiful caves and abundant speleothem, a wide variety of typical landform types with global significance occurred in the South China Karst Nominated Property.

Few areas in the world have such a concentration of carbonate landforms (including pinnacle, pagoda, mushroom and pillar stone forest) as Stone Forest in Yunnan, but also the Stone Forest is unrivalled in the multi-phase and complicated geological evolution, and it was covered respectively by basaltic lava in the final phase of late Permian and by lacustrine sediments (red beds) in Early Eocene, and reemerged afterwards due to constant tectonic uplifts.

The cone karst is represented by Libo Karst is believed to be the most typical and spectacle continental karst landform due to its gigantic area and unique formation like in pyramid-shape hills.

The landform features of Wulong Karst is the perfect combination of both surface karst and underground karst, including a variety of phenomenon and aspects like gorge, sinking stream, natural bridge, group of giant doline (Tiankeng), karst spring and abundant speleotheme, etc.

In the broad domain of from 300m hills to 2000m plateau and 700km width from east to west, various karst geomorphology in the South China Karst Nominated Property exemplifies geological evolutionary history and geological process of geomorphology development in these regions, and they annotate intrinsic genetic relation of various karst geomorphology development under the integrated process of tectonic

movement, climate and hydrology, etc, as well as some formation mechanism of special geomorphology. So the South China Karst Nominated Property is proved to be best Textbook of continental tropical-subtropical karst evolution in the Northern Hemisphere. Beside *Keichousaurus Hui* formed in Triassic limestone, the middle Permian from which the nominated areas developed contains exceptional rich marine fossils such as branchiopod, coral, foram and fusulina, etc. They are of great regional stratigraphic correlation significance and of important record of earth life.

The South China Karst Nominated Property displays a significant and on-going karst biological and ecological evolutionary process. Libo Karst is a representative case, conserves virgin karst forest ecosystem with the top natural succession stages, covering the areas of $3.35 \cdot 10^4 hm^2$, mainly including karst ever-green broad-leaved forest (*Castanopsis, Cyclobalanopsis,* etc), karst ever-green mixed broadleaf-conifer forest (*Platycarya longipes, Pinus kwangtungensis,* etc.). It is proved to be the intactest and most representative subtropical karst forest ecosystem at the same latitude in the world. So it turns to be the natural background to study karst forest vegetation in bare cone karst regions, and be an ideal place and natural experimentation base to study the configuration, function and equilibrium of forest ecosystem, and is reputed as green diamond and the lattest karst forest at the same latitude of the North Hemisphere. Therefore it plays an important role in forest vegetation in the world for its uniqueness and rarity. Because the nominated sites are located on the joint areas of several biogeographical provinces, vegetation system embody typical transition and uniqueness, besides variety of biological features like typical xerophyte, lithophyte and calciphile in short-soil, short-water, high-calcium ecosystem. Therefore the forest system not only is a typical and special ecosystem, but also displays the on-going biological ecological process under the conditions of this soil and climate.

The South China Karst Nominated Property possesses prominent biodiversities and contains abundant endangered, endemic and rare propagation. The Libo Karst Nominated Sites in Guizhou is the presentative example with 1532 species advanced plant and 112 species of protected plants of national importance, which occupy 10% of plant species in total. In addition, there are plenty of endemic species including *Cycas guizhouensis, Kmeria septentrionalis*, *Handeliodendron bodinieri* and *Mussaenda anomala.* In the case of animal, the nominated site enriched abundant mammal, bird, amphibian, fish, cave animal, etc. including many endangered and endemic species, such as *Presbytis francoisi*, *Neofelis nebulosa*, *Moschus*

berezovskit, etc. Therefore the nominated sites provide habitats and refuges for many endangered and endemic propagation.

For centuries, many nominated areas of the South China Karst, due to their exceptional natural beauty manifested by various and unique karst landforms, have been traditional Chinese scenic and historical interest. The Stone Forest is well known in the world for its natural miracle with outstanding esthetic significance. The karst system of Furong Cave, Three Natural Bridges, Houping Tiankeng in Wulong Karst section combines surface and underground karst phenomenon to embody virgin, natural, systemic, grand and wonderful esthetic values.

In addition to wide geographical distribution, long and complex geological evolutionary history, the South China Karst Nominated Property plays a very important role in world karst distribution region due to their prominent karst geomorphology diversity and biodiversity. In terms of scientific, esthetic and protective views, the nominated sites meet outstanding universal values.

3.c Comparative Analysis

3.c-1 Comparative Analysis with other Karst Areas of China

Although the carbonate rocks widely outcrops in China, it mainly concentrates in three typical zones, namely the South China Karst of Guizhou as the centre, North China Karst of Shanxi as the centre and Alpine karst of Tibetan Plateau. But North China Karst and Alpine karst unrivalled with the South China Karst on the area, development of karst geomorphology, geomorphology type diversity, besides ecotype, biodiversity, landscape values. That is because North China Karst is located in semi-arid temperate areas, Alpine karst is located in alpine and cold areas.

3.c-2 Comparative Analysis with other Karst Areas in the world

The karst areas cover 12% of global continental areas, approximate $20.00 \cdot 10^6 km^2$, mainly distributing in Mediterranean areas, Eastern Europe, Middle East, Southeast Asia, Southeast America, Caribbean areas. On the world scale the South China Karst is unrivalled in area and depth, karst geomorphology diversity and typicality, bioecological character. As a result, the South China Karst is of the most representative

tropical- subtropical karst area reflecting a unique physical geographical character on the earth (Fig.3-1).

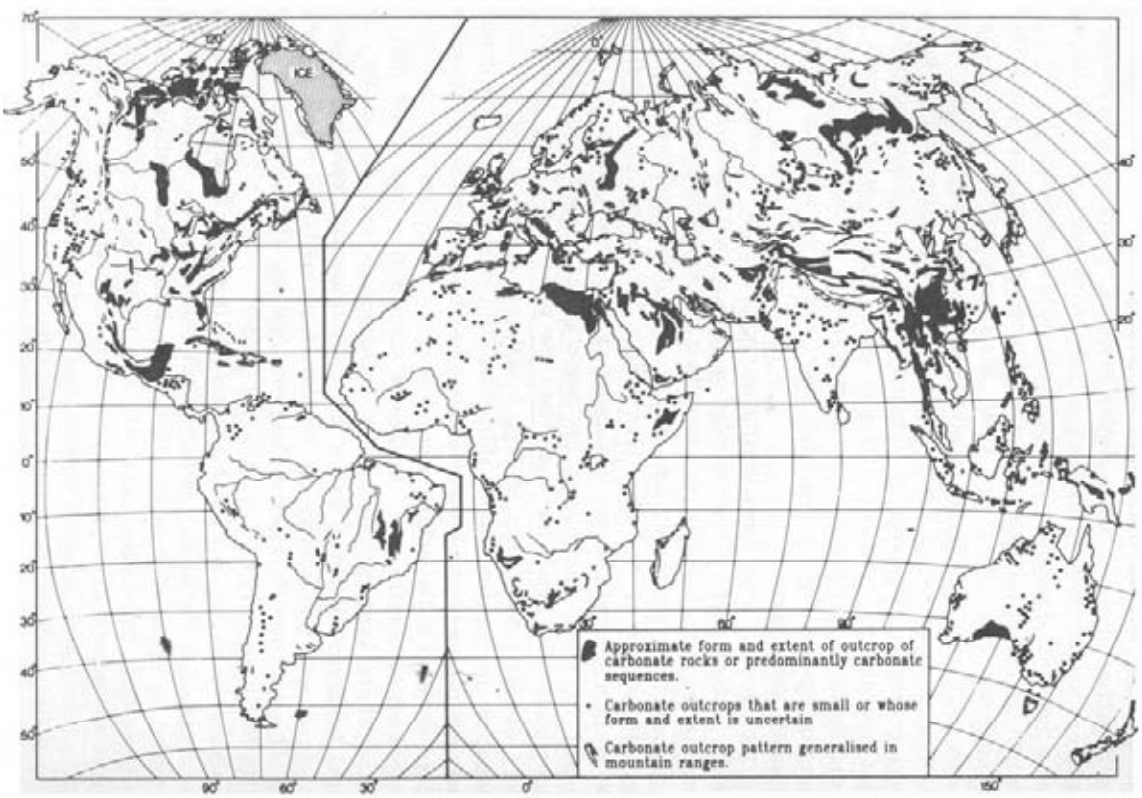


Fig. 3-1 Major outcrops of the carbonate rocks in the world (Ford and Williams, 1989)

3.c-3 Comparative Analysis with the Similar Karst Areas in the World Heritage List

The number of World Heritage nominated areas inscribed specifically for their cave and karst features and the reasons with karst account to 47 areas up to 2004. Of them, the number is 10 for World Heritage areas inscribed specifically for their cave and karst features; 28 for World Heritage areas inscribed specifically for other reason, but with significant cave and karst features; 9 for Cultural World Heritage sites containing cave and karst features. A general comparative analysis (Table 3-2) shows that: the South China Karst (Phase 1) is proved to have at least the following uniqueness:

a) The Shilin Karst: Although there are many countries which display various forms of dissected karst landscapes with cones, towers, pinnacles and other forms, many of them with special local terminology, the stone forests of China are distinctive in both their processes of origin and the resulting landscapes. Thus the mix of shapes found together at Shilin does not have a precise equivalent anywhere else in the world. There are certainly other pinnacle karsts at Gunung Mulu (Malaysia) and the Tsingy de Bemaraha of Madagascar, but these lack the great diversity of the Stone Forest (Table 3-3). Compared with

these, the characteristics of Shilin are: lies in continent plateau area;the development period, with 4 periods since Permian, was relatively ancient; the cause of pinnacle karst formation is relatively complex and comprises both the surface erosion of rainwater and the erosion under soil of groundwater; the shapes are rich including typical pinnacle-shaped, pillar-shaped, needle-shaped, tower-shaped, mushroom-shaped and irregularity-shaped, etc.

Table 3-2 Comparision of the Nominated South China Karst Sites with the World Heritage Sites Inscribed Specifically for Their Cave and Karst Feature

World Heritage Site	State Party	Year	Key Features/Justification for Inscription	Criteria
Proposed South China Karst Sites	China	2005		Criteria after 2005
Shilin Karst			Typical sites of plateau karst, outstanding for the high limestone pinnacles decorated with deep, sharp karren, which is the result of subjacent karst process under the Tertiary red sandstone and the Permian basalt. They are representative of the immense variety of stone forests that are found in China Karst. They illustrate the episodic nature of these karst evolution, which in this case span 270 million years. They are known throughout the world as being one of the finest examples of the natural beauty that karst processes give to rock.	**N** viii, vii
Libo Karst			Typical sites of cone karst and outstanding for their full spectra of gradual change from plateau karst to the lowland karst, with a combination of numerous tall karst peaks, deep dolines, sinking streams and long river caves.The cone karst landscape constitute superlative examples of *fengcong* and *fenglin* karst landscapes including fengcong-depression, fengcong-valley (polje), fengcong-gorge, fenglin-depression (polje), fenglin-valley and fenglin-plain (basin). The sites illustrate the geomorphological exchange and evolution between fengcong and fenglin landscapes. The cone karst landscape supports special immense karst forest ecosystem with biodiversity, it is the habitat of many endemic species and endangered fauna. As field study areas they have great potential to extend the current knowledge of ecosystems developed in fengcong landscapes.	**N** viii, vii, ix, x
Wulong Karst			Classic sites of deep gorge karst, unique for their rich information about the long history of geological evolution kept in the Furong Cave, as well as the changes from peneplains on different altitude above knickpoints to the deeply dissected gorge nearby, and its relevant special karst forms such as dolines several hundred meters deep and natural bridges. The sites are outstanding examples of a karst landscape evolved in areas where thick sequences of pure carbonate rocks have been subjected to tectonic uplift. The result is a fengcong karst dissected by deep gorges, huge cave system, giant dolines (*tiankeng)* with numeral natural bridges.	**N** viii
Inscribed World Heritage Sites				Criteria before 2005
Puerto-Princesa Subterranean River National Park	Philippines	1999	Spectacular karst landscape, underground river and caves. Most significant forest in Palawan Biogeographical Province.	**N** iii, iv

Gunung Mulu	Malaysia	2000	295km explored caves, Sarawak Chamber—world's largest; Speleothemes with spectacular aragonite and calcite needle.1.5 myo sediment sequence, giant doline-karst collapse, lateral planation; Bats and swifelets energy transfer from forest to cave; karst, bats, pinnacle forest, Forest and cave biodiversity	**N** i, ii, iii, iv
Desembarco del Granma National park and System of Marine Terraces of Cabo Cruz	Cuba	1999	Uplifted marine terraces and ongoing development of karst topography. Aesthetic value of stair-step terraces and cliffs	**N** i, iii
Carlsbad Caverns National Park	USA	1995	81 caves, Huge caverns and decorative mineral features, scenic values esp. Lechuguilla. (Most types of limestone cave formation are found here, including long passages with huge chambers, vertical shafts, stalagmites, stalactites and gypsum "flowers" and "needles". Excellent examples of karstification by sulphur acids. Rich microfauna.)	**N** i, iii
Mammoth Cave National Park	USA	1981	Continuous cave formation (100 mya-present). Large level passages and jagged domepits. Rich troglobitic fauna.	**N** i, iii, iv
Plitvice Lakes National Park	Croatia	1979/ 2000	Spectacular travertine barriers and lake systems; forest in excellent condition.	**N** ii, iii
Caves of Aggtelek and Slovak karst	Hungary /Slovakia	1995/ 2000	712 caves. Variety and concentration of cave types, speleothems and an array of typical termperate zone karst features. (Includes aragonite and sinter formations and an ice filled abyss)	**N** i
Skocjanske Jame	Slovenia	1986	Awesome river canyons, textbook portrayal of karst Hydrogeology. On-going process; Collapsed dolines and caves.	**N** ii, iii
Ha Long Bay	Vietnam	1994/ 2000	Most extensive and best-known example of marine invaded tower karst and one of the most important areas of fencong and fenglin karst in the world.	**N** i, iii
Phong Nha Ke Bang	Vietnam	2003	One of the finest and most distinctive examples of a complex karst landform in SE Asia. Phong Nha displays an impressive amount of evidence of earth's history.	**N** i

From Elery Hamilton-Smith (Australia) on the World Heritage Sites Inscribed for Cave and Karst Feature

Table 3-3 Comparison between the Shilin Karst Landform and the Similar Heritages

Name	Environment of formation	Climate	Development period of physiognomy	Shape	Cause of formation
Stone forest in Yunan	Continent plateau	Subtropical monsoon	Experience 4 periods since Permian	Typical pinnacle , pillar, needle, tower, mushroom, irregularity, etc.	Erosion under soil of groundwater
Tsingy de Benaraha Strict Nature Reserve	Island	Tropic	Tertiary	Ridge, Pinnacle	Surface erosion of rainwater
Gunung Mulu National Park	Island	Tropic	Tertiary	Pinnacle	Surface erosion of rainwater

b) The Libo Karst: The complex geological history of the Libo sites (see description above) has resulted in a remarkable diversity of surface landforms, probably demonstrating one of greater variation than any other karst area of similar size in the world, and for its full spectra of gradual change from plateau karst to the lowland karst, In turn, this has led to an unusually complex hydrology. The combination of a complex land surface, with a similarly variable groundwater regime, had led to very high level of biodiversity, again one of the most diverse karst ecological systems in the world. In general terms, it is comparable with the many forested karst regions of South-east Asia, but distinguished from all of them by

its level of both geodiversity and biodiversity. The unique karst forest community preserved in the Reserve provides a valuable nature laboratory for people to realize the formation and growing history of karst landforms and the development and variation of flora and fauna in karst forests.

c) The Wulong Karst: Turning to the Wulong Karst features, the diversity of speleothems of the Fulong Cave certainly can be found in caves throughout the world. However, some of the minerals appear to provide evidence of thermal environmental changes while the extent of the dust, sediment and clastic deposits, coupled with the evidence of both tectonic movement and other damage to major speleothems together provide an unusual and important opportunity for unraveling the complex geo-climatic history of the site. Further, the Tiankengs are a remarkable form of doline not generally found elsewhere in the world. Giant bridges and arches are found in many karst areas throughout the world, and in themselves, the Wulong Arches do not provide an important justification, but they are an important complement to the cave and the tiankengs, thus providing a more comprehensive sample of the Wulong Karst.

d) General Conclusion

- The South Chian Karst is unique in the world because it inherited from the unique synergy of the strong and intermittent Cenozoic uplifts of Himalayan Orogeny and the heat-moisture matched Asian Monsoon;
- It features the geological, ecological and biological processes of continental tropical-subtropical karst;
- It demonstrates the richest karst landform diversity, containing unique tower karst, pinnacle karst, cone karst and gorge karst geomorphological development mechanism, and the geomorphological development series from the watershed and paleo planation surface to valley, plain and modern gorge. And geomorphology formations display the regional geological physiognomic evolutionary process and mechanism since neotectonic movement;
- It shows high biodiversity, especially in subtropical, tropical and temperate region, as well as in humid to sub-humid region. Additional, the site is characterized by the unique importance of habitat protection as well as the strong character and high density of rare and endangered species;
- It displays exceptional natural beauty, containing some world-class natural spectacles.

3.d Integrity and/or Authenticity

3.d-1 Boundary

The boundary of nominated areas (Phase 1) and proposed buffer zone of each site of the South China Karst is clearly labeled on the maps and actual spots. In the boundary of nominated areas, they mainly remain the integrities of natural geomorphology and ecosystem, and prohibit all human activities with negative impacts on the nominated areas in exception of scientific researches. In buffer zone, the contents and patterns of human activities are also controlled in some extent.

The delimitation of boundary for the Shilin Karst Nominated Sites mainly take the integrality of Shilin geomorphology development and distributing to consideration, and in accordance with areas of Shilin national scenic and historical area and Shilin National Geological Park. The delimitation of boundary for buffer zone mainly accord to the protection of Shilin scene.

The delimitation of boundary for the Libo Karst Nominated Sites mainly accord to the integrality of cone karst geomorphology development and distributing, karst forest ecosystem and habitat of rare and endangered species. The boundary keeps coherence with the boundary of Maolan National Nature Reserve and Daqikong and Xiaoqikong Scenic Spot in Libo Zhangjiang National Scenic and Historical Area. The delimitation of boundary for buffer zone not only accord to the integrality of cone geomorphology development and distributing, but also according to the factors of protection of nominated site, such as avoiding the influence of human activities. But because the southern nominated site is located in the joint areas of Guizhou and Guangxi, the natural conditions also are relatively better; the region is planned to become further extending nominated sites, so there is no buffer zones in the southern nominated sites.

The delimitation of boundary of the Wulong Karst is mainly accord to the integrality of cave karst, gorge karst and doline scenes. The nominated sites are coincident with Furongjiang Scenic and Historical Area and National Geological Park of Wulong. The delimitation of boundary of buffer zone mainly accord to the integrality of karst drainage area, especially the boundary of Furong Cave buffer zone adequately according to the integrality of Furongjiang drainage area.

3.d-2 Area

The South China Karst Nominated Property (Phase 1) occupies enough large area, containing natural parts with *outstanding universal values* and various associated natural elements.

The Shilin Karst is nominated because it satisfies the Criteria viii and vii. In the 30km zones from south to north, the area covers northern Naigu Stone Forest to southern Suoyishan Stone Forest. It contains special Stone Forest landforms and various pertinent karst elements including stone teeth, depressions, karst hills, dolines, rivers and lakes, etc, which display intact inland plateau Stone Forest karst geomorphology types. In addition to the geological testimonies exhibiting complex evolution, it includes and exhibits the typical Stone Forest karst ecosystem corresponding to the geomorphology types, the special landforms and ecological elements with exceptional beauty.

The Libo Karst is nominated because it satisfies the Criteria viii, ix and x. The nominated area contains typical cone karst and the associated surface and underground karst features, the special karst forest ecosystem praised as “Green diamond” as well as the pertinent natural elements indicating on-going biological and ecological processes such as rock, soil, hydrology and propagation communities, etc. Besides containing abundant endangered, endemic and protective propagation, it also provides the depending habitats for them, and develops various physiognomic and ecological landscapes exhibiting the natural beauty.

The Wulong Karst is nominated because it satisfies the Criterion viii. The nominated area represents three different landscape types for karst development in the uplift regions. In terms of natural beauty, it is characterized by perfectly system and integrity. The geological history of the formation and development come back to the Cambrian, $5.4 \cdot 10^8$ years ago. The geological evolution before Neogene provides the basic conditions for the three karst sites. The land uplifts, landform and evolution from Neogene provide an evolutionary platform for the three karst systems, each with respective systematic integrity. And they are controlled by the same uplifted mechanism, belong to the different systems with different expression patterns and types developed in the concretely geological and geomorphic conditions.

3.d-3 Negative Effects

Effects for the South China Karst Nominated Areas (Phase 1) of from natural factors are mainly embodied on the intrusions from exotic species, like *Eupatorium coelestrium* scattering in Stone Forest in

Yunnan; there are the intrusions from four-o'clock, *Eupatorium coelestrium* in Libo, Guizhou. The effects for the nominated areas from human factors contain various human activities such as the infrastructure constructions of agriculture, quarry, cutting, poach and road, etc, as well as local exceeding tourism activities (see Part 4.a and 4.b). The South China Karst Nominated Areas are located in lower density of population zones, because some nominated sites are the habitations of traditional minorities, together with rugged karst landforms and thin soil layer, they are not suit for the development of merchantable agriculture. So the effective extent from human activities is relatively lower. On the side, the above effects mainly occurred in buffer zones, but the core zones (nominated areas) are well kept raw nature without effects from human activities.

3.d-4 Conservation Management

Each nominated site of the South China Karst (Phase 1) is designated as the national scenic and historic interest (Photo 3-7) or national nature reserve (see 5.b) (corresponding to the I and II of IUCN reserve), and is protected by national laws and regulations (see 5.b). There are managing organization, enough managers, managing plan, assurance of managing fund, index of protection and inspection and measure of protection in every nominated site. Natural attribute, integrality and accumulating all outstanding characters of every nominated site are protected and maintained efficiently.

Photo 3-7 The Yuanyanghu Lake in Autumn in the Libo Sites

4. State of Conservation and factors affecting the Property

4.a Present state of conservation

Each of the nominated South China Karst Sites (Phase 1) is endowed with different protective designation (see 5.b-1). Therefore, they are all protected by national laws such as *the "Constitution of People's Republic of China", "Forest Law of People's Republic of China", "Environmental Protection Law of People's Republic of China", "Water Resource Protection Law of People's Republic of China", "Law of People's Republic of China on Wildlife Protection", "Regulations for Nature Reserve of People's Republic of China", "Regulations for Wild Plants Protection of People's Republic of China", "Rules for Implication of the Law of People's Republic of China on Forest", "Provisional Regulations of People's Republic of China Concerning the Administering of the Places of Scenic and Historic Interest"*. At present, South China Karst Nominated Sites are well protected.

Efficient administering systems of different levels have been built in all nominated sites of South China Karst, which provide the areas with enough staff and finance.

South China Karst Nominated Sites have been compartmentalized definitely, and the monitoring indicators have been built accordingly (see 6.a).

South China Karst Nominated Sites, outstanding universal value including special landforms, ecosystem, endangered species and habitats, trend of species, ecosystem and integrality of natural environment for instance are undamaged subject to rehabilitation plans.

South China Karst Nominated Sites are influenced to varying degrees by natural events and human activities. Natural elements include earthquake, forest insect pest and fire in Shilin Karst Nominated Sites, storm and flood in Libo Sites, mud-rock flow and earthquake in Wulong Sites. Human impacts include cultivation, deforestation, hunting and building projects in nominated sites. Administrations have taken effective measures to counteract impacts, including returning lawn for farming to forestry on karst hills, on some slopes, growing economic forest, readjusting agricultural structures and developing mixed farming; the resulting effects are beneficial. Thus, impacts on outstanding universal values of South China Karst nominated sites are confined to relatively small parts and are actively being reduced.

4.b Factors affecting the property

South China Karst Nominated Sites are influenced by human activities. As a result, the karst landscape, ecosystem, biodiversity and national culture get pressures. However, nominated sites have different protective qualities, such as nature reserves, scenic and historic interest, geological park, etc. Therefore, South China Karst Nominated Sites are well protected, and adverse impacts are limited.

4.b-1 Developmental pressures

In South China Karst (Phase 1) nominated sites, there are some traditional houses in buffer zones with thousands of years of inhabitation history. Conflicts exist between human survival and development which impose demands on natural resources such as soils and forests, and resource protection. As development of social economy and the demands of modern life, increase the intensity of human activities, pressure on the natural environment and resources in the nominated sites is increased. There is potential pressure on the outstanding universal values and integrity of the South China Karst (Phase 1) nominated sites from a wide range of human activities.

Population: The average population density in the South China Karst (Phase 1) nominated sites is 22/km^2, and in buffer zones is 54/km^2 approximately 95% of which are engaged in traditional agriculture, therefore, the population pressure is relatively low. Population density in the Shilin Nominated Site is 8/km^2 and in its buffer zone is 20/km^2; in the Libo Nominated Site, density is 19/km^2 and in its buffer zone is 57/km^2; in the Wulong Nominated Site, density is 66/km^2 and in its buffer zone is 75/km^2. Measures have been established to reduce the population pressure; for example, people have already been removed to periphery areas of Daqikong and Xiaoqikong Scenic Spot in the Libo Nominated Site and the farmland is undergoing rehabilitation.

Agriculture and soil erosion: There is a universal demand to increase agricultural intensity around the South China Karst nominated sites and buffer zones, with the result that natural environment and vegetation is in danger. In some areas, deforestation and reclamation, has brought some environmental problems. For instance, reclamation leads to soil erosion and rock desertification in some areas. In addition, in the Shilin Area, farmland reclamation and pasturing have influenced the vegetation and natural ecology in the nominated sites and buffer zones.

Effects of industry and mining: Construction of houses and work, such as roads and railways, around South China Karst nominated sites will influence the scenery, hydro-environment and activities of wildlife. In the case of the Shilin Nominated Sites, construction work can visually impact on the background to the stone forest. The population density in the Libo Nominated Site is low and there is no industrial activity. Therefore, the atmosphere, soil and water are not polluted by industry, and the environmental quality is good. The upper reaches of the Sanshahe, which bounds the east of Maolan Natural Reserve, is polluted lightly. In the Wulong Nominated sites, construction as had some visual effect on the nominated area and buffer zone.

Exotic species encroachment: Some exotic species have been discovered in parts of the South China Karst (Phase 1) nominated areas, such as *Eupatorium coelestrium, Alternanthera philoxcriodes*, *Radix Mirabilis*, *Eryngium*, *Solanum capsicoides* and *Aster subulatus*. Planting of species such as *Eucalyptus*, and *Cupressus* also influences natural vegetation and scenes in some nominated areas. No exotic species have been discovered in the Wulong Nominated Sites.

4.b-2 Environmental pressures

Soil and water loss and stone desertification have largely been controlled since protective areas established in South China Karst Nominated Areas. Environmental conservation and scenic environment protection become the primary environmental consideration.

The Shilin Nominated Area lies in karst hill area. Some traditional quarrying has destroyed plants and aggravated soil and water loss. Atmospheric quality and water is good because there is no polluting industry. Meanwhile, some water has been subject to eutrophication.

The Libo Nominated Area is far from any city and factory, so it is not influenced by waste water, polluted air or solid waste. However, the ecosystem is still threatened by pollution in the form of tourism garbage.

The vegetation in the Wulong Nominated Area has never been threatened because of the local traditional life style. There is no polluting industry in the nominated area or buffer zone and as a result the quality of the atmosphere and water is good. Meanwhile, the population density in the nominated area is

low, with the result that there is almost no pollution of the local atmosphere, soil and water. The impacts of human activities and environmental pressures are low in most areas of the nominated sites.

4.b-3 Natural disasters and risk preparedness

Earthquake and collapse: Earthquake of Shilin Nominated Area in 1733 and 1833 made some stone pillars collapse. Earthquake intensity at Furong Cave scenic area in Furongjiang is degree, karst collapse is the potential risk, and may cause some damage.

Fire and insect pests in forest: In Shilin Nominated Areas the cambium beetle and pine moth are harmful. The climate has the feature of dry season and wet season. Fire is induced easily on wilderness and grass slope in dry season.

Drought, flood and debris flow disasters: The nominated areas suffered from drought and flood frequently, even debris flow. Global climatic change is likely to increase the possibility of these damaging events.

Risk preparedness of natural disasters:

- Establish a training system, undertake training in awareness of natural disasters and disaster countermeasures;
- Set up warning signs and take protective measures in dangerous locations, and check periodically;
- Establish a Government-Community-Corporation-Resident fire prevention and warning system and a forest fire fighting team. Put up signs promoting fire prevention and educate villages to enhance resident fire prevention consciousness. On grassy slopes and forests with high fire danger, construct fire breaks, and prohibit the lighting of fires in the open in periods of high fire danger.
- Prevent and cure plant diseases and insect pests in forests, such as the Libo Nominated Area, for which there is *The Plan of Prevention on Plant Diseases and Insect Pests in Forest,* by implementation of such plans. Preventive measures include biological, chemical and physical elements. Technicians can undertake prevention and forecasting of outbreaks of plant diseases

and insect pests. Depending on the situation, technicians can draft preventive plans and take measures as well as selecting monitoring locations and facilities to investigate and monitor the nominated area. Steps could be taken to strengthen quarantine measures for exotic seedlings, wood and bamboo to control the introduction of plant diseases and insect pests. Residents should be encouraged to plant native trees and improve the condition of forest land. Trees already infected by diseases and pests should be cut, and steps taken to improve the forest ecological environment, in order to prevent plant diseases and insect pests.

4.b-4 Visitor/tourism pressures

4.b-4-1 The Shilin Karst Nominated Area

Present conditions and forecast of tourism development: Tourism is a mainstay industry in Shilin. The current number of visitors is 2,100,000 per year. Most visitors travel in the major stone forest region. Effective measures will be taken to balance the visitor numbers in minor stone forest region, long lake region and other travel regions. The likely number of visitors is to be controlled between 2,000,000 and 2,500,000 per year.

Carrying capacity and tourism pressures: The carrying capacity of Shilin Karst Nominated Sites is currently estimated at 2.5 million per year. Increasing number of visitors and the enlarging of the sites visited will increase pressures on the environment. In addition, the naturalness of the stone forest will be threatened by the increase in facilities, such as hotels, shops and restaurants. Improper forestry in the scenic area also threatens the natural quality of the Shilin scenery. Moreover, increasing numbers of visitors will increase pressure in relation to rubbish and sewerage. Some waters have already been polluted.

Steps taken to manage visitors/tourists are:

- Implement the *"protecting and administering plan"* strictly, demarcate the boundaries of the Scenic Areas, and make certain the various reserves function as planned.
- Control the areas of the tourism regions and tourism development programs, and reduce the ecological impacts of tourism.
- Establish rules for the development of tourism and impose limits on the numbers admitted.

- Protect the environmental qualities of the nominated sites and implement regular monitoring.
- Improve the resident-community-enterprise-government network; develop monitoring research and the evaluation of tourism impacts.
- Demarcate ecological and scenic recovery areas, reafforest and recover local ecological communities and natural scenic quality.
- Establish mechanisms to share tourism benefits; improve residents' and communities' participation in tourism in the nominated sites.

4.b-4-2 The Libo Karst Nominated Sites

Present conditions and forecast of tourism development: There are high-class tourism resources in the Libo Nominated Sites, which constitute the physical foundation of the tourism industry and economic development. From 2000 to 2004, the number of tourists increased from 100,000 per year to 280,000 per year. In the scenic area named Sanchahe in the nature reserve, tourist entry is limited because of the need for protection. It is predicted that the number of tourists in the Libo Nominated Sites will increase to 572,000 per year in 2010, 810,000 per year in 2015 and 1,074,000 per year in 2020.

Tourism environmental capacity and tourism pressure: The transient tourist capacity is 6,500 people, and the proper tourist capacity is 11,250 people in the Libo Karst Nominated Sites. Total tourist numbers will fall within the planned range in next 15 years. Tourism should not produce more pressures except in relation to waste. Water quality will meet the second level standard of GB3838-2002. Without any industries in Libo Karst Nominated Site, atmospheric environment quality should approach the first level standard of *Environment Atmosphere Quality Standards.*

Steps taken to manage visitors/tourists are as below:

- Apply the relevant laws and regulations strictly; demarcate the boundaries of scenic areas and nature reserves.
- Establish a set of protective regulations, such as regulations for core areas of scenic areas, fire prevention regulations for forests in scenic areas and resource protection in scenic areas. These will provide that cutting or destroying forest, clearing land and damaging wildlife are forbidden.
- Improve the health conditions in the nominated areas by providing dustbins, health administering

organization and health administering system.

- Establish ecological parks and control entry to core areas of scenic spots and periphery of tourism villages; prohibit vehicles which do not meet *the motor vehicle emission standard* from entering scenic spots. Vehicles entering scenic areas are to be energy-conservative, environment-protective and highly efficient.
- Strictly control scenic areas and items exploited for tourism; reduce ecological impacts of tourism.
- Establish mechanisms to administer tourism; implement capacity controls.
- Demarcate ecological recovery areas and scenic recovery areas, reafforest by using indigenous flora, helping ecological communities and natural scenic qualities recover.
- Demarcate scenically protected areas.
- Establish a research station to investigate karst hydrology and biological hydrology.

4.b-4-3 The Wulong Karst Nominated Site

Present conditions and forecast of tourism development: In the last 10 years the number of tourists in Furong Jiang scenic area of Furong Cave was about 100,000; in The Three Natural Bridges geological national park the number was between 70,000 and 90,000 in the last 5 years. The annual tourism capacity is greater than a million people. However, the number of tourists is under the daily capacity even in the busy tourist season.

Tourism environmental capacity and tourism pressure: There is no service area within the Wulong Karst Nominated Sites, and the time spent by tourists in each scenic area is about 2 hours. The number of tourists is not expected to be above the capacity in subsequent years, however, the number of tourists must be limited because the road is narrow in The Three Natural Bridges and the cave space is limited in Furong Cave. The necessary measures should be established to deal with future tourism pressures. Whereas the number of tourists is presently under capacity, phenomena such as the cave environment are changing and rare biological resources are in danger. Proper ly planned tourism will not adversely influence the caves, The Three Natural Bridges, giant doline (Tiankeng) gorges, water and hills.

Steps taken to manage visitors/tourists are as below:

- Implement relevant laws and regulations strictly, demarcate scenic areas and nature reserves.
- Strictly control scenic areas and items exploited for tourism; reduce ecological impacts of tourism.
- Establish mechanisms to administer tourism; implement capacity controls.
- Protect the environmental qualities of the nominated sites, review the administering system annually.
- Protect cave environments strictly; prohibit changes to the natural conditions in caves.
- Demarcate ecological and scenic recovery areas; reafforest by using indigenous flora; recover local ecological communities and natural scenic quality.
- Demarcate scenically protected areas.
- Establish a research station to investigate karst hydrology and biological hydrology.

4.b-5 Number of inhabitants within the property and the buffer zone of South China Karst

Table 4-1 Number of Inhabitants within the Property and Proposed Buffer Zone

Nominated Property	Population
Shilin Karst	Estimated population located within the area of the nominated property: 961 Estimated population located within the buffer zone: 4632 Total: 5593 Year: 2004
Libo Karst	Estimated population located within the area of the nominated property: 5751 Estimated population located within the buffer zone: 24747 Total: 30498 Year: 2004
Wulong Karst	Estimated population located within the area of the nominated property: 3940 Estimated population located within the buffer zone: 23993 Total: 27933 Year: 2004
Estimated population located within the area of the nominated sites: 10652 Estimated population located within the buffer zone: 53372 Total: 64024 Year: 2004	

5. Protection and Management

5.a Ownership

The nominated South China Karst Areas is owned by the People's Republic of China.

Constitution of the People's Republic of China

Article 9. Mineral resources, waters, forests, mountains, grassland, unreclaimed land, beaches and other natural resources are owned by the state, that is, by the whole people.

5.b Protective Designation

5.b-1 Contents of Protective Designation

5.b-2 Summary of Legal Provisions and Relevant Articles That Ensure the Legal Status of the Nominated Sites

Table 5-1 Protective Designation of the South China Karst Nominated Sites

Nominated Sites	Protective Designation and Approved Date
Shilin Karst	National Scenic and Historic Area (year 1982) National Geological Park (year 2001) UNESCO Geological Park (year 2004)
Libo Karst	National Nature Reserve (year 1988) National Scenic and Historic Area (year 1994) Member of World Biosphere Protected Area Network (year 1996)
Wulong Karst	National Scenic and Historic Area (year 2002) National Geological Park (year 2003)

Table 5-2 Summary of Legal Provisions and Relevant Articles That Ensure the Legal Status of the Nominated Sites

Name	Issued Date	Issued By
Constitution of the People's Republic of China	1982	National People's Congress
Environmental Protection Law of the People's Republic of China	December 1989	The 11th Meeting of the Standing Committee of the 7th National People's Congress
Law of the People's Republic of China on the Protection of Wildlife	January 1988	The 4th Meeting of the Standing Committee of the 7th National People's Congress
Forestry Law of the People's Republic of China	April 1998	The 2nd Meeting of the Standing Committee of the 9th National

		People's Congress
Water Law of the People's Republic of China	January 1988	The 24th Meeting of the Standing Committee of the 6th National People's Congress
Provisional Regulations of the People's Republic of China Concerning the Management of Scenic and Historic Areas	June 1985	State Council
Regulations of the People's Republic of China On Nature Reserves	October 1994	State Council
Regulations of Yunnan Province Concerning the Management of Scenic and Historic Areas	May 1996	The Standing Committee of the 7th People's Congress of Yunnan Province
Measures of Guizhou Province Concerning the Management of Scenic and Historic Areas	January 1995	The People's Government of Guizhou Province
Regulations of Chongqing City Concerning the Management of Scenic and Historic Areas	1998	Chongqing City
Regulations of Lunan Shilin Concerning the Management of Scenic and Historic Areas	February 1991	The Standing Committee of the 7th People's Congress of Yunnan Province
Regulations of Libo County, South Guizhou Buyi and Miao Autonomous Prefecture, Concerning the Management of Zhangjiang Scenic and Historic Areas	July 2001	The 23rd Meeting of the Standing Committee of the 9th People's Congress of Guizhou Province
Regulations of the People's Government of Libo County Concerning the Management of Maolan Karst Forest Nature Reserve	May 1988	The People's Government of Libo County
Measures of Wulong County Concerning the Management of Furongjiang National Scenic and Historic Area	September 2002	The People's Government of Wulong County

Constitution of the People's Republic of China

Article 22. The state protects places of scenic and historical Area, valuable cultural monuments and relics and other important items of historical and cultural heritage in China.

Article 26. The state protects and improves the living environment and the ecological environment, and prevents and controls pollution and other public hazards. The state organizes and encourages afforestation and the protection of forests.

Environmental Protection Law of the People's Republic of China

Article 17. The people's governments all levels shall take measures to protect regions representing various types of natural ecological systems, regions with a natural distribution of rare and endangered wild animals and plants, regions where major sources of water are conserved, geological structures of major scientific and cultural value, famous regions where karst caves and fossil deposits are distributed, traces of

glaciers, volcanoes and hot springs, traces of human history, and ancient and precious trees. Damage to the above shall be strictly forbidden.

Article 19. Measures must be taken to protect the ecological environment while natural resources are being developed or utilized.

Article 23. In urban and rural construction, vegetation, waters and the natural landscape shall be protected and attention paid to the construction of gardens, green land and historic sites and scenic spots in the cities in the light of the special features of the local natural environment.

Law of the People's Republic of China on the Protection of Wildlife

Article 6. The governments of all levels shall strengthen the administration of wildlife resources and formulate plans and measures for the protection, development and rational utilization of wildlife resources.

Article 9. The state shall give special protection to the species of wildlife which are rare or near extinction. The wildlife under special state protection shall consist of two classes: wildlife under first class protection and wildlife under second class protection. Lists or revised lists of wildlife under special state protection shall be drawn up by the department of wildlife administration under the State Council and announced after being submitted to and approved by the State Council.

Forestry Law of the People's Republic of China

Article 24. The competent department of forestry under the State Council and the people’s governments of provinces, autonomous regions and municipalities directly under the Central Government should delimit nature reserves and step up protection and administration in typical forest ecological regions, forest regions where in rare and precious animals and plants grow and breed (multiply), natural tropical rain forest regions and other natural forest regions with special value of protection in different natural belts.

Article 25. Hunting and catching of wild animals under state protection in forest regions are prohibited; where hunting and catching are necessitated for special requirements, they shall be handled pursuant to relevant state provisions.

Water Law of the People's Republic of China

Article 5. The state shall protect water resources and adopt effective measures to preserve natural flora, plant trees and grow grass, conserve water sources, control water and soil losses and improve the ecological environment.

Provisional Regulations of the People's Republic of China Concerning the Management of Scenic and Historic Area

Article 14. In The Scenic and Historic area, the intensity of its exploitation and utilization shall be strictly controlled, attention paid to excessive exploitation and construction, and its original natural and historical looks maintained, pursuant to the relevant state provisions and the characteristics of the area, and the requirement of resource protection and environment capacity.

Article 15. Scenic and Historic Areas shall be categorized based on type, area, size, and level, and protected accordingly, pursuant to the differences of their scenery, scenery value, type, size and the environment.

Regulations of the People's Republic of China on Nature Reserves

Article 18. Natural reserves may be divided into three parts: core zone, buffer zone, and experimental zone. In the nature reserve, the ecosystems which are well-preserved and in natural state, and the centralized distributing areas of the animals and plants which are rare and near extinction, should be designated as the core area, and all units and individuals shall be prohibited to enter. Unless approved in conformity to the article 17 of this regulation, entering the core zone is also off-limits to scientific research activities. A certain area surrounding the core zone is designated as buffer zone, in which only scientific observations and research activities are allowed. The area surrounding the buffer zone is designated as experimental zone, which may be used for such activities as scientific experimentation, education, tourism and the domestication and breeding of rare and endangered wild animals or plant species. If considered necessary by the people's government who originally approved the establishment of the nature reserve, an outer protection area surrounding the nature reserve may be designated.

Article 26. It is forbidden to engage in such activities as fell, graze, hunt, catch and fish, pick herbs, reclaim, burn the grass on waste land, mine, quarry, dig sand, and so on, in nature reserves, except the special cases stated in law or the rules of administrative law.

Article 27. It is forbidden to enter the core zone of nature reserves. If entering the nature reserve is necessary for scientific research, an application and action plan must be submitted to nature reserve's administering agency, and approved by the nature reserve's relevant administering department under the people's government at or above provincial level before entering it to engage in scientific observations and research activities. In particular, in order to enter the core zone of national nature reserves, approval must be obtained from the competent administering department of nature reserves under the State Council.

Regulations of Yunnan Province Concerning the Management of Scenic and Historic Area

Article 12. The Scenic and Historic Area shall maintain original natural and historical looks. The local administering agency shall be equipped with the professionals, complete protection system, and carry out protection measures. At the entrances to the scenic historic areas and related scenic spots, protection explanations and signs shall be set up. All units, residents, and tourists who enter the Scenic and Historic area must comply with all management provisions of the area, take good care of scenic establishment and facilities, and protect the environment. Any damage or remodeling of the Scenic and Historic Area is prohibited.

Measures of Guizhou Province Concerning the Management of Scenic and Historic Area

Article 11. The Scenic and Historic Area shall clearly delimit its management boundary and outer protection zone, in accordance with the overall planning.

Article 12. The administering agency of the Scenic and Historic Area must take the conservation work of Scenic and Historic resources as the primary task, be equipped with necessary strength and facility, establish and complete the bylaws, and carry out conservation responsibility.

Article 13. All units and individuals are forbidden to engage in the following activities in Scenic and Historic Areas: a) Encroach on land illegally. b) Establish development and vacation areas, lease land, and

sell or transfer resources of the area. c) Mine, quarry, dig sand and collect earth without authorization. d) Cut down ancient trees and famous woods and scenic woods, climb trees, break tree branches, pick flowers, destroy woods, and reclaim barren land, cut firewood, and graze in sight-seeing areas. e) Hunt wild animals. f) Emit wastewater, exhaust gas, or exhaust residue. g) Build tombs in scenic spots. h) Damage cultural relics, depict or smear on sceneries. i) Set up campfire in woods. j) Or other activities that possibly damage the resources of the Scenic and Historic Area.

Regulations of Chongqing City Concerning the Management of Scenic and Historic Area

Article 4. The Scenic and Historic Area must stick to the policy of conservation, unified management, rational exploitation, and continued utilization.

Article 5. The people's governments at or above county level shall strengthen the leadership for the work of The Scenic and Historic Area, organize relevant departments, do a effective job on the conservation, plan, construction and administration of The Scenic and Historic Areas, and achieve the economical, social, and environmental benefit, while complying with law.

Regulations of Lunan Shilin Concerning the Management of Scenic and Historic Area

Article 8. Serious protection should be given to the geophysiognomy and natural landscape of Shilin Scenic Area. It is forbidden to inscribe or depict on rocks. It is forbidden to damage and sell stone hills, stone teeth and stalagmite, stalactite, pillars and other stone landscapes. In the Class I and II reserves, it is forbidden to mine, quarry, dig sand and collect earth, and reclaim barren land.

Article 9. Serious protection should be given to flowers, grass, trees, woods, and natural vegetation of Shilin Scenic Area. It is forbidden to cut down trees, climb trees, break tree branches, or inscribe onto trees. It is forbidden to tramp on flowerbeds and pick flowers. It is forbidden to graze and picnic in the first class reserve.

Article 10. Serious protection should be given to wild animals of Shilin Scenic Area. It is forbidden to harm or hunt wild animals.

Article 11. Serious protection should be given to the human landscape of Shilin Scenic Area. It is

forbidden to depict, smear, damage, or destroy cultural relics and revolutionary sites such as Moya Carved Stone, and garden architecture. It is forbidden to engage in activities that harm the local ethnical culture.

Article 12. Serious protection should be given to public engineering facilities, tourism facilities, and hospitality service facilities in Shilin Scenic Area. Damages to such facilities are prohibited.

Article 14. The waters of reservoirs, Changhu lakes, and karst caves in Shilin Scenic Area shall be protected in accordance with State Ground Water Environment Quality Standards (GB3838-88) and Grade II Standards. Yue Lake, Grand Waterfall, Shilin Lake, Jianfengchi Pond, and other bodies of water shall be protected in accordance with State Ground Water Environment Quality Standards (GB3838-88) and Grade II Standards.

Article 15. Serious protection should be given to the environmental atmosphere of scenic areas. Soot is controlled in Scenic Areas. All boilers and furnaces must take effective measures to eliminate soot, in accordance with the state emission standard.

Regulation of Libo County, South Guizhou Buyi and Miao Autonomous Prefecture, Concerning the Management of Zhangjiang Scenic and Historic Area

Article 4. In the conservation and construction of Zhangjiang Scenic and Historic Area, the principles of serious protection, scientific plan, unified management, rational exploitation, and continued utilization shall be followed, and ecological, economic, and social benefits harmonically developed.

Article 7. In Zhangjiang Scenic and Historic Area, the following actions are prohibited: a) Cutting down or destroying ancient trees, famous trees, sceneries, woods, flowers, and grass. b) Burning up woods to reclaim land, and willfully cutting down trees. c) Mining, quarrying, digging sand, and collecting earth. d) Filling up or walling up rivers, brooks, lakes, streams, and waterfalls. e) Piling up, loading, storing, or emitting polluting waste residue, wastewater, toxic gas, and harmful gas. f) Dumping garbage and other solid castoff matter into waters, washing toxic and polluting items in water. g) Harming wild animals by hunting, catching, blasting, poisoning or using other methods. h) Other actions are harmful to the scenic and historic resources.

Article 10. Already established polluting construction projects in Zhangjiang Scenic and Historic Area shall be handled within time constraints. Those that fail to meet the environmental quality standard shall be closed, stopped, transferred, or moved.

Article 11. It is forbidden to encroach on or damage the riverways, beaches, riverbanks and related facilities in Zhangjiang Scenic and Historic Area.

Regulations of the People's Government of Libo County Concerning the Management of Maolan Karst Forest Nature Reserve

In the reserve, it is strictly forbidden to fell or steal trees, destroy forest, burn up woods to collect manure, produce charcoal to sell, hunt wild animals, pollute water. Without the authorization of administering committee, all units and individuals are not allowed to enter the reserve to purchase bamboo, wood, firewood, medicinal herbs, wild animals and fur. Any violator shall be strictly dealt. Serious cases shall bear legal liability in accordance with the provisions of relevant laws. Environment and natural resources of the nature reserve shall be managed by administering committee. Without approval of the people's government at county or above level, any unit or individual is not permitted to willfully enter the reserve to establish organizations and build facilities.

Measures of Wulong County Concerning the Management of Furongjiang National Scenic and Historic Area

Article 7. The administration of Furongjiang, together with the departments of forestry, environmental protection, country resources, and other related departments, is responsible for investigating the resources of Furongjiang National Scenic and Historic Area, and setting up dynamic records. It shall constitute special measures, and implement effective protection to such key protection targets as special geological relics, and precious and rare wildlife.

Article 9. The department of county forestry shall do a good job on closing mountains to facilitate afforestation, stopping farming to restore forests, planting trees and afforestation, altering forest appearance. Good protection shall be given to breeding, growing, and habitation of the species sources of wild animals.

5.c Means of Implementing Protective Measures

5.c-1 Management System and Regulations

On the basis of following the existing Chinese laws and regulations, in order for protection measures to have better pertinence and feasibility, nominated areas of South China Karst have established a series of management systems and regulations, further improved protection measures in heritage nominated areas.

5.c-2 Management Agency

The Nominated Areas of South China Karst are managed under the umbrella of the State Ministry of Construction (the Libo Karst Nominated Sites is also under the management of State Forestry Bureau). Each of their corresponding provinces, cities, or prefectures have also set up their own departments, such as Construction Department (or Garden Bureau) and Heritage Management Committee, etc, to implement more direct management to the heritage nominated area. Moreover, every nominated area further improves the establishment of management agency, and correspondingly set up direct management agencies: a) Administration of Shilin Scenic and Historic Area (the Libo Karst Nominated Sites). b) Administration of Zhangjiang Scenic and Historic Area of Libo (the Libo Karst Nominated Sites). c) Administration of Furongjiang Scenic and Historic Area of Wulong County (the Wulong Karst Nominated Sites), etc. Every department takes its own responsibility, takes charge of its duty, cooperates with each other, and manages together to carry on every protection and management work.

Table 5-3 Major Management Agencies and Their Responsibilities

NO.	Name	Responsibilities	Address
1	Ministry of Construction of People's Republic of China	Master plan, protection, construction, administering, harmony and guidance of the scenic and historic Area all over country.	Sanlihe Road, Beijing, the People's Republic of China
2	Environmental Protection Department of People's Republic of China	Approval and harmony of the natural reserves in scenic Area.	Nanxiao Street, Xizhimen Area, Beijing, the People's Republic of China
3	Forestry Department of People's Republic of China	Industrial management of biodiversity resources and administrative management in the scenic and historic Area.	Chaoyang Area, Beijing, the People's Republic of China
4	Ministry of Land and Resources of People's Republic of	Investigation, protection and Industrial management of soil and mine resources or geological relic in the scenic and historic Area or the national geological park.	Yingguanyuan, Beijng, the People's Republic

	China		of China
5	Ministry of Water resources of People's Republic of China	Harmony and management on protection and exploitation of water resources in the scenic and historic Area.	Baichang Road, Xuanwu Area, Beijing, the People's Republic of China
6	World Heritage Management Committee of Yunnan Province	Important decision-making and complete guidance on the management of heritage in Yunnan Province.	Kunming City, Yunnan Province
7	Construction Department of Yunnan Province	Industrial management, daily protection and construction of the scenic and historic Area.	Kunming City, Yunnan Province
8	Administration of Scenic and Historic Area and Garden, Construction Department of Guizhou Province	Studying out the management rule of law and actualizing method; protection, plan, construction, management, monitoring and execution of the garden and greening; guidance of the operation work of administering organs in the scenic and historic area; organization and guidance on the master plan and particular plan; nomination and approval scenic and historic area; guidance the protection of biodiversity in the scenic and historic area.	Western Yanan Road, Guiyang City, Guizhou Province
9	Office of World Heritage Application and Management of Guizhou Province	Nomination and management the world heritage, maintenance the heritage resources. Authorized by the director department, it is responsible for investigation, evaluation, nomination, protection, inspection and management of the world heritage resource all over province; plan, organization, examination and approval of the heritage sites; as well as training the personnel being charged with the heritage work.	Western Yanan Road, Guiyang City, Guizhou Province
10	Forestry Department of Guizhou Province	It aims at the management of nature reserves	Guiyang City, Guizhou Province
11	World Heritage Management Committee of Chongqing City	It is responsible for significant decision and complete guidance for world heritage management	Chongqing City
12	Construction commission of Chongqing City	It is responsible for the industrial management and daily management on scenic and historic area.	Chongqing City
13	Garden Bureau of Chongqing City	It is responsible for the industrial management on gardens in scenic and historic area.	Chongqing City
14	Construction Bureau of Kunming City	Industrial management on the scenic and historic areas in Kunming City.	Kunming City, Yunnan Province
15	Administration of Shilin Scenic and Historic Area	Protection, construction and management on the Shilin Scenic and Historic Area.	Kunming City, Yunnan Province
16	Administration of Maolan National Nature Reserve of Guizhou	Protection, management and research on the karst forest resources and other natural resources in the area of Molan Reserves.	Yuping Town, Libo County, Guizhou Province
17	Administration of Zhangjiang River Scenic and Historic Area of Libo, Tourism Bureau of Libo County	It is responsible for protection, plan, construction and management of the Zhangjiang Scenic and Historic Area; tourism plan and tourism product exploitation; industrial management, approving and direction on the tourism corporations and enterprises in Libo County; monitoring and management of the tourism products and service quality; monitoring and inspection on the tourism security.	Yuping Town, Libo County, Guizhou Province

18	The People's Government of Wulong County	Protection, construction and management of the Wulong Scenic and Historic Area.	Wulong County in Chongqing City
19	Administration of Furong River Scenic and Historic Area of Wulong County	Exploitation, protection and management of the nominated sites for the heritage.	Wulong County in Chongqing City
20	Land and Resources Bureau of Wulong County	It is responsible for management and harmony of soil management, geological relic and mine resources.	Wulong County in Chongqing City

5.c-3 Conservation Planning

Each of the South China Karst Nominated Areas for world natural heritage has established relevant plans. Each plan, from different perspectives and layers, brings forth detailed provisions and requirements for the management and protection of the heritage nominated area. For more effective protection, each heritage nominated area also establishes protection and management plan, which brings forth effective protection measures aiming at the protection problem of the nominated areas outstanding universal value. See 5.d and 5.e for details

5.c-4 Area Conservation

The South China Karst Nominated Areas for world natural heritage are divided into areas with different protection levels, and are protected separately.

The Libo Karst Nominated Sites are divided into special class reserve, class I reserve, class II reserve, and class III reserve. Special class reserve is utterly protected. No construction is allowed in special class reserve. Except for scientific research, tourists are not allowed to enter. Each facility in Class I reserve must be relevant to its scenic landscape, and no mobile vehicles are allowed to enter. Class II reserve restricts the construction unrelated to sightseeing. The number of mobile vehicles on premises is restricted. Class III reserve ensures every construction and establishment project is in line with its scenic environment.

The Scenic and Historic Area of Daqikong and Xiaoqikong in the Libo Karst Nominated Sites are divided into special class reserve, class I reserve, class II reserve, and class III reserve. In special class reserve, the construction of any facility that obstructs the resources and environment is not allowed,

however, the necessary sightseeing paths, rest booths or corridors, and washrooms may be constructed. The entering of tourists should be strictly controlled. Local manufacturing activities are prohibited. In class I reserve, the exploitation is controlled, local manufacturing activities limited, and mobile vehicles controlled. In class II reserve, sightseeing items and tourism facilities may be arranged, and local manufacturing activities controlled. In class III reserve, the facilities in line with the characteristics and capacity of the scenic area may be constructed, the original land use methods and forms allowed to be preserved, and local manufacturing activities rationally arranged. Maolan Nature Reserve is divided into core area, buffer zone, and experimental zone. The core area is utterly protected. It is forbidden for any unit or individual to enter the core area. In the buffer zone, jamming should be minimized. Planned scientific research or field trips in the buffer zone are allowed after an application is submitted to Administration of Nature Reserve of Maolan, and officially approved by the authorities. In experimental zone, scientific experiments, field trips, visiting and investigation, zoology tours, breeding or domestication of wildlife, and other rational utilization and manufacturing demonstrations, which are beneficial to the resources, may be carried on, if permitted by the relevant laws and regulations.

The Libo Karst Nominated Sites are divided into the core scenic area and the important scenic area. In the core scenic area, serious protection should be given to the natural scenery. It is strictly forbidden to modify its original physiognomic and geologic formation. It is strictly forbidden to mine, quarry, and irrigate.

5.c-5 Monitoring

In order to better research the dynamic changing process of Karst integrality, environment, animal species, plant species, social economy, population, geologic disaster, forest felling, tourist quantity, and land use type, etc, in The Nominated Areas of South China Karst, detect problem in time, solve problem, and expect better protection of the nominated area outstanding universal value, the nominated areas of the South China Karst have established the corresponding monitoring guidelines to periodically or aperiodically monitor and review, inspect, detect problem, and solve problem in time. For more details, see 6.a.

5.c-6 Local Traditional Conservation

Formulation of the village rules and conservation of Fengshui Forest are very effective traditional conservation methods. Established by all villagers, the village rules are documents with criterion and force effect, which have superior authority among villagers, and are action guidelines for the villagers. In The Nominated Areas of South China Karst, most are traditional minority groups. They have adopted some traditional methods to protect their living environment, while managing to adapt it over the years. On adoption is the modification of village rules. In the Shilin Nominated Sites, there is the Mizhishan Culture tradition of protecting natural vegetations in Yi People villages. For example, the village rules of Laqiao Group, Raolan Village, Yongkang Town in the Libo Karst Nominated Sites state: felling, stealing and selling of such trees as *Eucommia ulmoides* (saplings), *Prunus mume* (saplings), *Cunninghamia lanceolata*, *Toona sinensis*, *Pinus massonianai*, etc, will be fined ranging from 10 Yuan to 500 Yuan according to the type and size of the tree. Damage of forest resources by livestock from other groups or villages should be controlled, and reported to the group leader. The group leader will carry out punishment. Serious cases should be reported to the administering bureau of the reserve. It is forbidden to cultivate forest marshland. It is forbidden to destroy wetland forest and herbage, and pollute water source. Violators who are caught will be fined ranging from 50 Yuan to 500 Yuan. The village rules have boosted the villager's awareness of natural resource conservation, increased the participation of the local residents, and enhanced the community competence and self-control. It plays an important role in effectively manage the local environment, ecosystem, and natural resources.

5.d Existing Plans Related to Municipality and Region in Which the Proposed Property is Located

5.d-1 Existing Plans Related to municipality, County, and Region in Which The Nominated Areas of South China Karst is Located

Table 5-4 Existing Plans Related to Municipality, County, and Region in which the Nominated Areas of South China Karst is Located

Name	Plan	Written By	Approved Date
Shilin Karst	*Yunnan Province 10th 5-year Social and Economic Development Plan and Long-Term Plan (year 2000 – 2020)*	Yunnan Reform Development Committee	2001
	Kunming City 10th 5-year Social and Economic Development Plan and Long-Term Plan (year 2000 – 2020)	Kunming City Reform Development Committee	2001

	Shilin Yi Autonomous County 10th 5-year Social and Economic Development Plan and Long-Term Plan	The People's Government of Shilin Yi Autonomous County	2001
	Shilin Scenic and Historic Area Integrated Plan (Draft)	Administration of Shilin Scenic and Historic Area、Yunnan Fangcheng Planning Office	2002
	Shilin Yi Autonomous County Ecological Construction Plan	The People's Government of Shilin Yi Autonomous County	2002
	Shilin Yi Autonomous County Tourism Development Plan and Long-Term Plan (year 2000 – 2020)	Shilin Yi Autonomous County	2002
Libo Karst	*Libo County Environment Protection Plan*	Environmental Protection Administration of Libo County	1998
	Libo Integrated Tourism Development Plan	Guizhou Urban and Rural Planning Engineering Institute	2001
	Libo County Integrated National Ecological Construction Demonstration Area Plan	The People's Government of Libo County, Guizhou Environmental Engineering Research Institute	2001
	Guizhou Province Integrated Tourism Development Plan	The People's Government of Guizhou Province, World Tourism Organization, State Bureau of Tourism	2002
	Libo Zhangjiang Scenic and Historic Area Integrated Plan	Guizhou Construction Engineering Institute, Guizhou Scenic and Historic Area Association	2003
	Guizhou Maolan National Nature Reserve Integrated Plan (year 2003 – 2015)	Guizhou Forestry Investigation Planning Institute	2003
	Libo County Integrated Desertification Prevention and Cure Plan	Guizhou Normal University	2005
Wulong Karst	*Furongjiang's Sichuan Section Tourism Resource Development Plan*	The People's Government of Wulong County Sichuan Province, Geography Department of South West Normal University	1995
	Wulong County Integrated Tourism Development Plan	Urban Development Research Office of Chongqing Institute of Social Science	2000
	Chongqing Wulong Integrated Tourism Development Plan (Year 2004 – 2020)		
	Chongqing Integrated Tourism Plan		2001
	9th 5-year State Economy and Social Development Plan and Long-Term Objectives For Year 2010		
	Integrated Wulong Natural Bridge, Gorge, Sanchaoshenshui Tourism Development Plan	Wulong Town Planning Engineering Development Center	
	Wulong Baiguo Gorge Scenic Area Integrated Plan and Park Scenic Area Detailed Plan	Chongqing Garden Construction Planning and Engineering Institute	2001

	Furongjiang Scenic and Historic Area Integrated Plan	Chongqing Garden Construction Planning Engineering Institute	2001
	Chongqing Wulong Karst Geological Park Integrated Plan	Sichuan Geological Park, Geological Relics Investigation and Evaluation Center	2002

5.d-2 Summary of the Articles in Relevant Plans

Summary of the articles related to the Libo Karst Nominated Sites:：a) Develop and cultivate the supporting base of backbone industries in Yunnan Province. Strictly protect the important natural and cultural relics and key ecological areas. Strictly protect Shilin landscape and its geological relics, natural vegetation, wild animal, protect and restore the natural environment and zonal vegetation, and complete area and type protection system. b) Improve the construction measure of fundamental protection and tourism facilities of Shilin, enrich the sight-seeing and folk-custom tour of Shilin. Develop scientific research tour, ecology tour, and countryside tour, etc. Increase the tourism income of the local residents. c) Control the tourist scale in the sight-seeing area, increase fundamental sanitation, replace the developing projects that harm the environment and the integrity of the scenic area. d) Construct the Zhujiang shelter forest system, clean up the Bajiang, restore river bank forest, earnestly develop ecological construction, and clean up areas losing water and soil e) Improve the structure of household energy sources, develop marsh gas, hydroelectricity. Construct firewood bases. f) Construct rural vegetation, restore species breeding bases, improve unitary human forests, clean up forest diseases and insect pests. Quit farming and grazing, and close the mountains for afforestation in the class I reserve of Shilin Scenic and Historic Area. Cutting of natural vegetation is strictly prohibited.

Summary of the articles related to the Libo Karst Nominated Sites：a) In the scenic areas, it is strictly forbidden to mine, quarry, and damage natural vegetation. b) Strictly control the size, quantity, and color of the tourism facilities. Rationally construct environment protection facilities. c) Visitors are not allowed to enter the absolute protection area of the nature reserve. To ensure its natural and original state, only simple observation and experiment facilities can be set up for the scientific researching professionals. The scientific experiment areas are off-limits to visitors. d) The local residents shall be guided to develop mixed farming such as medicinal materials, wild fruits, and breeding of garden plant species, while not destroying the natural resources. In the ecological tourism areas, educational tourism service on geography, geology, and propagation shall be offered, while not destroying the natural resources. Sightseeing rest

places with natural style shall be properly constructed, while midway accommodation is not provided. e) The Maolan Nature Reserve and the Zhangjiang Scenic and Historic Area shall apply for the world natural heritages. c) Improve household energy resource structure, and develop marsh gas, coal, hydroelectricity, and a firewood base.

Summary of the articles related to the Libo Karst Nominated Sites： a) Serious protections shall be given to the natural landscapes of the core area, including valley, gorge, and water quality and quantity of the underground rivers, etc. It is strictly forbidden to alter the original physiognomic and geological formation. It is strictly forbidden to mine, quarry, and irrigate. b) In the important scenic areas, control population, existing buildings and constructions which are inappropriate for the scenery are torn down or reconstructed. Strictly control the constructions of the houses, and develop ecological agriculture. c) Close the hills for afforestation in the ecology conservation areas. d) It is forbidden to mine, quarry, cut trees, destroy woods, and hunt animals. Constructions are not allowed except for the protection facilities. e) Certain amount of tourism activities are allowed, but there are limitations. Only planned tour routes are allowed to open to visitors. f) The primary role of the Scenic and Historic Area is to protect water quantity and quality of water sources, especially upriver water quality and quantity of Natural Bridge scenic area and Furongjiang. g) The selection of the service and reception center base shall be discreet, which shall be constructed in accordance with local natural environmental conditions and economic development, to avoid excessive pressure to the local environment that negatively impact scenery resources. The service and reception center shall be set up in Wulong Country instead of in the heritage the Libo Karst Nominated Sites. h) In the regular areas, it is forbidden to directly damage and indirectly disturb scenery resources. It is forbidden to blindly mine, quarry and hunt. Land use and construction density shall be strictly controlled, and the villages' natural environment maintained.

For the abstracts of the plans related to the South China Karst Nominated Areas for world natural heritage, please see the annex.

5.e Property Management Plan or Other Management System

5.e-1 Existing Management Plan of the South China Karst Nominated Areas for World Natural Heritage

Table 5-5 Existing Management Plan of the Nominated South China Karst Sites

Name	Management Plan	Issued By	Approval Date
Shilin Karst	*Shilin National Park Management Plan*	Administration of Shilin Scenic and Historic Area	2005
Libo Karst	*Protection and Management Plan of the World Natural Heritage Nominated Area of Libo Cone Karst*	Guizhou Construction Engineering Institute	2005
Wulong Karst	*Protection Plan of the Heritage The Libo Karst Nominated Sites*	Institute of Karst Geology, Chinese Academy of Geological Sciences	2005

5.e-2 Analysis and Explanation

The conservation management plans of the South China Karst Nominated Areas for world natural heritage have delimited the locations and areas of the heritage nominated property, expatiated their outstanding universal value, analyzed the conservation status quo of the nominated areas, brought forward the importance and necessity of protection and conservation management plans, and formulated conservation objectives, such as protection of resource authenticity, environment integrity, wildlife diversity and habitat, etc, in order to effectively protect original karst, natural beauty, forest ecosystem, rare and endangered wildlife, and rich cultural relics. Consequently, the public gains more awareness of conservation, and is more willing to participate in environmental protection, in turn, the community adopts the goal of continuing development, and the heritage outstanding universal value is maintained and strengthened. Finally, on the basis of dividing the heritage into different protection function areas, a series of effective conservation management measures and strategies are created, such as mending of major management projects and plans, development of management ability, comprehensive repair of environment, protection of life diversity and rare and endangered wildlife, heritage monitoring, heritage scientific research, heritage management training, education of heritage value and protection awareness, tourism management and development of ecological tourism, continuing development of the community, and conservation of cultural relics, etc.

For the details of the conservation management plan of the South China Karst Nominated Areas for world natural heritage, please see the annex.

5.e-3 Guarantee of Effectively Implementing Management Plans or Other Management Systems

Guarantee of Law： The laws and regulations of the People's Republic of China provide a legal basis for conservation and management planning of the heritage nominated areas. The laws must be followed when implementing conservation measures. At the same time, every nominated area has also formulated the relevant regulations and management measures, and provided guarantee for the implementation of conservation and management plan.

Management Agencies： The Nominated Areas of South China Karst have a strong management force, ranging from the State Ministry of Construction, the Competent Department of Forestry, and the Ministry of Land Resources at state level, to the Construction Department (Garden Bureau), the Department of Forestry, and the Department of Land Resources at province (or city) level. The nominated areas have also established relevant management agencies of different levels. For example, the Libo Karst Nominated Sites has established the Administration of Maolan Nature Reserve and the Administration of Zhangjiang Scenic and Historic Area of Libo. Under the Administration of Maolan National Nature Reserve of Guizhou are level 2 agencies, such as Office, Administration Section, Scientific Research Section, Forestry Administration Section, Community Development Management Section, Forestry Police Station and Forest Ecology Tourism Development Company, etc. These are followed by the Yongkang Management Station, the Wengang Management Station, the Sanchahe River Management Station, and the Dongtang Management Station and one orientation observation station. Under Administration of Zhangjiang Scenic and Historic Area of Libo are Office, Planning and Construction Section, Planning and Financing Section, Monitoring and Protection Section, Management Section, Tourism Planning Section, and Scenic Area Police Station, etc. The Libo Karst Nominated Sites is managed by Administration of Furongjiang Scenic and Historic Area of Wulong, under which are Office, Planning and Construction Section, and Security Protection Section. The agencies have their own responsibilities, cooperate with each other, manage together, and guarantee a strong leadership for the implementation of management planning of the heritage nominated area.

Community Participation： Community residents are an important part of the buffer zone of a heritage nominated area. Resident life is closely linked to its environment, and more so with the conservation effect of the heritage area. With the establishment of different types of conservation areas such as scenic and historic areas and nature reserves, participation and management ability of the community

residents is increased, execution of the forestry laws enforced, and ecological awareness of the farmers gradually increased. Consequently, sharing of forest resource management is satisfyingly transformed from passive participation and management to initiative participation and management, and community participation in the implementation of management planning of every heritage nominated area is guaranteed.

5.f Sources and Levels of Finance

All parts of the South China Karst Nominated Areas for world natural heritage have relatively sufficient financial sources.

Table 5-6 Sources and Levels of Finance of the Libo Karst Nominated Sites

Year	Sources and Amounts of Finance (Million Yuan)			
	Ticket Income	Government Funds	Project Funds	Total
2000	80.00	1.20	1.00	82.20
2001	100.00	1.00	1.20	102.20
2002	110.00	1.00	2.10	113.10
2003	120.00	1.20	3.20	124.40
2004	150.00	1.50	4.00	155.50
2005	160.00	4.00	20.00	184.00

Table 5-7 Sources and Levels of Finance of the Libo Karst Nominated Sites

Year	Sources and Amounts of Finance (Million Yuan)			
	National Debt	Guizhou Province	Local	Total
2000	7.56	1.10	7.29	15.95
2001	0.56	1.83	1.99	4.38
2002	10.56	0.91	7.01	18.48
2003	0.56	1.17	3.65	5.38
2004	23.69	6.49	7.88	38.06
2005	28.00	8.00	9.00	45.00

Table 5-8 Sources and Levels of Finance of the Libo Karst Nominated Sites

Year	Sources and Amounts of Finance (Million Yuan)			
	State Funds	City, County Funds	Self-raised Funds	Total
2000		5.00	12.73	17.73
2001		6.25	12.00	18.25
2002		7.00	11.98	18.98
2003		7.50	13.46	20.96
2004	1.00		13.00	14.00
2005	1.00		15.00	16.00

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

The South China Karst Nominated Areas for world natural heritage have paid attention to improving personnel quality and expertise training. The Libo Karst Nominated Sites has established Shilin Research Center to carry through the research and academic exchange of Shilin Karst. The Libo Karst Nominated Sites has established the Scientific Research and Education Section according to the characteristics of the Maolan Nature Reserve, formulated the scientific research plan, put together the scientific research projects, organized the implementation, and carried out the research and academic exchange of the cone Karst forest ecosystem. Famous Chinese experts and scholars have been invited to provide technical guidance for the research, protection, and management of the South China Karst. Foreign experts have often been invited to Shilin, Libo, and Wulong to investigate and provide technical consultation. Every management agency of the nominated area also has also sent people to the world heritage area and national park in China or other countries to learning and investigating. The Ministry of Construction of the People's Republic of China and other agencies have paid serious attention to improving personnel quality of the nominated area of South China Karst, providing training periodically or aperiodically. Up to these days, The Nominated Areas of South China Karst have been supported and coached by the State Ministry of Construction, State Competent Administration of Forestry, CAS, and other departments and scientific agencies, as well as supplied with different types of training by the Department of Construction (or Garden Bureau), Department of Land Resources, Department of Forestry, Administration of Cultural Relics, and Administration of Tourism, etc. The training covers areas of scenic area planning, construction management, resource conservation, laws and regulations regarding the scenic area, forest fireproofing, computer network and application, operation of touching system and hardware and software in the scenic area, world heritage area management, wildlife diversity conservation, continuing development of ecological tourism in nature reserves, nature reserve and community development, and boatman skill, etc. Therefore, both managers and tour guide personnel have good understanding of the world heritage knowledge and geology, environment protection, park management in the areas of South China Karst.

5.h Visitor Facilities and Statistics

5.h-1 Recent Visitor Statistics of the South China Karst Nominated Areas for World Natural Heritage

Table 5-9 Recent Visitor Statistics of the South China Karst Nominated Sites

In million persons

Name \ Year	2000	2001	2002	2003	2004
Shilin Karst	1.23	1.35	1.38	1.50	2.10
Libo Karst	0.10	0.16	0.15	0.22	0.28
Wulong Karst	0.10	0.19	0.16	0.13	0.38

5.h-2 Visitor Facility Statistics of the South China Karst Nominated Sites

Table 5-10 Visitor Facilities of the Libo Karst Nominated Sites

Visitor Facility		Amount	Explanation
Explanation	Trails (km)	16	Mainly traditional stone path of the sightseeing areas (The Major Stone Forest and the Naigu stone forest)
	Guides (person)	300	Local Yi tour guide.
	Notices (piece)	200	Scenic spot signs, visitor service signs, etc.
	Publications (type)	15	Special publication, tour handbook, picture book, thesis, and special report, etc.
Property museum		1	Shilin Karst Museum covering 900 m^2.
Visitor center		1	Shilin Visitor Center, covering 2500 m^2.
Overnight accommodation		9	All are located outside the core area.
Restaurant or refreshment facility		12	Located at the sightseeing area and visitor center.
Shops		30	Located near the sightseeing area and visitor center.
Car parking		3	Located near the visitor center and the Naigu Stone Forest.
Lavatories		17	Located at the sightseeing area, visitor center and parking lot.
Search and rescue		3	8 fixed personnel, distributed at the major sightseeing area.

Table 5-11 Visitor Facilities of the Libo Karst Nominated Sites

Visitor Facility		Amount	Explanation
Explanation	Trails (km)	34.3	The highways within Xiaoqikong scenic area shoulder passenger transportation from Libo to Mawei. To reduce traffic pressure within the scenic area, a route surrounding the scenic area is currently under contruction.
	Guides (person)	35	A certificate acquired through training and a test is required to get this position.
	Notices (piece)	110	Include different type of scenic spot explanation and direction signs, and sightseeing maps.
	Publications (type)	8	7 special publications, 1 published disk, and more than 300 publicly published research articles.

Property museum	1	Under construction.
Visitor center	4	It covers 2208 m^2.
Overnight accommodation	2	It can accommodate up to 270 people at a time.
Restaurant or refreshment facility	4	2 restaurants in Xiaoqikong scenic area, 1 in Daqikong scenic area, and 1 in Maolan Nature Reserve.
Shops	3	Located at the entrance of the scenic spot.
Car parking	14	It covers 19000 m^2.
Lavatories	14	There are 182 toilets in total.
Search and rescue	4	1 help center in Xiaoqikong scenic area, 1 in Daqikong scenic area, and 2 in Maolan Nature Reserve.

Table 5-12 Visitor Facilities of the Libo Karst Nominated Sites

Visitor Facility		Amount	Explanation
Explanation	Trails (km)	45	A well-paved 35km road for tourists leading to the scenic area, a 10 km walking path, and 1 cable railroad.
	Guides (person)	28	A certificate acquired through training and a test is required to get this position.
	Notices (piece)	135	Include different type of scenic spot explanation, direction signs, and sightseeing maps.
	Publications (type)	18	
Property museum		1	Three Natural Bridges scenic area.
Visitor center		3	Furong Cave, Furongjiang River and Three Natural Bridges
Overnight accommodation		40	They are mainly located in the county and Jiangkou, with 500 beds, with 15 beds in Three Natural Bridges scenic area.
Restaurant or refreshment facility		3	
Shops		12	8 shopping centers in Three Natural Bridges, 5 in Furongjiang Scenic Area.
Car parking		4	Parking lots cover 12000 m^2 in total, of which ecological parking areas cover 2000 m^2.
Lavatories		8	60 toilets.
Search and rescue		3	Located at Furongjiang River, Three Natural Bridges, and Furong Cave.

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

- The South China Karst Nominated Areas for world natural heritage have been brought into the local integrated social economic development plan and other relevant plans. This has established its status of being under continuous protection and the role it has played in local social economic development.

Information about the prominent natural characteristics and important scientific and aesthetic value of the South China Karst Nominated Areas for world natural heritage will be widely disseminated using modern media such as TV, Radio, and the Internet, etc, and boost the public's conservation awareness of Karst in South China.

Table 5-13 Part of the Media Report Presenting the Libo Karst Nominated Sites

Date	Media	Column	Contents	Broadcasting
2000.2	SDTV	Tour the World	Scientific Study	Past broadcast
2001.3	CCTV	Oriental Homestead	Karst Forest	Broadcasting on CCTV 1, 4, 10
2002.8	13 satellite TV stations including GZTV, YNTV, and GXTV, etc.		Focus "Emerald"	Past broadcast
2003.3	GZTV		World Heritage Nomination Special	On DVD
2003.8	China Ethnic News	Periodicals	Culture of Shui Minority Group	Published
2004.4	People and Biosphere	Editing Department	Maolan Biophere Protective Area Special	Published
2004.9	GZTV	News	Walk Through Karst	Ongoing broadcast
2005.4	CCTV	Explore and Discover	Maolan Natural Sights and Culture	Future broadcast
2005.4	BJTV	Tour the World	Natural Landscape and Human Culture	

- Scientific research institutes and colleges will be relied on to further increase the force of scientific research, continuously explore and discover the potentials of the nominated areas, publish a large amount of articles, and increase the well-known degree of the nominated areas. The Nominated Sites of Libo alone has already published more than 300 research articles related to Libo Karst. This has established Libo as the scientific research base of Karst forest among academia in China and other countries. The Nominated Sites of Shilin and The Nominated Sites of Wulong have also published a large number of articles.
- Experts and scholars from China and other countries will often be invited to The Nominated Areas of South China Karst to attend discussions on specialized subjects, technical consultations on geological and physiognomic landscape of Karst, cave, wildlife resources, Karst ecological environment, Karst tourism, conservation development of karst culture and arts obtained, and tour guide personnel trained on the heritage knowledge and conservation management.

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

The South China Karst Nominated Areas for world natural heritage currently have 561 full-time personnel. Among them, 209 people are professionals and technicians, 168 management personnel, and 159 other full-time personnel. The professions include natural geography, geology, environmental protection engineering, administration management, botany, zoology, planning engineering, Scenic and Historic area and garden management, geography information system, finance and accounting, sociology, tourism management, forestry, Chinese, and water conservation and hydrology engineering. The personnel are skilled in their fields.

The Nominated Areas of South China Karst have also been hiring part-time security personnel from local villages over the years. Among them, the Libo Karst Nominated Sites has 10 security personnel, the Libo Karst Nominated Sites 150 to 200 security personnel, and the Libo Karst Nominated Sites 10 security personnel.

Table 5-14 Daily Management Personnel of the Nominated Sites

In persons

Name	Management Personnel	Professionals	Other Full-Time Personnel	Total
Shilin Karst	89	109	0	198
Libo Karst	49	59	29	137
Wulong Karst	30	41	130	226

6. Monitoring

6.a Monitoring index for measuring state of conservation

Pursuant to the requests on world heritage protection and integrity maintaining, also taking into account of the natural characteristics of the nominated South China Karst areas, a series of monitoring indicators for administering of the nominated properties have been established (Table 6-1,2,3):

Karst monitoring processes: solution rate, dynamic hydrology and elements of surface and underground water.

Ecological processes and biodiversity monitoring: monitoring on vegetations, observation of animals, changes of animal species, vegetation meteorological phenomena, quality of species and cave animals species, monitoring on exotic species.

Environmental monitoring: observation of atmosphere, waters, noise and environmental health.

Land using monitoring: cropland, construction, water, mining, logging, afforestation and transportation facilities.

Visitors administering monitoring: number of visitors, tourism items, scenic spot, quality and quantity of tourism facilities.

Natural disasters monitoring：meteorologic disasters, fire, draught and flood, mud-rock flow, ground sinking, earthquakes, etc.

Table 6-1 Monitoring Index Chosen for Measurement of Conservation State of the Shilin Karst Nominated Sites

Monitoring Index	Periodicity	Location of Record
Integrity of Stone Forest (distributing, boundary and types)	Year	Administration of the the Shilin Scenic and Historic Area, Town Construction Bureau of Shilin County
Quantity and quality of the Stone Forest Scenic Spots	Year	Administration of the the Shilin Scenic and Historic Area
Vegetations, types and quantity of plants	Year	Administration of the Shilin Scenic and Historic Area, Forest Bureau of Shilin County
Type and quality of animals	Year	Administration of the Shilin Scenic and Historic

		Area, Forest Bureau of Shilin County
Exotic species and harm	Year	Administration of the Shilin Scenic and Historic Area and other correlation agencies of Yunnan Province
Quality of atmosphere	Year	Environmental Protection and Meteorology Bureau of Shilin County
Dynamic changes of hydrology, quality and erosion	Year	Environmental Protection Bureau of Shilin County, Water Conservancy Bureau of Shilin County
Quantity of villages and population in the buffer zone	Year	Administration of the Shilin Scenic and Historic Area, Land and Resources Bureau of Shilin County
Area of cropland in buffer zone	Year	Administration of the Shilin Scenic and Historic Area, Soil resources Bureau of Shilin County
Tourism and recreation facilities	Year	Administration of the Shilin Scenic and Historic Area, Town Construction Bureau of Shilin County
Tourist, tourism items	Year	Tourism Bureau of Shilin County, Town Construction Bureau of Shilin County
Natural Disasters	Year	Administration of the Shilin Scenic and Historic Area

Table 6-2 Monitoring Index Chosen for Measurement of Conservation State of the Libo Karst Nominated Sites

Monitoring Index	Periodicity	Location of Record
Area of Maolan National Nature Reserve of Guizhou		Administration of Maolan National Nature Reserve of Guizhou
Structure and function of the ecosystem	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Biodiversity of forest and dynamic changes	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Forest hydrology and microclimate	Day	Administration of Maolan National Nature Reserve of Guizhou
Dynamic observation of threatened and endemic taxa population	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou Office of Zhangjiang Scenic and Historic Area of Libo
Quality of karst environment	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Development of social economy	Five Years	Administration of Maolan National Nature Reserve of Guizhou
Effect of community developmental plans on the scenic area and nature reserve	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Monitoring on extent of condominium of the community and participation	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou

Changes of land using	Five Years	Administration of Maolan National Nature Reserve of Guizhou
Forest insect pest	Day	Administration of Maolan National Nature Reserve of Guizhou
Efficiency of the Zhujiang protection forest plan in Guizhou Province	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Rainfall and runoff in forest	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Forest fire	Day	Administration of Maolan National Nature Reserve of Guizhou Administration of Zhangjiang Scenic and Historic Area of Libo
Water quality	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Changes of physicochemical character of Soil	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Exotic species and harm	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Quantity of villages and population in the buffer zone	Five Years	Administration of Maolan National Nature Reserve of Guizhou
Type and quantity of vegetations	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
Type and quantity of animals	Aperiodicity	Administration of Maolan National Nature Reserve of Guizhou
State of climate and meteorology	Day	Meteorology Bureau of Libo County
Quantity and source of visitors	Day	Administration of Zhangjiang Scenic and Historic Area of Libo Administration of Maolan National Nature Reserve of Guizhou
Monitoring on karst dynamics and hydrology	Year	Administration of Maolan National Nature Reserve of Guizhou, Institute of Karst Geology in Guilin, China Academy of Geology Science

Table 6-3 Monitoring Index Chosen for Measurement of Conservation State of the Wulong Karst Nominated Sites

Monitoring Index	Periodicity	Location of Record
Quality and quantity of surface water	Aperiodicity	Environmental Protection Bureau of Wulong County, Water Conservancy Bureau of Wulong County
Quality and quantity of underground water	Aperiodicity	Environmental Protection Bureau of Wulong County, Water Conservancy Bureau of Wulong County
Atmosphere quality	Aperiodicity	Environmental Protection Bureau of Wulong County

(in 5 Places)		
Dynamic observation on community of rare animal (*Presbytis francoisi*)	Aperiodicity	Forest Bureau of Wulong County, Administration of Furongjiang Scenic and Historic Area of Wulong County
Ecological environment (Mainly in Furongjiang)	Season	Forest Bureau of Wulong County, Administration of Furongjiang Scenic and Historic Area of Wulong County
Biodiversity and dynamic change	Year	Forest Bureau of Wulong County
Environment in Furong Cave	Automatic Monitoring	Administration of Furongjiang Scenic and Historic Area of Wulong County, Institute of Karst Geology Chinese Academy of Geological Sciences
Quantity of visitors	Day	Administration of Furongjiang Scenic and Historic Area of Wulong County, Tourism Bureau of Wulong County
Fire	Day	Forest Bureau of Wulong County, Administration of Furongjiang Scenic and Historic Area of Wulong County
Collapse rocks (mainly in Furong Cave and Three Natural Bridges)	Periodic check in major region	Administration of Furongjiang Scenic and Historic Area of Wulong County
Population and land Using states in the nominated areas and buffer zone	Tow years	Administration of Furongjiang Scenic and Historic Area of Wulong County, State Soil resources Bureau of Wulong County
Monitoring on extent of condominium of the community and participation	Aperiodicity	Administration of Furongjiang Scenic and Historic Area of Wulong County

6.b Administrative arrangements for monitoring area

Table 6-4 Agencies Responsible for the Monitoring of the Nominated South China Karst Sites

Nominated Area	Agencies Responsible for the Monitoring	Contact		
		Tel.	Address	Post Code
Shilin Karst	Administration of The Shilin Scenic and Historic Area	86-871-7711439	Shilin Yi Autonomous County, Kunming City, Yunnan Province, China	652200
	Environmental Protection of Shilin Yi Autonomous County	86-871-7796892	Lufu Town, Shilin Yi Autonomous County, Kunming City, Yunnan Province, China	652200
	Forest Bureau of Shilin Yi Autonomous County	86-871-7796853	Lufu Town, Shilin Yi Autonomous County, Kunming City, Yunnan Province, China	652200

	Shilin Yi Autonomous County, Town Construction Bureau of Shilin County		Lufu Town, Shilin Yi Autonomous County, Kunming City, Yunnan Province, China	652200
	Geological Environmental Monitoring on Yunnan province	86-871-3813954	Wangda Bridge, Kunming City, Yunnan Province, China	650216
Libo Karst	Administration of Maolan National Nature Reserve of Guizhou	86-854-3611115	Yuping Town, Libo County, Guizhou Province	558400
	Environmental Protection Bureau of Libo County	86-854-3619962	Yuping Town, Libo County, Guizhou Province	558400
	Environmental Monitoring Station of South Guizhou	86-854-8224268	No.16, Wenfeng Road, Duyun City, Guizhou Province	558000
Wulong Karst	Administration of Furongjiang Scenic and Historic Area of Wulong County	86-023-77713333	Xiangkou Town, Wulong County, Chongqing City, China	408500
	Environmental Protection Bureau of Wulong County	86-023-77722308	Xiangkou Town, Wulong County, Chongqing City	408500
	Meteorology Bureau of Wulong County	86-023-77723207	Xiangkou Town, Wulong County, Chongqing City	408500
	Forest Bureau of Wulong County	86-023-77712363	Xiangkou Town, Wulong County, Chongqing City	408500
	Water Conservancy and Electric Power Bureau of Wulong County	86-023-77722125	Xiangkou Town, Wulong County, Chongqing City	408500
	State Soil Resources Bureau of Wulong County	86-023-85619567	Xiangkou Town, Wulong County, Chongqing City	408500
	Construction Committee of Chongqing Wulong County	86-023-77724585	Xiangkou Town, Wulong County, Chongqing City	408500
	Tourism Bureau of Wulong County	86-023-77721248	Xiangkou Town, Wulong County, Chongqing City	408500

6.c Results of previous reporting exercises

Table 6-5 Earlier Reports on the State of Conservation of the Nominated Shilin Karst Sites

Name	Contents	Writer
Atlas of Geomorphologic Landscape of Stone Forest	Geomorphologic and human being Landscapes from 1930s to 1980sin Shilin Area are kept.	Yang Chunzhou
Atlas of Geomorphologic Landscape of Stone Forest	Geomorphologic and human being Landscapes from 1930s in Shilin Area to 1980s are kept.	Yang Xinming, etc.

Vegetation in Lunan	Element of vegetation and species in Shilin Area are kept.	
Report on Survey of the Present Eco-environment Condition of Shilin Yi Autonomous County	Climate, land using, natural disasters, vegetation, biodiversity, hydro-environment, country energy structure, farmland fertilizer using, forest crop insect pest trend are investigated and evaluated, environmental situation of nomination are all right.	Environmental Protection Bureau of Shilin County
Environmental Quality Reports of Shilin Yi Autonomous County Between 1996～2000	Result of environmental monitoring for 5 years are evaluated, atmosphere, water conditions, environment, etc of nomination are stabilization, qualities are all right.	Environmental Protection Bureau of Shilin County
Research on Stone Forest in Lunan, China	Characteristics, form and evolvement, scientific value, aesthetical value, ecological value and economical value of stone forest are investigated and evaluated, international comparison are proceeded preliminarily, distribution map are work out, its conservation method are discussed, etc.	Stone Forest Research Group
Stone forest, jewelry of the nature heritage.	Evaluation and contrastive research from domestic and overseas famous karst experts are collected, unique value and conserved significance, etc are indicated.	Song Linhua, etc.

Table 6-6 Earlier Reports on the State of Conservation of the Nominated Libo Karst Sites

Name	Contents	Writer	Location of Records
Scientific Survey on the Maolan Karst Forest	Natural geographical environment, biological resources, and national conserved propagation of karst forest in Maolan are investigated and noted.	Zhou Zhengxian, etc.	Guiyang: Guizhou People's Press, 1987
Ecological Research on Karst Forest ( )	Community, microenvironment, and water environment of trees in karst forest are monitored. Forest plants, moss, forest biology of *Denfrocalamus tsiangii*, mammals, and agricultural environment of karst area etc. in karst forest are investigated.	Forestry Department of Guizhou Province, Administration of Maolan National Reserve	Guiyang: Guizhou Science and technology Press , 1993
Ecological Research on Karst Forest ( )	Records on moisture environment, developmental characteristics, coenocline, karst forest regional constitution, biomass structure, hydro-ecological function, spontaneous recovery , soil seed community and coenocline, erosion-resisting of	Zhu Shouqian, etc.	Guiyang: Guizhou Science and Technology Press , 1997

	carbonate developmental soil, ecological tourism, etc.		
Ecological Research on Karst Forest ( )	Expectation of ecological research in karst forest, karst ecological environment, community and synecology, ecological recovery, soil seed community, research and application on chemical induction action, ecology and utility technological research, etc.	Zhu Shouqian, etc.	Guiyang: Guizhou Science and Technology Press , 2003
Research on Speleology and Biospeleology	Synthesis research and observation test on genetic type, group system, its sediment and the relationship with karst type of about 170 caves in Libao county. Analyse on cave karst geological characteristics and its form and development, discussion on cave developmental, environmental scene and element of developing cave. Cave and natural resources characters, using and exploitation value of its organism are set out by enrich macro and micro phenomena and data. Space distribution, developing condition, cave scale and scenery characteristics of Dongge cave, Yamen cave, Dongfeng cave, etc, and cave cluster are dissertated particularly, their tourism, medical attendance, scientific research, exploration, preservation, experiment, investigation, etc. are indicated. Integrative exploitation and using and coordinative protection project of scenery of cave are indicated.	Ran Jingcheng, Lin Yushi	Guiyang: Guizhou People's Press. 2005.
The present State of the Environment Quality	Environmental quality of monitoring spots in nomination have reached the primary standard of AAQS (GB3095-1996), water quality of monitoring section in Xiaoqikong and Daqikong have reached the Ⅱ level of SWQS (GB3838-2002), groundwater in Xiaoqikong have reached the Ⅰ level of GWQS (GB/T14848-93), groundwater in Banzhai have reached the II level of GWQS (GB/T14848-93).	Environmental Monitoring Station of South Guizhou	Environmental Monitoring Station of South Guizhou, Environmental Protection Bureau of Libo County

Table 6-7 Earlier Reports on the State of Conservation of the Wulong Karst Nominated Sites

Name	Contents	Writer	Location of Records
Master plan of Furongjiang scenic area	Natural environments, physiognomy, propagation, condition of human tourism resources, etc, of nomination are analyzed, scenic and historical Area are programmed.	Chongqing Gardens Architectural Plan and Project Bureau.	Administration of Furongjiang Scenic and Historic Area of Wulong County
Tourism resources and tourism exploiture and plan in Sichuan part of Furongjiang	Types, characters and general situation of resources in Furongjiang and its buffer zone are expatiated by investigating particularly.	The People's Government of Wulong County, Southwest China Normal University	Administration of Furongjiang Scenic and Historic Area of Wulong County
Report on survey of Wulong National Geological Park in Chongqing	Geological background, characters of main geological relic in Wulong karst geology of national park are dissertated, their form conditions and process are discussed, compared and evaluated.	Institute of Karst Geology, Chinese Academy of Geological Sciences	Institute of Karst Geology, Chinese Academy of Geological Sciences
Form and value of geological relique in Wulong National Geological Park in Chongqing	Distributing, characteristics, form conditions and process, comparison and evaluation, exploiture and protection, etc, of geological relic in Wulong karst geology of national park are expatiated, Furong Cave are discussed.	Chen Weihai, etc.	Beijing: Geology Press, 2004; Institute of Karst Geology, Chinese Academy of Geological Sciences
Master plan of Wulong Karst National Geological Park in Chongqing	Characters of tourism resource of geological park are summarized, exploitation conditions of scenic resources, marketable analysis, developmental foreground, planning project, trends and direction of development are researched. Discuss and dissertate on Furong Cave.	Sichuan Geological Park & Geological Relic Survey and Evaluation Center.	Administration of Furongjiang Scenic and Historic Area of Wulong County
Investigation and evaluation on the stability of Furong Cave in Wulong County, Chongqing	Geological conditions, types and characters of natural disasters of Furong Cave are analyzed, in addition.	Institute of Karst Geology, Chinese Academy of Geological Sciences	Administration of Furongjiang Scenic and Historic Area of Wulong County
Environmental influence statement of Jiangkou Power Station in Chongqing City	Latency influence to Furong Cave Scenic and Historic Area are analyzed.	Research Institute for Protection of the Yantze Water Resources	

Atlas of Furong Cave Scenic and Historic Area	Photographs of Furong Cave Scenic and Historic Area are collected.	Administration of Furongjiang Scenic and Historic Area of Wulong County	Administration of Furongjiang Scenic and Historic Area of Wulong County
Exploiture practice of visit for Furong Cave and exploiture of cave	Design idea and supervise principle of tourism plan of Furong Cave, master planning project, tourism establishment, basic request of construction, environmental protection of Furong Cave are introduced.	Zhu Xuewen	Carsologic Sinica, 1995
Secondary speleothems in Furong Cave	Characteristics of shape, form of caves, type of secondary sediment, phase of sediment and year of form in Furong Cave are analyzed.	Zhu Xuewen	Carsologic Sinica, 1994
Scientific data and epigraph of domestic & overseas experts for Wulong Karst Geology of National Park in Chongqing	Epigraph for Furong Cave, research dissertations and scenic presentations for national geological park from domestic & overseas experts are collected.	State land Resources Bureau of Wulong County	Administration of Furongjiang Scenic and Historic Area of Wulong County
Yangtze Caves	Explorative results of China-Great Britain ally, potential scene of the unexploited part in Furong Cave are explored.	Andy Eavisetal	Administration of Furongjiang Scenic and Historic Area of Wulong County
Implemental project of research on scenes in Furong Cave	Present conditions of atmospherical environment and scene in Furong Cave are analysed, protective project of scene in Furong Cave.	Institute of Karst Geology, Chinese Academy of Geological Sciences	Institute of Karst Geology, Chinese Academy of Geological Sciences
Exploration on silo cluster in Tianxing, Erwang Cave and Sanwang Cave in Houping	Exploration on decades of silo cluster, Houping Erwang Cave and Sanwang Cave in Tianxing Xiang area, Qikeng Cave is the first vertical deep Cave in China.	Erin Lynch, etc.	Hong Meigui Cave Exploration Society, http://www.hongmeigui.net
Survey of atmospherical environment in Furong Cave.	Monitoring on some representative scenic spot in Furong Cave between 2003 and 2005, temperature is 16.9-19.9 ℃, temperature in summer is higher; relative humidity is 86.1~93.7% ,		Administration of Furongjiang Scenic and Historic Area of Wulong County

	rangeability is limited; CO_2 is in normal level with 838~1540ppm; atmospherical negative ion in cave is higher than 20-50 times out cave with 8400~28000/cm^3.		

7. Documents

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

□ 60 slides which are in 35mm format and electronic images in jpg format at 300 dpi (dots per inch) resolution.

□ A vedio CD with 30 mins.

□ An album.

□ An album in jpg format.

□ Inventory of images.

□ The authorization table of photos and audio visual materials.

Table 7-1 Authorization Photos and Audio Visual Materials of the South China Karst

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 e-mail)	Non exclusive cession of rights
1	Slides with 35mm in jpg format at 300 dpi	Karst and ecology of the Nominated South China Sites	2005	Xiong Kangning, Liang Yongning, Zhao Chunyong, Li Yuhui Xie Shiyou, Zhou Zhongfa, Zhu Dehao, Xu Daling Chen Weihai Shao Jun	Construction Department of Guizhou Province Guizhou Normal University Construction Department of Yunnan Province Kunming University of Science and Technology Yunnan Normal University Garden Bureau of Chongqing City Chongqing Normal University Southwest China University	Xiong Kangning Xiongkn@163.com Liang Yongning liangyongning@hotmail.com Xie Shiyou xiesy@swnu.edu.cn	Authorization
2	30mins. vedio CD	Karst and ecology of the Nominated South China Sites	2005	Fu Yulin XiongKangning Xiao Gaolin	Construction Department of Guizhou Province, Guizhou Normal University	Xiong Kangning Xiongkn@163.com	Authorization
3	An album in prints and in	Karst and ecology of the Nominated South China	2005	Xiong Kangning, Liang Yongning, Zhao Chunyong,	Construction Department of Guizhou Province Guizhou Normal	Xiong Kangning Xiongkn@163.com Liang Yongning liangyongning@hotm	Authorization

	jpg format.	Sites		Li Yuhui Xie Shiyou, Zhou Zhongfa, Zhu Dehao, Xu Daling Chen Weihai Shao Jun	University Construction Department of Yunnan Province Kunming University of Science and Technology Yunnan Normal University Garden Bureau of Chongqing City Chongqing Normal University Southwest China University	ail.com Xie Shiyou xiesy@swnu.edu.cn	

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.b-1 Texts relating to Protective Designation

Scenic and Historic Area： Scenic and historical Area is the zone which is nominated and delimited, with the characteristic of concentrated historical resources and good-qualitied natural environment, provided to visit, relax and do scientific and cultural acativities.

International Biosphere Reserve： The biosphere reserve which advocated and developed with *the Project on the MAB* by UNESCO, is the representative area of land, coast and sea ecosystem.

Nature Reserve： Natural reserve which is the natural concentrated distributing area of representative natural ecosystem and rare and endangered wildlife, is the land, land water and sea area of especial natural relic, etc, the area delimited to protect and administer especially.

National Geological Park： National geological park is the natural area composed of geological relic with aesthetic viewing value and natural and human scenes.

UNESCO Geological Park： UNESCO Geological Park is the area which with clear boundary and enough land area to serve for local economic development, comprises a series of geological relics and geological entities with special scientific significance, rare and aesthetic value.

7.b-2 Copy of Administering Plan

The protective and administering plan of every part in the South China Karst Nominated Properties for

the world natural heritage were established, and the details are in the annex.

□ *Adminisering Plan of Shilin National Park* (see the annex).

□ *Protective and Administering Plan of the Libo Karst Nominated Sites for the World Natural Natural* (see the annex).

□ *Protective Plan of the Wulong Karst Nominated Sites for the World Natural Heritage* (see the annex).

7.b-3 Excerpt of other Relevant Plans

Yunnan Province 10th 5-year Social and Economic Development Plan and Long-term Plan (year 2000 ～ 2020): The 3th and the 24th article: protect natural resource and develope tourism in Yunnan.

Kunming City 10th 5-year Social and Economic Development Plan and Long-term Plan (year 2000 ～ 2020): The 5th, 27th and 32th article: protect Shilin karst, improve ecological environment in Shilin and developing national cultural tourism in Shilin.

***Shilin Yi Autonomous County Tourism Development Plan and Long-term Plan*:** The 6th, 12th and 21th article: protect Shilin karst and ecological environment, develop tourism in Shilin, promoting the development of Shilin national cultural tourism.

***Shilin Scenic and historic Areas Integrated Plan (Draft)*:** The 3th, 8th, 12th and 15th article: Shilin Scenic and historic Areas is divided into 3 foundation areas and 4 levels protection, perfect the construction of tourism establishment and protective force, improve the condition of foundational establishment.

Shilin Yi Autonomous County Ecological Construction Plan: The 1st, 5th, 8th and 17th article: protect Shilin karst and forest vegetation and water source, improve tourism environment, strengthen the construction of protive force, cultivate the protective consciousness and ability of community resident on ecological environment and geological relic.

Shilin Yi Autonomous County Tourism Development Plan and Long-term Plan (year 2000～2020): The 1st, 3rd, 8th, 13th and 24th article: develop Shilin tourism, protect Shilin karst, improve tourism environment, strengthen the construction of tourism force and tourism foundational establishment, establish the fund of tourism development and protection of Shilin karst and ecological environment, strengthen the participant ability of community resident.

Guizhou Province Integrated Tourism Development Plan: A new tourist center, between the scenic area of Daqikong and Xiaoqikong, which include exhibitions, maps and photographs, also can provide

tourists the information of local and other scenic areas. The craftwork shop, tea store and park should be built in the tourist center. The information plate about scenic spot with visit map should be set up in entery of Daqikong and Xiaoqikong. The protective work including prohibiting quarry and mining is important. The part of scenic spot destroyed should be recovered by afforestion.

Libo County Town Construction System Plan: Protect natural reserves and historical and cultural heritages, strengthen the protection of Zhang Jiang national scenic and historical Area and Maolan natural reserve. The cultural relic such as the Former Residence of Deng Enmin, ancient well and ancient banina, etc. should be protected, and the construction projects around the cultural relics should be censored strictly to make for the protection of cultural relic and historical environment.

Libo County Integrated National Ecological Construction Demonstration Area Plan: Maolan Nature Reserve has a karst forest ecosystem, which is rarely seen in other area of the same latitude on Earth. While Karst forests in mid-subtropic have been seriously damaged and disappearing, Maolan area has, on its typical bare karst physiognomy, kept complete Fenglin and Fengcong, which are covered by forests, stronger primary Karst forest and its unique natural geographic environment, special hydrogeological dualistic structure, and rich wildlife resources. This nature reserve is a scientific reserve aiming at the conservation of karst forest ecosystem, and the protection of rare and precious wildlife.

Libo County Environment Protection Plan: Environmental atmosphere quality in tourism areas shall reach the first level standard. Environmental atmosphere quality in counties and towns shall keep its second level standard, and approach first level standard in the future. Water condition shall reach secondary water quality. Noise condition shall not be higher than 50 decibel in the daytime and not be higher than 40 decibel in the nighttime. In the tourism area, it is forbidden to mine, quarry, and damage natural vegetation. The size, quantity, and color of tourism facilities should be strictly controlled, and sanitation facilities rationally constructed. Visitors are not allowed to enter the absolute protection area of the nature reserve, in order to keep its natural and original state. In the absolute protection area, only simple observation and experiment facilities can be set up for the scientific researching professionals. The scientific experiment areas are off-limits to visitors. The local residents shall be guided to develop mixed farming such as medicinal materials, wild fruits, and breeding of garden plant species, while not destroying the natural resources. In the ecological tourism areas, educational tourism service on geography, geology, and propagation shall be offered, while not destroying the natural resources. Sightseeing rest places with natural style shall be properly constructed, while midway accommodation is not provided.

Chongqing Furong Jiang National Scenic and Historical Area Integrated Plan: Treating properly the relationship between protection of scenic resource and exploitation of tourism market. The protective key of core area is karst gorge physiognomy scenes and rare propagation resources. The protection of scenic resources and ecological environment in scenic spot should be strengthened and exploited properly to avoid the short-time movement, make the using of resource permanently.

Chongqing Wulong County Integrated Tourism Development Plan: The centuties-old historical culture and local rustic folkway of Wulong County is the special market attraction in tourism development, the good social order, cultural order and quality tradition are the human environment of attracting tourists and developing tourism. The tourism consciousness is enhanced and the situation of resident participation in tourism. Investment tourism and service for tourism become the fashion as tourism is given prominence and the developing effect of tourism appearing. The situation is ensure and wealth of tourism in Wulong County.

7.c Form and Date of Most Recent Records or Inventory of Property

7.c-1 Form and Date of the Lastest Records

Table 7-2 Form and Date of the Lastest Records of the South China Karst Nominated Sites

Nominated Property	The latest record	Date
Shilin Karst	Research report on karst physiognomy of Shilin national scenic and historical Area	2001
	Research report on propagation of Shilin national scenic and historical Area	1988
Libo Karst	The list of animal in Libo Karst area	2004
	The list of cave animal in Libo Karst area	2004
	The list of vegetation in Libo Karst area	2004
Wulong Karst	The surface geomorphic relics of the Wulong Karst Nominated Property	2004
	The cave maps and materials of the Wulong Karst Nominated Property	2004
	The list of propagation in Wulong Karst Nominated Properties	2004

7.c-2 Inventory of Perproty

Table 7-3 Gernal View of Stone Forest Landscapes in the Shilin Karst Nominated Sites

No.	Site elevation(m)	Type of stone forest	Stratum	Development year	Surface cover condition	Stone column surface karren
No01	Luoshi Pool,Dima Po.	karst stone column, clint	P_2q	E_{2-3}	scrub, broadleaf forest subterranean	cutting lapie

	1850				river, karst spring	
No04、17	Dalinkou Pu 1890-1880	pillar stone forest, clint	P_2q、C	N-Q	rock bare land	pepino lapie, undersoil clint
No06-11	Naigu Stone Forest 1897-1870	pinnacle stone forest, pillar stone forest	P_2q	E_{2-3}	broadleaf forest, scrub, subterranean river, karst window, karst cave	karren
No12	North Hemo Village 1932-1880	pillar stone forest, mushroon stone forest, pinnacle stone forest, stone forest slope, stone valley	P_2q、E_{2-3}、	E_{2-3}	scrub,pine forest, karst spring	pepino lapie
No14	Shiban Bridge 1907-1880	karst stone column, stone forest slope, clint	C	E_{2-3}	scrub, eucalyptus forest	lapie
No15	Heishan Hill 1935-1880	pillar stone forest, stone forest slope	P_2q	E_{2-3}	drought farmland, groundwater confining stratum	pepino lapie, underground pipe, subterranean river relic
No19	Tiaozao Cave 1845-1870	pepino stone column, clint	C_2	N-Q	depression, sink hole	lapie, undersoil clint
No20	Gaoshi Shao, Heiqing Tou 1845-1870	pillar stone forest, mushroon stone forest	P_q	N-Q	scrub, subterranean river,sink hole	pinnacle, peak and all kinds of lapize
No21	Relic of Tuanjiehu Dam 1840	cone stone forest, burialstone forest	P_2q、$P_3\beta$	P_1、N-Q	abrasion channel, slope	undersoil clint, corrosion valley
No22	Pudou Village 1840-1820	pillar stone forest, pinnacle stone forest, mushroon stone forest, stone forest basin, stone forest hill	P_2q、P_2m	E_{2-3}、N-Q	eucalyptus forest, green broadleaf forest,scrub,sink hole,subterranean river	lapie, karren
No23	North Xiaojianshan Village 1900-1880	pillar stone forest, pinnacle stone forest, cone clint	P_2q	E_{2-3}、N-Q	grass slope, scrb, seasonal depression	pepino lapie
No24	Dibanlong Aaozi1830-1810	stone forest hill, burial stone forest	P_2q、$P_2\beta$	P_1、Mz	scrub, drought farmland	peak, karst valley
No25	Zhucao Qing, Jiama Shi 1760-1740	pillar stone forest, clint	P_2m、E_{2-3}	Mz、N-Q	scrub, subterranean river,drought farmland	pepino lapie, undersoil clint
o26-27	Daqinggou 1810-1740	pinnacle stone forest, pillar stone forest, stone forest valley, clint	P_2m	N-Q	Pinus yunnanensis forest, scrub, grass slope land	lapie
No28	Leida Shi, Zhiyun Cave 1810-1780	pillar stone forest, clint slope	P_2m、E_{2-3}	Mz、E_{2-3}、N-Q	Pinus yunnanensis forest, scrub	pepino corrosion well, lapie
No29	South Slope of Lvyin Pool 1810-1780	pinnacle stone forest, pillar stone forest, clint	P_2m、E_{2-3}	Mz、E_{2-3}、N-Q	scrub, grass slope, depression	longitudinal lapie, corrosion well
No30	Lanhanshan Hill 1787-1730	clint, karst stone column	P_2m、E_{2-3}	N-Q	grass slope	undersoil clint
No31	Natural Bridge 1750-1720	stone forest hill	P_2m	Mz	scrub	pinnacle and peak karren
No32	West Ayilin 1810-1790	clint, pillar stone forest, stone forest slope	P_2q、P_2m、$P_3\beta$、E_{2-3}	P_1、E_{2-3}、N-Q	scrub	undersoil clint, pepino lapie
No33	Laofenshan Hill, Ayi Lin	pillar stone forest, stone forest slope	P_2m、E_{2-3}	E_{2-3}、N-Q	Pinus yunnanensis forest, hassock	pepino corrosion valley, lapie

	1750-1770					
No34-37	Train station 1780-1800	pillar stone forest, stone forest slope, stone forest hill, stone forest basin	P_2q 、P_2m	E_{2-3} 、N-Q	formland, scrub	pepino pepino and well karst valley, lapie
No38	Daqingshan Hill 1800-1820	pinnacle stone forest, pillar stone forest, stone forest hill, stone forest slope	P_2q 、P_2m	E_{2-3} 、N-Q	Pinus yunnanensis forest, scrub, farmland	lapie
No39	Wanyaoshan Hill 1849.8-1810	pillar stone forest, clint	P_2q 、P_2m	E_{2-3} 、N-Q	Pinus yunnanensis forest, scrub,	pepino karren
No40	West Dazhai	pillar stone forest, stone forest slope	P_2q 、P_2m	E_{2-3} 、N-Q	scrub	pepino karren
No41	Grain Administering Office 1847-1800	pillar stone forest, stone forest slope, stone forest hill, clint	P_2q 、P_2m	E_{2-3} 、N-Q	Pinus yunnanensis forest	pepino karren
No42	Jilongshan Hill 1900-1880	stone forest hill, pillar stone forest	C	E_{2-3} 、N-Q	scrub, herbosa	pepino karren
No44	Laohuangshan Hill	pillar stone forest, stone forest ridge	P_2q 、P_2m	E_{2-3} 、N-Q	scrub, herbosa	corrosional pan, karst valley
No49	Guzhuishan Hill, Baozishan Hill	pillar stone forest, stone forest hill	P_2q	N-Q、E2-3	Huashan pine, Pinus yunnanensis forest	karren, corrosional pan
No50、51	Wangze Po, Guzhuishan Hill	pillar stone forest, stone forest ridge, stone forest slope	P_2q 、P_2m	E_{2-3} 、N-Q	Pinus yunnanensis forest, scrub,	karren
No52-53	Qifeng Cave	pillar stone forest,, stone forest depression, stone forest slope	P_2q 、P_2m	E_{2-3} 、N-Q	Pinus yunnanensis forest, scrub	karst valley, karren, lapie
No54	Bianfu Cave	irregular stone column, karst cave	P_2q		rock, farmland	
No55 -56 、60	Sanjia Village	pillar stone forest, stone forest basin,	P_2q 、P_2m	E_{2-3} 、N-Q	cypress forest	dense karren
No57	Livestock Farm	pinnacle stone forest, pillar stone forest, stone forest basin, stone forest hill	P_2q	E_{2-3} 、N-Q	scrub, farmland	lapie, karst valley, corrosional pan
No59	Shuanglongtan Pumping Factory	pillar stone forest, stone forest slope, stone forest valley	P_2q 、P_2m	E_{2-3} 、N-Q	Pinus yunnanensis forest, cypress forest	karren
No61、62	Shuitang Pu	pinnacle stone forest, pillar stone forest	P_2q	E_{2-3}	cypress forest, Pinus yunnanensis forest,	lapie
No63 、64	Liuyin Pool	pinnacle stone forest, stone forest ridge	P_2m	Mz 、N-Q	Pinus yunnanensis forest	corrosional pan, karst valley, lapie
No65、66、68	Laohuqing	karst stone column, pinnacle stone forest, undersoil clint, stone forest slope, stone forest depression	P_2m	Mz 、N-Q	Pinus yunnanensis forest	lapie, corrosional pan
No69 、o70	Ten thousand-year Ganoderma Lucidum	pillar stone forest, mushroom stone forest,tower stone forest,pinnacle stone forest	P_2m、$P_3\beta$	E_{2-3} 、N-Q	scrub, herbosa, rock	tower stone forest, lapie
No71、72	Songmaoshan Hill	pillar stone forest, pinnacle stone forest,stone forest	P_2m、E_{2-3}	Mz 、N-Q	Pinus yunnanensis forest, scrub,herbosa	karst well band, pepino lapie, pepino corrosion conduit

		slope				
No73、74	Major Stone Forest, Minor Stone Forest	pinnacle stone forest, pillar stone forest,stone forest depression,stone forest slope	P_2m	E_{2-3}、N-Q	scrub, conifer forest, broadleaf forest	shallow corrosion shape, surficial corrosion shape
S001	Suoyishan Hill	pillar stone forest, pinnacle stone forest,stone forest slope, stone forest depression	P_2q	E_{2-3}	broadleaf forest, scrub	All kinds of corrosion shape
S002	Wenbishan Hill, Douheishan Hill	pillar stone forest, pinnacle stone forest,stone forest slope, stone forest hill	P_2m、P_2q、$P_2\beta$	Mz、E_{2-3}	conifer and broadleaf mixed forest, scrub	lapie, karst valley
S005	Dushishan Hill 2000-1900	pillar stone forest, stone forest hill	P_2q、P_2m	Mz、E_{2-3}	Pinus yunnanensis forest	pepino lapie
S006、007	Zumo Village 1880-2012	pillar stone forest, stone forest hill	P_2q	E_{2-3}	limestone land, farmland, karst spring	pepino karren
S008	Jihei Village 1920-1990	pillar stone forest, pinnacle stone forest, stone forest slope,stone forest hill	P_2q、P_2m	Mz、E_{2-3}	Pinus yunnanensis forest	karst valley, lapie
S009	Akaoyi 1820-1780	tower stone forest, stone forest ridge	P_2m、E_{2-3}	Mz	Pinus yunnanensis forest, herbosa	lapie, karst valley
S010、011,012	Shangxingze Village 1850-1800	tower stone forest, pillar stone forest, clint slope	P_1q、P_1m、E_{2-3}	Mz、E_{2-3}	Pinus yunnanensis forest, herbosa	lapie, karst valley
S013、014、015	Shuijingshan Hill, Duoyishan Hill 1960-1930	pillar stone forest,	P_2q	Mz、E_{2-3}	scrub, Pinus yunnanensis forest	lapie
S016、017	Wangchengshan Hill Shixiangzi	pillar stone forest, pinnacle stone forest,stone forest slope, stone forest ridge	P_2m、$P_2\beta$	Mz、E_{2-3}	Pinus yunnanensis forest, scrub	lapie
S018-019	Suoge Yi 1880～1950	pillar stone forest, stone forest hill	p_1q	Mz、E_{2-3}	Pinus yunnanensis forest	pepino karren
S020、024-027	Weibo Yi 1970-1850	pinnacle stone forest, pillar stone forest,stone forest slope, stone forest hill	P_2q、P_2m	Mz、E_{2-3}、N-Q	Pinus yunnanensis forest,shrub,scrub, karst spring,karst cave	pepino karren, well karren
S021	Xiaogan Pool 1940-1870	pinnacle stone forest, pillar stone forest,stone forest slope	P_2m、$P_2\beta$、E_{2-3}	P_2、E_{2-3}	broadleaf forest, Yunan pine forest, scrub.	lapie
S022	Jiama Xiang, Xianren Cave 1800-1730	pillar stone forest, pinnacle stone forest,stone forest slope, stone forest hill	P_2m、$P_3\beta E_{2-3}$	P_2、N-Q	slope, farmland	corrosion lapie, well karst valley
S022	Yuanbaoshan Hill 1890-1830	pillar stone forest, stone forest hill	P_2m	Mz	limestone land	pepino karren
S028、029	Qingshui Pool 1770-1930	pinnacle stone forest, pillar stone forest,stone forest depression,stone forest slope, stone forest depression	P_2m、$P_3\beta$、E_{2-3}、	Mz、E_{2-3}、N-Q	Pinus yunnanensis forest, broadleaf forest, scrub, karst lake, karst spring, subterranean river	lapie, well lapie

S030	Shuangjian Hill, Mahuang Pool 1790-1760	pinnacle stone forest, pillar stone forest, stone forest depression, stone forest hill	P_2m,$P_2\beta$、E_{2-3}、	Mz 、E_{2-3}、N-Q	Pinus yunnanensis forest scrub, karst lake, subterranean river	lapie
S031	Shihuangniu 2008-1990	pinnacle stone forest, clints slope, stone forest ridge.	P_2m	Mz	Pinus yunnanensis forest	karst well bank, lapie, karst window cave

Table 7-4 Plant Species in China Species Red List of the Shilin Karst Nominated Sites

Species	Endangered Category
Magnolia delavayi Franch	VU A2c
Paeonia.lutrea Franch	VU A2c
Psammosilene tunicoides W.C.Wu et C.Y.Wu	EN A2c
Reevesia rubronervia Hsue	CR B1ab(ii,v)
Dichotomanthus tristaniaecarpa Kurz	VU A2c
Malus halliana Koehne	NT
Rosa odorata(Andr)Sweet	VU A2c
Indigofera pampanzniana Pamp	CR B1ab(ii)
Nothapodytes obscura C.Y.Wu	VU A2c
Ziziphus mairei Dode	EN Bab(ii,iii,v)
*Toona ciliate Roem.*var.*pubescens* (Franch) Hand－Mazz	VU A2c
Lyonia compta Hand.－Mazz.	VU D2
Pieris formosa (Wall) D.Don	VU B1b(ii,iii,iv,v)c(ii,iii,iv)＋2b(ii,iii,iv,v)c(ii,iii,iv)
Crepis phoenix Dunn	EN B2ab(ii,iii,v)
Ehretia corylifolia C.H.Wright	EN B2ab(ii,iii,v)
Pterygiella ingrescers Oliv	VU B2ab(ii)
Petrocosmea duclouxii Craib	VU B2ab(ii)
Ottelia acuminata Dandy	VU A2c
Trachycarpus nana Becc	EN A2c
Bletilla formosana (Hayata) Schlecht	EN A4c
Bletilla striata(Thunb)Rchf.f	VU A4cd
Cymbidium erythraeum Lindl	VU A4c
Cymbidium goeringii Reichb.f.	VU A4c
Habenaria delavayi Finet	NT to VU A2c
Habenaria dentata(SW.)Schlecht	NT to VU A2c
Keteleeria evelyniana Mast	NT to VU A2c
Cryptomeria fortunei Hooibernk	NT to VU A2c
Calocedrus macrolepis Kurz	VU A2c
Cupressus duclouxiana Hickel	VU A1c
Cupressus torulosa D.Don.	VU

Notes：EX: Extinct EW: Extinct in the Wild RE: Regional Extinct CR: Critically Endangered EN: Endangered VU: Vulnerable NT: Near Threatened

Table 7-5 National Protected Plants of the Shilin Karst Nominated Sites

Species	Protected grade and category

Psammosilene tunicoides	□,Rare
Paeonia delavayi var.*lutea*	□,NT
Calocedrus macrolepis	□,NT
Neocheiropteris palmatopedata	□,NT
Ottelia acuminate	□,NT Rare
Rosa odorata	□,Rare

Table 7-6 Rare and Endemic Plants in the Shilin Karst Nominated Sites

Species	Specificity
Impatiens loulanensis var. *intermedia*	Endemic to Shilin area
Lecanthus pileoides	Endemic to Shilin area
Salvia breviconnectivata	Endemic to Shilin area
Ainsliaea bonatii	Endemic to Kunming area
Ainsliaea pertyoides var. *alto-tomentosa*	Endemic to Kunming area
Artemisia dubia var. *longeracemulosa*	Endemic to Kunming area
Aster oreophilus	Endemic to Kunming area
Berberis kunmingensis	Endemic to Kunming area
Indigofera mairei	Endemic to Kunming area
Milletia bonatiana	Endemic to Kunming area
Millettia dielsiana	Endemic to Kunming area
Petrocosmea barbata	Endemic to Kunming area
Senecio cavaleriei	Endemic to Kunming area
Ulmus changii var. *kunmingensis*	Endemic to Kunming area
Nothopodytes tomentosa	Endemic to Yunnan province
Crataegus scabrifolia	Endemic to Yunnan province
Delphinium yunnanensis	Endemic to Yunnan province
Paris polyphylla var.*yunnanensis*	Endemic to Yunnan province
Ainsliaea yunnanensis	Endemic to Yunnan province
Albizia mollis	Endemic to Yunnan province
Allium mairei	Endemic to Yunnan province
Asplenium yunnanense	Endemic to Yunnan province
Begonia yunnanensis	Endemic to Yunnan province
Camellia pitardii var. *yunnanica*	Endemic to Yunnan province
Carpinus monbeigiana	Endemic to Yunnan province
Celtis tetrandra (yunnanensis)	Endemic to Yunnan province
Cinnamomum glanduliferum	Endemic to Yunnan province
Cirsium chlorolepis	Endemic to Yunnan province
Craspedolobium schochii	Endemic to Yunnan province
Crotolaria yunnanensis	Endemic to Yunnan province
Cyclobalanopsis delavayi	Endemic to Yunnan province
Cynanchum wallichii	Endemic to Yunnan province

Dioscorea yunnanensis	Endemic to Yunnan province
Dipelta yunnanensis	Endemic to Yunnan province
Docynia delavayi	Endemic to Yunnan province
Eragrostis ferruginea var. *yunnanensis*	Endemic to Yunnan province
Habenaria delavayi	Endemic to Yunnan province
Heracleum scabridum	Endemic to Yunnan province
Impatiens uliginosa	Endemic to Yunnan province
Itea yunnanensis	Endemic to Yunnan province
Magnolia delavayi	Endemic to Yunnan province
Merremia hungaiensis	Endemic to Yunnan province
Michelia yunnanensis	Endemic to Yunnan province
Myrica nana	Endemic to Yunnan province
Neocinnamomum delavayi	Endemic to Yunnan province
Olea yunnanensis	Endemic to Yunnan province
Onosma paniculata	Endemic to Yunnan province
Populus yunnanensis	Endemic to Yunnan province
Quercus dentata var. *oxyloba*	Endemic to Yunnan province
Rapanea yunnanensis	Endemic to Yunnan province
Rubus delavayi	Endemic to Yunnan province
Sabia yunnanensis var. *mairei*	Endemic to Yunnan province
Salvia yunnanensis	Endemic to Yunnan province
Sapindus delavayi	Endemic to Yunnan province
Scutellaria amoena	Endemic to Yunnan province
Stellaria yunnanensis	Endemic to Yunnan province
Swertia yunnanensis	Endemic to Yunnan province
Toxicodendron delavayi	Endemic to Yunnan province
Tylophora yunnanensis	Endemic to Yunnan province
Zizyphus yunnanensis	Endemic to Yunnan province
Pyrus pashia	Endemic to South-West realm in China
Campanula pallida	Endemic to South-West realm in China
Castanopsis delavayi	Endemic to South-West realm in China
Cotoneaster franchetii	Endemic to South-West realm in China
Cupressus duclouxiana	Endemic to South-West realm in China
Cupressus torulosa	Endemic to South-West realm in China
Cyclobalanopsis glaucoides	Endemic to South-West realm in China
Ehretia corylifolia	Endemic to South-West realm in China
Galium elegans	Endemic to South-West realm in China
Helwingia himalaica	Endemic to South-West realm in China
Keteleeria evelyniana	Endemic to South-West realm in China
Lithocarpus dealbatus	Endemic to South-West realm in China

Pinus yunnanensis	Endemic to South-West realm in China
Potentilla fulgens	Endemic to South-West realm in China
Sanicula astrantiifolia	Endemic to South-West realm in China
Antiotrema dunnianum	Endemic to China
Dichotomanthes tristaniaecarpa	Endemic to China

Table 7-7 Mainly Protected Animals in the Shilin Karst Nominated Sites

Sort	Spceies	Status quo and protection	Flora
Mammal	*Tupaia belangeri chinensis* Anderson	Common species	Endemic to Oriental Realm
	Rhinolophus ferrumequinum tragatus Hodgson	Common species	Wide-spread in Europe-Asia
	Hipposideros armiger armiger (Hodgson)	Common species	Oriental species
	Viverricula indica thai Kloss	Common species of South China,the second protected of nation	Oriental species
	Paguma larvata intrudens Wroughton	Southeast of Asia common species,common in forest of Shilin area	Oriental species
	Felis bengalensis bengalsis Kerr	Common species,the same subspecies with the Indian and Burma,was listed in addendum□of CITES. But because of the big community amount, theYunnan community was degraded to addendum □in 1985.	Oriental species
	Manis pentadectyla aurita Hodgson	The second protected of nation , broadleaves forest,shaw	Oriental species
	Lepus comus peni Wang et Luo	Common species	Oriental species (endemic to Yunnan-Guizhou plateau and west of Yunnan)
	Callosciurus erythraeus michianus Robinson Et Wroughton	Common species	Oriental species
	Muntiacus reevesi reevesi (Ogilby)	endemic to China,small amount	Oriental species
	Moschus bereaoskii cavbangis Dao	The second protected bird of nation,small amount	Oriental species
Bird	*Podiceps reficollis poggei* (Reichenow)	Common natatorial bird,resident.	wide-spread species
	Ardea cinerea rectirostris Gould	Common wading bird,resident.	wide-spread species
	Tsdorna ferruginea (Pallas)	Common,big mallard,winter bird。	
	Falco tinnunculus saturatus (Blyth)	The second protected bird of nation,resident,common raptor	wide-spread species
	Bambusicola fytchii fytchii Anderson	Resident,common species	Oriental species
	Phasianus colchicus rothschildi La Touche	Resident,common species	wide-spread species
	Chrysolophus amherstiae (Leadbeater)	Resident,EN of world,the second protected bird of nation.	Oriental species
	Bubo bubo kiautschensis Reichenow	Resident,small amount,the second protected bird of nation.	wide-spread species
	Pericrocotus ethologus ethologus Bangs et Phillips	More common,summer bird, feather colorful,decorative value	Oriental species
	Spizixos cantfrons Blyth	Big amount,resident,shape peculiar,decorative value	Oriental species
	Cissa erythrohyncha erythrohyncha (Boddaert)	More common,resident,feather colorful,decorative value	Oriental species
	Copsychus saularis Prosthopellus Oberholser	Resident,more common, decorative value	Oriental species
	Pomatorhinus erythrogenys odicus Bangs et Phillips	Resident,more common, decorative value	Oriental species

	Paradoxornis webbianus yunnanensis (La Touche)	Big amount,decorative value	Oriental species
	Aethopyga gouldiae dabryii (Verreaux)	Resident,small amount,decorative value	Oriental species
Fish	*Sinocyclocheilus angustiporus* Zheng Et Xie	Common species	Oriental species
	Acrossocheilus yunnannensis (Regan)	Common species	Oriental species
Amphibian	*Rana pleuraden* Boulenger	Common species	Oriental species (endemic to South-west in China)
	Bufo bufo andrewsi Schmidt	Common species	wide-spread species
Reptiles	*Japalura vrcoae* (Boulenger)	Common species	Endemic species to Shilin area
	Zaocys nigeomargin atus (Blyth)	Common species (rare in Shilin area)	Oriental species

Table 7-8 General View of Main Natural Landscapes in the Libo Karst Nominated Site

No.	Name	Characteristic
1	Maolan Karst Forest	There is original karst forest conserved in the habitat with high bare rate of rock and little soil, is the relict forest with relatively strong mid-subtropical karst primary nature, nearly cover 20,000 hectare. The ecosystem, comprises forest and cone karst physiognomy, include complex and abstruse science content.
2	Yezhu Forest	It is Karst doline forest with overlapping jungle. There are bamboo forest covering hundreds are, therefore, the doline looks like a green swirl over the forest. There also are all kinds of wild animals, even many animals enjoying the national protection such as giant salamander.
3	Di'e Forest	An original karst valley forest covering 100hm^2. There is too dense forest to be penetrated by sunlight, and cloud-kissing peaks.
4	68-level Waterfall	In the river reach of 3km long, there are multilevel calcific sediments and waterfall scene. Fall of the waterfall is from 0.5m to several meters. Totally, there are 68 levels waterfall and 20 deep plunge pools.
5	Guibenshan Mountain	A miniature of karst original forest wonder. In the dense forest, there are unique and rare tree species everywhere growing on the cliff and rare limestone even on the collapse rock.
6	Forest above Water	There are shrubs symmetrical distribute on a rapid river. Surprisingly, the limbs of the shrubs are flourishing, although the limbs have been scoured perennially.
7	Yuanyang Lake	The lake, with an area of 13hm^2 and depth of more than 40m, comprises two deep pools resulting for seeper of Huanghou Subterranean River. It covers an area of 13hm^2.
8	Natural Bridge	The bridges, with tallness of 60m, depth of more than 10m and width of more than 20m, lie in Daqikong Scenic Spot. There is a river below the bridge with clear water.
9	Wolong Pool	A subterranean river-the vent of Wolong River. There are plenty of karst cone summits and trees near to the pool.
10	Xiaoqikong Bridge	Built in the 15th of Daoguang in Qing Dynasty (1835). The bridge, with tallness of 10m, width of 2.2m and length of 5m, comprises 7 bridge openings. It was a stone arch bridge in the road from Guizhou to Guangxi.
11	Daqikong	Built in the 20th of Daoguang in Qing Dynasty (1847), completed in the 30th of Daguang (1850).

	Bridge	The bridge, with tallness of 7m, width of 4.5m and length of 35m, crosses over from east to west, comprises 7 bridge openings. One opening was washed off in flood. Rebuilt in the 3th of Guangxu in Qing Dynasty (1877).

Table 7-9 Caves in the Libo Karst Nominated Sites

No.	Name	Type	Strike	Elevation (m)	Sediment	Length (m)	Remarks
1	Gedu Cave	Fissuring	EW	770		60	
2	Dongdao Cave	Conduit	SSW	720 (0-10)*	stalactite, impulsion	120	Water source flow from stala-ctite and conne- ct with underground land
3,4	Bimangao Cave	Chamber	SSW	740 (70)	stalactite,stalagmite	200	Light through cave with double openings
5,6	Ganshayi Cave	Chamber	Approach EW	940 (200-220)	rush-shoal materials, slide accumulation	110	Light thtough cave
7	Yaolanhou Cave	Chamber	Approach EW	950 (180-230)	rush-shoal materials, stalactite, stalagmite	180	Collapse cave opening
8	Layong Save	Chamber	NWW	850 (100-120)	slide accumulation, shoal materials	30	
9	Lalang Cave	Chamber	Approach EW	710 (0-20)	stalactite, rush-shoal materials	180	Subterranean river at dry cave terminal
10	Baiyan Cave	Chamber	NWW	770 (50-60)	stalactite, stalagmite	400	Many branches and a cuple of openings
11	Wengkai Cave	Fissuring	SEE	900 (50-60)	stalactite, clay	70	
12	Ken xishan Cave	Drain cave	Approach EW	820 (0-20)	clay, adarce	50	Subterranean river main cave terminal
13	Huada Cave	Chamber	NWW	880 (100-110)	Stalactite	200	
14	Gerui Cave	Chamber	Approach EW	780 (200)	stalactite, stalagmite, cave pearl	30	Adarce sediment cave bottom
15	Dongchangshui Cave	Conduit	NE	680	Sediment	≥500	Entry of subterranean river
16	Dong changao Cave	Chamber	NWW	790 (100-120)	Stalactite, stalagmite	50	
17	Banshan Cave	Chamber	SW	720 (40)	Stalagmite	50	Deep seeper
18	Bibashui Cave	Conduit	SW	900 (90-100)	stalagmite, stalactite, shoal materials, sediment	1500	Perennial seeper, water source is forest perched band.
19	Po baohou Cave	Conduit	NE	900 (90-100)			The different opening of the the same cave with Bibshui Cave
20	Dong liangshui Cave	Fissuring	Approach EW	820 (0-10)	alluviation, shoal materials	≥200	Main cave terminal and subterranean river
21	Kamai Cave	Chamber	Approach EW	560 (0-5)	collapse rock	≥100	New-collapsed subterranean channel with underground water flow.
22	Baixian	Conduit-	NWW	805	stalagmite, clay	≥200	Pipe and fissuring

	Cave	fissuring		(-300)			cave
23	Lubian Cave	Chamber	Approach EW	590	caly, stalactite	50	
24	Lubian Cave	Chamber	Approach EW	590	clay, stalagmite	40	
25	Ban zhaishui Cave	Conduit	Approach EW	520 (0-20)	silt, stalagmite	≥500	Main cave terminal with subterranean river
26	Maanpo Cave	Chamber	NWW	510 (50-100)	collapse rock, flowstone dam	200	Upper and lower stratum connected because of collapse.
27	Wenggen shui Cave	Conduit	Approach EW	800 (280)	Stalactite	20	
28	Wenggen po Cave	Conduit	Approach EW	800 (150-280)	alluviation, flowstone dam, stalagmite	330	Vertical downwards trend.
29	Jiluda Cave	Chamber	SSE	650 (120-150)	slide accumulation, alluviation, stalag- mite, flowstone dam	200	Another small cave opening.
30	Ligenao Cave	Conduit	NNE	590 30-90)	silt, stalagmite, Stalactite	170	Subterranean river at terminal
31	Ligensh-ui Cave	Conduit	Approach EW	500	Stalactite		
32	Hetou Cave	Chamber	Approach EW	500	stalactite, curb dam	300	Subterranean river opening, channel and land way interphase.
33	Liang feng Cave	Chamber	NNE	580 (-140)	slide rock, stalactite, stalagmite	2000	A branch connect with subterranean river
34	Wuniu Cave	Chamber	EW	730 (190)	stalagmite, stalactite, cave pearl	50	Secular seeper
35	Hei Cave	Chamber	NNE	740 (180-190)	stalactite, huge cave pearl	60	Light through cave, karren on cave ceiling
36	Pusa Cave	Chamber	EW	750 (190)	stalactite, huge stalagmite, quartz	70	Light through cave, karren on cave ceiling
37	Jiuchongtian Cave	Chamber	NWW	770 (200)	stalactite, cave pearl	250	Light through cave with nine openings.
38	Wuyanqi-ao Cave	Chamber	NWW	580 (30-50)	Stalactite		
39	Yuandongpang Cave	Conduit	Approach EW	570 (0-20)	Alleviation	≥200	
40	Huadong shui Cave	Conduit	SSE	550 (0-20)	mud, sand, hydrops	≥200	Subterranean channel
41	Loudou Cave 1	Conduit	Approach EW	450 (0-70)	silt, stalactite	≥500	Connected with subterranean river at terminal
42	Gaowang Cave	Chamber	Approach EW	580	Stalactite	150	
43	Loudou Cave 2	Conduit	Approach EW	450 (0-70)	stalactite, silt	≥500	Connected with subterranean river at terminal
44	Bake Cave 1	Conduit	SSE	520	silt, alluvium	≥200	Seasonal subterranean channel and land channel
45	Bake Cave 2	Conduit	SSE	540	clay, alluvium, stalactite, stalagmite	4000	Complex branches
46	Dongge Cave	Chamber	NWW	670 (-170)	flowstone dam, stalactite, stalagmite	≥500	A shaft over 70m, labytinth cave
47	Chashan	Chamber	NWW	650	flowstone dam,	≥500	Three openings,

	Cave			(-120)	stalactite, stalagmite		one is collapse opening, the other two are light through cave openings
48	Wawu Cave	Chamber	NWW	650 (120)	collapse rock, stalagmite, clay	360	Cave ceiling take shape of ridge

Table 7-10 Species of Important Protected Wild Plants in the Libo Karst Nominated Sites

No.	Name	Character				Life style			Vertical distributing (m)	Value(of national importance)
		Arbor	Shrub	Liane	Herb	Evergreen	Deciduous	Other		
1	*Kmeria septentrionalis*	□				□			700 ～800	Class □
2	*Handeliodendron bodinieri*	□					□		560 ～780	Class □p
3	*Mussaenda anomala*		□				□		480～600	Class □
4	*Taxus chinensis* var.*mairei*	□				□			750	Class □
5	*Taxus chinensis*	□				□			780	Class □
6	*Orchidaceae Paphiopedilum emersonii*				□	□			760	Class □
7	*Paphiopedilum barbigerum*				□	□			750	Class □
8	*Paphiopedilum micranthum*				□	□			820	Class □
9	*Parkeriaceae ceratotteris Thilectroides*				□	□			750	Class □
10	*Sinopteris grevilleoides*				□			□	680	Class □
11	*Sinopteris grevilleoides*	□				□				Class □
12	*Cephaoltaxus oliveri*	□				□			720	Class □
13	*Calocedrus fokienia hodginsii*	□				□			880	Class □
14	*Calocedrus fokienia hodginsii*	□				□			860	Class □
15	*Pinus kwangtungensis*	□				□			850～1000	Class □
16	*Pseudotsuga sinensis*	□				□			890	Class □
17	*Pseudotsuga brevifolia*	□				□			890	Class □
18	*Hamamelidaceae terathyrium subcordatum*	□				□			780	Class □
19	*Lauraceae cinnamomum camphora*	□				□			480～600	Class □
20	*Lauraceae phoebe bournei*	□				□			700	Class □
21	*Zenia insignis*	□					□		720	Class □
22	*Manglietia aromatica*	□				□			720	Class □
23	*Toona ciliata*	□					□		600～800	Class □
24	*Camptotheca acuminata*	□					□		760	Class □

25	*Trachycarous nana*		□			□			750～850	Class □
26	*Emmenopterys henryi*	□					□		740	Class □
27	*Eurycorymbus cavleriei*	□					□		650～750	Class □
28	*Zelkova schneideriana*	□					□		650～1000	Class □
29	*Liriodendron chinense*	□					□		500～800	Class □
30	*Rhoiptelea chiliantha*	□					□		850～1200	Class □
31	*Dipeniodon sinicus*	□					□		900～1000	Class □
32	*Rehderodendron macrocarum*	□					□		550～750	Class □
33	*Acampe multiflora*				□			□	550～850	Class □
34	*Anoectochilus raxburghii*				□			□	550～850	Class □
35	*Bletilla striata*				□			□	500～850	Class □
36	*Bletilla strata ochracea*				□			□	500～850	Class □
37	*Bulbophyllum kwangtungense*				□			□	700～900	Class □
38	*B.shweliense*				□			□	650～800	Class □
39	*B.pyschoon*				□			□	600～800	Class □
40	*B.odoratissimum*				□			□	600～800	Class □
41	*B.andersonii*				□			□	750	Class □
42	*Calanthe discolor*				□			□	700	Class □
43	*C.arngenteo striata*				□			□	700	Class □
44	*C.tracarnata*				□			□	700	Class □
45	*C.masuca*				□			□	850	Class □
46	*C.davidii*				□			□	850	Class □
47	*C.hamaa*				□			□	800	Class □
48	*C.*sp.				□			□	800	Class □
49	*Cleisostoma rostratum*				□			□	780	Class □
50	*C.brevipes*				□			□	780	Class □
51	*Coelogyme flaccida*				□			□	700～800	Class □
52	*C.fimbriata*				□			□	600～900	Class □
53	*Corallorrhiza trifida*				□			□	600～900	Class □
54	*Cremastra appendiculata*				□			□	600～900	Class □
55	*Cymbidium faberi*				□			□	600～950	Class □
56	*C.goeringii*				□			□	750～950	Class □
57	*C.serratum*				□			□	620～950	Class □
58	*C.longibracteatum*				□			□	750	Class □
59	*C.ensifolium*				□			□	700～850	Class □
60	*C.kanran*				□			□	700～850	Class □
61	*C.floribundum*				□			□	700	Class □

62	*C.pumilum*				□			□	850～950	Class □
63	*C.hancifolium*				□			□	800～900	Class □
64	*C.javeanicum*				□			□	600～800	Class □
65	*C.erythraecum*				□			□	600～800	Class □
66	*C.cyperifolium*				□			□	600～800	Class □
67	*Dendrobium bellatulum*				□			□	750	Class □
68	*D.loddigesii*				□			□	700	Class □
69	*D.aduncum*				□			□	700	Class □
70	*D.monilifonme*				□			□	850	Class □
71	*D.olhohense*				□			□	800	Class □
72	*D.hancockii*				□			□	550～800	Class □
73	*D.thrysanthum*				□			□	550～800	Class □
74	*D.candidum*				□			□	550～800	Class □
75	*D.wilsonii*				□			□	500～700	Class □
76	*L.caespitosa*				□			□	480～750	Class □
77	*L.distans*				□			□	480～800	Class □
78	*L.inapera*				□			□	750	Class □
79	*L.japonica*				□			□	800	Class □
80	*L.nervosa*				□			□	850	Class □
81	*L.cathcartii*				□			□	800	Class □
82	*L.nigra*				□			□	780	Class □
83	*L.stricklandiana*				□			□	750	Class □
84	*Listera puberula*				□			□	700	Class □
85	*Luisia morsei*				□			□	750	Class □
86	*Malaxis latifolia*				□			□	700～900	Class □
87	*Nervilia fordii*				□			□	500～800	Class □
88	*Oberonia integerrima*				□			□	500～800	Class □
89	*Liparis bootanensis*				□			□	500～800	Class □
90	*D.fimbriatum*				□			□	500～900	Class □
91	*Eria cornaria*				□			□	500～780	Class □
92	*E.szetschuanica*				□			□	500～750	Class □
93	*E.clausa*				□			□	500～750	Class □
94	*E.corneri*				□			□	750	Class □
95	*Goodyera biflora*				□			□	800	Class □
96	*G.schlechtendaliana*				□			□	750～850	Class □
97	*G.velutina*				□			□	800	Class □
98	*Herminium* sp.				□			□	800	Class □
99	*Pecteilis susannae*				□			□	850	Class □
100	*Paius woodfordii*				□			□	850	Class □

101	*P.tankervilliae*				□			□	800	Class □
102	*P.guizhouensis*				□			□	800	Class □
103	*Pholidota yunnanensis*				□			□	850	Class □
104	*P.chinensis*				□			□	850	Class □
105	*P.cantonensis*				□			□	750	Class □
106	*Phyreatia evrardii*				□			□	750	Class □
107	*Pleione bulbocodioides*				□			□	650～750	Class □
108	*Stauropsis* sp.				□			□	550～650	Class □
109	*Tainia dunnii*				□			□	500～750	Class □
110	*Uncifera acuninata*				□			□	500～750	Class □
111	*Vanda concolor*				□			□	500～750	Class □
112	*Vanilla siamensis*				□			□	780	Class □

Table 7-11 Plant species of the Libo Karst Nominated Sites in the Red List

China Species Red List Grade: Critically Endangered (CR) 12 species			
Species	Family	Distribution	World Species Red List Grade
1 *Carya Kweichowensis*	Juglandaceae	Endemic to China	—
2 *Michelia angustioblonga*	Magnoliaceae	Endemic to China	—
3 *Sycopsis yunnanensis*	Hamamelidaceae	Endemic to China	—
4 *Camellia rubimuricata*	Theaceae	Endemic to China	—
5 *Mussaenda anomala*	Rubiaceae	Endemic to China	—
6 *Paphiopedium emersonii*	Orchidaceae	Endemic to China	—
7 *Paphiopedium malipoens*		Endemic to China	—
China Species Red List Grade: Endangered (EN) 54 species			
1 *Castanopsis amabilis*	Fagaceae	Endemic to China	—
2 *Kmeria septentrionlis*	Magnoliaceae	Endemic to China	—
3 *Manglietia aromatica*		Endemic to China	VU
4 *Uvaria Kweichowensis*	Annonaceae	Endemic to China	—
5 *Tetrathyrium subcordatum*	Hamamelidaceae	Endemic to China	VU
6 *Acer sycopseoides*	Aceraceae	Endemic to China	—
7 *Handeliodendron bodinieri*	Sapindaceae	Endemic to China	—
8 *Chirita longgangensis*	Gesneriaceae	Endemic to China	—
9 *Trachycarpus nana*	Palmae	Endemic to China	—
10 *Cymbidium tortisepalum*	Orchidaceae	Endemic to China	—
11 *Dendrobium aduncum*		China is minor distributed region	—
12 *Dendrobium bellatulum*		China is minor distributed region	—
13 *Dendobium fimbriatum*		China is minor distributed region	—
14 *Dendobium guangxiense*		Endemic to China	—
15 *Dendobium hancockii*		Endemic to China	—

16 *Dendobium loddigesii*		China is minor distributed region	—
17 *Dendobium lohohense*		Endemic to China	—
18 *Dendobium moniliforme*		China is minor distributed region	—
19 *Dendobium wilsonii*		Endemic to China	—
20 *Paphiopedium barbigerum*		Endemic to China	—
21 *Paphiopedium bellatulum*		China is minor distributed region	—
22 *Paphiopedium concolor*		China is minor distributed region	—
23 *Paphiopedium dianthum*		Endemic to China	—
24 *Paphiopedium hirsutissimum*		China is minor distributed region	—
25 *Vanda concolor*		Endemic to China	—
26 *Vanilla siamensis*		China is minor distributed region	—
China Species Red List Grade: Vulnerable (VU) 50 species			
1 *Keteleeria davidiana* var. *calcarea*	Pinaceae	Endemic to China	—
2 *Pinus kwangtungensis*		Endemic to China	—
3 *Pseudotsuga brevifolia*		Endemic to China	—
4 *Pseudotsuga sinensis*		Endemic to China	VU
5 *Calocefrus macrolepis* var. *macrolepis*	Cupressaceae	China is minor distributed region	VU
6 *Cupressus funebris*		Endemic to China	—
7 *Fokienia hodginsii*		China is minor distributed region	NT
8 *Cephalotaxus oliveri*	Cephalotaxaceae	China is minor distributed region	VU
9 *Amentotaxus argotaenia*	Taxaceae	China is minor distributed region	VU
10 *Taxus wallichiana* var. *mairei*		China is minor distributed region	DD
11 *Taxus wallichiana*		China is minor distributed region	—
12 *Lithocarpus fordianus*	Fagaceae	China is minor distributed region	—
13 *Rhoiptelea chiliantha*	Rhoipteleaceae	Endemic to China	VU
14 *Dysosma versipellis*	Berberidaceae	Endemic to China	VU
15 *Liriodendron chinense*	Magnoliaceae	China is minor distributed region	NT
16 *Magnolia coco*		China is minor distributed region	—
17 *Alseodaphne hainanensis*	Lauraceae	China is minor distributed region	VU
18 *Phoebe bournei*		Endemic to China	NT
19 *Sycopsis laurifolia*	Hamamelidaceae	Endemic to China	—
20 *Eucommia ulmoides*	Eucommiaceae	Endemic to China	NT
21 *Zenia insignis*	Leguminosae	China is minor distributed region	NT
22 *Dipentodon sinicus*	Celastraceae	Endemic to China	CR
23 *Acer paxii*	Aceraceae	Endemic to China	—
24 *Eurycorymbus cavaleriei*	Sapindaceae	Endemic to China	NT
25 *Lagerstroemia caudata*	Lythraceae	Endemic to China	—
26 *Rehderodendron macrocarpum*	Styraceae	Endemic to China	NT
27 *Abelia forrestii*	Caprifoliaceae	China is minor distributed region	—
28 *Bletilla striata*		China is minor distributed region	—
29 *Bulbophyllum andersoii*		China is minor distributed region	—
30 *Bulbophyllum kwangtungense*		Endemic to China	—
31 *Bulbophyllum shweliense*		China is minor distributed region	—

32 *Calanthe argenteo-striata*	Orchidaceae	Endemic to China	—
33 *Calanthe discolor*		China is minor distributed region	—
34 *Castrodia elata*		China is minor distributed region	—
35 *Coelogyne flaccida*		China is minor distributed region	—
36 *Cymbidium cyperifolium*		China is minor distributed region	—
37 *Cymbidium ensifolium*		China is minor distributed region	—
38 *Cymbidium erythraeum*		China is minor distributed region	—
39 *Cymbidium faberi*		China is minor distributed region	—
40 *Cymbidium floribundum*		Endemic to China	—
41 *Cymbidium goeringii*		China is minor distributed region	—
42 *Cymbidium kanran*		China is minor distributed region	—
43 *Cymbidium lancifolium*		China is minor distributed region	—
44 *Eria clausa*		China is minor distributed region	—
45 *Liparis cathcartii*		China is minor distributed region	—
46 *Liparis distans*		China is minor distributed region	—
47 *Liparis nigra*		China is minor distributed region	—
48 *Oberonia integerrima*		China is minor distributed region	—
49 *Phaius tankervilleae*		China is minor distributed region	—
50 *Uncifera acuminata*		China is minor distributed region	—
China Species Red List Grade: Near Threatened (NT) 32 species			
1 *Podocarpus neriifolius*	*Podocarpaceae*	China is minor distributed region	—
2 *Pteroceltis tatarinowii*	Ulmaceae	Endemic to China	—
3 *Acer wilsonii*	Aceraceae	Endemic to China	—
4 *Emmenopterys henryi*	Rubiaceae	Endemic to China	—
5 *Acampe rigida*	Orchidaceae	China is minor distributed region	—
6 *Anoectochilus roxburghii*		China is minor distributed region	—
7 *Bulbophyllum odoratissimum*		China is minor distributed region	—
8 *Calanthe davidii*		Endemic to China	—
9 *Calanthe tricarinata*		China is minor distributed region	—
10 *Cleisostoma rostratum*		China is minor distributed region	—
11 *Coelogyne fimbriata*		China is minor distributed region	—
12 *Corallorhiza trifida*		China is minor distributed region	—
13 *Cremastra appendiculata*		China is minor distributed region	—
14 *Eria corneri*		China is minor distributed region	—
15 *Eria coronaria*		China is minor distributed region	—
16 *Eria szetschuanica*		Endemic to China	—
17 *Goodyera biflora*		China is minor distributed region	—
18 *Goodyera velutina*		China is minor distributed region	—
19 *Liparis bootanensis*		China is minor distributed region	—
20 *Liparis caespitosa*		China is minor distributed region	—
21 *Liparis inaperta*		Endemic to China	—
22 *Liparis japonica*		Endemic to China	—
23 *Liparis nervosa*		China is minor distributed region	—

24 *Liparis stricklandiana*		China is minor distributed region	—
25 *Listera puberula*		China is minor distributed region	—
26 *Luisia morsei*		China is minor distributed region	—
27 *Malaxis latifolia*		China is minor distributed region	—
28 *Nervilia fordii*		China is minor distributed region	—
29 *Pholidota cantonensis*		Endemic to China	—
30 *Pholidota chinensis*		China is minor distributed region	—
31 *Pholidota yunnanensis*		China is minor distributed region	—
32 *Tainia dunnii*		Endemic to China	—
China Species Red List Grade: Least Concern (LC) 6 species			
1 *Acer davidii*	Aceraceae	Endemic to China	—
2 *Acer fabri*		Endemic to China	—
3 *Acer oblongum*		China is minor distributed region	—
4 *Acer laevigatum*		China is minor distributed region	—
5 *Enkianthus quinqueflorus*	Ericaceae	China is minor distributed region	—
6 *Goodyera schlechtendaliana*	Orchidaceae	China is minor distributed region	—

Notes：CR: Critically Endangered； EN：Endangered； VU：Vulnerable； NT：Near Threatened；LC：Least Concern, DD：Data Deficient； NE：Not Evaluated； —：Not Listed

Table 7-12 Endemic Plants in the Libo Karst Nominated Sites for the World Natural Heritage

No.	Name	Charcter				Life style		Vertical destributing Altitude (m)	Value
		Arbor	Shrub	Liane	Herb	Evergreen	Deciduous		
1	*Amentotaxu sorgotaenis (hance)* Pliger ver.	□				□		800	Model native habitat
2	*Carpinus lipoensis* Y.L.Li	□					□	850	Model native habitat
3	*Morus liboensis* S.S.chang	□					□	740	Model native habitat
4	*Clematis liboensis* Z.R.Xu				□		□	750	Model native habitat
5	*Cryptcarya autro-kweiehowensis* X.H.Song	□				□		700	Model native habitat
6	*Cinnamomum calcareum* Y.K.Li	□				□		760	Model native habitat
7	*Neolistea calcicola* Xu		□			□		780	Model native habitat
8	*Kmeria septentrionalis* Dandy	□				□		780	Model native habitat
9	*Manglietia catcarea* X.H.Song	□				□		760	Model native habitat
10	*Distylium lipoense* Y.K.Li et X.M.Wang		□			□		700	Model native habitat
11	*Rubus liboensis* Huang			□			□	680	Model native

									habitat
12	*Zanthoxylum liboensis* Huang		□				□	720	Model native habitat
13	*Ilex rivularis* Y.K.Li		□			□		750	Model native habitat
14	*Euonymus lipoensis* Xu		□			□		760	Model native habitat
15	*Rhammus saxitilis* X.H.Song		□			□		780	Model native habitat
16	*Rhamnus calcicolus* Q.H.chen		□			□		720	Model native habitat
17	*Camellia rubimuricata chang* et Z.R.Xu		□			□		750	Model native habitat
18	*Camellia lipoensis Chang* et Xu	□				□		860	Model native habitat
19	*Elaeagnus s-stylata* Xu			□		□		720	Model native habitat
20	*Elaeagnus lipoensis* Xu			□		□		750	Model native habitat
21	*Elaeagnus calcarea X*u			□		□		740	Model native habitat
22	*Toxicodendron calcicolum* C.Y.Wu	□					□	720	Model native habitat
23	*Dendrobenthamia longipedunculata* S.S.chang et X.chen		□				□	800	Model native habitat
24	*Enkianthus quinqueflorus* Lour		□			□		850	Model native habitat
25	*Primula levicaly* C.M.Hu et Z.R.Xu			□		□		820	Model native habitat
26	*Osmanthus racemosus* X.H.Song	□				□		700	Model native habitat
27	*Gongronema multibracteolatum* P.T.Li et X.M.			□		□		730	Model native habitat
28	*Hoya lipoeu* P.T.Li et Xu				□	□		720	Model native habitat
29	*Chirita liboensis* W.T.Wang et D.Y.Chen				□	□		740	Model native habitat
30	*Chirita glabrescens* W.T.Wang et D.Y.Chen				□	□		730	Model native habitat
31	*Chirita brachytricha* W.T.Wang et D.Y.Chen				□	□		720	Model native habitat
32	*Chirita brachytricha* Var.Magnibracteata W.T.Wang et D.Y.Chen				□	□		750	Model native habitat
33	*Salvia sonchifolia* C.Y.Wu				□	□		700	Model

									native habitat
34	*Ampelocalamus calcareous* C.D.Chu et C.S.			□		□		850	Model native habitat
35	*Indosasa lipoensis* C.D.Chu et K.M.Lan		□			□		560	Model native habitat
36	*Gelidocalamus tessellates* Wen et C.C.Chang	□				□		480	Model native habitat
37	*Dendronealamus minor* Chia et H.L.Fang	□				□		600	Model native habitat
38	*Dendroncalamus tsiangii* f.var.disratus X.H.Song	□				□		580	Model native habitat
39	*Bambusa papillata* Q.H.Dai	□				□		730	Model native habitat
40	*Indocalamus soliolus* C.D.Chu et C.S.Chao		□			□		700	Model native habitat
41	*Paphiopedilum emersonii* Koopowita et Cribb				□	□		710	Model native habitat

Table 7-13 Species of Protected Wild Animals of National Impoortance in the Libo Karst Nominated Sites

No.	Name in Latin	National protected class	Note
1	*Panthera pardus*	□	
2	*Python molurus*	□	
3	*Symaticus ellioti*	□	
4	*Macaca mulatta*	□	
5	*Macaca thibetana*	□	
6	*Manis pentadactyla*	□	
7	*Selenarctos thibetanus*	□	
8	*Profelis temmincki*	□	
9	*Viuerricula indica*	□	
10	*Capricornis sumatraensis*	□	
11	*Priondon pardicolor*	□	
12	*Falco tinnunculus*	□	
13	*Aviceda jerdoni*	□	
14	*Otus bekkamoena*	□	
15	*Otus scops*	□	
16	*Glaucidium brodiei*	□	
17	*Glaucidium cuculoides*	□	
18	*Tyto capensis*	□	
19	*Lophura nycthemera*	□	
20	*Moschus berezovskii*	□	
21	*Pana tigrinu*	□	
22	*Tylototrition asperrimus*	□	
23	*Sinocyclocheilus longibarbatus*	□	Endemic to Libo

24	*Sinocyclocheilus marcrolepis*	□	Endemic to Libo
25	*Sinocyclocheilus multipunctatus*	□	
26	*Sinocyclocheilus angustiporus*	□	
27	*Sincoyclocheilus rboustus*	□	
28	*Pitta nympha*	□	
29	*Aviceda leuphotes*	□	
30	*Pernis ptilorhyncus*	□	
31	*Milvus korschum*	□	
32	*Accipiter soloensis*	□	
33	*Accipiter trivirgatus*	□	
34	*Buteo.buteo*	□	
35	*Spilornis cheela*	□	

Table 7-14 Animal Species in Red List of the Libo Karst Nominated Sites

China Species Red List Grade: Critically Endangered (CR) 3 species			World Red List Grade
Species	Family	Percent (%)	
1 *Python molurus*	Boidae	90%	NT
2 *Rana wuchuanensis*	*Ranidae*		—
3 *Protelis temmincki*	Felidae		CR
China Species Red List Grade: Endangered (EN) 4 species			
1 *Ophiaphagus hannah*	Elapidae		—
2 *Manis pentadactyla*	Felidae		CR
3 *Moschus berezovskit*	Cervidae		NT
4 *Manis pentadactyla*	Manidae		NT
China Species Red List Grade: Vulnerable (VU) 38 species			
1 *Byasa alcinous*	Papilionidae		—
2 *Oreolalax rhodostigmatus*	Pelobatidae	30%	NE
3 *Rana boulengeri*	Randiae	30%	NE
4 *Rana spinosa*		***30%***	NE
5 *Rana phrynoida*		30%	NE
6 *Rana tigrina*		30%	NE
7 *Tylototriton asperrimus*	Salamandridae		—
8 *Ptyas korros*		20%	—
9 *Ptyas mucosus*		30%	—
10 *Trimeresurus monticola*		50%	—
11 *Carrulax canorus*	Muscicapidae	90%	—
12 *Passer montanus*	Ploceidae	Amount shap decline	—
13 *Syrmaticus ellioti*	Phasianidae		NE
14 *Aselliscus wheeleri*	Hipposideridae		—
15 *Myotis altarium*	Vespertilionidae		—
16 *Ia io*			NT
17 *Hipposideros pratti*			NT
18 *Pipistrellus coromandra*			—
19 *Belomys pearsoni*	Petauristidae		NT

20 *Dremomys rufigenis*	Sciuridae		—
21 *Hystrix hodgsoni*	Hystricidae		NT
22 *Vulpes vulpes*	Canidae		—
23 *Nyctereutes procyonoides*			—
24 *Mustela sibirica*	Mustelidae		—
25 *Mustela kathiah*			—
26 *Martes flavigula*			—
27 *Melogale moschata*			—
28 *Meles meles*			—
29 *Paguma larvata*	Viverridae		—
30 *Viverricula indica*			—
31 *Prionodon pardicolor*			—
32 *Felis bengalensis*	Felidae		—
33 *Muntiacus muntjak*	Cervidae		—
34 *Muntiacus reevesi*			—
35 *Elaphodus cephalophus*			DD
36 *Macaca thibetana*	Cercopithecidae		NT
37 *Macaca mulatta*			NT
38 *Selenarctos thibetanus*	Ursidae		VU

Notes：CR: Critically Endangered； EN：Endangered； VU：Vulnerable； NT：Near Threatened；LC：Least Concern, DD：Data Deficient； NE：Not Evaluated； —：Not Listed

Table 7-15 Endemic Animals to the Libo Karst Nominated Sites

No.	Name in Latin	Note
1	*Gekko liboensis*	Endemic to Libo
2	*Nemacheilus liboensis*	Endemic to Libo
3	*Sinocrossocheilus microstomacus*	Endemic to Libo
4	*Diplommatina liboensis*	Endemic to Libo
5	*Diplommatina xiaoqikongensis*	Endemic to Libo
6	*Daipotamon minos*	Endemic to Libo
7	*Sryliniscus liboensis*	Endemic to Libo
8	*Sinaphaenops mirubilissims*	Endemic to Libo
9	*Sinaphaenops wangorum*	Endemic to Libo
10	*Sinaphaenops gralilior*	Endemic to Libo
11	*Libotrechus nishikwai*	Endemic to Libo
12	*Oodinotrechus kishimotor*	Endemic to Libo
13	*Glyptotermes succineus*	Endemic to Libo
14	*Stylotermes orthognathus*	Pattern
15	*Neoperla maolunensis*	Endemic to Libo
16	*Rhopatopsote sinensis*	Pattern
17	*Garinata albusa*	Pattern
18	*Flexocerus maolamus*	Endemic to Libo
19	*Ophiuchus bizonatus*	Endemic to Libo

20	*Mileewa mira*	Endemic to Libo
21	*Kolla lunulusa*	Pattern
22	*Purutkina nigrifa*	Endemic to Libo
23	*Thagria furcata*	Endemic to Libo
24	*Calodia opicalis*	Endemic to Libo
25	*Scaphoideus turbinatus*	Endemic to Libo
26	*Onukia flaoopunctata*	Pattern
27	*Mileewa anchora*	Pattern
28	*Mileewa ponta*	Endemic to Libo
29	*Mileewa papillata*	Pattern
30	*Tituma fusca*	Endemic to Libo
31	*Specinervures basifusca*	Pattern
32	*Malluchiella interstitialis*	Endemic to Libo
33	*Nwchauliodes discretus*	Pattern
34	*Retipenna callioptera*	Endemic to Libo
35	*Coniopteryx(Coniopteryx)bispinalis*	Pattern
36	*Conwentzia yunguiana*	Pattern
40	*Semidalis anchoroides*	Pattern
41	*Thyridosmylus maolans*	Endemic to Libo
42	*Thyeeidosmylus rifasciatus*	Endemic to Libo
43	*Rhagio maolunus*	Endemic to Libo
44	*Sciaru maolana*	Endemic to Libo
45	*Sciaru hamatlis*	Pattern
46	*Qisclara bellula*	Endemic to Libo
47	*Phorodonta longiantenna*	Endemic to Libo
48	*Bradysia fureata*	Endemic to Libo
49	*Milesia muolana*	Endemic to Libo
50	*Leptoner falcate*	Endemic to Libo
51	*Leptoneraxw*	Endemic to Libo
55	*Achaearanea qianensis*	Endemic to Libo
56	*Andhita maolan*	Endemic to Libo
57	*Telema dongbei*	Endemic to Libo
58	*Mallinella maolanensis*	Endemic to Libo
59	*Subibulbistridulous giacilis* sp.nov.	New species
60	*Neopterla maolanensis*	New species
61	*Neopterla flexiscrotata*	New species
62	*Kaminuria brerinata*	New species
63	*Kaminuria maolanensis*	New species
64	*Kaminuria microdonata*	New species
65	*Kaminuria* lii	New species
66	*Idocyha maolanensis*	New species
67	*Planaeschna maolanensis*	New species
68	*Sophonia spathulata*	New species

69	*Carinata rucurvana*	New species
70	*Carinata unipuncta*	New species
71	*Sophonia zonulata*	New species
72	*Concaveplana maolana*	New species
73	*Mukaria pallipes*	New species
74	*Oniella nigronotum*	New species
75	*Chudania guizhouana*	New species
76	*Vangama picea*	New species
77	*Anatkina livimacula*	New species
78	*Anatkina bistriata*	New species
79	*Anatkima rubipennis*	New species
80	*Mileewa holomacula*	New species
81	*Ujna maolanana*	New species
82	*Kolla nigrifascia*	New species
83	*Kolla fusciosigna*	New species
84	*Atkinsoniella xanthovena*	New species
85	*Sphinctogonia lingual*	New species
86	*Onukiades albicostatu*	New species
87	*Carinata signigena*	New species
88	*Bundera nigrimargina*	New species
89	*Thagria geniculata*	New species
90	*Thagria aciculata*	New species
91	*Thagria aciculara*	New species
92	*Horcoma choui*	New species
93	*Taidephax furca*	New species
94	*Taidephax microdana*	New species
95	*Belocera fuscifrons*	New species
96	*Neodicranotropis arrowiana*	New species
97	*Miranus kuohi*	New species
98	*Miranus circus*	New species
99	*Orientoya orientalis*	New species
100	*Opiconsiva albimarginata*	New species
101	*Sulculus liboensis*	New species
102	*Sermyloides* lii	New species
103	*Omeisphaera flavimaculata*	New species
104	*Sinaphaenops wangorum*	New species
105	*Sinaphaemops irabilissimus*	New species
106	*Sinaphaenops irabilissimus*	New species
107	*Csrabus liboicus*	New species
108	*Oodinotrechus kishimotoi*	New species
109	*Libotrechus nishikawai*	New species
110	*Uenotrechus*	New species
111	*Trechiotes qiannanicus*	New species

112	*Arge megacincta*	New species
113	*Arge acuminitheca*	New species
114	*Are libona*	New species
115	*Genatomostethus sculpturalis*	New species
116	*Nesoselandria maliae*	New species
117	*Nesoselandria libona*	New species
118	*Nesoselandria wangae*	New species
119	*Neostromboceros bifovella*	New species
120	*Neostromboceros bifovella*	New species
121	*Neostromboceros maculifemoratus*	New species
122	*Neostromboeros rugosulus*	New species
123	*Denticornia bruneiventris*	New species
124	*Nesoselandriola pedicella*	New species
125	*Busarbia nigrocapa*	New species
126	*Linorbita sessilia*	New species
127	*Caliroa liui* vei	New species
128	*Caliroa psudocerasi*	New species
129	*Busarbidea libona*	New species
130	*Heptamelus lateralis*	New species
131	*Priophorus niger*	New species
132	*Priophorus paranigricans*	New species
133	*Pristiphora lineogenata*	New species
134	*Dolerus glabratus*	New species
135	*Protemphytus rufithoracinus*	New species
136	*Darjilingia guizhouensis*	New species
137	*Athlophorus albocincta*	New species
138	*Pachyprotarsis bicoloriornis*	New species
139	*Pachyprotarsis* Libona	New species
140	*Macrophya commixta*	New species
141	*Jmacrophya micromacula*	New species
142	*Macrophya minutitheca*	New species
143	*Macrophya quadriclypeata*	New species
144	*Macrophya stigmaticalis*	New species
145	*Tenthredo tilineata*	New species
146	*Tenthredo leucotrochanteratina*	New species
147	*Beleses nigrolividus*	New species
148	*Abeleses nigrolividus*	New species
149	*Onychostethomostus bimaculatus*	New species
150	*Megatamostethus fulvitergus*	New species
151	*Onychostethomostus pedicellus*	New species
152	*Eutomostethus albipes*	New species
153	*Jmallachiella interstitialis*	New species
154	*Eutomostethus rani* Wei sp.nov.	New species

155	*Eutomostethus rani* Wei sp.nov.	New species
156	*Eutomostethus wangae* Wei s.nov.	New species
157	*Phymatoceridea nigrotegularis*	New species
158	*Phymatoceridea acutitheca*	New species
159	*Conaspidia latifasciata*	New species
160	*Corrugia libona*	New species
161	*Yangixiphia brachygenata*	New species
162	*Onycholyda euapicalis*	New species
163	*Yangicoris genichulatus*	New species
164	*Sphedanolestes sinicus*	New species
165	*Brachytonus lii*	New species
166	*Brachytonus lii*	New species
167	*Neopanorpa maolanensis*	New species
168	*Telema liangxi*	New species
169	*Wendilgarda coddingtoni*	New species
170	*Steatoda nigrimaculata*	New species
171	*Steatoda uncata*	New species
172	*Gibber brevirostris*	New species
173	*Dryocoetiops coffeae*	New species
174	*Coptodryas mus* Eggers	New species
175	*Ambrosiodmus asperatus* Blandford	New species
176	*Cosmoderes monilicollis* Eichhoff	New species
177	*Xyleborus mucronatus* Eggers	New species
178	*Xyleborus cristatus* Schedl	New species
179	*Xyeborus juglans* Luol.	New species
180	*Canonia rufiventris* Malaise	New species
181	*Macrophya planate* Mocsary	New species
182	*Phymaloceridea birmana* Malaise	New species

Table 7-16 Endemic Cave Animals to the Libo Karst Nominated Sites

No.	Species
1	**Nemacheilus fasciolatus**
2	*Sinocrossocheilus micrestomatus*
3	*Sinocyclocheilus longibarbatus*
4	*Sinocyclocheilus marcrolepis*
5	*Sryloniscus liboensis*
6	*Daipotamon minos*
7	*Sinaphaenops gralilior*
8	*Sinaphaenops mirabilissimus*
9	*Sinaphaenops wangorum*
10	*Libotrechus nishikawai*
11	*Oodinotrechchus kishimotor*
12	*Leptoneta falcate*

13	*Leptoneta xui*
14	*Telema dongbei*
15	*Chamalycaeus liboensis*
16	*Euphaedusa liboensis*
17	*Uniclavellus cavicolous*

Table 7-17 Habitat of Protected Animal (Critically Endangered and Endangered) in the Libo Karst Nominated Sites

No.	Species	Distribution and habitat
1	*Python molurus*	Yaolan in Maolan Natural Reserve (mountain fortest)
2	*Rana wuchuanensis*	Maolan Natural Reserve (channel, paddy field)
3	*Protelis temmincki*	Maolan Natural Reserve (forest)
4	*Ophiophagus hannah*	Maolan Natural Reserve (shrubs、forest)
5	*Manis pentadactyla*	Dongsai , Dongying , Xiao Qikong in Maolan Natural Reserve (shrubs, forest)
6	*Panthera pardus*	Maolan Natural Reserve (forest)
7	*Moschus berezovskit*	Yaolan, Dongying, Dongduo, Banzhai in Maolan Natural Reserve (forest)

Table 7-18 Caves in the Wulong Karst Nominated Sites

No.	Name	Type	Strike	Entrance altitude(m)	Length(m)	Depth(m)	Main sediment	Note
1	Furong	Gallery and conduit		480	2846		Collapse accumulation, secondary chymic sediment	
2	Qikeng	Conduit and gallery		1162	5880	920		The vertical deepest shaft cave in China at present.
3	Shuairen	Conduit		1060				
4	Weijiangling			970				
5	Tongba			878	7234	656		
6	Xinlukou	Conduit and gallery	NNE	900	438			
7	Shuilian	Conduit and gallery	SSE	670			Drop stone, flow stone (curtain)	
8	Gangan			200				
9	Sifang			180				
10	Xianren	Conduit		1110	7000		Gravel erosion and collapse accumulation	
11	Baiguo	Conduit					Alluvium accumulation, stalactite	
12	Longquan	Gallery and conduit	NEN	850	528	26	Sand, collapse accumulation	There are toad and other cave animals in pool of cave, and cup shape in cave.
13	Qishiercha	Gallery and conduit	NNE	1169	460	73	Erosion Gravel accumulation	There are hundreds of branch caves.
14	Erwang		NNE	878	8297	83.3	Stalactite	Stalactite and dolomite of top

								cave is weathering.
15	Sanwang	Gallery and conduit	NNE	923	10099	236	Stalactite	
16	Dadong				795	413		

Table 7-19 Giant Dolines (Tiankeng) in the Wulong Karst Nominated Sites

No.	Tiankeng Name	Diameter of opening (m)	Area of opening (m^2)	The biggest depth (m)	Volume (10^6m^3)	Shape characteristics
1	Qinglong	522~398	193,975	275.7	31.67	Crisscross plane, cliffy cave wall, there is slope in northwest.
2	Shenying	300~260	51,226	284.7	9.73	Heart shape plane, cliffy cave wall, there is valley in southeast.
3	Zhongshiyuan	697~555	278,200	213.7	34.78	Pear shape plane, doline shape body.
4	Xiashiyuan	1000~545	352,064	373.0	31.47	Oval plane, there is an opening in Southeast.
5	Sanwangdong	120~100	8,681	56.0	0.39	Plane is approximate round, cliffy cave wall, karst cave in cave bottom.
6	Dayannao	140~100	11,284	50	0.56	Plump and dapper body, flourished forest.
7	Haziyan	150~120	13,117	47.9	0.43	Oval plane, slope in west.
8	Meiziao	100	8,220	46.6	0.22	Rounded opening, slope in west.
9	Hejiatuo	290~140	45,000	74.2	2.47	Gourd shape body, form of two caves.
10	Midong	246~50	19,320	208	4.93	Long-eggplant shape plane.
11	Qingkou	220~250	40,754	295.3	9.21	Plane is approximate round, cliff circled, perfect shape.
12	Niubizi	80~380	26,670	198.8	3.47	Eggplant shape plane, upper is escarpment, midst and lower is cliff, bottom and around is forest.
13	Shiwangdong	140~170	25,896	252.5	5.13	Approximately rectangle plane, cliff around is slick, surrounded by bloom forest.
14	Daluodang	220~240	32,405	370	10.4	Plane is roundness.
15	Tianpingmiao	180	26,376	420	9.89	Plane is approximate triangle, surrounding cliff is very cliffy and incline into the cave.

Table 7-20 Species of the Protected Wild Animals with National Importance in the Wulong Karst Nominated Sites

Protected Wild Animals with National Importance		
No.	Species	Protected class
1	*Ginkgo biloba*	I
2	*Taxus chinensis* var. *mairei*	I
3	*Cinnamomum camphora*	II
4	*Camptotheca acuminata*	II
5	*Liriodendron chinense*	II
6	*Phellodendron chinense*	II
7	*Fagopyrum dibotrys*	II
8	*Metasequoia glyptostroboides*	I
9	*Juglans regia* Linn	II
10	*Gynostemma pentaphyllum*	II
11	*Eucommia ulmoides*	II

According to: The 4th File of National Forestry Bureau and National Agriculture Ministry in Sep. 9, 1999. (ratified by the State Council in Aug. 4, 1999)		
No.	Species	Protected class
1	*Actinidia coriacea*	II
2	*Arisaema heterophyllum*	II
3	*Arisaema* sp.	II
4	*Paris* sp.	II
5	*Cymbidium goeringii*	I
6	*Bulbophyllum* sp.	II
7	*Gastrochillus calceolaris*	II
8	*Gastrochillus* sp.	II
9	*Coptis chinensis*	II
According to：*List of Protected Wild Plants with National Importance*(the 2nd patch)		

Table 7-21 Species of Protected Wild Animals with National Importance in the Wulong Karst Nominated Sites

Protected Wild Animals with National Importance		
No.	Species	Protected class
1	*Presbytis francoisi*	I
2	*Panthera pardus* L·	I
3	*Neafelis nebulosa nebulosa* Griffith	I
4	*Aquila chrysaetos*	I
5	*Macaca arctoides*	□
6	*Macaca mulatta*	□
7	*Felis temmincki dominicanorum* Sulater	□
8	*Veverra zibetha axhtoni* Swinhoe	□
9	*Veverricula indica pallida* (Gray)	□
10	*Prionodon pardi lolor* Hodgson	□
11	*Lutra lutra chinensis*	□
12	*Martes fLavigula flavigula* Boddaert	□
13	*Cuon alpinus Lepturus* Heude	□
14	*Manis pentadactyla*	□
15	*Aix galericulata* (L·)	□
16	*Chrysolophus pictus* L•	□
17	*Megalobatrachus davidianus* (Blanchard)	□
18	*Syrmaticus reevesii*	□
19	*Mos chus be rezovskii* Flerov	□
According to: *List of Protected Wild Animals with National Importance* (ratified by the State Council in Dec. 10, 1988)		
Endemic species in China		
No.	Species	
1	*Chrysolophus pictus* L•	
2	*Syrmaticus reevesii*	
3	*Garrulax poecilorhynchux be rthemyi* (D·et O·)	

4	*Pycnonotus sinensis* (Ome lin)	
5	*Spizixos Semitorques* Swihoe	
6	*Bambusicola thoracica thoracica* Tem·	
7	*Paradoxornis webbianus* (G·R·Gray)	
8	*Elaphodus cephalophus* M,-E	
9	*Sciurotamias davidianus* M·-E·	

Table 7-22 Protected Common Species in the Furong River Karst Nominated Sites

Sort	Species	Protected status quo	Family
Fish	*Anguilla japonica*	In Furong River	Anguillidae
	Silurus meridionalis	In Furong River	Siluridae
	Varicorhinus simus	In Furong River	Cyprinidae
	Procypris rabaudi	In Furong River	Cyprinidae
	Spinibarbus sinensis	In Furong River	Cyprinidae
	Semilabeo prochilus	In Furong River	Cyprinidae
	Pelteobagrus fulvidraco	In Furong River	Bagridae
Bird	*Ardea cinerea*	Common species	Ardeidae
	Ardea cinerea jouyi	Common species	Ardeidae
	Streptopelia chinensis	Dominant species	Columbidae
	Acridotheres cristatellus	Dominant species	Sturnidae
	Cissa erythrohyncha erythrohyncha	Rare species	Corvidae
	Cinclus pallasii	Common species	Cinclidae
	Alcippe nipalensis	Common species	Muscicapidae
	Parus major subtibetanus	Dominant species	Paridae
	Aethopyga christinae	Dominant species	Nectariniidae
Mammal	*Muntiacus reevesi*		Cervidae
	Vulpes vulpes		Canidae
	Nyctereutes procyonoides		Canidae
	Martes flavigula		Mustelidae
	Paguma larvata		Viverridae
	Cuon alpinus		Canidae
	Callosciurus erythraeus		Sciuridae
	Sciurotamias davidianus		Sciuridae
	Dremomys rufigenis		Sciuridae
Amphibians and Reptiles	*Rana boulengeri*		Ranidae
	Polypedates megacephalus		Rhacophoridae
	Zaocys dhumnades		Colubridae

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

Table 7-23 Latest Record of Possessor Address of the Nominated South China Karst Properties

Nominated	Name of the Agencies	Address of the Agencies	Post

Property			code
Shilin Karst	Administration of Shilin Scenic and historic Area	Autonomous County,Kunming City, Yunnan Province, People′s Republic of China	652211
Libo Karst	Construction Department of Guizhou Province	Guiyang City, Guizhou Province, People′s Republic of China	550001
	Guizhou Normal University	Baoshan Road, Guiyang City, Guizhou Province	550001
	Administration of Maolan National Nature Reserve of Guizhou	No.131, Shichang Road, Yuping Town, Libo County, Guizhou Province	558400
	Administration of Zhangjiang River Scenic and historic Areas of Libo	No.23, East Zhangjiang Road, Yuping Town, Libo County, Guizhou Province	558400
Wulong Karst	Administration of Furong Jiang Scenic and historic Areas of Wulong County	Xiangkou Town, Wulong County, Chongqing City	408500
	Institute of Karst Geology, Chinese Academy of Geological Sciences	No.50, Qixin Road, Guilin City, Guangxi Province	541004
	Hong Meigui Cave Exploration Society		
	Speleological community, Geological Society of China	No.50, Qixin Road, Guilin City, Guangxi Province	541004
	Southwest China University	Beibei, Chongqing City	400715

7.e Bibliography

Books：

[1] Fan Chengxun, Ding Weizuan. Annals of Yunnan Province (in Chinese).Block-printed edition of the 30th year of Kangxi Dynasty.

[2] Volumes of Yunnan, Pedagogic Volume. The 13th year of Guangxu Dynasty. Officia l Press of of Yunnan Province (in Chinese).

[3] Chen Wen, Wang Guxiu. Jingtai annals of Yunnan Province (edited in the 6th year of Jingtai) (in Chinese). In the Library Yunnan Province.

[4] Annals of Lunan County. 1713. Edition of the 51th year of Kangxi Dynasty. Kunming: Collection of library in Yunnan University (in Chinese).

[5] Annals of Lunan Prefecture (in Chinese). 1917. In the library of Yunnan University.

[6] Local Annals of Lunan Country (in Chinese), 1920. In the Library of Lunan Yi Nationality Autonomous County.

[7] Institute of Geography of Chinese Academy of Science. 1959. China geomorphological regional planning (Primary Edition) (in Chinese). Beijing: Science Press.

[8] Institute of Hydrogeology and Engineering Geology. 1976. Carsologica Sinica (Picture Album) (in

Chinese). People Press of Shanghai.

[9] Karst Research Group of Insititute of Geology of Chinese Academy of Science. 1979: China Karst Study (in Chinese). Science Press. 1-2, 5, 112-123.

[10] Group of Sichuan Vegetation Study. 1980. Sichuan Vegetation (in Chinese). People Press of Sichuan.

[11] Wu Zhengyi (editor). 1983. China Vegetations (in Chinese). Beijing: Science Press.

[12] Yunnan Institute of History. 1983. Nationalities Of Yunnan (Revised) (in Chinese). People Press of Yunnan.

[13] Fang Guoyu. 1984. Manuscript of Histry Study of Yi Nationality (in Chinese). Sichuan Nationality Press.

[14] Fang Guoyu. 1984. The Brief of biliograpraphy of History Information of Yunnan Province (in Chinese). Beijing: Zhong Hua Book Company.

[15] Shen Yuchang. 1965. Geomorphology of Rivers and Valleys in the upper reaches of Yangtse (in Chinese). Beijing: Science Press.

[16] Cui Zhijiu. 1981. Paleokarstology and uplift of Tibetan Plateau s (in Chinese). Beijing: Science Pres.

[17] Guizhou Regional Geology Investigation Group. 1982. The Brief of Guizhou Geology (in Chinese). Guizhou Geology Bureau.

[18] Ma Xueliang. 1983. Analects of etiquette and custom of Yi People of Yunnan Province (in Chinese). Sichuan Press of People.

[19] Hu Jinchu, Wang Youzhi. 1984. Records of resources and animals in Sichuan (Volume 2, animal) (in Chinese). Chengdu: Sichuan Press of Science and Technology.

[20] Che Yongtai, Yu Jinzi. 1985. Karst of China (in Chinese). Beijing: Science Press.

[21] Li Guiyuan. 1985. Records of resources and animals in Sichuan. (Volume 3, bird) (in Chinese).. Chengdu: Sichuan Science and Technology Press

[22] Zhang Yingjun, Miu Zhongling, etc. 1985. Applied karstology and speleology (in Chinese). Guiyang: Guizhou People's Press.

[23] Geomorphology Committee of China Geology Institute. (Ed.). 1985. Karst geomorphology and speleology (in Chinese). Beijing: Science Press.

[24] Edition Committee of *China Physical Geograph* 1985. China physical geography(in Chinese). Beijing: Science Press.

[25] Edition Committee of the Situation of Guizhou Province (in Chinese). 1986. The Situation of

Guizhou Province. Guiyang: Guizhou People's Press.

[26] Gao Daode, Zhang Shicong, etc. 1986. Research of Karst in South Guizhou (in Chinese). Guiyang: Guizhou People's Press.

[27] Tian Wanshu, Jiang Yaoming. 1986. Appraisal handbook of amphibious reptile in China (in Chinese). Beijing: Science Press.

[28] Fang Guoyu. 1987. Investigation and annotation of historical geology in southwest Chin (in Chinese). Beijing: Zhong Hua Book Company.

[29] Guizhou Forestry Bureau. 1987. Volume of investigation in Libo Karst forest (in Chinese). Guizhou People's Press.

[30] Town and Country Construction Environment Protection Bureau of Honghe Hani ethnic group and Yi ethnic group autonomous Prefecture, Kunming Institute of Animal.etc. 1987. Survey report of biological resources in Honghe area, South Yunnan (Volume 1). Kunming: Yunnan Ethnic Press (in Chinese).

[31] Wu Zhengyi. 1987. Vegetation of Yunnan (in Chinese). Beijing: Science Press.

[32] Huang Weilian, Tu Yulin, Yanglong. 1988. Vegetation of Guizhou (in Chinese). Guiyang: Guizhou People's Press.

[33] Yuan Daoxian. (Ed.). 1988. Glossary of karstology (in Chinese). Beijing: Geology Publication House.

[34] Edition Group of *The Agricultural Regional Planning of Libo County*. 1989. The agricultural regional planning of Libo County (in Chinese). Guiyang: Guizhou People's Press.

[35] Guizhou Environment Protection Bureau. 1989. Guizhou rare and endangered vegetation. Beijing: China Environmental Science Press (in Chinese).

[36] Kang Yanren, Xiang Shijun, etc. 1989. Karst collapse in south China. Nanning: Guangxi Science Press (in Chinese).

[37] Zheng Zuoxin. 1989. Survey of bird region in China (Volume 5) (in Chinese). Beijing: Science Press.

[38] Yunnan Bureau of Geology and Mineral Resources. 1990. Regional Geology of Yunnan (in Chinese). Beijing: Geology Publication House.

[39] Fu Liguo, Jin Jianming. 1992. China red date book of vegetation – Rare and endangered vegetation (Volume 1) (in Chinese). Beijing: Science Press.

[40] Guo Fangming. 1992. China stone forest (in Chinese). Beijing: China Ethnic Press.

[41] Yang Lan. 1992. *Pheasant* in China-*Chrysolophus amherstiae* (in Chinese). Beijing: China Forestry Press.

[42] Edition Committee of *The Situation of Guizhou Province* (Revised Edition). 1993. The Situation of Guizhou Province (in Chinese). Guiyang: Guizhou People's Press.

[43] Yang Mingde. 1993. Theory of geomorphological structure and evolution of tropical karst (Geomorphological process and environment). Beijing: Earthquake Press (in Chinese).

[44] Edition Committee of *Annals of Wulong County*, *Sichuan*. 1994. Annals of Wulong County (in Chinese). Chengdu: Sichuan People's Press

[45] Song Xueliang, Wu Yuan, Jiang Zhiwen, etc. 1994. Survey of Karst plateau Lakes paleolimnology in the middle Yunnan (in Chinese). Kunming: Yunnan Science and Technology Press. 50-55.

[46] Ying Junsheng, Zhang Yulong. 1994. Characteristics of spermatophyte in China (in Chinese). Beijing: Science Press.

[47] Yuan Daoxian, Zhu Dehao, Weng Jintao, etc. 1994. China karstology (in Chinese). Beijing: Geology Publication House.

[48] Zhu Shouqian. 1993, 1997, 2003, 1994. Research of karst forest ecology. (I, II, III) (in Chinese) Guiyang: Guizhou People's Press. 50-55.

[49] Jiang Guofang. 1995. Preliminary survey report of biodiversity in karst forest area (in Chinese). Biodiversity. 3(2): 91-94

[50] Wan Guojiang, etc. 1995, 2000. Carbonate and environment (Volume 1, 2). Beijing: Earthquake Bureau (in Chinese).

[51] Wang Zuguan. 1995. Picture album of lithofacies and paleogeography of Yunnan Provonce (in Chinese). Kunming: Yunnan Science and Technology Press.

[52] Edition Committee of *Vegetation of China.* 1995. Vegetation of China (in Chinese).. Beijing: Science Press

[53] He Yaohua. 1996. Series of the situation of China—Economic and societal investigation of a hundred counties and towns (Volume of Lunan County). Beijing: China Encyclopedia Press (in Chinese).

[54] Annals of the Lunan Yi Autonomous County (in Chinese). Kunming: Yunnan Ethnic Press.

[55] Wang Wenfu. 1996. Yunnan soil resource. Kunming: Yunnan Science and Technology Press (in Chinese).

[56] Yang Zigeng, Lin Hemao, Wang Shengyu, etc. 1996. Strata characteristics of the quaternary period in

China and Asia-Pacific Ocean Area. Beijing: Geology Publication House. 1-30 (in Chinese).

[57] Group of Stone Forest Study. 1997. Study on Lunan stone forest karst. Kunming: Yunnan Science and Technology Press (in Chinese).

[58] Song Linhua, etc. 1997. Stone forest—a jewellery of nature heritage. Beijing: China Environmental Science Press (in Chinese).

[59] Yang Qinzhou. 1997. Distribution of Plants in Sichuan Province. Guiyang: Guizhou Science and Technology Press.

[60] Chen Xiaoping, etc.1998. South China Karst, Volume I. ZRC SAZU.

[61] Hou Kuangzhao. 1998. Dictionary of the type of spermatophyte in China. Beijing: Science Press (in Chinese).

[62] Jin Zhenzhou. 1998. Vegetation of Kunming. Kunming: Yunnan Science and Technology Press (in Chinese).

[63] Ma Jingneng, etc. 1998. Summary of biodiversity conservation of China. Beijing: China Forestry Press (in Chinese).

[64] Wang Song, Le Peiqi, Chen Yiyu. 1998. China red date book of endangered animals (Fish). Beijing: Science Press (in Chinese).

[65] Wang Song, Zhao Ermi. 1998. China red date book of endangered animals (Amphibian and Reptile). Beijing: Science Press (in Chinese).

[66] Wang Song, Zheng Guangmei, Wang Qishan. 1998. China red date book of endangered animals (Bird). Beijing: Science Press (in Chinese).

[67] Yang Mingde, Tan Ming, Liang Hong. 1998. The system of karst drainage hydrogeomorphology. Beijing: Geology Publication House (in Chinese).

[68] Liu Jiayan. 1999. Ecological environment in Guizhou, China. Guiyang: Guizhou Education Press (in Chinese).

[69] Liu Mingchun. 1999. Compilation of the first nationwide agricultural general investigation in autonomous county of Yi ethnic group, Shilin. Kunming: Yunnan Xinhua Press (in Chinese).

[70] Guizhou Forestry Bureau. 2000. Wild and precious vegetation resource in Guizhou. Beijing: China Forestry Press (in Chinese).

[71] Tu Yulin. 2000. Cradle of unique culture—Karst and Guizhou culture. Guiyang: Guizhou People's Press (in Chinese).

[72] John·MacKinnon, Karen Phillipps, He Fenqi. 2000. A field guide to the birds of China. Changsha: Hunan Education Press (in Chinese)

[73] Lu Yaoru. 2001. Karst—the world of unique peaks and caves. Beijing: Qinghua University Press, Jinan University Press (in Chinese).

[74] Tan Haiou, Zhu Xuewen, Li Yusheng. (Eds). 2001. Wonder of the Yangtse three-gorge. Chongqing: Chongqing Press (in Chinese).

[75] China Imports and Exports Administer Office of Endangered Species. 2001. China rare and endangered animals. Shanghai: Shanghai Science and Technology Press (in Chinese).

[76] Zou Tiancai. 2001. Unique and special spermatophyte of Guizhou. Guiyang: Guizhou Science and Technology Press (in Chinese).

[77] Yuan Daoxian, Liu Zaihua, Lin Yushi, etc. 2002. China karst dynamical system. Beijing: Geology Publication House (in Chinese).

[78] Chen Weihai, Zhu Dehao, Zhu Xuewen, etc. 2003. Research of value of Tiankeng faulting karst landscape and the world heritage in Fengjie. Beijing: Geology Publication House (in Chinese).

[79] Gao Guilong, Deng Ziming, Xiong Kangning, etc. 2003. Whoop and hope of karst. Guiyang: Guizhou Science and Technology Press (in Chinese).

[80] Yuan Daoxian, Liu Zaihua, Lin Yushi, etc. 2003. Carbon cycle and karst geological environment. Beijing: Science Press (in Chinese).

[81] Zhu Xuewen, Huang Baojian, Zhu Dehao, etc. 2003. Group of Tiankeng in Da Shiwei, Leye, Guangxi—Discovery, exploration, definition and survey. Nanning: Guangxi Science and Technology Press (in Chinese).

[82] Chen Weihai, Zhu Dehao, Huang Baojian, etc. 2004. Form and value of geological relics in Wulong Karst Geology Park, Chongqing. Beijing: Geology Publication House (in Chinese).

[83] World Tourism Organization, China National Tourism Bureau, Guizhou Tourism Bureau. 2004. Guizhou province tourism development master plan. Guiyang: Guizhou People's Press (in Chinese).

[84] Wang Song, Xie Yan. 2004. China species red list. Beijing: Higher Education Press (in Chinese).

[85] Zhang Lian. 2004. Guizhou forest wildlife and wetland nature reserves. Guiyang: Guizhou Science and Technology Press (in Chinese).

[86] Zhang Yuanhai, Erin Lynch. 2004. Spelunking. Shanghai: Shanghai Science Popularization Press (in Chinese).

[87] Edition Group of *General History of Guizhou Province*. 2005. Summary of general history of Guizhou. Beijing: Modern China Press (in Chinese).

[88] Xiong Kangning, Du Fangjuan, Miu Jinglin. 2005. Karst culture and art of ecological architecture. Guiyang: Guizhou People's Press (in Chinese).

[89] Ran Jingcheng, Lin Yushi. 2005. Speleology and Biospeleology Reaearch in Libo. Guiyang: Guizhou Ethnic Press.

[90] M.Herak (Yugoslavia), V.T.Stringfield (U.S.A). 1972. Karst important Regions of the Northern Hemisphere. New York: Elsevier Publishing Company NY.

[91] Sweeting.M.M. 1972. Karst landform. MACMILLAN.

[92] Jennnings J.N. 1985. Karst Geomorphology. New York: BASILBlackwell.

[93] James N P, Choquette. 1988. Paleokarst. New York, Berlin et al Springer-Verlag.

[94] White W. B, 1988. Geomorphology and Hydrology of Karst Terrains. Oxford: Oxford University press.

[95] D.Ford, P.Williams. 1989. Karst geomorphology and hydrology. London: UNWIN HYMAN.

[96] Yuan Daoxian. (Ed.). 1991. Karst of China. Beijing: Geological Pubulishing House.

[97] A.C. Waltham, R.G. Willis. 1993. XINGWEN, China Caves Project 1989-1992. London: British Cave Research Association.

[98] Fornós A. Joan-J Ginés. 1996. Karren Landforms. OVRICH. Yuan Daoxian,Liu Zaihua. 1998. Global Karst Correlation. Beijing: Science Press.

[99] Franci Gabrovsek, Martin Knez, Janja Kogovsec etc. 1998. South China Karst. ZRC SAZU. 11-133.

[100] Stone Forest Research Center et al. 2000. Regulation of Stone Forest Foundation (□□□/□). Carsologica Acta.

[101] Gunn J. (Ed.). 2004. Encyclopedia of Caves and Karst Science. Fitzroy Dearborn, New York London.

Paper:

[102] Ma Xirong. 1936. Primary observation of geomorphology in stone forest area, Yunnan. Science analects 1(1) (in Chinese).

[103] Yang Zhongjian, etc. 1939. Cenozoic geology of Lunan. Geological Review. 4(3-4)：165-171 (in

Chinese).

[104] Chen Shupeng. 1954. Karst geomorphology in Southwest China. Geography knowledge 3.

[105] Zhou Mingzhen. 1958. Mammalian fossil of the Oligocene Epoch in Lunan, Yunnan. Paleovertebrate transaction 4(3-4)：165-171 (in Chinese).

[106] Xu Yuxuan, Qiu Zhanxiang. 1962. Mammal of the Eogene Period in Lunan, Yunnan. Paleovertebrate and palaeoanthropology 6(4)：313-325 (in Chinese).

[107] Zhou Mingzhen. 1962. A new species of Primitive Chalicothere from the Tertiary of Lunan, Yunnan. Paleovertebrate and palaeoanthropology. 6(3)：219-223 (in Chinese).

[108] Tang Xin, Zhou Mingzhen. 1964. Distribution and character of vertebrate fossil locus and fauna of the Eogene Period in South China. Paleovertebrate and palaeoanthropology 8(2)：119-133 (in Chinese).

[109] Li Jijun, Fang Shixuan, Zhang Qingsong, etc. 1979. Survey of era, range and form of Tibet plateau uplift. Science in China (6)：608-616 (in Chinese).

[110] Ren Meie. 1979. Disscusion of China Karst Development and Evolotuin. Journal of Nanjing University (Natural Science). (4): 95-104 (in Chinese).

[111] Li Datong, Luo Yan. 1983. Measurement of carbonate rocks distribution area in China. Carsologica Sinica. 2(2): 147-150 (in Chinese).

[112] Chen Shulun, Liu Shiqing. 1984. Discussion of development history of south Sichuan karst. Journal of Chengdu Geology Academy. 2 (in Chinese).

[113] Zhang Shouyue. 1984. The development and evolution of Lunan stone forest. Carsologica Sinica. (2): 78-87 (in Chinese).

[114] Guizhou Academy of Science. 1985. Investigation volume of plant in Libo. Guizhou Science 2 (in Chinese).

[115] Liang Qizhong, Ding Shen, Ding Ruiyan, etc. 1986. A case study on the Eogene Paleomagnetic pole sites and characteristics of magnetic strata in eastern Yunnan, China. Geological Review. 32(2) (in Chinese).

[116] Ding Jinhui. 1987. The identification of the physiographic epoch in west Hubei Plateau. 6(3): 255-262 (in Chinese).

[117] Li Heng. 1988. Aquatie vegetation and aquatie area in Changhu. Journal of Yunnan University (Natural Science) 10 (Suppl.) (in Chinese).

[118] Luo Zhili, Jin Yizhong, Zhu Bianyu, etc. 1988. On EMei taphrogenesis of the upper Yangtze platform. Geological Review. 134(1) (in Chinese).

[119] Yang Lan. 1988. Studies on the waterfowl of Yunnan Province. Zoological Research. (Suppl.) 21-31 (in Chinese).

[120] Tu Yulin. 1989. Preliminary study on karst forests in Guizhou. Carsologica Sinica. 8(4) (in Chinese).

[121] Wu Xianghe. 1989. Preliminary study on Carboniferous paleogeomagnetism in south Guizhou. Lithofacies paleogeology. 4 (in Chinese).

[122] Li Yuhui.1991. Preliminary study on landscape structure of stone forest scenic landform. Journal of Yunnan Academy of Education 3：104-107 (in Chinese).

[123] Zhu Meili. 1991. The Flora from the Early Late Permian in Tonglouba, Gusong Area, Southern Sichuan. Journal of China University of Mining & Technology. 20(1) (in Chinese).

[124] Chen Fubin. 1992. Hengduan envent: An important tectonic envent of the Late Cenozoic in eastern Aisa. Journal of Mountain Research. 10(4) (in Chinese).

[125] Zhu Dehao. 1992. China karst tourism resources and their position in the world. Carsologica Sinica. 11(4): 332-339 (in Chinese).

[126] Tan Ming. 1993. Karst landscape of Xijiang drainage area in China and environmental variation of Cenozonic Era. Carsologica Sinica. 12(2)：102-108 (in Chinese)

[127] Chen Yinrui.1994. A new blind loach of triplophysa from Yunnan stone forest with comments on its phylogenetic relationship. Zoological Research (in Chinese).

[128] He Yaohua. 1994. History and present conditions of ethnic relation in Lunan. Yunnan Social Science (in Chinese).

[129] Zhang Ren. 1994. New consideration on classification of karst caves. Carsologica Sinica. 13 (in Chinese).

[130] Zhu Xuewen. 1994. Secondary Speleothems in Furong Cave. Carsologica Sinica. 3(4): 357-368 (in Chinese).

[131] Zhu Xuewen, Zhang Yuanhai. 1995. Huge karst doline and fissure-shape gorge in Sichuan Carsologica Sinica .14 (Suppl.): 1-11 (in Chinese).

[132] Chen Zhengren. 1996. Analysis on geographical element of spermatophyte in karst forest, Maolan. Guizhou forestry science and technology. 24(4): 34-37 (in Chinese).

[133] Cui Zhijiu, Gao Quanzhou, Liu Gengnian, etc. Planation surface, paleokarst and uplift of Tibet Plateau. Science in China, Ser.D. 26(4): 378-385 (in Chinese).

[134] Xiong Kangning. 1996. Development of Cone Karst in Response to Neotectonism in Guizhou. Guizhou Geology. 13(2) (in Chinese).

[135] Zhong Daben, Ding Lin. 1996. Discussion on process and mechanism of uplift in the Tibet Plateau. Science in China, Ser.D. 26(4)：289-295 (in Chinese).

[136] Gu Zhaoyan, Liu Dongsheng. 1997. Application of the *IN SITU* cosmogenic nuclides ^{10}Be and ^{26}A1 for studies of formation and evolutionary histories of the earth surface. Quaternary Sciences. (3): 211-221 (in Chinese).

[137] Lin Junshu. 1997. Formation of Lunan stone forest and environmental change. Carsologica Sinica. 16(4): 346-350 (in Chinese).

[138] Yuan Daoxian. 1997. Environment and geology of karst tor in southwest China. Research and Development of World Science and Technology. 19(5) (in Chinese).

[139] Cui Zhijiu, Li Dewen, Wu Yongqiu, etc. 1998. About planation surface. Science Bulletin. 43(17): 1974-1805 (in Chinese).

[140] Li Yuhui, Liang Yongning, Geng Hong. 1998. Research on development ages of stone forest in Lunan, middle Yunan. China Regional Geology. 17(1): 44-51 (in Chinese).

[141] Ran Jingcheng, Chen Huiming. 1998. A Survey of Speleobiological Studies in China. Carsologica Sinica. 17(2): 151-159 (in Chinese).

[142] Wang Xunyi, Yang Riying. 1998. Environment changes and conservation of show caves. Carsologica Sinica. 3 (in Chinese).

[143] Yang Mingde. 1998. The characteristics and conservation of karst cave tourism resources. Carsologica Sinica. 17(3) (in Chinese).

[144] Ceng Qingya, Xie Weicheng, Ji Shuyi. 1999. The plant flora of Zhaoqing limestone area in Guangdong Province. Guihaia 19(2): 124-130 (in Chinese).

[145] Feng Tianjie, Wang Deyi, Li Dongyi, etc. 1999. Research on the tracheophyta flora in nature reserve of Wulin Mountain. Bulletin of Botanical Research. 19(3): 259-267 (in Chinese).

[146] Ran Jingcheng, Chen Duniu, Zhang Guoqing. 1999. Two new species of land snail from China. Acta Zootaxonomica Sinica. 24(3) (in Chinese).

[147] Rong Li. 1999. Emigration thinking and poverty alleviation in karst areas with hard living

conditions in Guizhou. Carsologica Sinica. 18(2): 190-196 (in Chinese).

[148] Yin Hongmei. 1999. The tourism resources' changes and sustainable utilization in Guizhou karst region. China Population, Resources and Environment. 9(2) (in Chinese).

[149] Zhang Lisheng. 1999. A trip to South Sichuan─The home of dinosaur. Geology and mineral of volcano. 20(2) (in Chinese).

[150] Zheng Du. Li Bingyuan. 1999. Progrss in studies on geographical environment of the Tibet Plateau. Scientia Geographica Sinica. 19(4): 296-302 (in Chinese).

[151] Chen Huiming, Gao Li, Zhu Mingsheng. 2000. Two new species of the genus Leptoneta From China. Acta Ecologica Sinica. 9(1) (in Chinese).

[152] Deng Peiyan, Gaoli, Zhu Mingsheng. 2000. The present situation of variety injured spermatophyte in Guizhou karst area and countermeasures. Journal of Guizhou Normal University (Natural Science). 18(3): 17-21 (in Chinese).

[153] Guizhou Forestry Bureau. 2000. Wild and rare vegetation resource of Guizhou. Beijing: China Forestry Bureau (in Chinese).

[154] Liang Fuyuan, Song Linhua, etc. 2000. The case study of subsoil solution features and soil CO_2 concentration in stone forest region, Lunan, Yunan, China. Carsologica Sinca 19(2)：180-187 (in Chinese).

[155] Peng Jian, Yang Mingde, Liang Hong. 2000. A Quantitative study on Bajiang karst drainage basin in Lunan County, Yunan Province based on GIS. Carsologica Sinica. 21(2): 89-94 (in Chinese).

[156] The Centrer of Stone Forest Study. 2000. Administer method of stone forest research fund. Carsologica Sinica. 19(2): 195-196 (in Chinese).

[157] Tang Yancheng. 2000. On the Affinities and the role of the Chinese Flora. Acta Botanica Yunnanica. 22(1): 1-26 (in Chinese).

[158] Xiong Kangning, Su Weici. 2000. Grain production potential and population supporting capacity of the cultivated land in both good and bad karst eco environment—with special references to Maolan natural Boyuhe catchment of Guizhou. Guizhou Science. 18(1-2): 149-155 (in Chinese).

[159] Yang Mingde. 2000. The process of evolution dynamic of cone karst and the exploitation of the water resource. Carsologica Sinica. 19(1) (in Chinese).

[160] Yuan Daoxian. 2000. Aspects on the new round land and resources survey in karst rock desertification areas of South China. Carsologica Sinca. 19(2) (in Chinese).

[161] Zhou Guofu. 2000. Land use reserch of Maolan natural reserve. Journal of Guizhou Normal University (Natural Science). 18(1): 5-7 (in Chinese).

[162] Zhu Wenxiao, Li Po. 2000. Weather denudation, color change, improvement and protection of speleothem scene in tourist cave. Guizhou Sciences 18(1-2)：135-138 (in Chinese).

[163] Li Daohong, Luo Rong, Chen Hu. 2001. Study on the animal communities in Dadongkou Cave, Guizhou Province. Acta Ecologica Sinica. 21(1) (in Chinese).

[164] Li Yuhui, Yang Yiguang, Liang Yongning, etc. 2001. Study of paleoenvironment of stone forest karst development, Yunnan, China. Carsologica Sinica. 20(2): 91-95 (in Chinese).

[165] Liang Hong. 2001. The hydrological characteristic of the karst basin in Lunan stone forest. Carsologica Sinica. 20(4): 269-273 (in Chinese).

[166] Ran Jingcheng, Chen Huiming, Chen Zhengren, etc. 2001. Present conditions of hunt and wildlife conservation in Maolan nature preserves. Chinese Biodiversity. 9(4): 482-486 (in Chinese).

[167] Ran Jingcheng. 2001. Surroundings ecological characteristic in sub-tropical karst forest and its protection and use-such a Maolan karst forest area. Journal of Southwest China Normal University (Natural Science) (26): 71-79 (in Chinese).

[168] Song Linhua, Tao Honglin. 2001. Acceleration on world heritage application of China karst-summarization of attendance of the IUCN Aisa-Pacific Area Karst Ecosystem & the World Heritage Forum. Carsologica Sinica 20(3)：241-246 (in Chinese).

[169] Tian Youping. 2001. The taxa of Chroococcaceae from stone forest, Yunnan, China. Acta Phytotaxonomica Sinica (in Chinese).

[170] Tian Youping. 2001. A study on aerial *cyanophyta* (*cyanobacteria*) on the surface of carbonate rock in Yunnan stone forest, Yunnan Province, China. Acta Ecologica Sinica (in Chinese).

[171] Yao Changhong, Jiang Zhongcheng, Yuan Daoxian. 2001. Plant karst effects on the karst area of Southwest China. Acta Geosicientia Sinica. 22(2) (in Chinese).

[172] Ying Junsheng. 2001. Species diversity and distribution pattern of spermatophyte in China. Chinese Biodiversity. 9(4): 393-398 (in Chinese).

[173] Yu Jinbiao. 2001. A discussion about the sustainable development of tourism industry in stone forest scenic area. Carsologica sinica. 20(2): 85-90 (in Chinese).

[174] Zhangcheng, Xie Yunqiu, Jiang Guanghui. 2001. Preliminary study on permeability of fractured medium and its significance to the development of stone forest in Lunnan Shilin. Carsologica Sinca

20(2)：97-100 (in Chinese).

[175] Zhu Xuewen. 2001. Karst Tiankeng and its science & tourism value in China. Science & Technology Review. (10): 60-63 (in Chinese).

[176] Li Zizhong, Jin Daochao, etc. 2002. Sight insect in Maolan. Guiyang: Guizhou Science and Technology Press (in Chinese).

[177] Liang Fuyuan, Song Linhua, Tang Tao. 2002. Limestone dissolution in the air in Shilin national park, Yunnan, China. Carsologica Sinca 21(2)：79-83 (in Chinese).

[178] Peng Jian. 2002. The status quo on the reasearch of the development of stone forest in China. Carsologica Sinica. 21(1): 67-72 (in Chinese).

[179] Su Weici. 2002. Rare and endangered plants in Guizhou karst regions with the Consideration of their conservation. Resources and Environment in the Yangtza Basin. 11(2): 111-116 (in Chinese).

[180] Yu Tianhong. 2002. Comparison between the flora of Mt. Fanjingshan and Maolan area.. Journal of Guizhou Normal University (Natural Science). 20(2): 50-54 (in Chinese).

[181] Zhang Wenhui, Li Dengwu, Liu Guobin, etc. 2002. The characteristics of the spermatophyte flora in Loess Plateau. Bulletin of Botanical Research. 22(3): 373-379 (in Chinese).

[182] Zhu Xuewen, Zhu Dehao, Huang Baojian, etc. 2003. A brief study on karst Tiankeng. Carsologica Sinica. 22(1): 51-65 (in Chinese).

[183] Rong Li, Yang Long. 2004. Biodiversity of Guizhou Province and its karst environment. Journal of Guizhou Normal University (Natural Science). 22(4): 1-6 (in Chinese).

[184] Jennins J.N., Bike M.A. 1962. Karst morphology in Australian New Guinea. Nature. 194: 1034-1038.

[185] Brook G.A., Ford. D.C. 1978. The origin of Labyrinth and tower karst and the climatic conditions necessary for their development. Nature. 275: 493-496.

[186] Longman M.W, Tulsa Brownlee D.N. Makati. 1980. Characterristics of karst topography, Palawan, Philippines. Zeitschrift Geomorphologie. 24: 299-317.

[187] Bull P.A., M. Laverty. 1982. Observations on Phytokarst. Geomorph, 26: 437-57.

[188] Yu Jinbiao, Wang Xueyu, Wang Zhonghan. 1985. Lunan stone forest, Yunnan Province – Its morphological characteristics and Paleo-graphical environments. Kexue Tong Bao. 219-223.

[189] Song Lin Hua. 1986. Origination of Stone Forest in China. Int. Speleo. 15:3-13.

[190] Sweeting M.M. 1986. Limestone Landscape of South China. Geology Today. 11.

[191] Xiong K.N. 1992. Morphometry and evolution of fenglin karst in the Shuicheng area, western Guizhou, China. Z.Geomorph.N.F. 36(2).

[192] Yang Mingde. 1992. Geomorphological structure of karst Drainage Basin and the Effect hydrology. Carsologica sinca.

[193] Zhang Yingjun, Yang Mingde ect. 1992. Karst geomorphology & environmental implication in Guizhou. Cave Science. 1.

[194] Waltham A.C. 1995. The pinnacle karst of Gunung Api, Mulu, Sarawak. Cave Science. 22: 123-126.

[195] George Vein. 1997. Maya Utilization of Karst Groundwater Resouces. Environ Ground Water Sci. 16(1): 63-66.

[196] Xiong Kangning, Zhu Wenxiao. 1994. Karst geomorphology and speleogenesis of the Zhijin Cave area.Caisologica Sinica. 3: 281-292.

[197] Daoxian Yuan, Hai Cheng, R.lawrence Edwards, etal. 2004. Timing, Duration, and Transitions of the last Interglacial Asian Monsoon. Science. 304(23).

[198] Yongjin Wang, Hai Cheng, R. Lawrence Edwards, Yaoqi He, Xinggong Kong, etc. 2005. The Holocene Asian Monsoon: Links to Solar Changes and North Atlantic Climate. Science. 308: 854－857.

[199] Zhu Xuewen. 2005. Karst Areas and types in China Geographische Rundschall. 1(2): 37-47.

Symposium Published：

[200] Zheng Jiajian. 1978. Strata of the Eogene Period of Lunan basin, Yunnan. Analects of stratum paleobiology. Beijing: Geology Publication House.

[201] Chen Zhiping. 1985. Primary study on karst zonality in China. Karst geomorphology and cave. Beijing: Science Press.

[202] He Xinlu. 1985. The age of karst cave in south China. Karst geomorphology and cave. Beijing: Science Press.

[203] Lin Junkuang, Zhang Yueguang. 1985. The evolvement of survey of karst cave in China. Karst geomorphology and cave. Beijing: Science Press.

[204] Liu Shiqing. 1985. Preliminary study on cause of formation of the Yangxin limestone in Yuanjiadong area, south Sichuan. Karst geomorphy and cave. Beijing: Science Press.

[205] Liu Shiqing. 1985. The character of karst geomorphology and cave in Longtan and Donghe area. Karst geomorphology and cave. Beijing: Science Press.

[206] Wang Xueyu. 1985. Analysis on surface microshape of quartzite in Shilin, Lunnan. Karst geomorphy and cave. Beijing: Science Press. 87-95.

[207] Wang Yingxiang. 1987. Animal resources in Yunnan and its using and conservation rationally. Analects of exploiture and using of biological resources in Yunan. Kunming: Yunnan People's Press. 204-215.

[208] Song Linhua. 1993. Discussion of double-deck structure of peak cluster geomorphology and peak forest geomorphology. Karst landscape and cave toutism. Beijing: China Evironmental Science Press.

[209] Wang Fuchang, Li Zhongde, Genghong, etc. 1994. Primary study on exploitation histry of stone forest in Lunan, China. Research of karst and cave landscape tourism resources. Beijing: Earthquake Press. 219-222.

[210] Song Linhua. 1994. Environment variation and sight conservation of tourism caves. Research of karst and cave landscape tourism resources. Beijing: Geology Publication House. 118-125.

[211] Chen Weihai, Huang Baojian, Zhu Dehao, etc. 2003. Characteristics, form and sight value of Tiansheng three-bridge in Wulong, Chongqing. Construction of geology of national park and exploitation of tourism resources, the 8th volume of Analects of tourism geology. Beijing: Geology Publication House. 255-260.

[212] Lan Xiangyi. 2004. Strategic consideration of economic development in karst area. Basic Theory and Exploitation Research of Karst Tourism Resources. Beijing: Earthquake Press.

[213] Zhu Xuewen, Chen Weihai, Huang Baojian. 2004. Karst Tiankeng in China. Basic Theory and Exploitation Research of Karst Tourism Resources. Beijing: Earthquake Press.

[214] Chen Zhiping, Song Linhua, Sweeting M.M. 1986. The Pinnacle Karst of the Stone Forest, Lunan, Yunnan, China: an example of a sub-jacent karst. Proceedings of Anglo-French karst Symposium. Norwich: Geo Books Regency house. 591-596.

[215] Rossi G. 1986. Karst and structure in tropical areas: the Malagasy example. The New directions in Karst: proceedings of the Anglo-French karst Syposium. 189-212.

[216] Yang Mingde. 1993. The characteristics of cave development in the karst gorge districts of Guizhou, China. Proceedings of the XI International Congress of Speleology (in Chinese).

[217] Ford D., Jean-Noel Salomon, Paul Williams. 1997. The Lunan Stone Forest as a Potential World Heritage Site. Stone forest—a jewellery of nature heritage. Beijing: China Environmental Science Press (in Chinese). 107-12.

[218] Hill C, Forti P. 1997. Cave Minerals of the World. Second Edition. National Speleological Society. 463.

[219] James J. 1997. A Comparison of the Stone forest of Lunan with Pinnacle Karst of the World. Stone forest—a jewellery of nature heritage. Beijing: China Environmental Science Press (in Chinese). 22-29.

[220] Trimmel. H. 1997. Karst Forms comparable to Stone Forest within the Mediterrannean Basin. Stone forest—a jewellery of nature heritage. Beijing: China Environmental Science Press (in Chinese). 46-51.

[221] Yuan Daoxian. 1997. A global perspective of Lunan stone forest. Stone forest—a jewellery of nature heritage. Beijing: China Environmental Science Press (in Chinese). 68-70.

[222] Xie Yunqiu, Li Yuhui. 2001. A guide to karst geology, geomorphology and ecolosystems of Shilin, Yunnan. In Guidebook for Ecosystems of Semiarid Karst in North China and Subtropical Karst in Southwest China. 59-75.

8. Contact Information of Responsible Authorities

8.a Preparer

Name：Fu Yuliang

Title：Section Director

Address：Construction Department of Guizhou Province

City, Province/State：Country：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550002

Tel：+86-5954545

Fax：+86-851-5952862

E-mail：gzyl0048@163.com

Name：Xiong Kangning

Title：Professor

Address：Guizhou Normal University

City, Province/State：Country：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550001

Tel：+8613608547678

Fax：+86-851-6702162

E-mail：Xiongkn@163.com

Name：Liang Yongning

Title：Professor

Address：Kunming University of Science and Technology

City, Province/State, Country：Kunming City, Yunnan Province, the People's Republic of China

Post Code：650031

Tel：+8613658716633

E-mail：liangyongning@hotmail.com

Name：Zhao Chunyong

Title：Professor

Address：Chongqing Normal University

City, Province/State, Country：Chongqing City, the People's Republic of China

Post Code：400047

Tel：+8613608332037

Fax：+86-023-65362083

E-mail：zcy.zcy@263.com

Name：Li Yuhui

Title：Professor，Doctor

Address：Yunnan Normal University

City, Province/State, Country：Kunming City, Yunnan Province, the People's Republic of China

Post Code：650031

Tel：+86-871-5516919

E-mail：lyh123@public.km.yn.cn

Name：Xie Shiyou

Title：Professor

Address：Southwest China University

City, Province/State, Country：Chongqing City，the People's Republic of China

Post Code：400715

Tel：+86-023-68380060

Fax：+86-023-68253912

E-mail：xiesy@swnu.edu.cn

Name：Xiao Gaolin

Title：Office Head

Address：Construction Department of Guizhou Province

City, Province/State, Country：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550002

Tel：+8613985125918

Fax：+86-851-5952862

E-mail：xgl9596@163.com

Name：Xiao Shizhen

Title：MSc

Address：Guizhou Normal University

City, Province/State, Country：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550001

Tel：+86-0851-8714105

Fax：+86-851-6702162

E-mail：xiaosz2004@163.com

Name：Liu Ziqi

Title：PhD.

Address：Southwest China University

City, Province/State, Country：Chongqing City, the People's Republic of China

Post Code：400715

Tel：+8613637990180

Fax：+86-023-68253912

E-mail：michelle-lily@126.com

Name：Chen Hongyun

Title：MSc.

Address：Guizhou Normal University

City, Province/State, Country：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550001

Tel：+8613765148152

Fax：+86-851-6702162

E-mail：hychhy812@163.com

Name：Gao Qiang

Title：MSc.

Address：Guizhou Normal University

City, Province/State, Country：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550001

Tel：+8613595080548

Fax：+86-851-6702162

E-mail：gq_01@163.com

8.b Official Local Institution /Agency

8.b-1 National and Provincial Agency

Name：Ministry of Construction of People's Republic of China

Address：No.9, Sanlihe Road, Beijing, the People's Republic of China

Post Code：100835

Tel：+86-010-68393014

Fax：+86-010-68393014

E-mail：zuoxp@mail.cin.gov.cn

npo@mail.cin.gov.cn

Name：Construction Department of Yunnan Province

Address：No.129, Xichang Road, Kunming City, Yunnan Province, the People's Republic of China

Post Code：650032

Tel：+86-871-4113446

Fax：+86-871-4113447

E-mail：sjbl2000@21cn.com

Name：Construction Department of Guizhou Province

Address： Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550002

Tel：+86-851-5954664

Fax：+86-851-5952862

E-mail：gzxgl2002@163.com

Name：Garden Bureau of Chongqing City

Address：No.179, Eling Street, Yuzhong Region, Chongqing City, the People's Republic of China

Post Code：400014

Tel：+86-023-63858381

Fax：+86-023-63624871

E-mail：cqylwangwendi@sina.com

Name：World Heritage Management Committee of Yunnan Province

Address：No.129, Xichang Road, Kunming City, Yunnan Province, the People's Republic of China

Post Code：650032

Tel：+86-871-4113446

Fax：+86-871-4113447

E-mail：sjbl2000@21cn.com

Name：Office of World Heritage Application and Management of Guizhou Province

Address：Guiyang City, Guizhou Province, the People's Republic of China

Post Code：550001

Tel：+86-851-5954664

Fax：+86-851-5952862

E-mail：gzxgl2002@163.com

Name：World Heritage Management Committee of Chongqing City

Address：No.179, Eling Street, Yuzhong Region, Chongqing City, the People's Republic of China

Post Code：400014

Tel：+86-023-89068667

Fax：+86-023-89068666

8.b-2 The Local Agency

Name：Administration of Shilin Scenic and Historic Area

Address：Shilin Yi Autonomous County, Kunming City, Yunnan Province, the People's Republic of China

Post Code：652211

Tel：+86-871-7711439

Fax：+86-871-7711778

E-mail：ynsl@chinastoneforest.com

Name：Administration of Maolan National Nature Reserve of Guizhou

Address：Yuping Town, Libo County, Guizhou Province, the People's Republic of China

Post Code：558400

Tel：+86-854-3611115

Fax：+86-854-3610675

E-mail：rjc68cn@yahoo.com.cn

Name：Administration of Zhangjiang River Scenic and Historic Area of Libo

Address：Yuping Town, Libo County, Guizhou Province, the People's Republic of China

Post Code：558400

Tel：+86-854-3610516

Fax：+86-854-3610516

E-mail：xdl@263.com

Name：Administration of Furong River Scenic and Historic Area of Wulong County

Address：Xiangkou Town, Wulong County, Chongqing City, the People's Republic of China

Post Code：408500

Tel：+86-023-77713333

Fax：+86-023-77713099

E-mail：yaz333@163.com

8.c Other Local Agency

Name：Land and Resources Department of Yunnan Province

Address：No.2, Huguo Road, Kunming City, Yunnan Province, the People's Republic of China

Post Code：650011

Tel：+86-871-3116002

E-mail：webmaster@yndlr.gov.cn

Name：Construction Bureau of Kunming City

Address：No.47, Dongfeng East Road, Yunnan Province, the People's Republic of China

Post Code：650011

Tel：+86-871-3145199

Fax：+86-871-3145886

Name：Forestry Department of Guizhou Province

Address：No.91, Yanan center Road, Guiyang City, Guizhou Province

Post Code：550001

Tel：+86-851-6570806

Fax：+86-851-6571881

Name：Construction Bureau of Libo County

Address：Yuping Town, Libo County, Guizhou Province, the People's Republic of China

Post Code：558400

Tel：+86-854-3612260

Name：Construction Committee of Chongqing City

Address：Chongqing City, the People's Republic of China

Post Code：400015

Tel：+86-023-63870766

Fax：+86-023-63853948

E-mail：6367123@163.com

Name：Administration Bureau of State Land Resources and Real Estate of Chongqing

Address：No.99, Renhe Road, Yuzhong Region, Chongqing City, the People's Republic of China

Post Code：400015

Tel：+86-023-63651287 +86-023-63651130

Fax：+86-023-63651311

E-mail：jdf@sf.cq

8.d Official Web Address

Ministry of Construction of People's Republic of China

http://www.cin.gov.cn

Contact name：Zuo Xiaoping

E-mail：cin@mail.cin.gov.cn

The People's Government of Yunnan Province

http://www.yn.gov.cn

The People's Government of Guizhou Province

http://www.gzgov.gov.cn

Contact name：Bao Kexin

The People's Government of Chongqing City

http://www.cq.gov.cn/

Contact name：Yang Lin

E-mail：mssc@sf.cq

Construction Department of Yunnan Province

http：//www.ynjst.gov.cn/

E-mail：sjbl2000@21cn.com

Construction Department of Guizhou Province

http：//www.gzjs.gov.cn

Contact name：Fu Yuliang, Xiao Gaolin

E-mail：xgl9596@163.com

Garden Bureau of Chongqing City

Contact name：Wang Wendi

E-mail：cqylwangwendi@sina.com

The People's Government of Shilin Yi Nationality Autonomous County

http：//www.shilin.gov.cn

Contact name：Li Zhongde

The People's Government of Libo County

http：//www.libo.gov.cn/

Contact name：Pan Chaoxian

E-mail：lbdzkcj@public.gz.cn

The People's Government of Wulong County

http：//www.kmpg.gov.cn

Contact name：Ye Chengli

E-mail：xwwl@sw.cq

9. Signature on behalf of the State Party

Wang Guangtao

Minister of Construction

The People’s Republic of China

APPENDIX I:

Text of Covering Letter to World Heritage Committee of UNESCO

China has more than 1,250,000km^2 of carbonate rock outcrop that occupies 13% of the total country (see attached figure). Thus it has one of the highest proportions of karst in the World. The South China Karst is 55% of the total (see attached figure) and comprehensively reflects the geological history of a major region of China and its particular.

Physical geography. It embodies special karst landforms, karst ecosystems, biodiversity, natural landscape beauty and evolutionary processes, many of them of World significance.

The South China Karst covers nearly 500,000km^2 and lies mainly in Yunnan, Guizhou and Guangxi, but extends into parts of Chongqing, Sichuan, Hunan, Hubei and Guangdong. Representative sites within these provinces that contain the best examples of the South China Karst landscapes will be submitted to the World Heritage Committee in three phases of serial nominations. All the sites to be nominated are worthy of World Heritage listing in their own right but are grouped under the general title of South China Karst. Individually the nominated sites meet one or more of the World Heritage criteria for a natural property. All sites meet one common criterion. Criterion N(viii) – in that they are outstanding examples representing major stages in the earth's history including the record of life, significant on going processes in the development of landforms and significant geomorphic and physiographic features. A number of the sites also fulfill criterion N(ix) – in that they include outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial and freshwater ecosystems and communities of plants and animals and criterion. Also N(x) – in that they 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, and Criterion N(vii) – in that they contain superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance.

Brief descriptions of the sites to be nominated in the multi-phase serial nomination titled *South China Karst* are listed below.

Libo Karst (Guizhou): The nominated sites lie in Libo County, south Guizhou Province. They are typical sites of Fengcong karst on the transitional zone between Guizhou plateau and Guangxi lowland, outstanding for their full spectra of gradual change from plateau karst to the lowland karst, with a combination of numerous tall karst peaks, deep dolines, sinking streams and long river caves.The cone karst landscape constitute superlative examples of *fengcong* and *fenglin* karst landscapes including fengcong-depression (polje), fengcong-valley (polje), fengcong-gorge, fenglin-depression, fenglin-valley and fenglin-plain (basin). In addition, within them there is an impressive array of major karst features.

These sites illustrate the geomorphological exchange and evolution between fengcong landscapes and fenglin landscapes. The cone karst landscape supports immense biodiversity and this special karst forest ecosystem is the habitat of many endemic species and endangered fauna. As field study areas they have great potential to extend the current knowledge of ecosystems developed in fengcong landscapes.

Shilin Karst (Yunnan): The nominated sites lie in Shilin Yi Nationality Autonomous County, east Yunnan Province. They are typical sites of plateau karst, outstanding for the high limestone pinnacles decorated with deep, sharp karren, which is the result of subjacent karst process under the cover of Tertiary red sandstone and Permian basalt. Both sites contain outstanding examples of "stone forest" karst landscapes. They have been selected so that they are representative of the immense variety of stone forests that are found within the South China Karst. The Shilin stone forests illustrate the episodic nature of the evolution of these karst features, which in this case span 270 million years. They are known throughout the world as being one of the finest examples of the natural beauty that karst processes give to rock. Adding to this beauty is a special plateau karst ecosystem that has developed in the subtropical monsoon climate of the continental interior.

Wulong Karst (Chongqing): The nominated sites lie in Wulong County, south Chongqing. They are classic sites of deep gorge karst, unique for their rich information about the long history of geological evolution kept in the Furong Cave, as well as the changes from peneplains on different altitude above knickpoints to the deeply dissected gorge nearby, and its relevant special karst forms such as karst collapse dolines several hundred meters deep and natural bridges. The sites are an outstanding example of a karst landscape that has evolved in areas where thick sequences of pure carbonate rocks have been subjected to tectonic uplift. The result is a fengcong karst landscape dissected by gorges, caves and *tiankengs*. The sites selected all show fine examples of this process; the natural bridges site shows a series of tiankengs joined by natural bridges and gorges, the cave site illustrates how such down cutting creates large caverns that subsequently become infilled by decoration leading to an environment of great aesthetic value; the final site in this area exhibits the manner in which caves, tiankengs and underground rivers combine in such a landscape from streamsink to spring.

Guilin-Yangshuo Karst (Guangxi): Guilin-Yangshuo karst is located in Guilin City of Guangxi. It demonstrates to perfection the karst landform *fenglin*. This most dramatic karst landscape has isolated, steep-sided towers rising 50 to 100m above the surrounding countryside. *Fenglin* is regarded as an extreme karst type that is restricted to areas in the wet tropics that have a history of tectonic uplift. *Fenglin* are features of long and uninterupted karst development. Guilin-Yangshuo is the type location for this karst landform. It is the *fenglin*, standing isolated on plains that have given the Guilin-Yangshou karst its international reputation for scenic beauty. Without doubt Guilin-Yangshuo karst is one of the World's most dramatic karst landscapes and has always been an outstanding inspiration for China's artists. These karst landforms have been observed, recorded and studied by karst scientists since the 16th century, beginning with the Chinese scientist Xuxiake (1587-1641). In recognition of the great

importance of this site for karst research it was chosen as the location for the Chinese Institute of Karst Geology.

Jinfoshan Karst (Chongqing): The site lies in Nanchuan City, south Chongqing. It is isolated and almost uneffected by human activities. It contains pristine natural environments with a large area of virgin forest, a range of vegetation types and complex floral communities. It provides a safe habitat for rare and protected endemic fauna. Because of its special geology and climate it has developed highly unusual terrain. The site is exceptional for research programs in the fields of vegetation evolution, paleobiology, paleoclimate and paleogeology.

Fengjie Karst (Chongqing): This karst lies in Fengjie County, Chongqing, and comprises Xiaozhai Tiankeng, Tianjinxia Gorge and their associated karst landscapes. *Tiankeng* is the Chinese term for a gaint collapse doline and Xiaozhai Tiankeng is the largest of these in the World. These features are of immense scientific importanance and aesthetically spectacular. Xiaozhai Tiankeng and Tianjinxia Gorge are fine examples of Quaternary landform evolution and have provided invaluable natural refuges for vegetation during the Quaternary glaciation. The isolated environment developed within Xiaozhai Tiankeng is of special value for ecological research.

Xingyi Karst (Guizhou): This site lies in Xingyi, south Guizhou Province. At this site the *fengcong* karst landscape is exceptional and within its 49 km^2 there can be found a great variety of cone morpologies. The karst landscape at this site exhibits a continuous evolutional history from the Cenozoic to the present. In a valley within the *fengcong* there is another excellent illustration of the transition from *fengcong* karst to *fenglin* karst. This is the location where Guizhou Dragon fauna fossils have preserved paleobiological evidence of evolution for 230 million years.

Zhijin Cave (Guizhou): The cave is in Zhijin County, Guizhou Province. The cave caverns and passages have unusual shape and form, and contain complex sedimentary sequences. The abundant calcite speleothems in this cave are of great beauty. The multi-level character of Zhijin Cave and its multiphase sediments makes it an extremely fine example of cavern evolution and source of paleoenvironmental information.

Xingwen Karst: (Sichuan): The site lies in Xingwen County, southeast Sichuan. It is considered to be a natural karst landscape museum because there are many kinds of major karst features within only several hundred square kilometres. The complex karst landscape has developed from an integrated hydrogeological system comprised of surface water and groundwater drainage. Here there are 17 species of protected native plants of national importance and 30 species of protected animals of national importance. The site was the habitat of a fossil plant, *Sinopteris grevilleoides,* and the fossil fish, *Megalobatrachus davidianus*.

The South China Karst (Phase 1) is being serially nominated for World Heritage listing because,

although not contiguous, the nominated areas are located in the same geological-geomorphological region, unified by their karst topography, and because the nominated areas incorporate a range of features within a single geographical region (karst region of South China). The South China Karst serial nomination will be submitted progressively, starting with the Shilin karst, Libo karst and Wulong karst areas (Phase 1). Each respectively meets the requirement for outstanding universal value, satisfying World Heritage Criteria N(viii), with Shilin karst and Libo karst also respectively satisfying criteria N(vii) and criteria N (ix) and (x), thus demonstrating the universal significance of the “South China Karst”.

APPENDIX II:

An Overview of the South China Karst

Introduction

China has more than 1,250,000km^2 of carbonate rock outcrop that occupies 13% of the total country. Thus it has one of the highest proportions of karst in the World. The South China Karst, covering nearly 500,000km^2, lies mainly in Yunnan, Guizhou and Guangxi, but extends into parts of Chongqing, Sichuan, Hunan, Hubei and Guangdong. It contains an outstanding series of karst landforms - from humid to semi-humid and from tropical to subtropical - plains, hills, mountains and plateaux. The South China Karst comprehensively reflects the geological history of its region and its particular physical geography. It embodies special karst types, karst ecosystems, biodiversity, natural landscape beauty and evolutionary processes, much of them of world significance (fig.2A-1).

Representative sites within the South China Karst that contain the best examples of its karst landscapes will be submitted to in three phases of serial nominations. All the sites to nominated are worthy of World Heritage in their own right but are grouped under the general title of South China Karst. Individually the nominated sites each meet one or more of the World Heritage criteria for a natural property. All sites meet one common criterion. Criterion N(viii) – in that they are outstanding examples representing major stages in the earth's history including the record of life, significant on going processes in the development of landforms and significant geomorphic and physiographic features. A number of the sites also fulfill criterion N(ix) – in that they include outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial and freshwater ecosystems and communities of plants and animals and criterion. Also N(x) – in that they 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, and Criterion N(vii) – in that they contain superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance.

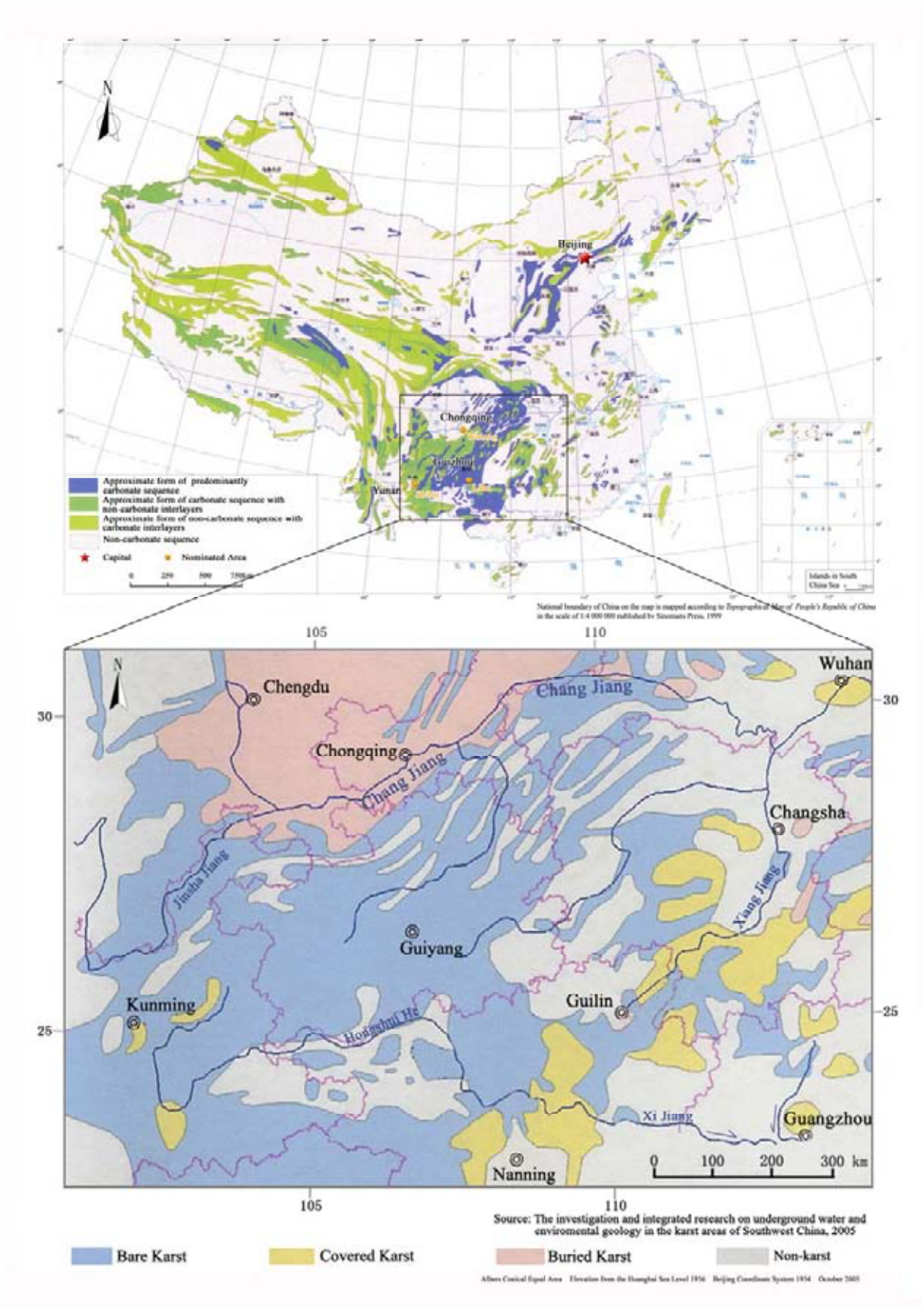


Fig.2A-1 Outcrops of the carbonate rocks in China (Lu Yaoru, 2001) and Karst Regions in South China

Physical Geography

Terrain: The South China Karst extends 1380km from west to east and 1010km from north to south (geographical coordinates: E 100°40' to 114°20', N 21°09' to 31°01'). The South China Karst is situated in the second and third Geographical Altitude Zones (GAZ) of China. The Yunnan-Guizhou Plateau is located in the second GAZ. The plateau's altitude ranges from 2000m to 1500m in the southeast. The main karst landscapes found on the plateau are fengcong, fenglin and stone forest. The plateau has been deeply incised by rivers by as much as a 1000m. The karst hills, fenglin-plains and karst valleys of Guangxi and Guangdong are in the third GAZ (altitude range from 800m to 200m). Here the relief amongst the karst landforms ranges from 100m to 300m.

Climate: The South China Karst is in three climate zones: subtropical warm-temperate, humid-temperate and humid-monsoon. The southeast monsoon from the Pacific Ocean, the southwest monsoon from the Indian Ocean and the cold airflow from the Tibetan Plateau combine to generate a large climatic gradient. The mean annual maximum temperatures across the region range from 14°C between 26°C, the mean annual rainfall ranges from 1100mm to 2300mm, and the mean annual evaporation ranges from 1000mm to 1800mm. The wet season is between April and September and contributes between 72% and 86% of the annual total.

Hydrology: South China Karst has two major catchments (Fig 2A-2); that of the Yangtze River and the Pearl River separated by the mountains Nan, Miao and Wumeng. In the northwest, the Yangtze River has cut three deep gorges. Its tributaries, for example, the Wujiang, also cut deeply into the Yunnan–Guizhou plateau to form gorges. In south, the Pearl River rises in the Shilin of Yunnan its tributaries the Nanpanjiang, the Beipanjiang and the Hongshuihe are also deeply incised into the edge of the Yunnan-Guizhou plateau and Guangxi Basin to form gorges. The South China Karst has a valuable resource in its abundant subterranean water.

Soil, Vegetation and Biodiversity: In the South China Karst Areas there are latosol, red soil, yellow soil and various lime soil series. In addition, there are obvious zonal vegetation changes from tropical rain forest to subtropical semi-humid evergreen-deciduous broad-leaved mixed forest, then to the warm needle-leaved forest, meadow, and karst endemic regional vegetation; surface fauna and cave animals are

exceptionally enriched. According to incomplete statistical, there are 4287 species of higher plants, belonging to 1213 genera, 225 families, occupies partial higher plants 90%, 60% and 30% in south China.

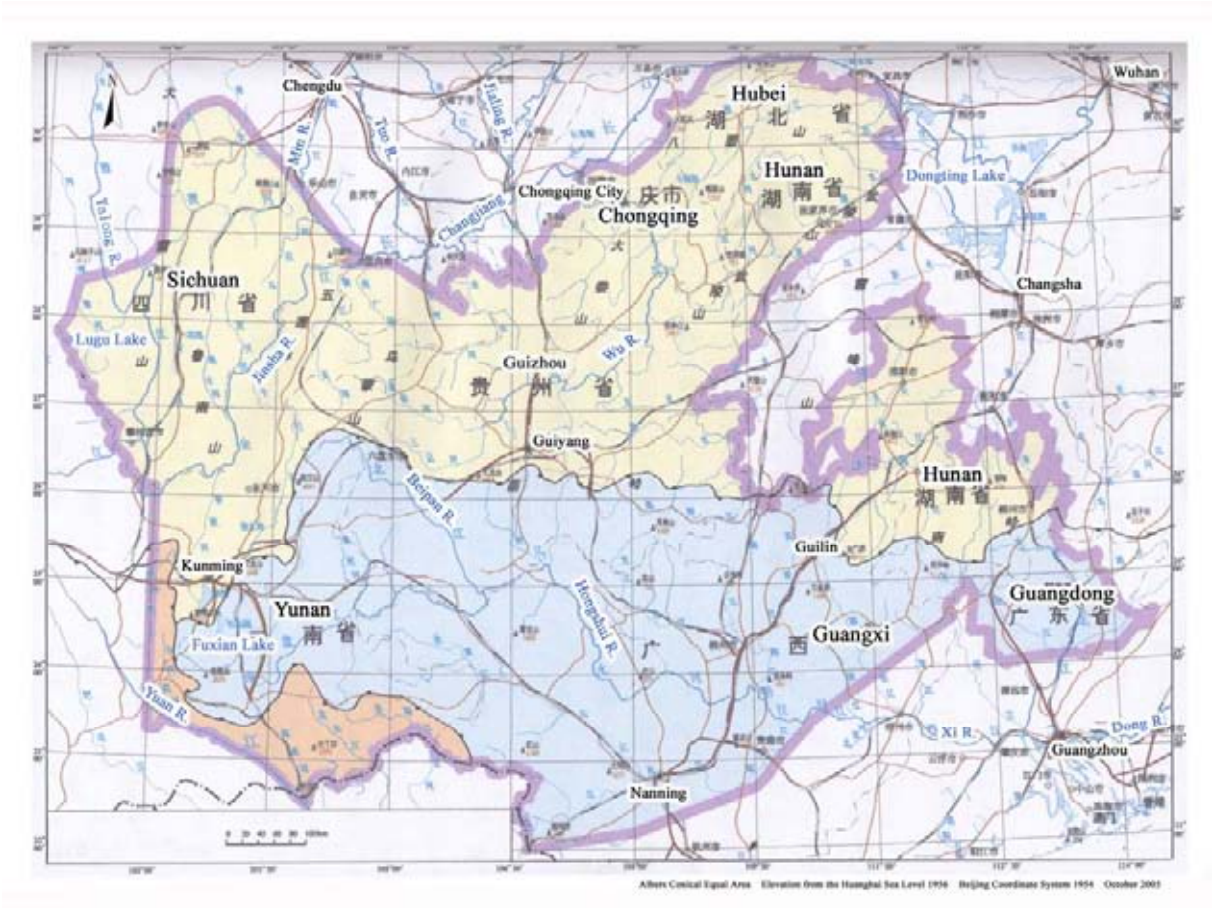


Fig.2A-2 South China Karst hydrology

Regional Geology

The northern and western parts of South China Karst are on the carbonate rocks of the Yangtze Massif. Outcropping strata are from the Sinian, Cambrian, Ordovician, Devonian, Carboniferous, Permian and Triassic periods. Dolomites, limestones and dolomitic limestones, mudstones and shales are the main rock types. South China was subjected to a number of ocean invasions before the Mesozoic in which the carbonate strata were laid down. In the late stage of Triassic, these were uplifted, folded and faulted by tectonic activity during the Indo-China, Yanshan and Himalayan Movements.

The southern and eastern parts of South China Karst are situated on Huanan (South China) fold system, the metamorphic rocks in Sinian and lower Palaeozoic are tightly folded. They are unconformably overlain with magmas. The earliest carbonate sediments are the Dengying Formation of Sinian and then more

carbonates were widely deposited in the Palaeozoic, especially during the Devonian, Carboniferous, Permian and Triassic periods. Resulting in a great depth of carbonate rocks (up to 10,000m in Guizhou and Guangxi) that are both folded and faulted; these strata are rich in fossils. South China Karst exhibits many paleokarst features from last stages of the Sinian, and Silurian, Permian, Triassic (the late stage of Indo-China Movement), Mesozoic and Paleocene. Each of these periods of karstification provides evidence as to the evolution of the earth's crust. In the South China Karst, there is a great variety of soil types, for example, latosol, red, yellow and various lime soils. The composition and location of the soils has assisted in establishing a history of the geological, geomorphological and climate changes there.

Quaternary tectonic activity uplifted the South China Karst at the same time as the Tibetan Plateau. The result of such uplifts is that karst development and landforms are both diverse and complicated. When the geological history and regional tectonics are considered together the development of South China Karst can be characterized by the following phases:

Higher Plateau Phase - The paleo-planation surface formed in the late Paleocene has survived to the present it was formed at the same time as the high altitude section of Tibetan Plateau. It is the highest altitude morphological unit with a mean altitude of 2700m in Mount Wumeng and Caohai zones of eastern Yunnan and western Guizhou. The altitude of the South China Karst above the Yangtze River in the Three Gorges area ranges between 1800m and 2000m.

Hilly Plateau Phase - In the late Pliocene during the Himalayan Movement, the paleo-planation surface collapsed in a series of extreme uplift events. The result was a stepped landform, high in west and low in east of rolling morphology with a mean altitude of 1600m to 2000m on the Yunnan-Guizhou plateau and 1200m to 1500m at the Yangtze Three Gorges. In western Guangxi, the top of fengcong hills exhibit this phase at altitudes that range from 300m to 1500m.

Gorge Phase - In the Quaternary, there were further periods of extreme tectonic uplift, which resulted in deep incision into the South China Karst by surface and subterranean rivers. In this period, the modern drainage pattern formed and as consequent a sequence of different karst landforms were formed from the top of the river catchments to their current base level. These dissected landscapes in the South China Karst were the last to form but in the present subtropical humid climate they are continuing to evolve.

The mature karst landscapes of the present and the paleokarsts of the past were hardly affected by Quaternary glaciations as the glaciers covered little of the South China Karst, so geological histories are relatively intact unlike those in Europe and North America.

Present karst landscapes

The South China Karst is regarded as the classical manifestation of a series of karst landscapes that have largely developed in a humid subtropical climate. Other major karst categories when defined by climate are humid tropical karst, arid and semiarid karst, humid temperate karst and polar and alpine karst. The combination of high temperatures and rainfall especially during a monsoon found in the South China Karst is ideal for rapid karst development both on the surface and underground. In such conditions, the surface and underground (caves) karst are simultaneously developed by corrosion and erosion. Since the late Cretaceous, the humid subtropical climate has been a key factor in the development of landscapes in the South China Karst.

A notable attribute of the South China Karst is the great diversity and extent of two cone karst landscapes, which are internationally known by their Chinese names of fengcong karst and fenglin karst.

Fengcong karst: Fengcong karst is a combination of conical hills and depressions, valleys and gorges, with the proportion of positive landforms being greater than that of negative landforms. Cones are connected at their bases and are of different heights. The fengcong-depression karst is characterized by enclosed depressions, which may take any polygonal shape. The fengcong-valley karst has narrow, flat dry valleys. The fengcong-gorge karst contains fast-flowing rivers in narrow beds, which often have steep gradients. The gorges are the result of plateau uplift and river incision.

Fenglin karst: Fenglin karst consists of isolated cones or towers on broad and flat karst peneplains. Here the proportion of positive landforms is much less than the proportion of negative landforms. Isolated cones exist on flat carbonate rock surfaces. Fenglin-depression karst is differentiated by large and shallow-irregular depressions that have level and broad bottoms. Fenglin-valley karst is characterized by valleys that extend longitudinally.

Two other exceptional karst landscapes occur throughout the South China Karst; they are stone forest

and its smaller relative stone teeth. The stone forests contain the greatest variety of pinnacles and towers found in the world because they have developed in different geological environments over a long period. The other is the landscapes that host the *tiankengs* – giant dolines; these are often in close proximity to spectacular gorges that may contain natural bridges and deep, large and well decorated caves some of which contain large rivers.

These landscapes not only have immense aesthetic value, but because they have taken place over such a long period of geological time and have on-going geological geomorphologic processes they also have great potential to advance karst science. Specific South China Karst landscapes are already appearing in textbooks and encyclopedias as the classical examples for such karst development.

The explanation as to why there is such a great variety of karst landscapes within the South China Karst is twofold: Firstly, the carbonate rocks on which the karst landscapes have formed are ancient. They accumulated from Sinian to Triassic to thicknesses of several kilometres. The individual beds in each deposition sequence may also be thick and have a gentle dip. Because they have been subjected to diagenesis by burial and other metamorphic processes, they are generally pure, have less porosity and permeability and greater compression strength than younger limestones. These properties lead to stable massive forms, which include cones, gorges, steep high cliffs, and pinnacles. Associated with the gorge karst areas deep and long caves are formed which in many cases can be entered through the giant dolines. Relict caves from past periods of karstification are found in both fengcong and fenglin karst often abandoned high above present water table. Secondly, in the South China Karst all the carbonate sequences have experienced numerous periods of tectonic activity and long and continuously slow uplifts which have resulted in fold structures and numerous faults and joints. Such features allow penetration of water and focus its attack into conduits. This leads to rapid corrosion and erosion assisting the formation of deep and long caves and gorges.

Biology and Biodiversity

The South China Karst biology is as abundant and rich as the karst landscapes in which it resides. The wide variations in climate from the subtropical with a monsoonal influence to humid temperate and with the significant variation in altitude coupled with the special landscapes have led to a range of

Photo 2A-1 Stone Forest karst in Shilin, Yunnan

Photo 2A-2 Cone karst in Guizhou

Photo 2A-3 Tower karst in Guangxi

Photo 2A-4 Gorge karst in Chongqing

bio-geographic communities. The result is that vegetation that is drought resistant, rock and calcium loving develops. Here, climax communities containing endemic species have evolved. The karst biological evolution record retained here by the preservation of ancient relict plants. The many karst reserves within the South China Karst are the type locality for specific species of both flora and fauna and thus are of vital significance to research into the occurrence, composition and evolution of karst eco-systems. Within the South China Karst, there is exceptional biodiversity. The lack of surface water in much of the karst and the often precipitous terrain has meant that ecosystems have survived in their primitive state and thus contain rare species of fauna and flora, many of which have had special protection both nationally and internationally because they are endangered. The biodiversity of the South China Karst is a unique and intact phenomenon. The local and national governments are dedicated to preserving it as well as the karst natural habitats in which it is found.

The South China Karst has the greatest variety of continental karst forest types in the subtropics. The succession of forests changes across the region from tropical rain to subtropical, to semi-humid evergreen-deciduous broad-leaved and finally to temperate needle-leaved. There is vertical forest zonation within a number karst landscapes. Within the karst lands and forests there are wetlands, lakes and rivers all of which contain special aquatic plant communities. Open grassland and shrub lands are found on the higher mountains. The evergreen-deciduous broad-leaved mixed and needle-leaved forests of Libo, Guizhou are the largest and best preserved not only in South China, but also throughout the continental subtropics. These massive primitive karst forests provide an important habitat for endemic, rare and endangered species of flora and fauna.

The plants growing in the karst regions are abundant and diverse, according to current but incomplete statistics, there are 4287 species of higher plants, belonging to 1213 genera, 225 families. Higher plants are estimated to occupy more than 90% of species, more than 60% of genera and more than 30% of families amongst the higher plants found in South China. In the South China Karst, there are 140 species of protected plants of class I and class II national importance.

Numerous vertebrates and invertebrates species are found on the surface of the South China Karst. Sixty of these species are class I and class II protected animals of national importance; other endangered species have been protected to prevent international trade in them or their parts. The karst surface and

underground fauna are frequently interrelated. However, as there is no light in the caves and they are nutrient poor, the underground fauna have had to adapt to these harsh conditions. As caves are isolated from each other the same faunal species may evolve differently, even in caves that close to one another. Thus, the cave fauna of the South China Karst having being derived from an already novel surface fauna is proving to be abundant with many new trogophilic and troglobitic species. These cave animals include bats, blind-fish, snails, spiders and myriapods. Hence bio-speleology is a rapidly expanding research area and is attracting many national and international investigators wishing to study the evolution of cave dwelling species. In the South China Karst, caves are regarded as special environments and are protected.

Archeology and Anthropology

There is a long history of human activities and abundant evidence of early human occupation in the South China Karst. The history of human activities in the region commenced in the Paleolithic. Relicts and sites from the Paleolithic, the Ceramic Age, the Bronze Age and the Iron Age have been discovered in the caves, lakes and mountains. Excavations at these sites have shown that both aboriginals and immigrants have inhabited the karst; at times, these humans would have been nomadic. These inhabitants would have a variety of impacts on the natural environment and at the same time, it would have influenced their lifestyles and cultures.

Human activities have included periods of hunting and gathering, cultivating, timber harvesting, and mining. Settlement developed from living areas in caves, to scattered houses near water supplies and then later to the growth of villages, towns and, eventually, cities. The minority nationalities especially have woven karst scenic elements into their religion, celebrations, literature, drawing, music, dancing and architecture. Their customs have included the protection of forests around their villages and water sources. In this way, parts of the climax forest community have been indirectly protected. Their activities are now restricted by traditional customs, local law and national law to sustainable agriculture, hunting, timber harvesting and plant gathering for medicinal purposes. Limiting the exploitation karst has led to recovery of the karst landscape and its associated wild animal populations.

Government protection of the karst commenced formally in the 1980s, when laws were established, the boundary of karst reserves were delimited. Although there records of visits to the South China Karst

from the 17th century exist. It was only in the 20th century that tourism focused on karst scenery and local national culture became the dominant industry. This has encouraged protection of the reserved karst landscapes and their biodiversity. Residents, associated communities and governments have carried out tree planting and conservation projects aimed at restoring natural environments.

It is impossible to describe in words the beauty of much of the scenery of the South China Karst. In this appendix, just four plates (Photos 2A-1 to 2A-4) have been selected to illustrate why these Chinese karst landscapes have stimulated artists of all callings and nationalities; the South China Karst has provided and continues to provide them with a treasure house for inspiration and design from its everlasting natural models. For centuries, the stone forests, due to their exceptional beauty (Photo 2A-1) have served as the natural model for traditional Chinese gardeners. In recent years, gardens based on this concept have been given by the People's Republic of China to many cities throughout the World.

Contents

Management Plan

Of Shilin (Stone Forest) Karst, Yunnan

The Management Bureau of the Shilin National Park

October 2005

CONTENTS

1. An introduction

The well-known Shilin (Stone Forest) karst is located in the Shilin Yi Nationality Autonomous County, Kunming City, Yunnan Province. Because of its impressive karst landscape and exceptional natural beauty, Shilin was formally established as Stone Forest Park in 1931 by Yunnan provincial government. Subsequently, in 1982, the Stone Forest was designated as China's National Park (also known as National Key Scenic Area) by the central government, and in 2001, designated as China's National Geopark, and in 2004, the Stone Forest was listed in the Global Geopark Network by the UNESCO. Currently, the Stone Forest is also an important component part of the proposed South China karst world natural heritage.

1.1Location

The Shilin National Park, located at 24°30'to 25°03'north latitude and 103°10'to 103°40'east longitude, is situated in the middle of the Shilin Yi Autonomous County[1] in Yunnan Province of China. With convenient transportation, it is 78 kilometers northwest from Kunming, the capital city of Yunnan Province. Both railways and highways are accessible to Kunming, Nanning and other major cities and towns.

1.2Physical geography

1.2.1Topography and Geology

The Shilin National Park stands in the west of the Yunnan-Guizhou Karst Plateau of the Southwest Karst Region in China, the most extensive karst area in the Globe. It lies in the intermediate terrace between the first terrace (Qinghai-Tibet Plateau) and the third terrace (Hills and Plains in the East) of China. The plateau surface there lightly undulates with mild cutting. With the main altitudes from 1700 to 1950m a.s.l, the highest point is Wenbi Mountain, at 2203m a.s.l. in the south of the Park, and the lowest point is 1560m a.s.l., at the foot of the Grand Waterfall in the southwest of Shilin County. The general topography of the Park is high in the northeast and low in the southwest, high in the east, and low in the west. The west side of the Park is Lunan Basin, formed in paleogene and the typical faulted-basin found in China.

[1] Before 1998, it was Lunan Yi Autonomous County.

The geological history of the Shilin National Park is complex, but the geological structure is simple and the joint networks well developed. The main strata is that of Sinian, Cambrian, Silurian, Devonian, Carboniferous, Permian to Paleogene and Quaternary, and the rocks are carbonate rocks, clastic rocks, argillites and basalts. With concern to the tectonics, the Shilin National Park with some small faults lines in the west wing of the significant anticlinoria (Mountain Niushou paleo-land) in Middle Yunnan. There are regional faults respectively in the east side and the westside of the park. One of them is the Jiuxian-Shiyakou fault in the northwest side of the park, extending from the northwest side to the Grand Waterfall and in multiple phases. And in the southeast side there is the Weize fault extending from the northeast to the northwest. Two faults dominated the evolution of landforms of the park that was a down block between the two faults. Apart from that, there is also a developed joint system. Having got rid of the oceanic environment since the later period of the middle Permian epoch, the Shilin area had always been ascending and denudating. Impacted by the closing of Paleo-Tethys Ocean and Himalayan Movement, the Shilin area experienced the dramatic changes from a littoral environment to the hill and the plain environment of a low latitude and low elevation, and finally the plateau river environment, and from continental basalt eruption to faulted-lake deposition. From such a complicated geological evolution, the Stone Forest came into being.

The dominant Karst landforms are that of Stone Forest, the karst hills, dolines and depressions, karst valleys, underground rivers and caves, lakes and waterfalls, the Stone Forest of which is notable worldwide. The Stone Forest refers to densely packed pinnacles from 5m to 40m high and fluted by sharp Rillenkarren, a typical kind of pinnacle karst formed on a low plateau of gently dipping limestone. It is Shilin Park that is the home of Stone Forest and provides representatives of the immense variety of the Stone Forest. There are four main varieties found in the Stone Forest: the sword-shaped Stone Forest, the pagoda-shaped Stone Forest, the mushroom-shaped Stone Forest, stalk-shaped Stone Forest, as well as spitzakarren rock city. In terms of evolution perspective, there is the paleo-Stone Forest, the petrified Stone Forest, the developing Stone Forest and the basalt-baked Stone Forest.

1.2.2Climate

The Shilin National Park, encounters subtropical-plateau monsoon season in a low latitude, is characterized by a climate of “neither too cold in winter nor too hot in summer, the all spring-like four seasons, and a clear seperation between the rainy season and dry season”. The annual mean rainfall reaches 967.9mm and the whole year can be divided into two seasons according to rainfall: one being the rainy season from May to October, taking up 80% to 88% of the total rainfall, and the dry season from November to the next April, only 12% to 20%. Since 1965, the annual mean temperature holds at 15.5°C with the highest temperature at 20.8°C in July and the lowest at 8.2°C in January. The highest temperature was 33.6°C on May 1, 1966, and the low, -8.9°C after the heavy snow on Dec. 29, 1983. The annual transpiration is about 2097.7mm, with the maximum of 321.1mm in April and the minimum of 105.6mm in November.

The southwest winds dominate the whole year, with the southeast, northeast and northwest incurring the rest. The average wind speed is 3m per second, and exceeds 4.1m per second in March and April, and reaches to 1.9m per second in August. Nature disasters include drought, flooding, low temperature, frost, hailstone and gale.

1.2.3 Soil, Vegetation and Biological Diversity

The Typical soils in Shilin National Park are red earth, locally called as the specific plateau mountain red earth, and calcareous soil.

The Shilin plant geography belongs to the Pan-Arctic flora, the Sino-Himalayan forest subrealm, the Subregion of Central Yunnan Plateau. The area, 32% covered in forests, conserves and lays out the typical subtropical plateau karst ecosystems. There are 7 kinds of vegetation types：evergreen broad-leaves forest, sclerophyllous evergreen broad-leaves forest, deciduous broad-leaves forest, subtropical needle-leaves forest, the shrubs and grassland with sparse trees, shrub, meadow ,and one kind of the typical plateau karst lake aquatic community—plateau *Ottelia acuminata* community. Among the vegetation, *Castanopsis delavayi* forest , *Cyclobanopsis glancoides* forest and *Cyclobalanopsis delavayi* forest are representatives of plateau karst evergreen

broad-leaves forests ; sclerophyllous evergreen broad-leaves forests, such as *Quercus cocciferoides* forest and *Quercus franchetii* forest, are ancient epibiotic having derived relation with paelo-Tethys vegetation.

In Shilin Park, there are a wide variety of seed plants divided into 72 families, 615 genera, 820 species. There are 8 species belonging to a national level protected species, such as *Psammosilene tunicoides*, *Paeonia delavayi franch.var.lutrea*, *Ottelia acuminata*, ect. ; 20 species from provincial level protected, such as *Gleditsia delavayi*, *Zizyphus mairei*, *Hymenodictyon flaccidum*, ect. ; over 100 species from the endemic and rare plants in the Shilin County, Kunming City and the Yunnan province, such as *Impatiens loulanensis var. intermedia*, *Salvia breviconnectivata*, ect. 30 species in the Shilin park are now included in The Species Red List of China.

Based on historical records and present surveys, there are 185 Chordate species in the Shilin area, including 42 mammal species, 87 bird species, 32 reptile species, 12 amphibians, and 12 fish. Among them, there are 7 mammal species and 8 bird species under the protection of the national level at the second class.

1.2.4Hydrology and Water Resources

The head water of The Ba River, the main river in Shilin County, originates from the north part of the Shilin National Park. The Ba River runs into the center of the Park from the northeast to the southwest, passing by Lunan Basin, and finally at Grand Waterfall, going into the river Nanpan of the Pearl River System, an important water system in South China. Besides the Ba River, there are more than eighty Karst lakes in the Park, for examples, the Changhu Lake, the Yuehu Lake, and the Yuanhu Lake, and more than fifty ponds and springs. Nine subterranean rivers had been discovered (Tab.1-1). The abundant water resource in the park, on the surface and underground, reaches $2.72\times108^{8}m^{3}$, accounting for 47.9% of the total water amount in the county, in which the underground water reaches $0.91\times10^{8}m^{3}$, 33.4%. The park is located in the upper part of the Lunan Basin, the productive and living center of the Shilin County, and provides the spaces for the key water reservoirs and water conservtories of the County, which provides nearly 70% of all the water used.

Tab. 1-1 the main karst lakes and subterranean rivers

No	Name	Location	elevation (m)	Areas, depth	Strata	Extending Direction	Hydraulic Gradient	Features
1	Stone Forest lake	Mid Part	1750	0.3 km^2	P_2、E	NE-NW		Modified karst lake, Pinnacle-acrete karst in the lake. Yi ethic villages beside the lake
2	Lv-fang reservoir	Mid Part	1762	0.4/	P_2			Built up from small karst lakes, Stone Forest slope, Stone Forest hills along the bank of the lake, Eocene system occurring on the banks of the lake.
3	White cloud reservoir	Naigu	1827	>2 km^2	E、$P_{3ß}$			Also called the Tuanjie reservoir, built up from the small karst lakes and occurring beside the Naigu shilin, catchments areas of the Ba River.
4	Changhu reservoir	South Part	1890	0.54km^2	D、C、P_1	E-W		Distributing into Fengcong and built up from small karst lakes. Form.Pinus yunnanensis, semi-humid broadleaves forest around the reservoir, typical aquatic vegetation of Yunnan-Guizhou karst plateau lakes (Form. *Ottelia acuminate*); firstly constructed in the early 17th century.
5	Yuehu reservoir	North Part	1880	2.97km^2	D	Nearly E-W		Distributing into the karst hills, semi-humid broadleaves forests and planted coniferous forests along the banks of the reservoir, Yi ethic villages around the reservoir, firstly constructed in the later 16th century.
6	Heilong-tang Reservoir	Mid and South Part	1708	1.5 km^2	P_2、E	NE-SW		Constructed in 1545 and colleting water from ascending karst springs. Stone Forest crest and Stone Forest slope around the reservoir, sparse coniferous vegetation and caves are also around it.
7	Heishan-Sibeihou sinking stream (-1)	North Part	1814~ 1844	2km^2	P_2	300~ 325°	15‰	Distributing in the north of the Park and extending to 300~325° in direction, the depth being 6~10m, the flow being 172~4.69 *l*/s, but changing greatly, three top windows along the underground river, occurring as ascending springs and entering into the Ba river; spitzakarren rock city, Stone Forest slope and Stone Forest hills being along the river.
8	Maoshezu-Xiaocun village sinking stream (-1)	Northwest Part	1880~ 1870	2.6km^2	C、P_1	Nearly E-W	3.6‰	Distributing in the north-east of the Park and receiving direct runoffs for recharging; extending in a 250° direction; the depth being 7~10m, flow quantity being 1134~18 *l*/s, karst hills and solution depression raising above the river level.

9	Xiaolinkoupu-Tianshengguan-Beidacun village sinking stream (- 2)	North part	1880~1790	10 km^2	C、P1、P2	From N-S Changed to E-W	9‰	The mouth of the underground river extends in a N-S direction and then turns to NE-SW towards the middle; cutting into P_1d aquifuge, the depth being 8.3~22.5m and flow amount 375~57 *l*/s, 14 top windows along the course; Stone Forest slope and hills and stone teeth over the course, reoccurring and entering into The Ba river in Beidacun village.
10	Tongjiazhuang-TianShengqiao sinking stream (-3)	Mid to West Part	1750~1700	3.8 km^2	P2	N-S	13‰	Entrance in the north west and receiving the recharge from the direct runoffs, flow amount being 3477~1159 *l*/s, 1 top window in the course; Stone Forest depression, Stone Forest valley over the course; reoccurring in Tianshengqiao and recharging into river Ba
11	Shuitangpu-Bailongtang subterranean river (- 4)	Mid Part	1880-1710	12 km^2	P2	Nearly E-W Changed to N-S	14‰	Occurring in the middle of the Park; consisting of 3 small subterranean rivers in the upper course; extend from E to W and then turn NW in the middle course; 6 top windows and 15~20 m buried depth; flow amount being 1264~133.2 *l*/s; Stone Forest depression, Stone Forest slope, Stone Forest valley and crests over the course; reoccurring as an ascending spring in Bailongtang and flowing into The Ba river
12	Weiboyi-Heilongtang subterranean river(-5)	Mid And South Part	1800-1720	9 km^2	P_2	S-N Changed to E-W	17‰	Distributing in the middle of the Park and consisting of 2 small rivers. NNW Extending in the upper course and turns to NE towards Qingshuitang village; flow amount being 1300 *l*/s, 8 top windows and 50~103m buried depth; Stone Forest depression, Stone Forest slope, Stone Forest crest, Stone Forest valley developing over the river; meeting another underground river in Heilongtang and recharging into The Ba river. Major Stone Forest and Minor Stone Forest occurring over the course.
13	Maoshuitong cave subterranean river (-6)	South Part	1750-1730	2 km^2	P2	Nearly E-W	10‰	Distributing into the south of the park; Stone Forest crest and Stone Forest develop along the river.

1.3 Human geography

1.3.1Nationalities and Population

The seven sites of the paleolithic relics were found along the banks of the Ba river lower course, and the neolithic relics in caves near Lake Yuehu. The population there is made up of 20 ethnic nationalities such as Han, Yi, Miao, Zhuang, Bai, Hui, Hani, Wa, Dai, Yao, Lahu, Shui, and Lisu etc. Among these, Yi people amount to 33.3% of the total, and in the southern part of the park, the Yi nationality reaches 90%. There are over 50 villages in the park, respectively distributed to the depressions, lakesides, and the intermediate belt between karst hills and basins. The population density reaches to 160/ km^2. However, the Core Zone, for the South China karst World Heritage Nomination, is low in population density, 17 persons / km^2 with 4000 local people inhabited, most of them being Sani people, a branch of Yi nationality.

1.3.2Land use and economic activities

Of the 350 km^2 of the Shilin National Park, farmlands hold 39.9%; forest 36.2%; Stone Forests18.5%; water2.4%; all kinds of constructed fields 2%; lone hills and grassland 1.7%. But, in the Core Zone of the 120.7 km^2 area, there is only 1.07% farmland.

The land tenure in the park is diversified such as state-owned, rural collectives-owned, contracted by inhabitants and by enterprises.

1.3.3 Economy and Folk Cultures

The main economic activities are involved into the tourist industry, agriculture, and stockbreeding. The income form tourism consists of the main part of the revenue of the local government, and the income of local inhabitants varies from the tourist industry, the service industry, farming, the animal industry, and the construction industry. With the annual net income of the rural resident reaching 2800 yuan, and that of the urban population reaching 6000 yuan, the mean annual income of people in the tourist spots of the park is considerably higher than that of the people in other places of Shilin County.

The local ethnic culture has a strong identity, including folk culture, costumes, arts and crafts, all kinds of ethnic festivals (e.g. Torch Festival), and ethnic songs and dances performance. All of them have been the important tourist attractions for Shilin tourist

industry.

1.4History of the Shilin Park

Shilin Park was firstly officially designated in 1931, and in 1942 the Construction Committee of Shilin park was founded by Lunan County, and then in 1964 the Stone Forest Management Division was founded. In June of 1980, the jurisdiction of the park was transferred from the provincial government to the Shilin (Lunan) County government. On Nov. 8th 1982, Shilin Park was issued by the State Council of the P.R.C. to be the national key scenic region or National Park, and The Management Bureau of Shilin National Park was authorized in June 1992. In March of 2001, Shilin National Geopark was officially designated by the Ministry of Land and Resources and it was then issued as a member of the Global Geoparks network with the assistance of UNESCO in February of 2004. Even with multi-attributes, the administration of the park is the only management setup and responsible for the management of the Stone Forest and landscapes, as well as other valuable heritages in the park.

1.5 Identity, Functions, Size, and Zones of Shilin National Park

Identity: Conserving Stone Forest/Shilin karst that is a characteristic of global significance, distributed in the Core Zone of Shilin National Park, and as well related to folk cultural heritages.

Functions: firstly carry out an effective comprehensive strategy for protecting Stone Forest, geologic relics, natural environment, and water reserves; secondly on the basis of the principle of the ecological and cultural sustainability, efficiently develop the Stone Forest, local cultural resources for promoting the development of the local society and economy and culture.

Area and zoning of the Park: total area is 350 Km^2, the core zone is 120.7 km^2, including a superfine protective zone and the first level one identified in the revised Master Plan of Shilin National Park in 2004; the Buffer zone is 100.21 km^2,including in the second level protective part in the Master plan, and the Proving Zone/Tourist serving zone with protected farmland is 129.09 km^2, including the third level protective zone in the Master Plan.

1.6 Key Points of the Management Plan of Shilin National Park

1.6.1Formulating and Responsible Organizations

The Management Plan of the Shilin National Park is formulated on the basis of the revised Master Plan of the Shilin National Park (2002-2030) in 2004 and The Operational Guideline for the Implementation of the World Heritage Convention (2/2005) and to be carried out by The Management Bureau of the Shilin National Park

1.6.2Ends of the Management Plan

(1) Carrying out the strategy of the developmental purposes designed in the revised Master Plan of the Shilin National Park (2002-2030) in 2004

The purposes include protecting and improving the natural environment of the park via applying an inscription to the World Heritage list in terms of the criteria of the World Heritage, especially protecting Stone Forest, natural vegetation and local ethnic culture; to improve infrastructure and serving facilities of the park for promoting sound development in regard to the Shilin tourist industry and better serving the social-economic developments of the Shilin County; to play a key role in deriving a coordinated development of the surrounding towns and villages evenly; and to make the Park into one of the top-ranking parks, famous both domesticly and worldwide.

(2) Ensuring the effective protection of the natural heritages that meet the criteria set up by the Operational Guidelines of Implementation of the World heritage Convention.

The stone forest in the park meets the basic criteria Ⅶ and Ⅷ for the World Heritage.

Criteriavii: Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

The property of the park which is suitable for Criteria **vii** is the vivid Stone Forest which is not only combined with a plateau landform, red earth and forests, but also merges into ethnic cultures, living concepts, and art pursuits. It achieves great view and admirational values. In addition, Stone Forest is reputed as the “Source of Gardening” owing to its dramatic shapes and the “model of Chinese Classic Gardening”.

Criteria viii: Be outstanding examples representing major stages of the earth's history, including the records of life, a significant on-going geological process in the development of landforms, or significant geomorphic or physiographic features.

The corresponding characters of the park are the unique Stone Forest/Shilin karst and its unique long evolutionary history. The Shilin karst is an extreme form of epikarst landform composed of pinnacles and spires of up 30~50m high and fretted with rillenkarrens and other impressive karrens. On the rolling plateau surface, with altitude of 1720~2200m, numerous stone forests distribute in patches and clusters on various topography, from hilltop to slope, from depression to basin, from valley to lake, every one having an impressive feature. On the world scale Stone Forest is unrivalled in the multi-phase complexity of its morphological evolution from the later period of the middle Permian epoch, to the present, and a wonderful combination of various phase's morphology. It encompasses within just one district all representative styles of 'Stone Forests'. Individually, a stone pillar or column may take the shape of a needle, fin, spire, mushroom, or whatever unsual shape. Collectively, Stone Forest patches occur as a pinnacle, column, mushroom, and /or pagoda groups together with more irregular shapes. Shilin Park gives a wonderful picture of geological evolution history of the Yunnan-Guizhou Karst plateau of Southwest China from the later Permian epoch to the present.

(3) Perfect management of integrity of the Shilin Park in terms of requirement from the operational guideline of the World Heritage convention.

The integrity required refers to a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes. The contents of the integrity include all elements necessary to express its outstanding universal value, and the adequate size to ensure the complete representation of the features and processes which convey the property's significance; and to suffer from adverse effects of development and/or neglect; and the relative intactness of biophysical processes and landform features. Even so, attention should be paid to the dynamic state of the natural areas and their contact with

people, such as human activities from traditional societies and local communities in the nominated area. As long as all of these activities are ecologically sustainable, they can be considered to be consistent with the outstanding universal value of the place.

With the basis of Criteria vii, the integrity of the Stone Forest comprises all the attractions maintaining its natural beauty and the space exhibiting its wholeness; and with Criteria viii, it covers all or most of the elements related to Stone Forest, both their landscapes and evolving relics, as well as its intact space.

Hence, the required items in the Shilin National Park include: the distinct heritages and enough space for effectively protecting them, such as various kinds of Stone Forest, their evolving relics, and correlating physical phenomena, e.g. vegetation, soil, and Karst hydrology; the clear boundaries of the nominated area with strong land-marks; the perfected laws and ordinances; the executable Master Plan; the improved management framework with corresponding staff; and the acceptance and involvement of both the communities and the residents in the park management.

(4) Realizing the social-economic goals of development stated in the revised Master plan for Shilin National Park, and ensuring the development of the park along with direction described by the Master Plan and the Operational Guideline for the Implementation of the World Heritage Convention.

The social-economic developing goals stated in the Master Plan of Shilin National Park are:

- improve the general social quality by nominating Stone Forest to the World Heritage and the World Geopark;
- promote sustainable development of the Shilin tourism industry;
- improve regional agricultural development by readjusting the agricultural structure and environmental rehabilitating, diversified agricultural economy, and constructing ecological sightseeing farm belts;
- prove eco-agricultural villages characteristic of Sani Ethnic traditions by improving the villages in the Shilin areas and by developing rural cultures, especially the Yi culture;

- readjust rural domestic energy structure and produce patterns which are contradictory to the protection of the park and diminish pressure on karst environment as much as possible;
- improve rural communities' infrastructures; develop rural education and train the local people in regard to practical skills and make a fare and just mechanism which benefits local stakeholders from the Shilin tourist industry, no matter who, communities, local farmer and town residents and enterprisers, government's units; and do its best to improve living conditions for local communities and residents
- make managers and other stakeholders aware that the utilization of the property of the Shilin Park must be ecologically and culturally sustainable, and can not damage the values, integrity and/or authenticity, and therefore, some construction and models of developing resources in the park are not accepted by the future of the park and the Criteria

(5) Efficiently put into effect the environmental goals stated in the revised Master Plan of Shilin National Park.

- strictly protect the stone resources such as Stone Forest both on surface and underground and natural vegetation
- carry out the strategy of revegetation in the core zone and other protective zones, cultivate scenic vegetation for both improving the landscapes and enhancing the values of the park
- focus on rehabilitating and restoring the damaged landscapes and plots from quarrying, farming, and road building
- protect the headwater areas and water resources, especially the underground water;
- Strictly carry out environmental standards and procedures set by government and corresponding regulations, and do its best to dispose the wastes and sewage from all activities in the park.
- Generally, the ultimate purpose of environmental construction and protection is to make Shilin National Park into an outstanding identifying characteristic of the unique Stone Forest, geologic relics, naturalness, local ethnic cultures and

the finest attractions through coordinating local various causes and industries.

1.6.3 Brief summary of the Management Plan

(1)Identifying values of interest in Shilin National Park, and ensuring the required space for protection of the park

(2)Arguing matters threatening the values of the park, and defining its development and the corresponding aims of management

(3)Putting forward an effective strategy for zoning and classifying the park management and implementing aims for the protection of values of the park and its basic space

(4)Providing the sub-area’s plans of management and executing points for the integral development of the park and the realization of the social and economic aims of the local region.

2. Values of the Shilin karst and its protected situation

The main protected objectives in the Shilin National Park are the Stone Forest/Shilin karst, relative geological relics and naturalness of the park, as well as the Sani culture of the Yi nationality. The Stone Forest is the key item being nominated to the South China Karst World Heritage Nomination.

2.1 Values of the Park

With comparison of Stone Forest to other karst sites worldwide, particularly those inscribed on the World Heritage List, the key values of the Shilin national Park have been assessed to be a scientific, aesthetic, cultural landscape, as well as a water source area. Among these, the scientific and aesthetic values provide the basis for the park joining the South China Karst World Heritage Nomination.

2.1.1Scientific values

"Stone Forest" is probably the earliest recorded karst term in the world. As an unusual and special landscape, Stone Forest attracted people's attention long ago, the term "Stone Forest" appeared for the first time in a famous poem "Ask Heaven" written by ancient Chinese poet Qu Yuan 300 B.C. It was questioned in the poem 'Is there really a Stone Forest in the world?' In 1931, the former Yunnan provincial governor Long Yun visited Shilin in his inspection tour, greatly enchanted by the exceptional beauty of the Stone Forest scenery, he wrote two Chinese characters "Shi Lin" (Stone Forest) to name the forest-like landscape. From these after, "Stone Forest" or Shilin became the formal name of this spectacular karst landform, and Long Yun's calligraphy was later inscribed in a giant stone pillar – one of the most well-known symbols of the Stone Forest. It was also in 1931 that Stone Forest Park was established. Because of a long and typical scientific study, the various Stone Forests or pinnacle karsts have been identified with the understandings of its much greater evolutionary complexity.

(1) Stone Forest and other landform

Within the Park's more than 300 square kilometer area and 500m altitudinal gradient, Stone Forests occurred as clusters or patches over the karst plateau topography. Based on topographical locations and associated with other karstic landforms, following typical

stone forest types can be classified within the park:

Stone Forest occurred on depressions: Many stone forest clusters occurred in karst depressions where surface water and groundwater concentrated and connected. Within the depression stone pillars densely distributed on both bottom and slope. On the depression center there is often a window of subterranean river, and some stone pillars are standing on the water. Major Stone Forest, and Liziyuan Stone Forest, are good examples of this type of stone forest.

Stone Forest occurred on hilltops: Stone forest clusters occurred right on hilltops or mountain ridges like the case in Mt. Wenbi, Gaoshitou and other hilly areas in the southern part of the park. Usually the clusters are composed of sparsely distributed residual stone pillars. These locations previously were high in hydrodynamism.

Stone Forest occurred on karst valley: In regards to Wangchengshan, Heiqingtou and Daqingpo where stone forest clusters occur on a valley slope and bottom. Usually on the valley bottom there are springs or subterranean river windows, showing favorable hydrological conditions

Stone Forest occurred on hill slopes: Typically in the southern hill county, stone forest clusters occurred on some hill slopes. If one slope is occupied by a stone forest from top to bottom, there will be many tiers, showing the stone forest “generation”, older stone pillars on upper slope and younger ones on lower slopes.

Stone Forest occurred on isolated hills: In the north-central area of the park, long term erosion and solution have moved fractured rock, and relatively intact rock blocks remained as isolated rocky hills. Usually residual stone pillars stand on hilltops. .

Stone Forest occurred on basins: In the flat northern area, such as in the vicinity of Beida Village, there are sparsely distributed stone forest clusters. Like isolated rocky hills, they are also the result of long periods of erosion.

(2) Morphological features of the Shilin

With Comparison to other remarkable pinnacle karsts in the world that were usually dominated morphologically by one main shape, Shilin National Park preserves and displays a most abundant morphological diversity. Almost all existing pinnacle karst types can be identified in Shilin, which makes its claim as the museum of pinnacle karst.

Individually, a stone pillar or column may take the shape of a needle, fin, spire, mushroom, or whatever unique shape. Collectively, stone forest clusters represent the following four major shapes:

Pinnacle-shaped Stone Forest: Developed mainly in thickly-bedded Maokou pure limestone, displaying typical pinnacle karst feature as other celebrated pinnacle karsts in the world such as the Bemaraha of Madagascar and the Mulu of Malaysia, etc. This type of stone forest is characterized by a sharp blade fretted with typical rillenkarren and honey-comb karren. The Major and Minor Stone Forest are good examples in the park.

Column-shaped Stone Forest: Largely developed in dolomitic limestone, since the rock is lithologically uneven and more resistant to weathering than pure limestone, stone pillar usually lack sharp spire and edge, Yingpan, Douhei, etc. are typical representatives of this type.

Mushroom-shaped Stone Forest: Developed in both dolomitic limestone and limestone, when a stone pillar is made from medium-thin bedded rock and suffered basal solution or collapse due to the gravitational effect, the pillar then takes mushroom shape. Wannianlingzhi and Naigu are ideal sites for this kind of stone forest.

Pagoda-shaped Stone Forest: mainly occurring in medium bedded Maokou limestone, when severe solution takes place along a bedding plane and nearly separates the rock horizontally, the pillar takes a pagoda-shape and looks like a pile of balanced stones. Akaoyi and Suoyishan are the best examples of this type of stone forest.

(3) Rock surface solution feature

In addition to the macro-karst – stone forest and stone teeth, a wide variety of micro-solution forms occurred on the rock surface such as karrens, solution grooves, solution holes, solution pans, solution slots, solution channels, etc. Lithological property controls an obvious rock surface solution; in general, a surface solution of dolomitic limestone, because of inhomogeneity, is more ragged than that of pure limestone.

Various solution surface patterns are not purely beautiful pictures contributing to the appeal of the park, but also important imprints reflecting upon subsoil, subaerial, and biological solutions suffered by the rock. For many stone pillars, the upper part are fretted with vertical karren, or rillenkarren which is obviously the result of subaerial solution by

rainwater, and the lower part are characterized by horizontal grooves or channels, which is the result of subsoil solution by groundwater. The tiny solution holes and pits are the work of likens

(4) Outstanding universal values in term of geology and geomorphology

Through comparison with other celebrated similar karsts in the world, following conclusions can be drawn for Shilin National Park:

- The park is the only area in the world that preserves and displays Shilin karst landform or pinnacle karsts developed over the last 200 million years;
- Compared to other stone forests in the world, the park is unrivalled in the multi-phase complexity of its evolution from the middle Permian epoch to the present;
- Pinnacles in the park display greater morphological variety in regard to individual features than anywhere else;
- Stone forest and associated various other landforms constitutes an integrated karst landform system and provides an excellent example illustrating various karst processes.

2.1.2 Aesthetic values

The park displays unique natural beauty and is of great aesthetic value. Because of its rich morphological diversity, the unrivaled natural beauty displayed by Stone Forest has long been praised in China. The well-known Chinese painter Mi Fu (1051-1107) has summarized the strange beauty of the stones in four words, i.e. “thin, wrinkled, holed, and penetrated”, and Stone Forest is complete in all aspects of beauty. Everywhere in the stone forest there are odd rocks, which rarely exist in many other famous mountains in China. Stone forest is a marvelous spectacle created by nature and its rock-shapes are more beautiful than the pictures painted by painters and more attractive than the rockeries forged by garden-makers. Stone Forest is the natural model of the Chinese rockery-making art, the natural example of the traditional Chinese painting and an inexhaustible source of inspiration for painters and garden-makers.

The assemblages of the odd rocks in the Stone Forest are countless and varied. There are single-shaped models such as “Stone Elephant” and “Stone Camel”; double shaped

models such as “Two Birds Feeding” and “Mother and Son Traveling Together”; two spectacles of one stone such as “A Camel Riding on an Elephant” and one spectacle of a collection of stones such as “the Stone City”. There are two rocks snuggling up to each other like two lovers meeting after a long separation and one rock towering aloft among a group of rocks like a herdsman tending sheep. In the Major and Minor Stone Forests the closely spaced rock-pillars, which are only 2~5m apart, provide a wide vision to visitors who may relax their tense mind and feel carefree and content while walking among them. The change of rock combinations is unlimited. Thus it is serving as a reference to any aesthete.

The sheerness and magnificence of the Stone Forest doesn’t exist in height or size, but in a breathless thrilling. The ‘Sword-blade rock’ sits on a small stone, and “A Critical Situation” looks so dangerous as if the rocks may fall. This is dangerous in a visual sense. To climb up and down the “Lotus Peak”, one seems to sit on a mountain of knives and swords. This is the danger experienced by the mind of the tourist. Stone Forest impartially distributes this beauty regarding danger, i.e. the danger of an object and the danger in the feeling of the subject. Stone Forest is a theoretical treasure house of aesthetics.

Stone Forest’s beautiful wilderness contains the aesthetical principle of primitive nature. When you are personally on the scene, walking on the rock block, entering the rock gates, stepping on wild weeds and exploring secluded woods, you will find everything fresh and new, singing birds on the rocky hill, densely-dispersed precipitous rocks, whiffs of a mountain breeze and sweet flowers, an intensely wild smell of the mountain bringing you back to remote primitive times. Only that state can help people build up the artistic conception of the natural beauty of the wilderness.

Most of the scenes in Stone Forest are not named, which not only has kept the inherence of a wild nature beauty, but also leaves as much room as possible for people’s aesthetic appreciation, letting them return to their childhood to hear the sounds of nature. In this sense, Stone Forest is a great teacher of aesthetics.

Quiet stone forests, murmuring streams, stretching mountains and mirror-like lades are in harmony with mother natures. Blue skies, white clouds, and green hills, and big rocks are in harmony with heaven and Earth. The outlines of stones, hills, lakes, ponds,

green and black, white and brown are in harmony with shape and color. Birds singing in the woods and flowers blooming all over rocks are signs of harmony between human beings and their surroundings. Lastly the national myths and legends, the rock inscriptions and poems are an integral part of nature in Stone Forest.

2.1.3 Cultural landscape value

The Sani people, a branch of the Yi nationality, are the dominant minority group settled in the stone forest area. There has been a long-standing relationship between human society and the Stone Forest landform. Partly because of the low local relief and positioned well for easy transportation between Yunnan and its neighboring eastern provinces, not only agricultural civilization has been developed in the Lunan basin but also a distinctive relationship between the native people and the karst landform has been established through its history.

Through a long human history, the Stone Forest landform has been endowed with a rich ethnic cultural context, the Yi nationality, particularly the Sani people, has helped to develop their colorful customs in the Stone Forest area. Stone Forest deeply influenced cultural and living concepts of Sani people of the Yi nationality. It encouraged the formation of an ethnic culture and became the symbol of the spirits of the Sani people and at the same time the representative of their physical lives. Because there is an obvious linkage between the culture and Stone Forest, the culture has been regarded as a “stone culture” or a “Stone Forest culture”. Folktales, poems, housing styles, festivals and celebrations all exhibit the long historic connection with Stone Forest. The epic “A-Shi-Ma” enjoys great popularity. The lively and bustling “Torch Festival”, the bright and cheerful dance “Axitiaoyue” (dance to music), and the affectionate song “Guests from afar please stay here” are known far and wide. Every stone pillar has its own story. All the stone forests, the villages, the local housing, Mizhi Mountain/local “Dragon Mountain or the mountains worshiped by local people” and Mizhi forests, that is a forest preserved by local tradition, ponds and springs, red earth, and the pastoral lands recorded the lives of the Sani people. All of them embody the supreme principle of Chinese aesthetics, i.e. integrity combining the natural with human being.

2.1.4Water resource and headwater catchments

Currently the surface and ground water of the park and the adjacent Lunan basin constitute a typical karstic water system, featuring a typical local plateau drainage area and not only does it demonstrate the interrelationship between water and karst landform in the period since at least early Tertiary, but also being a significant headwater for local people. The park is located at the mouth of the Ba river and the upper part of Lunan Basin. Its water quality directly dominates the water quality of the locally used water. With a total amount of 2.72×10^{8} km^2, the abundant surface and underground water in the Park takes up 47.9% of the water reserves for the county, of which the underground water reaches 0.91×10^{8} km^2, taking 33.4%.

2.2 Land Tenure f the Park and the Impacts

Shilin National Park is the home of the Sani people. With Paleolithic relics, the inhabitant history can be traced back to 300 B.C. There are over 50 villages, located around the karst ponds, karst lakes, the higher levels of riversides, the intermediate belt between karst mountainous areas and the Lunan basin. The population density exceeds 20person/km^2. The main economic income generates from agriculture. And the proportion of farm cropped lands overruns 70% of the farmed lands. Although ratio of farming land is made up of nearly 40% of the area of the park, the farmland in the Core Zone is small. The area of forests, zonal vegetation and planted forests, and scrub land covers over 36% of the total area of the Park. Even so, there still exist threats to the outstanding Shilin Karst and its integrity from the land development, including the local tourist industry, in peripheral areas. Although long agricultural activities have not damaged the valuable Stone Forest, and created significant living and productive styles with harmonious effects of the local karst environment, a special integrity of agriculture, grazing, villages, vegetation and the Stone Forest, serious phenomena are occurring from grazing and farming in the Buffer Zone. As well as those in the Proving Zone/Tourist serving zone with protected farmland have evidently invaded into the Core Zone, and at the same time, some producing activities, such as the tourism industry, mining and infrastructure construction, also have been /are being the serious or potential impact on the naturalness of Stone Forest. The increase in the population and living costs in the

periphery of the Core Zone, and the increased productions, such as farming and grazing, and other land development, with more waste, overrun the environmental-bearing capacity of the circumjacent area of the Core Zone, and more seriously is extending to the Core Zone.

2.3 Tourist industry in Shilin Park

Stone Forest, because of its geographical uniqueness and exceptional natural beauty, has long been a tourist attraction. Pioneer tourists and adventurers explored part of the park area in as early as the fourteenth century (Yuan Dynasty), leaving many descriptions, poems, and inscriptions praising the marvelous natural landscape. In 1931, the Major Stone Forest of the park formally became a public park, and in 1982 it was designated by the state government as a national park and in 2001 as a national geopark. Stone Forest has become one of China's major tourist attractions. Tourism highlighted by the stone forest has become one of Shilin County's pillar industries, and "Stone Forest" has become a big name far beyond academic field. The number of tourists increased frapidly by then, which exceeded 1,000,000 in 1988 and 2,000,000 in 2004. The main tourist activities are for sightseeing and scientific purpose tours and at the same time for holiday, health, folk and eco-tourism products. The significant tourist spots in the park include Major Stone Forest and Minor Stone Forest, Naigu (black) Stone Forest mixed with Sani folk arts, and other spots such as Grand Waterfall and Lake Changhu. Of these sites, about 95% of the tourists choose Major Stone Forest and Minor Stone Forest, and 95% of them are one-day sightseeing trips.

Domestic tourists always choose stone attractions as their first choice, followed by folk cultural attractions, caves, environment, local history, vegetation attractions, and pools and lakes. The favorites are items with natural beauty or vivid cultural contents. interestingly, the main attractions for international visitors are listed in order by stone attractions, lakes, vegetation attractions, folk cultures, caves and local history and they prefer folk art tour activities and the intact attractions of stones, waters and vegetation the most. The first choice of both the international and domestic tourists, the stone attractions, reflects the values and the correctly identified protection objectives and their significance in the park.

The tourist development of the park has brought various impacts on its values, both negative and positive:

(1) Providing the necessary funds for protection and research

(2) Effectively displaying the earth heritage , the scientific and aesthetic values, of which are not only well known in the earth scientific field, but also with the public

(3) Promoting the protection of local biodiversity together with protecting the stone forest

(4) Promoting the development and renaissance of the local culture, such as the Sani culture

(5) Diminishing the load from land development and creating new ways for regional social and economic sustainable development

(6) Meanwhile increasing the burden on the karst environment and sanitary facilities because of an increasing numbers of tourists

(7) Reducing opportunity for restoring local vegetation because of using too many exotic species for revegetation and landscape gardening as well with the Sani culture impacted because of an exotic culture

(8) Impact on the wilderness and naturalness of Stone Forest and the circumstance of traditional rural landscapes because of an increase buildings and architectures

(9) Impact on some geological heritages, geological landscapes and the karst hydrological systems because of mining and quarrying limestone or special marble in the periphery areas.

3. Directions and Strategy of Management of Shilin National Park

The key goal of the management of Shilin National Park is to effectively protect its outstanding universal values and demonstrate them. The chapter outlines a strategy of management for the realization of the goal on the base of the revised Master Plan of Shilin National Park (2004-2030) and for applying Shilin National Park to the inscription on the list of the World Heritage.

3.1 Protection of the Outstanding Values of the Park

Since issuing the Rules of the Lunan Shilin Park in 1991, the zoning of the park has been carried out on the base of Interim Articles of the Management National Parks of the P.R.C issued by the State Council in 1985. Its revised Master Plan (2004-2030) has defined four zones on the distribution of Shilin Karsts and their integrity in 2004.

Specially Protected Zone: Including Naigu Stone Forest, Wangchengshan-Qingshuitang Stone Forest, Wenbi Mt.-Suoyishan Stone Forest, covering a total area of 45.02km^2. The Special Protected Zone is largely in a pristine state and under absolute protection, without any man-made buildings inside, entry is prohibited except for scientific study. This zone, meanwhile, is also ecological protection area, a special scenic area and/or an important geological site.

The First Class Protected Zone: Including some important Stone Forest clusters and scenic spots such as Major Stone Forest, Minor Stone Forest, Long Lake, and Grand Waterfall, covering 69.9km^2. Within the first class protected zone, there are necessary track and limited tourist facilities, but automobile are prohibited.

The Second Class Protected Zone: Immediate peripheral area of the first grade protected area, covering 121.61km^2.Serving as the buffer area of special and first grade protected zone, this area contains some tourist and accommodation facilities, but non-tourist related facilities and automobile are restricted.

The third Class Protected Zone: Outermost and boundary zone of the park, covering 113.46km^2.This zone serves as the coordinating area of the whole park and delimits the boundary of the Park, within the zone construction and facilities are under control and must be in harmony with the nature of the park.

With the management ends of the various protected zones with its values, some potential threats have been found out.

(1)The specific protected zone and the first class protected zone:

- **Naigu Stone Forest**:

The values: The model place of the unique dolomitic limestone Shilin karst, key relics of the Shilin karst's development, underground hydrological systems, the relationships between Shilin karst and caverns, subterranean rivers, the superlative natural beauty of black Shilin karst, the local important cultural attractions, and headwater of local key the Ba river.

Situation of Protection: the Core Zone, Buffer Zone, and Proving Zone/Tourist serving zone were chosen with protected farmland, and patrol inspection, reoccurring of endemic vegetation, the Shilin karst landscapes and geologic relics are well demonstrated.

Potential threats: Sporadic farmlands, continual deforestation, some exotic species from replanting and some invasive species, frequent farming and grazing in surrounding areas, and influenced underground waters.

- **Major Stone Forest and Minor Stone Forest, Liziyuan Stone Forest**

The values: Classic model of superlative Shilin karst developed in pure limestone, various vivid stone pillars and fine relics of the Shilin karst evolution since the middle Permian epoch and dynamic process, typical Sani village and ethnic attractions, water catchments areas in the underground river.

Situation of Protection: t the Core Zone, Buffer Zone, and Proving Zone/Tourist serving zone were chosen with protected farmland, patrolling inspection, Shilin karst well displayed; zonal vegetation restored.

Potential threats: Overrun tourism; too many large buildings and tourist infrastructure; dense tourist route nets; influenced waters; impacted karrens; sweeping exotic species and invasive species; and sporadic farmlands, grazing.

- **Qingshui Pond-Shixiangzi Shilin karst**

The Values: Rich relics of Shilin karst evolution and diversified Shilin karst, typical wilderness and the naturalness of Shilin karst, various vegetation and catchments area of the local reservoir and underground rivers.

Situation of Protection: the Core Zone, Buffer Zone, and Proving Zone/Tourist serving zone were identified with protected farmland, and patrolling inspection.

Potential threats: land-tenure of both collectives and individuals, farming, grazing and deforestation; quarrying and economic forests planting; invasive species and poor living facilities in rural communities nearby the zones.

- Wenbi Mt.-Suoyi mountain Shilin karst

The Values: Various Shilin karsts developed from both dolomitic limestone and limestone ranging from 1900 to 2300 a. s. l.; wilderness and the naturalness of the Shilin karsts, remnants of zonal vegetation and ethnic villages.

Situation of Protection: the Core Zone, Buffer Zone, and Proving Zone/Tourist serving zone were chosen with protected farmland and patrolling inspection.

Potential threats: land-tenure of both collectives and individuals; farming and grazing, and deforestation; invasive species; quarrying and economic forests planting; over-cultivated land, poor living facilities in rural communities nearby the zones.

(2)The second class protected zone

The values: the Shilin karst and the relics of Shilin karst's evolution out of the Core Zone , the significant hydrologic attractions and headwater of the river and underground rivers, the local vegetation.

Situation of Protection: Identified Shilin karst attractions, specified requirements for vegetation protection, and local customs for protection of the Mizhi forests.

Potential threats: Over-farming, grazing and deforestation; various constructiion projects which would change karst landforms; exotic and invasive species; agrochemicals and pesticides; human waste; a poor infrastructure.

(3) The third class protected zone

The values: important hydrologic attractions, headwater and evolutionary relics of the Shilin Karst out of the buffer zones as well with some of the geologic relics and local vegetation, and cultural attractions.

Situation of Protection: Identified hydrologic attractions, headwater, Stone Forest attractions, vegetation, cultural and historic relic.

Potential threats: intensive farming, grazing and deforestation; various construction projects (architecture construction and roadway construction); exotic and invasive species; poor infrastructure; quarrying and mining.

3.2 Developmental Direction of Shilin National Park

The developmental direction of the park encompasses the following: firstly zoning and classifying; and secondly realizing the functions of the zones, and finally conserving and increasing the values of Shilin National Park with sustainable use of the stone forest.

3.2.1Zoning and Defined Functions

The area of the park was divided into three zones (Tab.3-1): the core zone which is part of the South China Karst World Heritage Nomination, Buffer Zone, and Proving Zone/Tourist serving zone with protected farmland. The functions of various zones are identified as the following（Fig.3-1）.

The Core Zone: The highly protected part of Shilin National Park. Protection here focuses on the outstanding Shilin karst, evolution's relics, the evolutional model of stone forest and its integrity with zonal vegetation. The core zone includes the Naigu Shilin karst, Major and Minor Stone Forest, Luomadong Shilin karst, Qingshui Pond-Shixiangzi Shilin karstand, Wenbi Mt.-Souyi Mt. Shilin karst.

The Buffer Zone: it refers to the periphery of the core zone as well as with Changhu Lake, and the Grand Waterfall. The functions of the buffer zone are to provide a buffer space to prevent the stone forest, geologic relics, vegetation, and naturalness in the core zone from the impact of human activities. In addition to that, it will keep the integrity of the natural and aesthetic attractions; preserve the wholeness and continuity of the Karst hydrological system and water reserves in the Shilin National Park, and at the same time protect the typical stone forest attractions and other evolutionary relics outside of the Core Zone, and other karst and aesthetic attractions.

The Proving Zone/Tourist serving zone with protected farmland: Located outside of the Buffer Zone, the Proving Zone/Tourist serving zone with protected farmland includes the second-class protected zone and the third-class protected zone. Its functions are to reduce the impact of human activities on the Buffer Zone, protect the stone forest,

the geologic relics, the local vegetation, and the cultural attractions in the Ba river drainage area. Generally, it is important to protect the integrity of the stone forest and its relics of evolution.

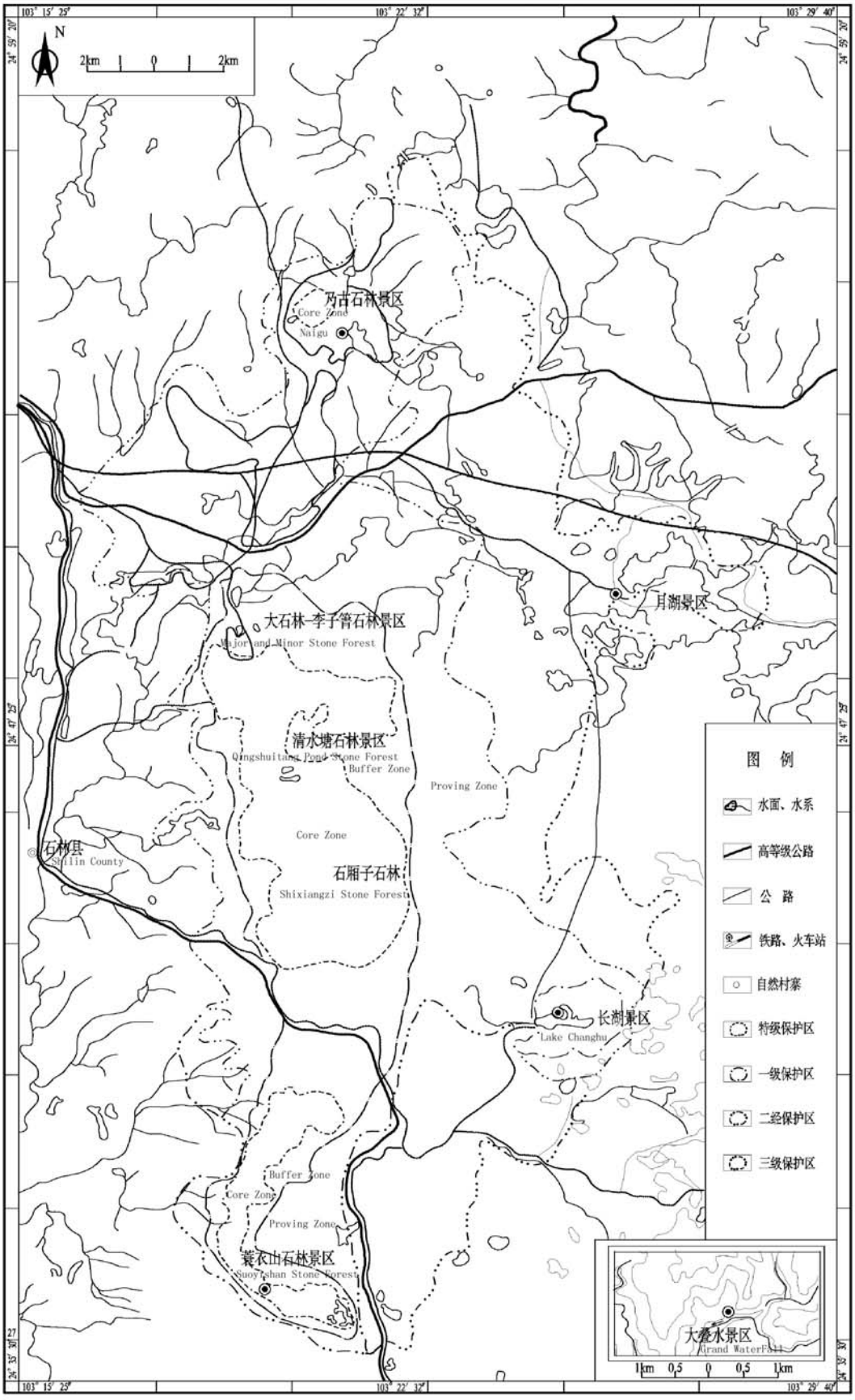


Fig.3-1 Schematic Map of Zoning of the Shilin National Park

Tab. 3-1 Zoning of Shilin Park and Heritages Spots

Zone	Names of Heritages Spots	Values	The Part of the Park
Core Zone	Naigu Stone Forest, Baiyun Cave, and subterranean rivers	Typical Shilin karsts qualified for ***Criteria VII*** and ***Criteria VIII.*** Of the World Heritage and Naturalness	Naigu
	Major and Minor Stone Forest, Ashima Pillar, Bushaoshan Stone Forest, and Stone Forests of Liziqing, Tiankongling, and Luomadong		Major Stone Forest-Liziqing
	The Stone Forests respectively at Shuangjian Mountains, Fairy Lake, Gaoshitou,, Leidashi, Daoshitou, Wangchengshan, Shixiangzi , Grandpa expecting Grandma, Yingpan, Daqingpo, Laohuqing, Liuyingtang, and Shihuangniu.		Qingshuitang - Shixiangzi
	Stone Forest respectively at Wenbi Mt., Suoyishan, Dawanqing and their vegetation		Wenbi Mt. -Suoyishan
Buffer Zone	Stone Forest respectively at Hemo, Zhantun, Pudoucun, Heiqingtou, and Tuanjie Reservoir.	To protect the Core Zone and the integrity of Shilin Park and Structure of the Karst hydrologic system and water reserves	Naigu
	Lake Bimutan, Wannianlingzhi Pillar, Shilin Lake, Lufangtang Pond, Stone Forests at respectively at Sifangtang Shuangtangzi, New Tourist Center and vegetation, and the zonal vegetation in Wukeshu Village.		Major Stone Forest-Liziqing
	Stone Forests respectively at Shangpucao, Heilongtan, Qingshuitan Village, Shuitangpu and Mizhi forests		Qingshuitang - Shixiangzi
	Shuijinshan Stone Forest, Douhei Stone Forest, and Geyihei Stone Forest.		Wenbi Mt. -Suoyishan
Proving Zone/Tourist serving zone with protected farmland	Stone Forests at Heishitou, Shibanshao, Sibeihou, Baozidong , Huoshipo, Ayilin, Majianshan, Shaorenchang, Daqingshan, Railway Station, Wanyaoshan, Guweishan, Stcokbreeding field , Sanjia Village, and Daqing.	To provide the spaces for the integrity of the park and the attractions of Shilin cultures, and to protect scattered stone forest and geologic relics.	Naigu
	Zhiyun Cave, Jibailong Cave, natural bridge, New Tourist Center, Stone Forests at Daxiao- Jianshan, and Jialianshan.		Major Stone Forest-Liziqing
	Zumo Stone Forest.		Qingshuitang - Shixiangzi
	Suoyishan Stone Forest.		Wenbi Mt.-Suoyishan
	Lake Changhu and Grand Waterfall.		Lake Changhu, and Grand Waterfall
	Stone Forests at Laohuangshan and Laoguanshan.		The third class protected zone.
	Qifengdong Cave, Lake Yuehu and vegetation, Huaishidu Stone Forest, Dalaowa Ponds, Mopanshan vegetation, and Sheshan Stone Forest.		The third class protected zone.

3.2.2 The Functions and Activities of the Zones and their boundaries

The Core Zone: Strictly conserving the naturalness and maintaining the natural state of Shilin karsts; prohibiting all construction activities, especially quarrying and differestation; restoring the degenerative vegetation and artificial forest with a local species; forbidding hunting; eliminating invasive species; and prohibiting polluted water from entering into the zone, stopping farming and grazing for revegetation. The delimiters of the boundary lines between the Core Zone and Buffer One are based on the topography, hydrological structure and inner human activities, For example, the north delimiter from the entrance of Minor Stone Forest, through Natural Dancing Field and Lion Pavilion, to the west section of the Rounding Tourist Trail-entrance of Liziyuan and Mushroom Pillar; the west from Mushroom Pillar-Luomadong to Qingshuitang village path, and the South one from Qingshuitang village path to Laoyingtan, and the east from Laoyingtan through Daqingpo and Liuyingtang-sifangtang to Bushaoshan.

The Buffer Zone: Furthering up the protection of stone forest landscapes; conserving and maintaining the integrity of evolutionary relics and karst ecological systems; establishing basic trails and facilities for tourists and tourist service which could not do damage to the topography, landscapes and geological environment; protecting rural attractions; prohibiting deforestation, quarrying, hunting and extended farmland; strictly controlling grazing areas, and actively replanting and landscaping along the sides of roads and lakes. The inner boundary line of the Buffer Zone is with the Core Zone and the definition of its outer line depends on the integral structure of karstic relics, topography, and hydrologic units as well with human activities.

Proving Zone/Tourist serving zone with protected farmland: Coordinating space for the Buffer Zone and tourist-serving infrastructure; furthering up replanting, landscaping and environmental reconstructing; controlling of felling, quarrying and excavating soil; repairing all sorts of damaged sites; removing factories and some enterprises which would cause contamination; forbidding all kinds of polluted materials and activities, readjusting farming structures; and developing pastoral scenery. The outer boundary is the boundary of the 35000 ha of the park.

3.3 Strategy of Protection and Management

3.3.1Scientific Value Protection

The scientific value of the Shilin National Park, which is the first item in regards to joining in the South China Karst World Natural Heritage Nomination, manifests in the Shilin karst and their natural and cultural attractions, mainly in the types of the Stone Forest, relics of their evolutionary history, modeling sites of Stone Forest's development, the pattern of their distributions, and landscape identity. Protection should be based on strict identification of the quality of Stone Forest and carried out on zoning and classification as described in the 3.2 section with the following measures.

The concrete measures are firstly to protect the sites characteristic of global significance in the earth science by conserving their appearance, wholeness, complete relics of the evolutionary and the dimensional patterns, and secondly to maintain natural combination of the Stone karst with other elements such as geological structure, rocks, vegetation, soils, and superficial and subterranean hydrological systems. Both of these two methods should be carried out under the protection principles for those exposed geological sites and integral geological ones.

The exposed geological site refers to the geologic sections and attractions exposed by the natural processes or other ways. The main ways for protecting them are to keep their occurrence, and maintain the natural exposition of special types of stone forest. The integral geological sites mean the harmonious state of the Stone Forest with rocks, geological structure, hydrological system, soils, landforms, vegetation and local ethnic styles, any damage to any of these elements will decrease their quality. The ways for such sites are to pay attention to conserving and maintaining the coordinating state of all elements free from damage and biological invasion. From this the realization of a coordination of geological diversity to biodiversity is made with splendid landscapes within the stone forest.

3.3.2Aesthetic Value Protection

The aesthetic significance of Stone Forest, which is another factor for joining in the South China Karst World Natural Heritage Nomination, is the splendid shapes and the dramatic structure of the stone forest as well as with a background of typical subtropical

karst red plateau and wonderful Sani culture. The stone forest is reputed as the natural model of Chinese Classical garden art.

The aesthetic values of the stone forest are protected together with its scientific values including naturalness, diversity, uniqueness, integrity and dependency. The area for tourism should be kept free of any obstacles that interfere with human activity. Generally, the exposed landscapes should hold its openness and convenience for visiting and studying, and be accompanied with nice and suitable vegetation from the local species, such as the suitable composition of trees, bushes, liana and grass together with the controlling of sizes, types and buildings; and protecting algae on the surface of rock. The integral landscapes should be protected as with the wilderness including natural bodies ofwater, seasonal scenery free from invasive species and poor construction. Attention must be paid to protecting and restoring local fauna and flora.

3.3.3Hydrology and water reserve protection

The main contents for protecting the hydrology and water reserves in the park include the headwater and catchments of Ba River, and the complex systems of underground rivers. The hydrogeological relics in the Park are an important part of the scientific values of the stone forest, which express the dominating factors of stone forest's evolution, such as surface and underground water system, solution basal level, caves, windows to subterranean river, springs, and ponds. From the view of water reserves, surface and underground water distributed in the park is basic for the water resource of the Shilin County as catchments of the Ba River and Heilongtang reservoir which provides nearly 75% of the water needed for the county.

Their protection should be carried out from points, lines to areas with recording the sites of hydrologic relics and bodies of water in the Core Zone, Buffer Zone and Proving Zone/Tourist serving zone with protected farmland, and combined with protecting the natural scenery, local vegetation and recovering of climax communities around the sites, trying to cultivate suitable hydrologic conditions for artificial waters, with no use of chemicals in the headwater areas.

3.3.4Cultural Landscape Protection

The cultural landscapes are complements of the scientific and aesthetic values of the

stone forest, and also an important part of the tourism industry in Shilin County, which is good for rejuvenating and advocating the local ethnic culture, for example of the Yi nationality, in the park's region.

The Shilin cultural landscape generally refers to an integration of complex and traditional settlements, the life styles, and folk arts of the Sani people of the Yi nationality born in the stone forest area, such as slabstone house, red earth house, Mizhi mountain and Mizhi forests (local worshiped hills and forests), springs, farming, grazing goats and cows over the stone forest field, ethnic costumes and cuisines (Sani, Axi, Baiyi, and Heiyi of Yi), ethnic folk arts and sports (wrestling, bullfighting, and the Torch Festival), and religions and nature worships (totem and procreation worship) as well as the embodied ideas of ecologically controlling and producing. The best way for preserving them is to popularize and develop them.

For traditional settlements, it is suggested to keep their appearances and modernize the interior with an improved rural infrastructure, to advocate the traditional knowledge of biodiversity protection and water protection, strictly to preserve remnants of zonal vegetation existing in Mizhi forests, to ameliorate rural infrastructure by creating and maintaining the coordinating styles of traditional settlements to modern architectures with natural beauty, to strengthen water protection and landscape restoration, to develop folk tourism and eco-tourism, and to readjust family energy structure to reduce felling, to readjust a growing structure in rural villages for both increasing output of crops and a good environment for the local tourist industry, and to control soil erosion, to change the styles of nomadic grazing with rules of environmental capacity and combining of feeding in a pen with in the field in order to restore local vegetation.

Besides those, the nature worship sites found in the park should be *in situ* protected with marking and improving the environment. For ethnic costumes, cuisines, folk arts and sports, it is advised to keep and develop, and nominate as non-substantial cultural heritage if necessary. At the same time, creating the atmosphere for admiring folk artists and promoting the learning of their skills by developing them into special tourist attractions are very important.

3.3.5Biodiversity Protection

Protecting of local biodiversity is also equally crucial to protecting the stone forest and the environment in Shilin National Park. The idea that local biodiversity and endemic vegetation are the identity of the park should be kept in mind. The key items of local biodiversity are the local climax vegetation or zonal vegetation such as *Cyclobalanopsis glaucoides* forests, *Cyclobalanopsis delavayi* forest and *Castanopsis delavay* forest and *Quercus cocciferoides* forest, *Quercus franchetii* forest, and rare and endangered species such as *Psammosilene tunicoides, Toona iliata var. pubescens*, *Calocedrus macrolepis*, *Neocheiropterris palmatopedata, Nouelia insignis, Zelkova schneiideriana Han.-Maz, Paeonia delavayi var.-lutea, Ottelia acuminate* and other local protected species, and some other local cavern creatures and soil animals such as *Boysidia shilinensis, Formosana lunanensis, Triplophysa shilinensis* Chen et Yang, and *Sicocyclo-cheilus macrocephalus* Li, *S. oxycephalus* L*i, S. lunanensis, Anabariliu golden*-linus Li et Chen*).* Because of the fragmenting of zonal vegetation and intensive disruption from human activity, lots of local animals and birds disappeared, and the opportunity such as the habitat and dispersing of local species propagula for reappearance of local vegetation are very weak. So, attention should be paid to creating a basis for the ecological restoration and landscape restoration. The main measures are the following:

- protect forests and green-lands according to laws and regulations, develop local techniques for biodiversity protection, and pay attention to developing the tradition, ideas and significance of Mizhi Mountain and Mizhi Forest
- strictly conserve remnants of local climax vegetation scattered in Mizhi Mountain and promoting the recovery of local vegetation in the park by effectively closing natural evolution
- make full use of the park's protected status to promote restoration of local vegetation both in natural evolution and by replanting local seedlings collected and bred in the park's eco-region
- set up the networks of local vegetation by afforestation along the roads and in other public green-lands for building up the local species' reservoir and dispersing banks

- gradually readjust the rural family's energy structure and reduce felling for deforestation
- monitor water quality and prevent the park from polluted water
- control exotic species and eliminate invasive ones
- allocate the special area outside of the Buffer Zone for centrally developing economic forests and to control them in natural forests, especially in the climax vegetation
- construct methane ponds in rural areas as a substitute to firewood

3.3.6 Demonstration of Shilin National Park

The effective demonstration of values of interest in the park is the best way for protecting the stone forest and the realization of the sustainable development, ecological and cultural, of the region which the park belongs to. The main ways for demonstrating are the following.

(1)The museum of Stone Forest

The museum can completely and systematically display the values of the park in ways, both traditional and modern, such as words and maps, pictures and sounds, three-dimensional animation and concrete modeling, interpretations and booklets, including:

- natural history and regional geology of the park
- the stone forest: types and shapes, evolution and relics, scientific and aesthetic significance, and modeling demonstration
- hydrological systems and water reserves in the park
- biodiversity of the park
- human history of local nationalities and their culture
- new ways for protection and sustainable utilization of the park's resources
- displaying other Stone Forests or pinnacle karsts around the globe
- outline the future/prospect of the Park in both protection and development

(2)Books, albums, tourist maps and booklets，VCD and DVD

- heritages and their sites in the park and resources of the park

- ethnic cultures and cultural attractions in the park
- the ordinances and regulations of protection related to the Park
- touring and recreational maps in the park and the county
- natural history and wilderness of the park
- biodiversity of the park and outlines of ecological restoration
- publications about the Park, for example study of achievements, biological, and geological, cultural and historical
- a variety of VCDs and DVDs about the park

(3)Identification's system, including:

- register stone forest's trade mark
- promote the image of the park and demonstrate the identity of the Stone Forest, for example, hanging up the icons, such as National Park, National Geopark, member of UNESCO Geopark Network, National Top Tourist Scenic Area(4A Tourist Scenic Area), National Exemplary Area for Civilized Tourist, and etc.
- Zone's identifying system, namely, introduction to Shilin National Park, maps of the heritage sites, and the brief look at the zones and cultural landscapes
- Delimiters of the various zones with clear descriptions and good plates made of sorts of materials suitable for the sign
- An signing system for spots of both scenic tourist and relics: marking those spots that well demonstrate unique values of the stone forest such as geological value, landscape value, biological value, and hydrologic value, and cultural and historic relics
- Identification for management and business in the park: signs for the management buildings of the park, staff uniforms, signs of the park administration's property, patrolling signs, signs for donation and investments, icons of enterprises and business
- signs for tour guides and security, e.g. signs for tourist roads and trails, tourist spots, sanitary signs, traffic signs, emergency signs, security signs and tourist serving signs, supervising signs
- signs for tourist serving standards for guides, food and souvenirs, and

accommodation

(4)Signs for public promoting and marketing, referring to:

- signs for Internet advertising and marketing
- promoting signs with a variety of public media and advertisement hoarding
- window demonstration of the park's development, scheduled and unscheduled

3.3.7 Management of tourist projects and tourist security

(1) Management of tourist projects

- all sorts of tourist projects, including proposals, must be controlled by the laws and regulations of the park and be consistent to the revised Master Plan of Shilin National Park
- all tourist projects must reach the standards defined in the Master Plans of Shilin National Park and Shilin World Geopark
- Strictly control the sites of tourist projects and other business on the basis of the zones' management
- The projects can not damage and spoil the ecological and cultural sustainability of the park

(2)Management of tourist security

- the Management Bureau of Shilin National Park controls tourist activities on the basis of classification and zoning management and environmental capacity
- provide and improve serial signs for tourist roads, tourist areas and tourist activities
- all tourist activities must meet the standards of the park management and can not conflict with local ethnic tradition
- The Management Bureau of Shilin National Park must be responsible for the security of all tourists and provide all posted warnings for the security of all tourists
- set up a network of monitoring security and patrolling which is in effect day and night
- improve the emergency system of the park with qualified staff, devices and techniques, money and regulations

3.3.8Assessment and Management of all constructing and developing projects

The projects here refer to tourist service facilities, public infrastructure, local

housing' construction, ecological restoration and landscape restoration. No matter which, from the government, enterprises and groups and individual, domestic and abroad, the projects and their feasibility must be assessed and proved not only in terms of benefits and values, but also in terms of its potential risks which may be serious to the park. So there must be strict standards and procedure for assessment, inspection of projects, which must correspond to national and local laws and regulations, as well as to international management practices.

(1) Assessing contents of construction and projects.

- impacts on the Shilin heritages, geological relics, landscapes and local cultures
- impacts on the natural beauty and attractions
- impacts on surface and underground waters, and hydrologic systems
- impacts on local biodiversity and the climax plant communities
- impacts on the stakeholders involved in the park and the protection of the park, especially on improvement of local communities, both farming and residential
- impacts on traditions and cultures
- carry out strict environmental assessment standards with a veto system for environmental impacts management

(2)The assessment system for construction projects

- inspection of assessment procedures for proposal of the projects, forms of relating units' assessment, ordinances and regulations qualification, to integral consultation from stakeholders, experts` arguments and public noticing, and follow-up
- assessment of the project plan; involved in public bidding of planning, plan assessment and public notification of the plan, and inspection by the units of interest in the government and legal censorships
- supervision of the project's construction, including the public bidding for construction, material used, and construction progress and quality
- checking for acceptance of the constructed project; referring to the corresponding technique criteria, environment criteria, attraction criteria, and security criteria, etc.

3.3.9Scientific Investigation and Monitoring

(1) Contents

According to laws and ordinances, and the revised Master Plan of Shilin National Park, monitoring and studying should be carried out in the park and the monitored items can be divided into three parts; namely, the situation and trend of the protected objectives, the change of land-used structure, and the environmental monitoring in order to provide the basis for improving the management of the park and set up the database of the park's environmental change and protected objectives. The items involved are:

- monitoring of geological relics and Stone Forest: quantity, distribution and natural appearance
- monitoring of biodiversity: communities, populations and species, rare and endangered species, aquatic species, cavern creatures, soil animals, famous and ancient trees, habitats
- monitoring of the dynamic tendency of the Stone Forest: solution ratio, carbon cycle, hydrologic condition including water level, runoff, and hydro-chemical indexes
- monitoring of the environmental quality's indexes such as atmosphere, water and soil
- monitoring of the land-used structure, the chemicals used on farmlands and forests
- analyzing of tourists and population change: quantity, places, consumption, interests and motivations
- Supervision of tourist service quality and management of complaints from tourist

(2) Setting up scientific investigation and monitoring networks:

- fixed monitoring networks for karst kinetics, biodiversity, atmosphere, hydrology and tourist activities
- database on the basis of GIS, RS, GPS
- monitoring-and-patrolling networks from residents, social communities, town and villages, to the Management Bureau of Shilin National Park and local government
- Organization system of qualified units and staff for monitoring and controlling
- An improved and qualified system for assessing
- supervising system to assess and monitor: supervising of monitoring, assessing, and analyzing of the monitored and assessed results and making predictions about the park's development

3.3.10The management organizations and educating and training of staff, including partners

(1)Management organizations

- set up management organizations and supervision systems matching Shilin National Park on the basis of the laws and regulations
- perfect the duty's system and operational mechanism for all levels of management from the government of Shilin Yi Autonomous County, the Management Bureau of the Shilin National Park, villages and town, social communities, staff and all of its employees
- establish an efficient internal organs of the Management Bureau for Shilin National Park for effectively carrying out the duty system of the park
- improve the group of scientific and technical advisory and perfect technical aid system for the park management
- perfect the negotiating system for dealing with complaints and conflicts, among the related departments of the governments, the bureau, communities, enterprises and investors, local inhabitants and the qualified units
- reform the management mechanism and improve the conditions of the bureau to ensure the effective protection of the values and integrity of the park

(2)Management and educating and training of staff

- set up an efficient staff team qualified for carrying out the management of Shilin National Park in both professionals and specialists, and a 70% of the staff consists of professionals and specialists
- put into reality the responsibilities for each post and carry out a comprehensive quality management
- persist in the post's management system consisting of the post qualification, post achievement, training in advance of taking post, scheduled post examination and on the post (job) training
- set up an efficient educating and training system for all of the staff from on-job training to off- work training for improving their posts' ability
- edit a training text book about the values, protection and development o f the park

from techniques to related laws and regulations, for both staff, local people and all of its stakeholders

- set up a mechanism for communicating experiences and skills, and discussing the park's management

3.3.11 Financing the park and distribution of management resources

The resources for park management include professionals, fund and devices, information and land.

(1)Financing the Park

- funds and allocated lands from all-levels, the central government, provincial government, and municipal and local government, to the donation of persons, groups and enterprises
- income from the tourist industry in the park
- donated devices and volunteers' service

(2)The distribution resources

- all the resources are distributed under the plan as a whole by the government and managed directly by the Management Bureau of Shilin National Park
- all of the resources must be controlled and partitioned by the Management Bureau of Shilin National Park on the basis of the reasonable mechanism accepted by all stakeholders
- the resources must only be used in the protecting, restoring engineering and monitoring, staff training, scientific popularization and education for the park
- strictly supervise the use of resources and improve self management of the Management Bureau of Shilin National Park with scheduled publishing of the resources to the public and the stakeholders

3.4 Construction of the Management Database

3.4.1Contents of the database

- basic data of Stone Forest: types, location, relics, physical attributes, human activities(including land use), significance, situation of protection and development, land tenure
- basic data of geological relics: kind, location and geologic significance, physical

attributes, human activities (including land use), situation of protection and development, land tenure

- basic data of biodiversity: vegetation and area, list of composed species, location, icons and distribution, land tenure; rare and endangered species lists, location, distribution and icons; famous and ancient tree lists, location, icons and distribution; local plant communities including Climax plant ones, location and distribution, habitat; planted species records including names, place of origin, site, raising measures and occurrence, planting records of local species including name, distribution, collecting methods and sites, breeding and protecting measures
- basic data of hydrology and water reserves: water registering: river, lake, reservoir, spring, water channel with name, owner, location, attribute and catchment area, situation; water condition registering: history, physical attributes, human activities and development and protection; controlled water registering: distribution, quality, disposal and flow of the living and producing waters in Stone Forest; the hydrologic system registering of the park: names, distribution, origins, attributes, collection areas, physical conditions and human activities; and hydrology observing data: observing sites, contents etc.
- meteorological data: meteorological elements with time, analyzing reports, and meteorological disasters in history
- data of human geography: population and distribution, villages with names, sites, history, population and physical conditions, land types and area, and economic activities and capital income; and living conditions: traffic, houses, water resources, devices and family energy
- land-used structure: kinds, size, spatial distribution, owner and land tenure and user, land quality, soil erosion situation
- basic data of the Management Bureau of Shilin National Park: staff, real estate, financial affair, capital, investment and enterprises
- basic tourist data: number and structure, guest places, spatial and temporal structure of tourist activities, consumption, travel modes and preferences, tour guides, tourist facilities and recreation facilities, tourist infrastructure

- basic data of scientific investigation and study: project and sponsor, achievement including thesis, books, reports, plans and proposals, observing records, and researchers and groups
- basic maps: geological map, relief and landform map, geologic environmental map, aerial photographic image, satellite imagine map, landscape map, land-use map, vegetation map, population map, hydrological map, key resources map, rare and endangered map, famous and ancient trees map, etc.

3.4.2 Management Databases Types and Techniques

- literature and maps database: managing all word files, recorded data and maps, pictures
- supporting techniques from 3S techniques, namely the Geographical Information System, the Remote Sensing and the Global Positioning System, as well as Internet technology
- basic information database for management based on the 3S techniques: monitoring, recording, analyzing and assessing, and forecasting, and renewing new data
- constructed period, going into use before 2010

4. Management Plan of Zoning and Classifying

Shilin National Park will be managed on the basis of Zoning and Classifying. The Defined zones are the Core Zone, Buffer Zone and Proving Zone/tourist serving zone with protected farmland. The details of the zones mentioned above are in 3.2 sections.

4.1Management Plan for the Core Zone

4.1.1 Definition and area

The Core Zone, which is nominated for South China Karst World Heritage Nominations and includes the Specially Protected Zone and The First Class Protected Zone defined in the revised Master Plan of Shilin National Park, contains all heritages of interest for protection with naturalness, uniqueness, integrity, diversity and beauty of the stone forest. There are fewer human activities and some patches of natural vegetation, especially patches of climax communities characteristic of subtropical karst plateau zonal vegetation with rich endemic species and dense forests. The area of the zone is 120.7 km^2, including four patches.

- Naigu Stone Forest
- Wangchenshan-Qingshui Pond
- Wenbi Mt.-Suoyishan with an elevation range from 1800 to 2203m a.s.l
- Major Stone Forest and Minor Stone Forest.

4.1.2Management measures

- fairly and justly readjust the land tenure and its management in the Core Zone for the purpose of effective protection of the relics in Shilin National Park in accordance with the laws and regulations
- combine legal protection with traditional conservation from local customs in order to maintain natural conditions for evolution of the local vegetation and stone forest
- perfectly preserve the geological relics and conserve the natural conditions and the diversity of Stone Forest with local biodiversity in the park
- prohibit construction and production, such as mining, quarrying, felling, and avoid fire disasters
- create habitats suitable for the evolution of artificial forests towards to local

vegetation with specially fostering and replanting of local seedlings

- forbid illegal hunting and polluted water in the zone
- allocate the lands for monitoring and studying and limit the number of people allowed into the zone
- strictly control transportation and prohibit certain motor vehicles and animal-driven carts

4.2 Management Plan for the Buffer Zone

4.2.1 Definition and area

The Buffer Zone refers to the peripheral areas of the Core Zone together with Lake Changhu and Grand Waterfall spots, including:

- Northern boundary and part: from the north to Hemo Stone Forest, south to the Nanning-Kunming Railway Road, east to the Ba river, and west to Pudou Stone Forest
- Southern part and boundary: from the north to Lufang Pond and Shuangtangzi Pond, south to the Suoyishan, east to Shuitangpu-Suogeyi road, and west to the border of the special –class protected zone; involving Major Stone Forest and Small Stone Forests, Bushaoshan Stone Forest, Geyihei Stone Forest, Shihuangniu Stone Forest,Tiankonglin Stone Forest, etc.
- Lake Changhu: with the north to Zumo Road, south to Shuangjian Mountains, east to Xiaotuanshan, and west to Jiuxiang-Shilin-Aluguodong Road; including Mopanshan Fengcong, Lake Changhu, and Dushishan fengcong
- Grand Waterfall: comprising Ba river, Dakehe River and Qingshuihe Valley

4.2.2 The Measures of Management

- strictly protect the natural conditions of Stone Forest and prohibit any activities which would damage the landforms and relief, except for building those basic tourist walking routes and sightseeing facilities
- prohibit the construction of any facilities that are of no interest to sightseeing, and control the amount of motor vehicles allowed into the Zone
- control those facilities which would spoilt the beauty of Stone Forest and its wilderness, and keep in mind those who just want to experience Stone Forest
- Landscape the sides of transportation routes such as roads and railways with seedlings, local and nice exotic, for both attractions and dispersing corridors of local species
- strictly confine expansion of rural housing and maintain the traditional styles of architecture while improving rural infrastructure
- restore the natural environment of water reserves by returning the farming land and

grazing land beside the waters to vegetation

- forbid felling, mining and quarrying, illegal hunting, and protect the zone from fire disasters
- control sewage

4.3 **Management Plan for the Proving Zone/ Tourist Serving Zone with protected farmland**

4.3.1 Definition and area

Proving Zone/Tourist Serving Zone with protected farmland, outside of the Buffer Zone, includes part of the second-class protected zone and the entire third-class protected zone for reducing the impact on the Buffer Zone and protecting the important geological relics, the local vegetation, significant cultural attractions as well as water reserves with a total area of 135.73 km^2, including Shilin Town, Beida Village, Weize Village and Lake Yue and other places of importance.

4.3.2Management measures

- all buildings, construction and tourist facilities should be characteristic of the local nature and history, and no interference with the natural beauty
- reinforce asforesting and improve the environment, and construct domestic energy bases and control the use of chemicals
- prohibit all activities which will do harm to attractions, the environment, geologic relics, water and local vegetation; and avoid fire disasters
- reconstruct damaged lands with local plant communities and some exotic species adapted to the Shilin region
- promote scientific and techniques and make full use of local skills for protecting biodiversity and water reserves; develop distinctive agriculture, forestry and animal husbandry by readjusting planting and raising structures with pastoral restored landscapes
- speed up construction of the rural infrastructure and improve environmental sanitary conditions in village and towns, control human wastes

4.4 Management on the classification protection

4.4.1 The protection of the landscapes and geological relics/sites

The landscapes defined here refer to all stone forests, stone teeth field, hills and depressions, fengcong, waterfalls and caves in the park. The geologic relics defined here are those relics of the stone forest's evolution, geological events, hydrogeology, including strata, fossils, geologic structures, ect. All of those demonstrate significant of interests in

the park. And therefore, it is necessary to carry out strict protection. The main measures include:

- prohibit quarrying and excavating, and carry out an efficient way to avoid fire disasters
- prohibit transporting of the stone pillars to places outside of the park
- return farming and grazing lands to vegetation and control the use of chemicals in the following areas: the peripheries of Stone Forest with the range of one time stone pillar's height, the range of 100 meters away from Stone Teeth field and fengcong, and the catchments areas of the underground rivers.
- encourage using local species for afforestation and promote natural restoration of local vegetation with suitable artificial aids
- publicize the lists, plans, skills for protecting Stone Forest, geologic relics/sites, species and vegetation with the prospects of Shilin National Park

4.4.2 Protection of ethnic cultural attractions and local plant communities

The ethnic cultural attractions refer to those characteristic of local history, customs, arts, religions, living ideas, and relics of the Yi nationality in the park, including traditional housing, architectural styles and materials used, costumes, arts and crafts, spoken and performing arts, festivals, producing styles and tools, and nature worship idols. The local plant communities refer to those vegetation characteristic of habitats of the Shilin region, especially those climax communities in Mizhi Mountain. The measures of protection are:

- publicize the ethnic cultural relics in the park with signs marking sites and significances and the protection required
- rationalize the local producing structure for the park and help wealthy locals with enriching the local cultural tourist products from folk song, dancing performances, folk arts and crafts to ethnic rural tourism, eco-tourism, cuisine tourism,etc.
- publicize the lists and icons of the places of the Mizi Forests, local climax plant communities, rare and endangered species, famous and ancient trees with cultivating techniques, as well as invasive species and their distribution and possible negative impact/danger

- combine the protection of the local architecture styles, the settlements, and surroundings with improving the infrastructure and sanitary facilities in rural areas
- keep in mind that any new construction and buildings should be in harmony with the integrity of the park and local traditional architecture; and the materials used for decorating the outer architecture design of the buildings and construction should not spoil the surroundings of the zone
- strengthen managing of raising livestock, both in nomadic and in the pen, and to protect waters and water scenery in villages
- make and publicize the plans and strategies for rejuvenating local ethnic cultures and restoring local vegetation with prospects of the villages and towns in mind

4.4.3Protection of Waterscapes and Hydrographic Relics

Lakes, waterfalls, reservoirs, the Ba river, subterranean rivers and karst springs are included here and the main measures for protection are the following:

- Marking the characteristics and significance of each attraction and relics
- preserve the natural beauty, and control soil erosion around all water, and carry out plans for ecological restoration and landscape restoration with the main goal of restoring local vegetation and integral structure of hydrological systems
- prevent the park from pollutants
- coordinate necessary building and architecture with the waterscapes and natural conditions

4.4.4 Restoration and Protection of Landscapes beside Railways, Highway and Tourist Routes

The landscapes beside means of transportation into the park are considered the windows to the park and they should be protected and repaired if any damages may occur. The main measures include:

- prohibit construction of any new means of transportation in the Core Zone, and control the new roads and railways across the Buffer Zone
- carry out the plans for ecological restoration and landscape restoration beside transportation routes mainly by natural selection in the park under the principle of taking advantage of good scenery, and getting rid of unpleasant scenary

- cultivate dispersing networks of local species along the sides of transportation routes, the land tenures of which are state-owned and collective, by landscape localization; and avoid the urbanization of landscapes
- use ecological materials for construction and ecological friendly vehicles for the park's transportation, such as battery-run vehicles
- mark significant attractions along the routes, such as landscapes, species and relics

4.4.5 Construction of the Entrances of Shilin Park and Protection of natural Surroundings

The main entrances to the park are the final stop of the Kunming-to-Shilin highway, which the Ashima Cultural Ecological Garden is found and goes to the new tourist serving center; the entrance to Naigu Stone Forest, the entrance to the Major Stone Forest sightseeing areas, the entrance to Grand Waterfall, and the entrance to Lake Changhu. All of these are the gateways for the identity and image of the park, and would inspire visitors to the park. The main measures for construction and protection are:

- mark the attractions characteristic of their scientific significance and clearly mark tourist routes
- strengthen to protect the surroundings of the natural attractions by safeguarding the natural scenery, and give prominence to both the natural and the cultural characteristics
- conserve or cultivate distinctive atmosphere in the areas open to tourist
- keep in mind that any construction and building for parking, tourist reception center, should not spoil the natural beauty and environment

4.4.6Construction of the Infrastructure of the Villages and Tourist Service Base

The construction of the infrastructure should be mainly involved in the residential areas, villages, tourist service areas in the Buffer Zone and Proving Zone/Tourist serving zone with protected farmland. The main measures for managing the construction include:

- protect the local residence and the surrounding characteristic of the local ethnic and natural beauty
- not damage the intrinsic landforms, and not disturb the natural evolution of Mizhi forests
- create afforestation next to all architecture

- improve infrastructures and sanitary conditions, and properly dispose of all waste materials

4.4.7 Management of the sizes and styles of construction and building

(1) Controlling the sizes and styles of architectures in the areas open to tourists

- the height of all buildings in areas open to tourists being kept to one storey and not over two stories
- materials for construction being local and ecological, instead of the modern ones such as ceramic tiles, colored glaze, glasses, etc
- the styles of new architecture being characteristic of ethnic and local flavor, and generally with the required sloped-roof
- architectural colors, preference on white, gray, green, blue and yellow, not to red

(2) Controlling of sizes and styles of architectures in other areas

The areas defined here refer to ones outside of the areas visited by tourists, including the villages in the park and the integral area of tourist service

- the stories of the buildings will normally be only two and absolutely not over three, except for special building
- materials for architecture should be local and ecological, instead of the modern ones such as ceramic tiles, colored glaze, glasses, etc
- architecture styles characteristic of the ethnic and local, generally with the required sloped-roof
- the colors for architectures preference on white, gray, green, blue and yellow, not to red
- keep afforesting coverage over 40% of the constructed areas
- buildings density preferably less than 40% of the constructed areas
- volume density of buildings being less than 0.8

4.4.8 Management of planting and creating forests

It refers to the controls of planting and creating forests in the park, especially in the Core Zone and Buffer Zone.

- set up an idea that the biodiversity and local vegetation is part of the integral identity of Shilin National Park

- publish and publicize the plans and the prospects of expected plant communities in Shilin National Park together with planting skills and list of species for afforestation
- publish and publicize the lists, icons, cultivation methods and techniques of the suggested species, especially endemic species, for local afforestation
- publish and publicize the lists, icons, and eradicating methods and techniques for dealing with harmful and invasive species
- set up a mechanism and an effective organization for checking introduced species and monitoring and controlling invasive species in the park
- allocate duty areas for afforestation to the organizations of interests in the park and county with defined aims of afforestation on the basis of land tenure, managing and running rights, and vegetation coordinated with functions of the park
- specify a leading role of The Management Bureau of Shilin National Park and the related departments of the county government in afforestation
- set up and improve seedling gardens of local species in Shilin National Park
- finance biodiversity protection and restoration and set up a fund for the protection and restoration

5. Management Plans of Sub-Areas of Shilin National Park

On the aims and requirements of the classification and zoning of park management, the management plans of sub-areas/zones should be erected, particularly for the next 10 years, and further to realize the aims of the park's development.

5.1 Management Plan for Comprehensive Tourist Serving Area

Location: in Proving Zone/the toursit serving zone with protected farmland**,** from the start to the final stop of the Kunming-Shilin highway, from the north to Sanjiacun Village, from the south to the newly built wrestling grounds, from the west to the east part of Lufangtang Reservoir, and from the east to the eastern part of Yangchang Seedling Garden

Functions: Shilin tourist service and management of the park

Projects: the center of the Shilin Ttourist Management, and Building of The Management Bureau of Shilin National Park, Stone Forest Geology Museum; center of tourist information and visitors distribution; center of educating-and-training of Shilin National Park, the center for local ethnic culture, arts, sports and festivals; tourist shopping centers, accommodations and recreation centers, the ethnic arts and crafts processing and selling centers, and the Shilin Convention center.

The management measures include:

- publish and publicize the developmental plan of the Shilin Comprehensive Tourist serving area with the current prospects of the area
- inspect all projects based on the corresponding laws and regulations and the revised Master Plan of Shilin National Park(2004-2030), all projects adopted to public bidding
- ensure that construction materials and colors match the natural beauty and the ethnic characters
- afforested species and landscapes match the management of planting and protect present local vegetation and waters
- fully afforest along side all buildings and demolished sites with demands of landscapes matching the natural surroundings(Stone Forests and Stone teeth)

- strictly control constructed materials which are non-compatible with the environment, and properly dispose of liquid waste, garbage, dust, noise and solid waste
- all of vehicles for tourists should be ecological and compatible with environment, in particular from the comprehensive tourist areas in the Major Stone Forest and Minor Stone Forest Sightseeing Spots
- improve ethnic-nationality touring guide teams and edit the series of prospectus for Shilin tours and touring maps

5.2 Management Plan of Major and Minor Stone Forest

Location: from the northern boundary of the present park through Stone Forest Lake, to the visiting areas of the Major and the Minor Stone Forests, from the southern end to Liziyuanqing, from the western end to Wukeshu Village, and Wangnianlingzhi (Mushroom Stone Pillar) and from the eastern end to Bushaoshan

Functions: the Core Zone, and the Buffer Zone and tourism

Projects: sightseeing, experiencing ethnic songs and dances, ethnic costumes displays, demonstrating values of interest in Stone Forest, protection of relics and models of Stone Forest's evolution as well as with hydrologic systems and water, protection and restoration of local vegetation

The measures for management include:

(1) For the Core Zone and Buffer Zone

- readjust the land-use structure with farmland and land for grazing returned to local vegetation and landscaped
- delimit the Core Zone and the Buffer Zone clearly marked and explaining
- demolish the unnecessary buildings, and restore environments characteristic of nature
- perfect all signs that demonstrate the values of interest in the Zones
- carry out the strict strategy of environmental and sanitary management and prevent the zones from liquid waste(polluted waters)
- control tourist flux to Liziyuanqing Stone Forest and Wangnianlingzhi Stone Forest in terms of the regulations of scientific tourism
- afforestation along the lakes and touring paths by natural methods and introduce

local species with the aims of localized attractions, especially those which are key member of the local climax plant communities and easy dispersal, and eliminate harmful species and invasive species step by step

- return patches of farmlands in the Core Zone to local vegetation, ecological planting in paddy fields in Bimutan Pond, and make the ecological orchards into attractions, and build up the forest networks along the periphery of the zones

(2) Readjusting and improving of touring patterns

- construct an integral touring space and perfect auxiliary facilities, by increasing touring areas from 1 km^2 to 3.18 km^2
- afforestation along all roads with aims of localized attractions by combining natural methods by planting suitable local and exotic seedlings, and control nomadic grazing and prevent the zones from fire disasters
- remove the entrance to the sightseeing destinations from the present to Shuangtang and construct the new comprehensive tourist service area on the basis of the plan of the Shilin Comprehensive Tourist Serving Area
- close down the routeways to the sightseeing area from Shilin town to Lufangtang Reservoir and from Lunan-Shilin Road, change the line of Luan-to-Shilin from the southwest side of the new staff residential quarter to the northwest site directly towards Shilin Town and towards new entrance, the present touring paths used as auxiliary path and evacuation route.
- construct the battery-driven car touring route from the Shuangtang Entrance,Tiankongling to Minor Stone Forest and finally to the rounded-Stone Forest-way with an increasing walk-and-sightseeing trail from 15km to 25km
- perfect tour guiding systems and edit touring and sightseeing brochures or handbooks

(3) Controlling and improving of touring routs and sightseeing spots

- reconstruct the landscapes around the Sifangtang Pond by landscape restoration characteristic of naturalness and perfect afforestation along side of the pond
- reconstruct Stone Forest Lake by demolishing and removing scattered construction and facilities around the lake while rebuilding a pre-area with a favored atmosphere

characteristic of Shilin naturalness, such as recreational attractions and green lands, before entering into the major sightseeing area, no permits for new facility construction except for basic tourist service

- permits only for dismantling in Wukeshu Village and not for new construction, i.e. demolish buildings and architectures which would spoil the values and integral attraction of the zone, retain those characteristic of local ethnic settlement and architectural style and change them for ethnic tourism and tourist service, reduce the population
- demolish the permanent building at the Wonder of Stone Forest and the Shilin Post Office building, and return the place to landscapes characteristic of nature

(4)Controlling the size of tourist guests and activities

- the maximum number of tourists per day being below 13,000 at Major and Small Stone Forest
- improve capacity analyzing and monitoring at tourist areas, and control tourist capacity at some key spots

5.3Management Plan for Naigu Stone Forest

Location: the northern part of Shilin National Park: from Sibeihou Village as the southern boundary, from Zhantun Village to the south side of Songyuan Mountain as the northern side.

Functions: the Core Zone, the Buffer Zone and Sightseeing, Eco-touring

Projects: display values of interest in Stone Forest and protect relics and models of Stone Forest evolution, particularly dolomitic limestone stone forest; protect and conserve local vegetation as well as hydrolic systems and waters, and popularize geological tours, sightseeing tours (cave showing) and ecological tours.

The main measures include the following

(1) Touring

- expand touring space from 0.59 km^2 to 0.93 km^2
- perfect facilities for touring service at the entrance including parking, food service, touring guides and shopping
- perfect recreation and holiday attractions at the western area of the entrance: including tourist reception, food service, facilities for recreation and health
- pay attention to protecting the harmonious environment of attractions with natural landscapes, and construction which obeyed the principle of low-level and small size pattern, and strictly carry out the environmental protection plan
- extend the present touring route to Damaidi Stone Forest by forming touring circling route by increasing touring pathway from 6.5 km to 11.5 km
- give up the peak-climbing route and operate battery-run cars for key circling routes
- clear up exotic plant populations and control the expansion of invasive plants
- train tour guide and edit tourist brochures or handbooks

(2)Village rebuilding

- reconstruct the Sibeihou Village for an ethnic tourist village and develop rural tours
- improve sanitary facilities and readjust domestic energy structure and reduce the use of firewood
- Readjust land-used structure for restoring nature on the basis of the revised Master Plan of Shilin National Park

- build an ethnic pagoda on the top of the Sishan Mountain as a symbol of Naigu Stone Forest

(3) Attractions and architectures

- strictly control the numbers and styles of projects/construction, and manage afforestation with clear standards for producing harmonious and integral landscapes
- return patches of farm lands in the Core Zone to local vegetation and develop pastoral landscapes
- cultivate sound environment for recreations and sightseeing in the periphery of the Buffer Zone by producing aesthetic forests, economic and fruit forests
- control nomadic grazing and prohibit hunting

(4) Environmental management

- protect Pudoucun Stone Forest and Mocun Stone Forest in the Buffer Zone as part of their integral environment
- Allocate 30m along side the Ba river from the Naigu Stone Forest for revegetation with no permit for man-made development, such as construction, buildings and farming
- prevent the catchments area of the Ba river from any non-disposed wastes and chemicals
- control chemicals in farmlands around the Tuanjie Reservoir
- control stony hills beside the Tuanjie reservoir and strive to bring back local vegetation
- improve sanitary conditions of Zhantun Village and readjust domestic energy structure and develop rural and ecological tourism

5.4 Management Plan for Wangchengshan - Qingshui Pond

Location: the central part of Shilin National Park

Functions: the Core Zone and the Buffer Zone

Projects: conserve and improve the natural environment of the stone forests, protect their relics and typical developed sites as well as local vegetation, protect catchment and headwater areas; display values of interest in Stone Forest, Shilin pastoral scenery and eco-touring characteristic of local ethnicities

The main measures of the management:

(1) Values of interest in Stone forest

- create clear signs for the border between Core Zone and Buffer Zone
- protect the Core Zone in a closed state
- register sites of various stone forest with types, character, relics and naturalness
- protect the environment beside the karst lakes and springs, and control soil erosion, and restore the integrity of the waters
- regulate land use according to corresponding laws and ordinances by stopping of farming extension in the zone; cultivate pastoral scenery in farmlands which could not return back to local vegetation, and control chemicals
- control the range and capacity of raising livestock in the zones, particularly in regard to nomadic livestock
- control those exotic/invasive species for afforestation which would have a negative impact on restoration of local vegetation, and economic forests cultivated in stretches in the Buffer Zone and Proving Zone/Tourist serving zone with protected farmland
- prevent the zones from fire disaster and no permits should be issued for hunting

(2) Ethnic village

- three ethnic villages in the Buffer Zone: Qingshuitang, Weiboyi and Suogeyi
- make plans for the three villages' development and maintain their traditional appearance with their infrastructure enhanced
- label the Mizhi forests with their values and afforest villages with local species for ethnic attractions
- control encroachment of new settlements to the Core Zone
- improve environmental sanitary conditions and readjust the domestic energy structure, and develop a forest designed for a rural energy base
- guide farming and control grazing areas and the number of livestock, and develop pastoral scenery, an economic forest and fruit forest
- control quarrying and restore damaged sites to new landscapes and new vegetation
- restore local vegetation beside rural roads for the rebuilding of dispersed sources of local species along the roads

(3) Touring management

- control scientific touring in the Core Zone and develop pastoral eco-touring products
- label sites of values of interest in Stone Forest
- mark sites of catchments and headwater areas
- mark significant species and plant communities and their areas
- Control kinds of vehicles and encourage hiking touring and investigation in the prohibited zones and do not leave any wastes
- no permits for construction and buildings except for basic facilities for security, tour monitoring and local residential housing

5.5 Management Plan for Suoyishan–Wenbi Mt.

Location: the southern part of Shilin National Park.

Functions: the Core Zone and the Buffer Zone

Projects: Protect values of interest in Stone Forest with natural environment, protect local species bank and patches of zonal vegetation, catchment and headwater areas, display values of interest in Stone Forest, and develop rural attractions and rural folk eco-touring

the main measures include:

(1) Values protection

- delimit the border between Core Zone and Buffer Zone with clearly marked signs
- protect the Core Zone in a closed state
- register Stone Forest by types, relics, characters, locations, natural states
- manage land with laws and regulations and control farming sizes by stopping expansion into the Core Zone, develop pastoral scenery in farmlands by controlling chemicals
- protect the Mizhi forests by conserving them in a natural state for evolution by prohibiting felling
- control grazing under principle of environmental capacity
- control the planting of species for afforestation in the zones, especially invasive and exotic ones which harm local vegetation, and develop the economy and forests designed as a source of fuel in stretch in or outside of the Buffer Zone and Proving

Zone/Tourist serving zone with protected farmland

- prevent the zones from fire disasters and control hunting

(2) Ethnic village management

- ethnic villages Suoyishan and Dawanqing being in the Buffer Zone
- make plans for the development of the two villages while combining and conserving ethnic traditional appearance by improving the infrastructure
- mark values of interest in the Mizhi forests and conserve their natural evolution, strengthen afforestation in rural areas with local species for rural attractions
- control new local settlements near to the Core Zone
- cultivate local vegetation attractions along rural roads for both the scenery and dispersing the source of local species
- improve environmental sanitary conditions, and readjust the family energy structure by developing a firewood base and other available means
- help local farmers to develop the economy by increasing incomes, and readjusting the planting structure and controlling grazing and the cultivation of pastoral attractions and economic forests
- control quarrying sites and size, and restore damaged sites with ecological and landscaping means

(3) Tourism management

- control tourism in the Core Zone and develop pastoral eco-tourist areas or lines
- mark values of interest in Stone Forest and their relics
- mark and protect headwater and catchments areas
- mark significant local species and plant communities
- edit tourist and traveling booklets and maps

5.6 Management Plan of Changhu Lake

Location: the southern part of Shilin National Park and along Weize ethnic village

Functions: the Buffer Zone and the Proving Zone/Tourist serving zone with protected farmland, eco-tourism and ethnic rural tourism with health activities

Projects: protect the Fengcong and karst lakes, local vegetation, ethnic cultural attractions, historical relics, headwater and catchment areas, and develop health sports

tourism with recreation and ethnic culture eco-tourism

The main measures include:

(1) Protection of environment and landscapes

- preserve the natural beauty around Lake Changhu and the surrounding Fengcong scenery
- mark values of interest in the Lake Changlu and their sites
- mark local species and plant communities
- mark the border of the protected areas of Lake Changhu
- prevent the lake and natural scenery from all construction and building
- control grazing, avoid fires and hunting
- manage planting species and promote restoration of local plant communities and develop headwater vegetation
- protect aquatic communities, especially *Ottelia acuminate* community which is typical in the Yunnan–Guizhou karst Plateau lakes
- control chemicals and exotic species, especially invasive ones from harming Changhu Lake

(2)Management of the ethnic village

- Village Weize nearby the lake is typical of the local Yi village
- identify the ethnic village and develop its uniqueness while maintaining the harmony of the village with nature
- improve environmental sanitary conditions and control solid and liquid wastes by enhancing the quality of receiving tourism for rural and eco tourism
- mark famous and ancient trees and the local plant communities
- readjust the farming structure near the lakesides and cultivate rural attractions
- construct local plant attractions along rural roads for both the scenery and the dispersing source of local species

(3) Tourism management

- construct a multi-functional ecological and a recreational tourist base characteristic of the local ethnic identity
- improve the tourist area of 1.47 km^2 of Lake Changlu with a walking-path beside the

southeast lakeshore, and landscape the jetty and complete other tourist facilities for Lake Changhu's tourism

- construct performance field for the Torch Festival celebrations, bullfights and other art performances at suitable sites
- construct recreational and sporting ground along the north shore of Changhu Lake, including a golf course, and indoor and outdoor sports arena
- improve the surrounding of Changlu Lake's dam and build local food services facilities
- construct paths to Shuangjian Mountains, forming a tourist trail from Changhu Lake, through Shuangjian mountains and Dushi Mountain to the Village
- control the tourist environment of Dushi Mountain
- use local species for Mopan Mouantian revegetation and construct paths to the mountain
- control fishing activities in the lake
- strictly manage the quality of water in the lake and prohibit sewage from coming in contact with the lake
- perfect guided tours and edit touring booklets and maps

5.7 Management plan of the Grand Waterfall

Location: the southwestern part of Shilin National Park and 25km away from the Major Stone Forest

Functions: the Buffer Zone and the Proving Zone/Tourist serving zone with protected farmland, and scenic spot

Projects: protect the Grand Waterfall as nice scenery with local species and plant communities; develop scenic tourism and eco-tourism.

The main measures include:

(1) Ecological reserve and protection of the waterfall attraction

- mark values of interest near the karst waterfall
- preserve the integrity of the waterfall attractions, protect the natural vegetation in the upper watercourse, protect the grandness of the waterfall, and maintain the naturalness of the waterfall pool with a pleasurable attractive complex

- restore local vegetation beside the Grand Waterfall, and control soil erosion
- protect local vegetation on two sides of the upper river of the Grand Waterfall, to landscape the rural paths on the west side of the Ba river as up to the Grand Waterfall together with the convenience of transportation improved
- demolish old construction and houses nearby the Grand Waterfall and restore local vegetation
- control the western outlet of the Grand Waterfall by extending eastward waterfall and restoring the Waterfall to a more grand state
- mark the rare and endangered species such as *Toona iliata var. pubescens, Nouelia insignis, Zelkova schneiideriana Han.-Maz*
- control grazing and avoid fires and hunting

(2) Manage tourist paths and service facilities

- construct the new entrance servicing area at the crossing of the Ba river with the Dakekehe river with suitable tourist service facilities, set up a sign for the entrance of the Grand Waterfall at the mouth of the Sanchahe river
- demolish all food facilities at the top of the waterfall and landscape the damaged site for water and local vegetation
- reconstruct a new circling trail from the north side of the Sanchahe River through the upper course of the Qingshui river, finally to the pool of the Grand Waterfall or the foot of Great Stony Mountain which allows tourist for experience the wholeness of the scenery of the Grand Waterfall and reconstruct the existing entrance for the final stop of the Grand Waterfall tour with facilities for a new stop which will allow for taking a break and time for shopping
- argue for the construction of a cableway 500m away from the Western Slope of the waterfall pool for improving accessibility and enjoying the conditions, and the cablecar connecting to the tourist trail along Qingshui river for a better circling tourist path
- construct convenient facilities for rest and viewing at the Waterfall Pool
- control the environment and construction in the Minor Waterfall and landscape the surrounding of the Dadieshui Power Station

- perfect tourist guidance systems and edit tourist brochures

Management Plan Of Libo Karst, Guizhou

Buyi and Miao Nationalities Autonomous Prefecture Of South Guizhou, October, 2005

Contents

1. Present situation of the Libo Karst Nominated Sites

1.1 Regional location

The Libo Karst Nominated Sites for World Natural Heritage in Guizhou Province (short name: the Libo Karst Nominated Sites) are located in Libo County of South Guizhou Buyi and Miao Autonomous Prefecture, Guizhou Province, China. Libo County (Yuping town) is 320 km from Guiyang City (province capital) and 145km from Dunyun City (prefecture capital).

1.2 Extension and area

The Libo Karst Nominated Sites includes Maolan National Nature Reserve in Guizhou, Daqikong and Xiaoqikong sections of Zhangjiang Scenic and Historic Interest in Libo. The Libo Karst Nominated Sites cover 29518ha (central coordination of E107°58′30″and N25°13′15″).

1.3 Resource values

1.3.1 Scientific values

Within the Libo karst nominated site, eco-environment developed a special one with thin soil, scant water and rich calcium due to the influence of special lithology, underlying rocks and karst process; and plants living there gradually adapt to this special environment and are characterized by drought hardy, lithophilous and calciphilous. Therefore, the ecosystem turned into a typical and special one — karst ecosystem.

The Libo karst nominated sites are characterized by trolling terrain, various landform types, favorable water and heat condition, abundant species and complex vegetations; so small habitat with diversities are gradually developed and provide feasible habitat for biology with different ecological features. Especially the karst forest covering most areas directly protect complex and various plant combination possessed by karst forest, and the special eco-environment combined by karst forest turn into natural habitats with the most significance and importance for biological diversity conservation.

The Libo karst is submitted for the World Natural Heritage because it satisfies the World Natural Heritage criteria ( )、( ).

1.3.2 Esthetic values

Within Maolan section, cone karst landforms and immense forest vegetation combine to display special, rare and graceful landscapes of landforms, hydrology and forest. So it is proved to be unrivalled comparing with other karst landscapes. The Daqikong and Xiaoqikong sections are composed of mountain, stone, water, forest, cave, lake and waterfall etc, together with steep cone summit and circumfluent streams, which is rather attractive because of the harmony of natural landscape with vital force and human landscapes with old history.

1.3.3 Cultural values

Libo is characterized by long history and colorful national culture. Within the Libo karst nominated sites, the aboriginal minorities include Yao People, Buyi People and Shui People, Zhuang People and Miao People etc. Their language, song and dance, festival and custom with each feature contain rich connotation and historical origin, whose values are embodied on their special views combining rustic culture of traditional custom and wonderful natural landscape environment.

1.3.4 Tourism values

A serial of activities, such as research education, forest trip, cave exploration, drifting, climbing activities and sharing ethnic customs, may be taken in the Libo karst nominated sites. Especially ecological tourism, the combination of sharing tourism and popular science education may promote public knowledge about environmental consciousness and passion for nature.

1.4 Present situation of conservation

The two sections included in the Libo karst nominated sites possess different features of national nature reserves and national scenic and historic interest, and are protected by relevant law and regulations, too. Maolan Nature Reserve is well protected through dividing into three parts: core area, buffer zone, and experimental zone (experimental zone, ecological tourism zone). The Daqikong and Xiaoqikong sections of the Zhangjiang Scenic and Historic Interest in Libo are protected according to Extra Grade, , , level. In addition, some sections are also protected by folk tradition.

At present, effective systems of multilevel management have been established in the

Libo karst nominated sites, so to possess some given guarantee on the aspects of personnel, organization and fund etc. The parts with outstanding universal values in each section remain completely perfect, and the integrity of ecosystem and natural environment also is kept in a good condition; but a lot of insufficiency still is found on administrative capacity.

1.5 Threat and pressure

1.5.1 Developmental pressure

Within the Libo karst nominated sites, population density in Maolan Nature Reserve is 19/ km^2; both the population quantities and lower land output determine that population need more cropland, even gradually more; so the natural reserves will take measures of *Construction Planning of Population Control and Community Development.* Although the natural forest and wildlife are under the protection of national law, cutting wood and hunting often take place in and around the Libo karst nominated sites. Therefore patrol for forest must be strengthened; to increase intercommunion with each community and promote inhabitants' participation protection.

1.5.2 Environmental pressure

Due to serial affects from various human activities, the natural landscape, biodiversity and eco-environment all are under given pressures; but most parts of the Libo karst nominated sites remain in good conditions, therefore we should lessen the bad affects from human activities in some extent.

1.5.3 Natural disasters

Within the Libo karst nominated sites, small scale forest fire occasionally take place because the local farms in mountain areas reclaim cropland through firing forest and burn up woods to collect manure. Therefore we should take effective measures to guard against forest fire and actively take forest diseases and insect pests prevention. The climate harms include flood, hail and drought, otherwise landslide, debris flow and soil erosion is likely to take place. In addition, the three systems constructions of monitoring prewarning, quarantine and prevention must be speeded.

1.5.4 Visitor/Tourism pressure

Because the regional economy of Libo County is undeveloped, tourism income will be favorable to protect resources and improve living standard of local inhabitants living in

and around the Libo karst nominated sites. But in the event of no control, rapidly developed tourism will result in ecological deterioration, spread of water loss and soil erosion and destruction of wildlife habitat to adversely affect karst landform and environment.

2. Target, basis and principle of conservation

2.1 Conservation target

1、Protecting the authenticity of resource: To protect the primary condition, the primary ability of ecosystem, authenticity of cultural resource and scientific, historic and cultural values in the process of conservation, succession and inheritance.

2、Protecting the integrity of resource: To protect the integrity of resource, environment and karst ecosystem. To definitude the boundary of the Libo nominated site and buffer zone and work out correct protection measures in order to effectively protect and manage.

3、Protecting the diversity of resource: To protect the basic ecological process and life support system of cone karst biosphere; to conserve hereditary diversity of biology, especially rare and endangered species and habitats; to ensure perpetual utilizations of ecosystem and specie resources.

2.2 Conservation principle

Integrated conservation principle, coordinated conservation principle, operability principle, sustainable principle

2.3 Conservation basis

1、*Environmental Protection Law of the People's Republic of China*

2、*Land Management Law of the People's Republic of China*

3、*Water Law of the People's Republic of China*

4、*Forestry Law of the People's Republic of China* and *Implementary Detailed Rules of Forestry Law*

5、*Law of the People's Republic of China on the Protection of Wildlife*

6、*Law of the People's Republic of China on the Protection of Cultural Relic*

7、*Regulations of the People's Republic of China On Nature Reserves*

8、*Provisional Regulations of the People's Republic of China Concerning the*

Management of Scenic and Historic Interest and *Implementary Measures of Provisional Regulations Concerning the Management of Scenic and Historic Interest*

9、*Measures of Guizhou Province Concerning the Management of Scenic and Historic Interest*

10、*Guizhou Province national folk culture protection rule*

11、*Regulations of Libo County, South Guizhou Buyi and Miao Autonomous Prefecture, Concerning the Management of Zhangjiang Scenic and Historic Interests*

12、*Guizhou Maolan National Nature Reserve Integrated Plan (year 2003 – 2015)*

13、*Libo Zhangjiang National Scenic and Historic Interest Integrated Plan (year 2003 – 2020)*

2.4 Planning term

The plan term is effective from 2005 to 2015, eleven years in total.

3. Conservation division and requirement

3.1 The Libo Karst Nominated Sites

The Libo Karst Nominated Sites cover 29518ha including Jiaou Xiang, Chaoyang Town, Yaoshanyao Xiang, Dongtang Xiang, Wengyang Xiang and Yongkangshui Xiang of Libo County.

Within the Libo karst nominated sites, limited human activities should be permitted; but agriculture should not be extend, agricultural land of > 25°, should be recovered ecological environment with manpower resource. To strictly control the construction of infrastructure, if necessary, passed by strictly scientific environmental estimation and monitoring. The inhabitants should decrease the dependence on natural resources through looking for substitutable sources; so it is a good idea to develop tourism, but must limit in tourist capacity and monitor the affects for environment resulted from tourism; in addition, existing industries must be gradually closed, even moved.

3.2 Buffer zone

Buffer zone covers 43498ha including Jiaou Xiang, Chaoyang Town, Yaoshanyao

Xiang, Dongtang Xiang, Maolan Town, Suiyaoshui Xiang, Wengyang Xiang, Yongkangshui Xiang and lao Cun of Libo County. Within the buffer zone, harmonious protections are implemented; for example, all construction projects in buffer zone should have better harmonious transition with the Libo karst nominated sites, and forbid to arrange contaminative industry to destroy landscape environment and ecosystem.

4. Conservation contents and measures

4.1 Cone karst conservation

4.1.1 Karst landforms

1、To forbid to quarry, dig sand and collect earth to prevent destroying vulnerable karst landforms. The digging due to searches activities must be passed through cautious scientific argumentation. The behavior destroying karst landforms should be imposed punishment in accordance with the law, even criminal responsibility for cases of gross violation.

2、To control the affects of human activities to karst landforms, gradually decrease or control the inhabitant quantities in the Libo karst nominated sites. The landforms destroyed by human activities should be taken measures to try best to recover original conditions of rock lanforms.

3、To strength the protection of karst margin environment to create characteristic environment belonging to own karst. What more is to prevent karst rock desertification, such as the phenomena of soil attenuation, bedrock nudity and productivity of land degeneration even loss; so we should formulate special planning of rock desertification integrated regulation.

4、Directed toward karst landforms, to formulate corresponding special protection planning and establish the monitoring system of karst landforms to timely treat with monitoring indicators and results.

4.1.2 Karst cave

1、Measures must be taken to protect ambient environment quality, and keep the variety of eco-environment in cave. Human activities, especially activities leading

underground cave distortion and destruction of digging, pumping, impounding, explosion and jolt should be controlled and forbidden. Natural ventilating conditions in caves should be strictly forbidden to prevent off-color, drying, abscission and damage of travertine sediment.

2、Opened karst caves should be take reinforce measure for dangerous cave passages to ensure tourist safety. Make sure reasonable tourist capacity and forbid building any service establishment in exception for necessary tourism and safety infrastructure; forbid picking stalagmite or destroying original objects in caves; don't permit discard any rubbish in cave for sanitation service in order to prevent pollution. The caves which are kept in good condition and is waiting for development should be shielded and set up signs on the cave entrance to prevent excavating.

3、Within the Libo karst nominated sites, at present opened karst caves include Di'e Cave, Tianzhong Cave, Jiudong Tian and Jinshi Cave etc, so they should be completely protected and monitored in means of ventilating equipment and treating measures. In addition, to intensified explanatory education of karst caves, strength protection consciousness and actively participate protection.

4.2 Biology specie conservation

4.2.1 Flora

1、Strictly forbid any destroying behaviors of reclaiming, burning, cutting and gazing etc, gradually return land for harming to forestry and conserve forest and strength vegetation greening and water and soil conservations to recover destroyed forest system.

2、The complete resource data base of rare and endangered plant is established in order to develop sustainable and long-term investigation and monitoring. Special protective belts are planned for rare and endangered plant, in which anybody isn't permitted to enter in exception of administrative demand and permitted scientific researches. Collecting plant samples in the Libo karst nominated sites is forbidden or permitted by relevant administrative departments if necessary.

3、Prevention and treatment of forest insect pest, especially biological prevention and

treatment techniques, should be strengthened. Exotic tree species are forbidden carrying and introducing into nominated sites in principle; if introduction is necessary, these exotic species must be passed environmental effect evaluation.

4、To strength fire protection and enrich fire prevention headquarters; in the Maolan and Xiaoqikong karst forest, means of escape, such as fire guard, monitoring warning, fireproofing passages and shelter belts, should be established to forbid fire into forest areas to prevent forest fire.

5、To establish experimental base of the Libo karst forest hydrographic effect and explore space-time relation between forest ecology and hydrographic effects; they may provide quantitative basis for scientific researches.

4.2.2 Fauna

1、Within the Libo nominated sites, various catching and hunting activities are strictly forbidden to prevent destroying wildlife habitant environment. Measures of animal quarantine are taken to forbid carrying wildlife with no quarantine into the nominated sites.

2、Rare and endangered animals are rescued and protected. The complete resource database of rare and endangered animals is established in order to develop sustainable and long-term investigation and monitoring. The special protective belts are planned for rare and endangered animals, in which nobody is permitted to enter in exception of administrative demand and permitted scientific researches. Collecting animal samples in the Libo karst nominated sites is forbidden or permitted by relevant administrative departments if necessary.

4.3 Environmental quality conservation

4.3.1 Water environment

Within the Libo Karst Nominated Sites, all rivers belong to hilly rainfall rivers, so they possess strong purification capacity. Water quality of surface water should reach the level of *Environmental quality standards for surface water* (GB3838-2002). According to *Integrated wastewater discharge standard* (GB8978-1996), the wastewater of

nominated sites should reach the discharge standard. The surface water and life wastewater discharge should be monitored. To regulate all pollution sources and forbid to establish new discharge exits on their banks. To strictly control the tourist accommodation quantity. In the process of exploitation, lakes and pools meet the contradiction of tourism development, breed on the water surface and water quality; we must strictly comply with the first protection principle to regulate environment.

4.3.2 Soil and vegetation

To workout and complete the soil resource listing and formulate corresponding special protection planning. To strength the protection of karst landforms and primary vegetation, do forest conservation and forest planting and strictly forbid human destroy behavior of hackling and cutting at random in order to preserve water, fix soil and prevent natural disasters. The forest percentage of coverage in the Libo karst nominated sites should reach above 70%.

4.3.3 Ambient environment

Ambient environmental quality in the Libo karst nominated sites should implement the level standard of *Ambient air quality standard* (GB3095 -1996) . To control coal smoke pollution, renovate the structure of life energy and popularize firedamp pools. To establish the monitoring system of ambient quality, strictly control new pollutant sources and mechanically-operated vehicles into these areas, lessen affects of tailgas discharge and popularize environmental protection energy-saving traffic vehicle.

4.3.4 Noise environment

Noise level in the Libo nominated sites should under level standard value of environmental noise *Standard of Environmental Noise of Urban Area (GB3096-93).* To overall popularize environmental protection energy-saving traffic vehicle and set up monitoring spot in main entryway to forbid vehicle horning.

4.4 Protection of local culture

4.4.1 Community life

The inhabitants in the Libo karst nominated sites and buffer zones respectively are 5751 persons and 24747 persons. The life of inhabitants is closely linked with its

environment; so referring to community developmental planning, we must improve their participant management, take effective measures to control their activities and workout the planning of villages and population. According to population fluctuation trend, community residential spots in the Libo karst nominated sites and buffer zones may be divided into four types for effective regulation and control: the type of movement, shrink, control and habitat.

4.4.2 National culture

To protect the integrity and/or authenticity of national culture, protect the significantly historic, cultural, scientific and emotional information carried in endemic villages and protect natural environment and cultural atmosphere of endemic villages. Must remain traditional architectural style and integral features on different aspects of architectural layout, shape, hue and material, completely remedy ones with serious destroy to recover “prototype”. To regulate village environment, complete the infrastructure of water, electricity and communities, sufficiently consider the requirements of fire protection and collect inhabitants’ living rubbish and wastewater to improve their living condition.

5. Reasonable utilization and development

5.1 Scientific research and investigation

The long-term localizations for ecosystem and other specie nature resource pool provide scientific basis to know nature and reasonably utilize natural resource and monitor environment quality. In addition, do the ecological investigation and research of main protective species and the affections of specie resources provoked by ecosystem change.

Before entering the nominated sites to engage in research practice and scientific experiments, must be approved by the relevant administrative department and work in the appointed areas. To set up the base of research practice and scientific experiments through collectting rare plant and establish rare plant garden. And to purchase apparatus and equipment refered to research practice.

5.2 Popular scientific education

For karst phenomena and specific phenomena of karst forest, to introduce their

formation reason, features, status and significance in the process of earth history and ecosystem and further evolution with popular scientific language. To actively organize tourist to develop ecological tourism, establish marker system and develop popular scientific activities of ecology, botany, zoology and physical geography. Tour guider should be educated to introduce some scientific knowledge of each spot and other environmental common sense to tourist.

5.3 Tourist capacity

For the Sanchahe tourism areas of Maolan Nature Reserve, the daily tourist capacity permitted of ecological tourism is 1349 persons; if there are 250 open days in a year, so the yearly tourist capacity reaches to 337,250 persons, and the most reasonable tourist capacity shouldn't exceed 300,000 persons. The Daqikong and Xiaoqikong spots adapt tourism course method and bayonet method, the tourist capacity of 3000 persons; if there are 300 open days in a year, so the yearly tourist capacity reaches to 900,000 persons.

The tourist capacity of the Libo karst nominated sites is measured adapting the totaling of each division capacity, up to 1.2 million persons of the yearly tourist capacity. To strictly forbid exceeding the capacity and gradually take some measures of sequential rest for some spots.

5.4 Tourism organization

Within the Libo karst nominated sites, a series of activities, such as forest trip, cave exploration, drifting, boating, climbing and tasting endemic customs, may be developed. Tourism service facility system must be uniformly planned according to best tourism course to reach the combination of comparative convergence and proper scatter. And the quantities of rest booths and tourism service facility should be strictly controlled and gradually established.

5.5 Explanatory education

It is an active and dynamic expressive mode of professional tour guider to explicate and answer the questions for tourists in the process of guiding tourist to tour. The relevant thematic explanation should be assisted with the shows of samples, model, pictures and literal; and to set up literal explanatory and pictorial brands and indicators; make tourist familiar with all items known and complied with manual.

5.6 Program evaluation

Within the Libo karst nominated sites, the site selection and distribution should meet the requirement of Nature Reserve Integrated Plan or Scenic and Historic Interest Integrated Plan for all construction projects. And construction projects must be certificated with *Construction Using Land Plan Permit, Construction Projects Plan Permit, Construction Item Selected Location Prospectus* and *Environmental Effect Appraisal Report*

6. Monitoring system and check

6.1 Monitoring means

GIS monitoring method, a usual monitoring method at present, abstract changed information through two phase comparison of satellite image to check changed areas according to the monitoring basis of relevant planning. In addition, sample survey and public opinion polls for local inhabitant and exotic tourist to improve protection and management.

6.2 Monitoring types

Including the monitoring on forest and environment, tourism, community, as well as national culture and human relics.

6.3 Monitoring indicator

Monitoring indicators are the most important representative of weighting protection condition, and closely contact with their outstanding values. According to itself characters and protection contents of the Libo karst nominated sites, the indexes may be summarized as the following main monitoring indicators:

Monitoring Indicators of the Libo Karst Nominated Sites

No.	Indicators	Periodicity	Location of Record
1	Cone karst integrity (distribution, boundary, type)	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature
2	Number and prefect intension of the Libo cone karst spots	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature
3	Species and numbers of animal	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou
4	Species and numbers of	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou
5	Exotic species and harm	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou

6	Atmosphere quality	Year	Meteorology Bureau of Libo County
7	Water quality	Year	Environmental Protection Bureau of Libo County
8	Number of town and population in the Libo nominated sites	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou
9	Number of town and population in buffer zone	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou State Soil Resources Bureau of Libo
10	Area of cropland in the Libo nominated sites	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou State Soil Resources Bureau of Libo
11	Area of cropland in buffer zone	Year	Administration of the Zhangjiang Scenic and Historic Interest of Libo Administration of the Maolan Nature Reserve of Guizhou

6.4 Check and treatment

After the Libo karst nominated sites construct perfect monitoring system and decide monitoring indicators, every year the monitoring results are fed back to Administrative Organization of World Natural Heritage in Guizhou, which will be timely checked and rectified by Administration of the Maolan Nature Reserve of Guizhou and Administration of the Zhangjiang Scenic and Historic Interest of Libo.

7. Management regulation and safeguard measure

7.1 Management target

To enable outstanding value of the Libo karst nominated sites to obtain the effective protection in order to maintain its integrity and authenticity; in addition, the local culture are well protected and inherited; participation of protection is well enhanced for the public; the resources are reasonably utilized to carry out the sustainable development.

7.2 Management system

After success of submitting, Guizhou People's Government will establish administrative organizations to instruct, coordinate and supervise the protection and management of world natural heritage sites.

Libo County People's Government answers for the protection and management of the Libo karst nominated sites. And according to respectively different responsibility, all bureaus, such as construction, forestry, culture, environmental protection, state soil, water conservation, tourism, do their best to coordinate, manage and supervise the nomination sites.

7.3 Management agency

Administration of nature reserve and administration of scenic and historic interest are respectively established in Guizhou Maolan National Nature Reserve and in the Zhangjiang National Scenic and Historic Interest of Libo, which concretely implement the protection and management according to respectively different responsibility and power. Other bureaus, such as construction, forestry, culture, environmental protection, state soil, water conservation, tourism and town government, complete other relevant works.

7.4 Management responsibility

1、To propagandize and carry out the national and regional laws, regularity and policy of world natural heritage sites; to organically implement *Guizhou Maolan National Nature Reserve Integrated Plan*, *Libo Zhangjiang Scenic and Historic Interest Integrated Plan* and relevant safeguard measures.

2、To responsibly organize investigation, estimation and registration of various resources in the Libo karst nominated sites; to formulate its detailed planning or

special planning; to establish dynamic monitoring information system in order to strengthen the supervision and integrated management, and to periodically send planning implementation , conditions of resources conservation and utilization to the department in charge.

3、To answer for managing infrastructure and other public installations in the Libo karst nominated sites, improve the condition of tourism service, strengthen the safeguard, and develop sightseeing tourism and scientific and educational activity.

4、To enhance protection consciousness of the public in the Libo karst nominated sites, strengthen management of community, and actively lead the local farms to develop ecological agriculture to gradually alleviate poverty and become prosperous.

5、To carry out special administrative punishment according to the commission of relevant administrative department.

7.5 Law and regularity

According to the national and regional relevant laws and administrative regularity related to Part 2.3, the Libo karst nominated sites are effectively protected and managed. After success of submitting, *Conservation Regularity of the Libo Cone Karst for the World Nature Heritage sites in Guizhou* should be worked out according to the present condition.

7.6 Training

To comprehensively improve administrative personnel quality, raises the high level and short talented person in order to provide safeguard of human resources for protection and management in the Libo karst nominated sites. Educational training includes working with license; to actively introduce into talented person, promote intercommunion and cooperation, strengthen academic education and establish information network etc.

8. Supplementary articles

8.1 Examination and approval of planning

Firstly, the planning passes the accreditation examined by relevant sections and experts which was organized by Construction Department of Guizhou Province and South Guizhou Buyi and Miao Autonomous Prefecture People's Government; then is reported to South Guizhou Buyi and Miao Autonomous Prefecture People's Government to accept examination and approval; finally, is filed in by Administrative Office of World Heritage submitted in Guizhou.

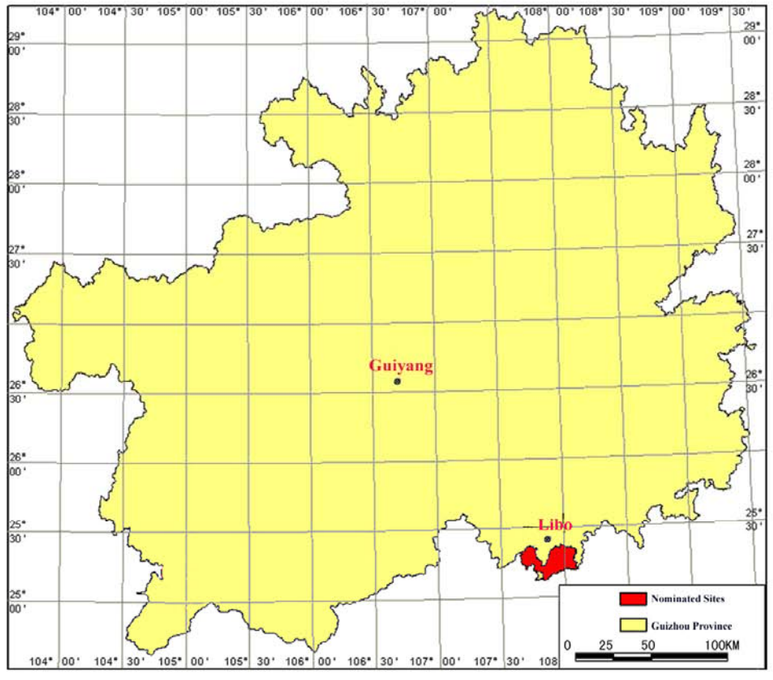
8.2 Planning implement

The planning will be brought into effect when South Guizhou Buyi and Miao Autonomous Prefecture People's Government approve, which will be concretely implemented by Libo County People's Government and supervised by superior relevant departments of construction, forestry and environmental protection etc.

Location of the Libo Nominated Sites

▲ Location of the Libo Nominated Sites in China

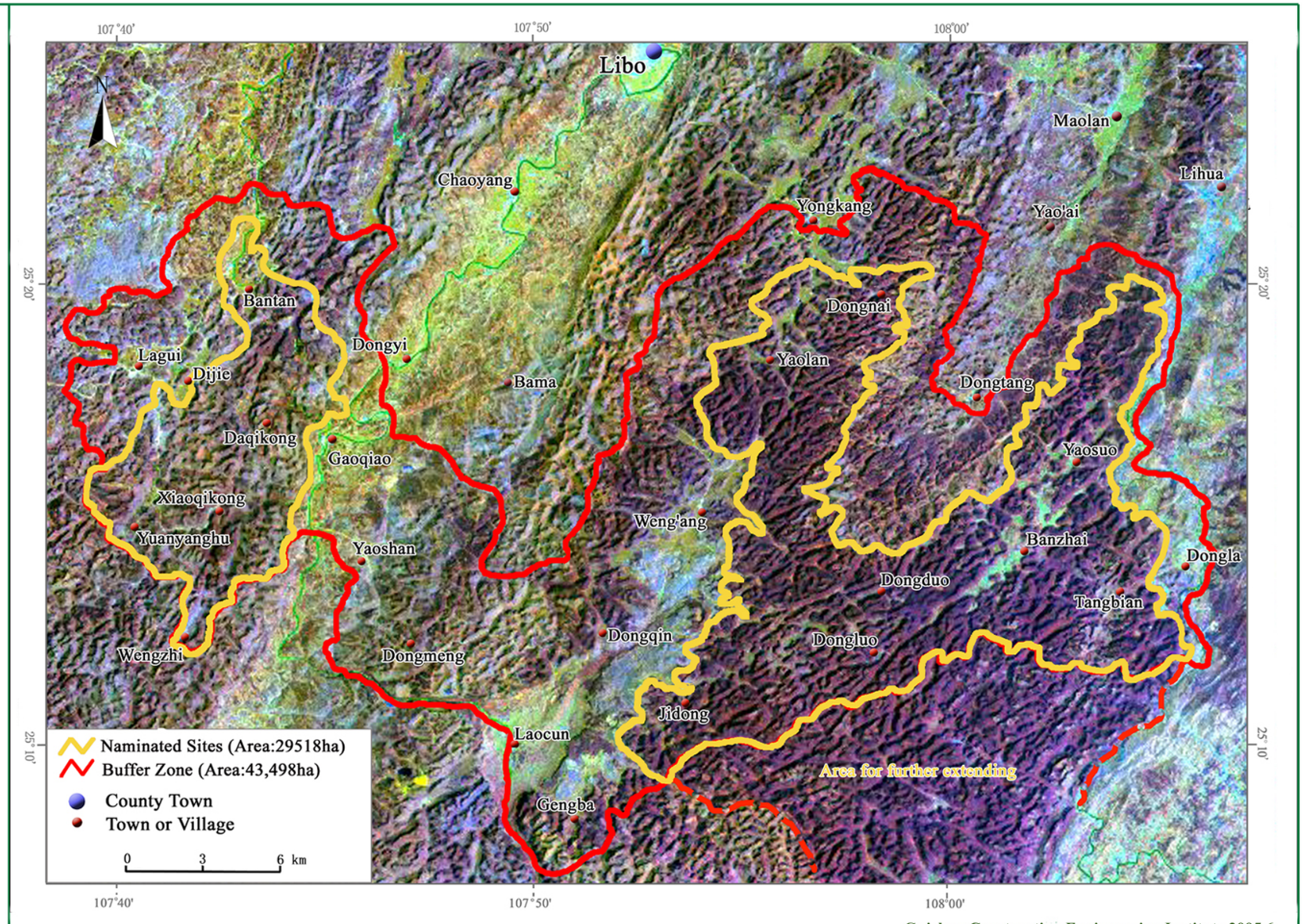
The Libo Nominated Sites are located in Libo County of South Guizhou Buyi and Miao Autonomous Prefecture, Guizhou Province, China, including Guizhou Maolan National Nature Reserve, Daqikong and Xiaoqilong sections of Zhangjiang National Scenic and Historic Interest.



Location of the Libo Nominated Sites in Guizhou ▶

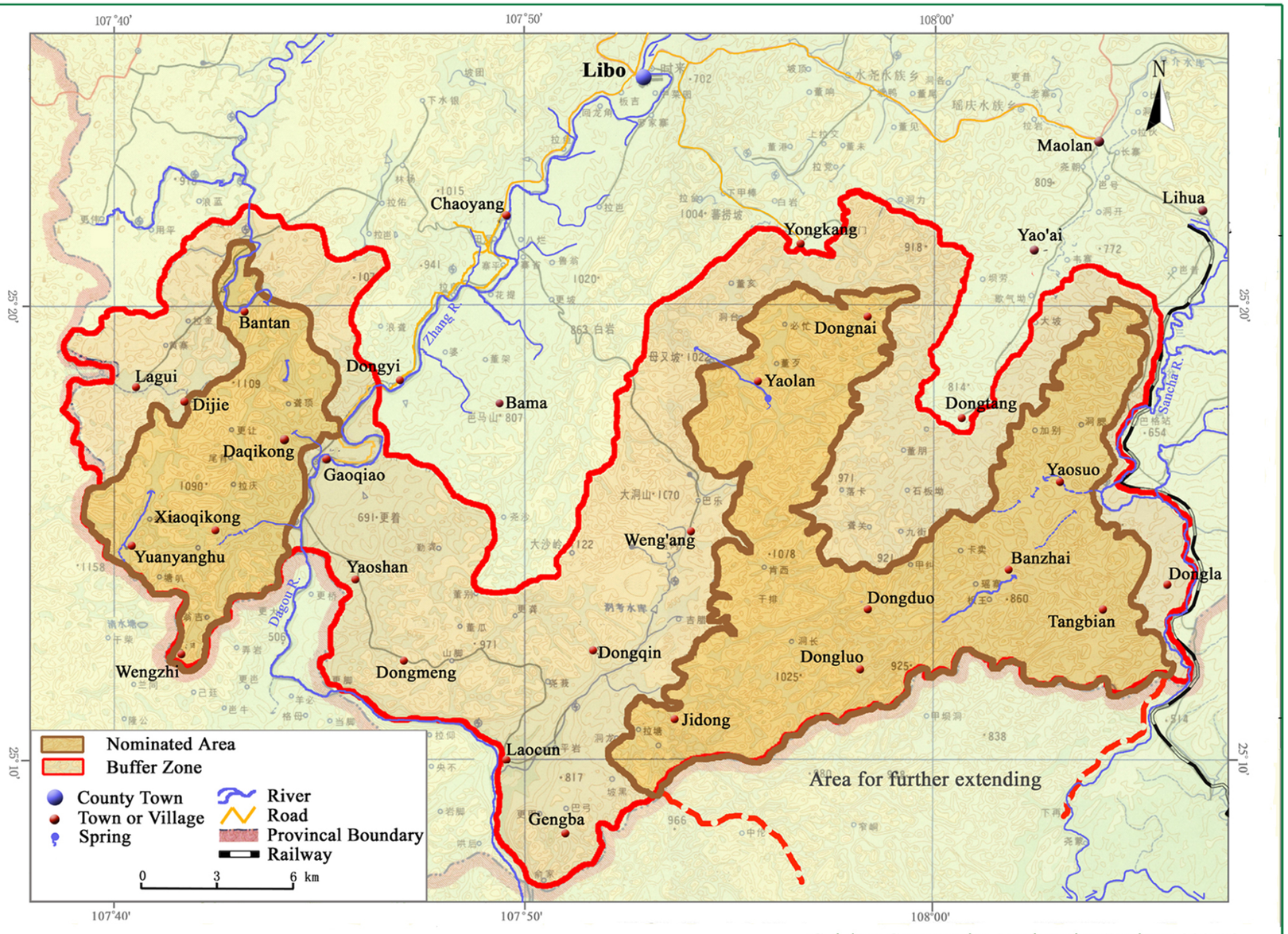
Guizhou Construction Engineering Institute 2005.6

Satellite Image of the Libo Nominated Sites

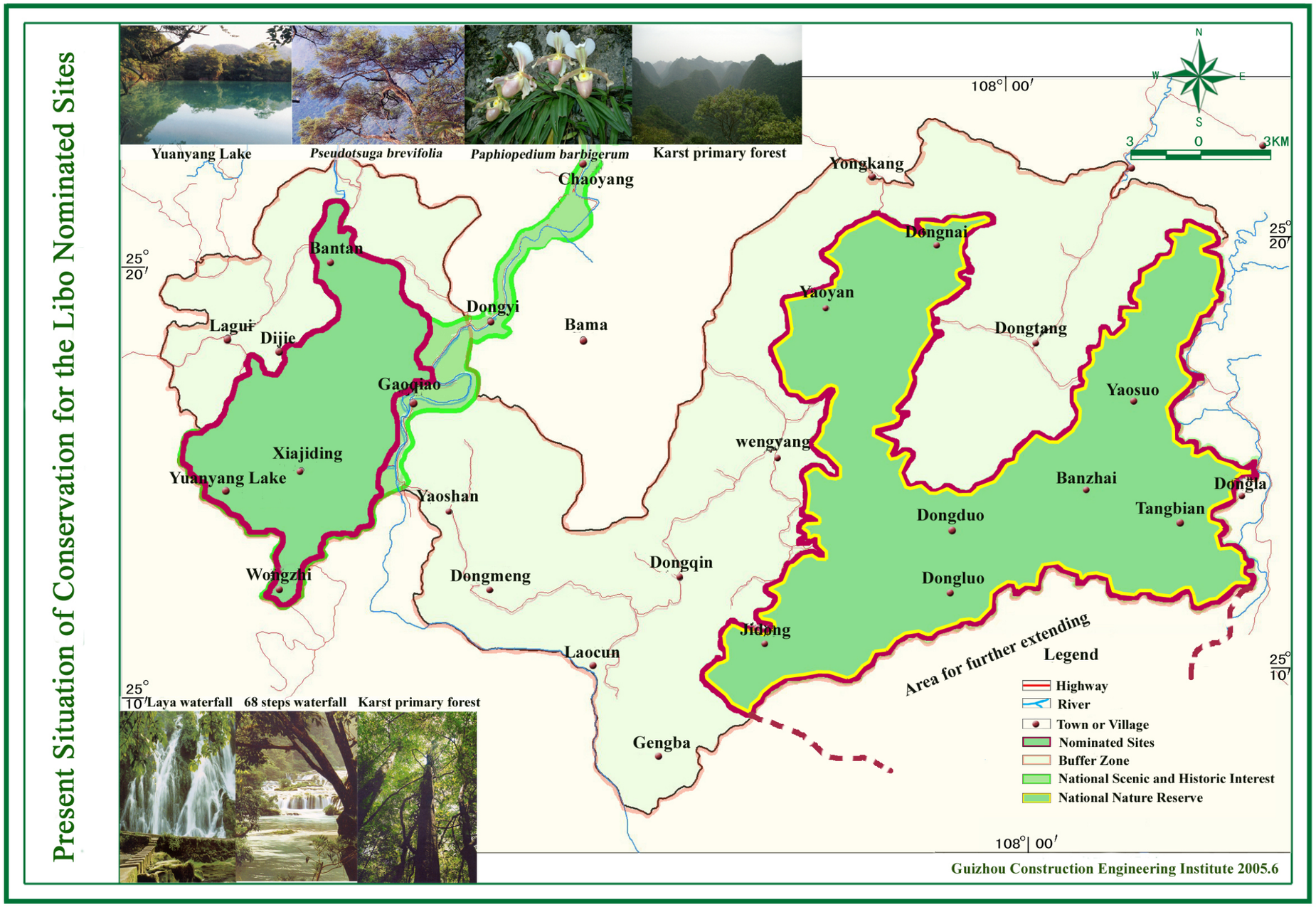


Guizhou Construction Enginneering Institute 2005.6

Area of the Libo Nominated Sites



Guizhou Construction Engineering Institute 2005.6


Present Situation of Conservation for the Libo Nominated Sites
Yuanyang Lake
Pseudotsuga brevifolia
Paphiopedium barbigerum
Karst primary forest
108° 00′
N
W
E
S
3 0 3KM
Yongkang
Chaoyang
Bantan
Dongnai
25° 20′
Yaoyan
Dongyi
Bama
Lagui
Dijie
Dongtang
Gaoqiao
Yaosuo
wengyang
Xiajiding
Yuanyang Lake
Yaoshan
Banzhai
Dongla
Tangbian
Dongduo
Dongqin
Wongzhi
Dongmeng
Dongluo
Jidong
Laocun
Area for further extending
Legend
Highway
River
Town or Village
Nominated Sites
Buffer Zone
National Scenic and Historic Interest
National Nature Reserve
25° 10′
Laya waterfall
68 steps waterfall
Karst primary forest
Gengba
108° 00′
Guizhou Construction Engineering Institute 2005.6

Management Plan

Of WuLong Karst, Chongqing

Administration of Furong River Scenic and

Historic Interest of Wulong County

CONTENTS

1. Summarization of the nominated property

1.1 Location and area of the nominated property

Wulong County, administrated by Chongqing city, is located at the southeastern margin of the Sichuan Basin. Situated at the transitional zone of Dalou mountain, Wuling Mountain and Guizhou Plateau, Wuong is the gorge part of the lower reach of Wu River, which is one of the anabranch of the Yangtze River. The geographic coordinate of Wulong county is N29°02′00″-29°40′14″, E107° 13′16″-108°04′34″. Wulong County neighbors east to Pengshui County, south to Daozhen county of Guizhou Province, west to Nanchuan county and Fuling region of Chongqing city, north to Fengdu county (Fig 3). The extension distance from east to west and from south to north of the Wulong County is 82.7km and 75km respectively; with the total area is 2901 km^2. Three karst nominated properties at located at the southeast, middle and northeast part of the region (Fig 4). The center coordinates are N29°13′48″, E107°54′12″ (Furong cave), N29°26′15″, E107°47′50″ (Three Natural bridges) and N29°36′09″, E108°00′13″ (Houpingkou Karst doline) respectively. The total area of the nominated properties and their buffer zone is 38000ha (380 km^2).

Tab 1-1 Geographical Coordinates of Wulong karst nominated properties

Name	Location	Coordinate(Central)
Furong cave karst system(sector)	Jiangkou town in southeast to Wulong county, the entrance of Furong river running into Wu river	N29°13′48″, E107°54′12″
Three natural bridges karst gorge system (sector)	The north of Wulong city, limestone region of Triassic system spreading where Yangshui river (the reach of Wu river) runs through	N29°26′15″, E107°47′50″
Houping karst doline system (sector)	Zhongling village in Houping town in Wulong county	N29°36′09″, E108°00′13″

1.2 Regional Geology

1.2.1 Tectonic and Structure

Geologically, the nominated properties are located at the Yangtze platform, which is a tectonic steady region of the southern part of China. In the late of Pre-Sinian, the Jining

Movement formed a uniform folded basement, which is the early base of the Yangtze Platform. After that, the nominated properties experienced several tectonic movements from the Cambrian to the Cenozoic.

During the Cambrian and Silurian period, a transgression-regression sediment sequences can be detected in this region, wihch mainly composed of shallow marine carbonate rock. The rocks are characterized by dolomite rock, dolomite-limestone, biogenic limestone intercalated by sand-shale and mudstone. The thickness of the sediment is nearly 3000m. Guangxi Movement, which happened in the late of Silurian period, uplifted this region to land. The sediment of Devonian and Carboniferous is absent in this region and a full sediment sequence in Permian and Triassic period can be found. The sediment thickness is over 2000m. The Permian sequence consists of shallow-sea, sea-land alternation siliceous carbonate rock, sand-shale rock and coal seam. The Triassic sequence is mainly composed of shallow-marine carbonate rocks intercalated by sand-shale rocks. Indo-China Movement lifted this region to land in the late of middle Triassic Epoch and ended the marine deposition. This region went into platform mobile period in the beginning of late Triassic epoch. Red land facies basin clastic rocks of Mesozoic deposited after continental rifting. The sedimentary rocks of this region (from Cambrian to Jurassic) were folded and fractured by Yanshan Movement and established geologic pattern in this region at the end of Jurassic period. The stratum of the nominated property is composed of anticline (extending from north-south to east-north) and syncline. Carbonate rocks of Cambrian and Ordovician expose on the anticline. But the syncline is composed of the rocks of Triassic and Jurassic. The crust has been lifted intermittently by Himalayan movement since Cenozoic Era, resulting multilevel plane of denudation and incised valley, bringing up various typical karst systems in the nominated properties.

1.2.2 Strata and Lithology

The carbonate rocks of Furong cave and Houping karst doline are developed in Cambrian and Ordovician, but carbonate rocks of Three Natural bridges are developed in middle-lower series of Triassic (Fig 7). The main strata and properties of rocks are described as follows:

(1) Triassic System (T)

Middle series: Leikoupo Formation (T_{2l})

Leikoupo Formation is the middle series of Triassic. It consists of versicolor calcareous shale, silty shale intercalated by marl in the upper part. The lower part is composed of middle-thick bedded limestone containing dolomitic limestone and conglomeradic limestone. It is 561m thick in total.

Lower series: Jialing River Formation (T_{1j})

The Jialing River Formation is the main karst strata. It is composed of light grey, middle-thick bedded with intercalated thin-bedded limestone; thin-bedded argillaceous limestone; dolomitic limestone and paste breccia. It is 538 meter thick in total.

Lower series: Feixianguan Formation (T_{1f})

Feixianguan Formation is composed of grey to dark grey middle –thick bedded limestone, oolitic limestone intercalated by thin-bedded argillaceous limestone. There are argillaceous limestone and shale internated at the upper and lower part. The thickness is 417m.

(2) Ordovician System (O)

Lower series: Meitan Formation (O_{1m})

Meitan Formation can be divided into three parts. The lower and upper parts consist of versicolored shale, siltstone with intercalated nodular limestone. The middle part is composed of thick-bedded bioclastic limestone. The gross thickness for this formation is 281m.

Lower series: Tongzi + Honghuayuan Formation (O_{1t}+O_{1h})

The upper part of Tongzi + Honghuayuan Formation is characterized by middle-thick bedded biogenic limestone with intercalated a small quantity of dolomite rock; the middle part consists of thick-bedded oolitic limestone intercalated by yellowish-green shale; the lower part is composed of middlet-thick bedded limestones and dolomite rocks, intercalated with siltstones and shales. The total thickness is 286 meter.

(3) Cambrian System (∈)

Upper series: Maotian Formation ($\in_{3m}$)

The formation consists of the interbed of middle-thick bedded limestone, dolomite

limstone and dolomite rock, intercalated with edgewise, oolitic limestone comprising with cherty nodules. The Maotian Formation is 122m in thickness.

Upper series: Houba Formation ($\in_{3h}$)

Houba Formation consists of middle-thick to thick bedded dolomite rock with intercalated middle-thin bedded argillaceous or conglomeratic dolomite, dolomitc limestone. The gross thickness of this formation is 319 m.

Middle series: Pingjing Formation (∈2p)

The lower part of this formation is characterized by yellowish and thick bedded dolomite; but the middle and upper part are composed of grey, middle-thick bedded dolomite intercalated with limestone. It is 339m thick in total.

1.2.3 Hydrogeology

The water horizon of the nominated property can be classified two essential types basing on carbonate rocks, sandshales and wirelike fold structure. The two horizons are carbonate karst water horizon and sandshale crack non-karst water horizon. The essential qualities of the two horizons are different. Sandshale crack non-karst water horizon often as exotic water supplies water to carbonate karst water horizon that accelerate to develop karst.

The karst water horizon has good secondary permeability and the precipitation infiltrates into it. For abundant exotic water supplying to it, the karst water horizon has the characters of large flux, water level imbedded deeply and continually adapting the drainage datum surface of the region. Ground water moving in the cracks can enlarge the cracks into channels and forming ground water cave at last. The karst water horizon is characterized by epikarst zone, vadose zone, seasonal change zone and phreatic zone from upper to lower. Every zone has different hydrodynamic character and the karst process is active in every zone. Affected by rivers corroding and climate, the thickness for the vadose zone and seasonal zone of the nominated property respectively ranges from 200-800m and 50-100m.

1.3 Geomorphology

1.3.1 Geomorphologic character

The region of the nominated property belongs to the middle-high mountain and lower mountain in the western Hubei province and the northern Guizhou province. It is located at the transitional zone between parallel mountains in Sichuan Basin and the middle-high mountains of Wushan Mountain and Loushan Mountain. The land is incised by Wujiang and its reaches. The incised depth may be kilometer. At the dividing ridge region, the topography main is hill and changes gently. For affected by carbonate rocks and sandshales, the character of topography is different from the character of geomorphology. The region of carbonate rock spreading consists of half-baked Fengcong Karst or Cone Karst. The Cone Karst is characterized by doline, depression and dry valley. The altitude of the region ranges from 165m to 1800m. Majority parts are 900-1200m height.

Wulong karst system consisits of three unattached systems such as Furong cave and Furong river karst system, Three Natural bridge karst system and Houping karst doline system. They developed at the mechanism of the Yangtze Gorges crust lifted since Neogene. They are significative carst system in the world.

Furong cave and Furong river karst system is located at Jiangkou town in southeast Wulong County and neighbors to the entrance of Furong river running into Wujiang river. The karst system developed on the carbonate rock of Cambrian and Ordovician. It is composed of Qikeng cave, Shuairen cave, Weijiangling cave, Dongba cave, Xinlukou cave, Shuilian cave,Furong cave, Gangan cave , Sifang cave and Furong Gorges. The caves are all spreading on the right bank of Furong river except Shuilian cave and spreading from the top of plateau through valley slope to the valley bottom. The elevation ranges from 1162m to 180m. The relative elevation of the caves is close to one kilometer. In this cave system, the caves' channels whose elevation is over 800m and lean to bank are vertical. Qikeng cave is the deepest vertical cave among the detected caves in China at present and the vertical depth is 920m. Dongba cave neighboring to Qikeng cave is the second deep and it is 656m deep. The caves whose elevation is less than 800m are main transvers caves, such as Shuilian cave, Furong cave, Gangan cave and Sifang cave. We can find similiarity in other vertical caves. The length of Furong cave is 2846m. The size of the cave is grandiose and there are so many various speleothems and cave minerals in Furong cave that we have not found in other caves in China.

Three Natural bridges karst gorge system is located at Baiguo town in northern Wulong county and on the limestone of Triassic where Yangshui river runs through. The types of karst geomorphology are rich and colorful, rare and typical. The types include surface river gorge which was captured about 14.5 kilometer, caves, several unprofitable and indraught karst cave mouths, karst doline, natural bridges and karst springs. Natural bridges are composed of Tianlong bridge, Qinglong bridge and Heilong bridge. The gorges are 200-400m deep. Yangshui gorge and Longshui karst suture gorge are the most splendid among the gorges. Karst dolines include Qinglong karst doline, Shenying karst doline, Zhongshiyuan, Xiashiyuan, Haziyan, Meiziao, Hejiatuo karst doline, etc. Caves are composed of Xianren cave, Longquan cave, Baiguo swallet stream cave and captured caves such as Seventy-two fork cave, Shuangmen cave and Mongkey cave. Springs comprise of Qingtian spring, Shenying spring, Fog spring, Three-layer spring, Thread spring, Pearl spring, Sanchao shengshui multi-tide spring, etc.

Houping karst doline system is located at Houping town in the northeastern Wulong county. The karst system developed on limestone of Ordovician and composes of Qingkou, Cattle Nose, Shiwang cave, Daluodang, Tianpingmiao and underground caves such as Erwang cave and Sanwang cave. Houping karst doline system is relatively peculiar and rare on the world because there must be special geologic geomorphology and hydrogeology to develop scouring karst doline system.

1.3.2 Geomorphologic evolution

The geomorphology pattern of the nominated property was formed after Yanshan Movement. The crust was lifted again by Yanshan Movement. The geomorphology of this region has evolved for three phases under the endogenetic action and epigenic action:

(1) Higer Plateau Phase: The most archaic geomorphology of the nominated property is at Yangtze Gorges and is named E’Xi period geomorphology. It was developed about in the late of Mesozoic to Paleogene when the surface was denuded and leveled for a long time. At the period, the highlands were denuded, the billabongs were filled and the surface turned into gentle hilly landform. At present, there leaves some rudimental landforms which spread in the region of high watershed, such as the top of Xiannu Mountain, the rudimental peak of the watershed at the both banks of Furong River. The

altitudes most are over 1500m. Because the geomorphology has been diastrophed and denuded for a long time, we identify it difficult now. The planation surface was lifted that related with Himalayan Movement. There is no direct connection between the geomorphology of Higher Plateau Phase and shaping three karst systems of the nominated properties.

(2) Hilly Plateau Phase: Hilly Plateau Phase is an important phase of developing geomorphology. Since Eocene Epoch (5.7 Ma), Indian Ocean Plate has dived toward north, producing vigoroso northsouthward compressive power so that Tibet Plateau was fast uplifted and Himalayan Mountain was formed. We name the tectonic movement as Himalayan Movement. Himalayan Movement is divided into two phases or three phases. The early Himalayan Movement occurred in the late of Eocene Epoch to the middle of Oligocene. It not only shaped the grand rudiment of Tibet Plateau but also destroyed the planation surface of Higher Plateau Phase, formed new folds and fractures. After Himalayan Movement, the surface turned to relatively steady and lasted to Pliocene. The climate was wet and hot in this phase. The surface of Hilly Plateau Phase which we can find today was formed by the active fluvial erosion, chemical weathering action and karstification. It is composed of large-scale basins and dales, spread at the watershed. The altitude is about 1200m. At the region of karst, there is particular shallow burden karst landscape. The karst landscape is not prominent and typical on the surface. But there developed ferociously karst system underground. The geomorphology of Hilly Plateau Phase was ended at the late of Pliocene and the lower limit time is about 2 million years ago. The three karst systems of the nominated properties began to develop roundly.

(3)Gorge Phase: Himalayan Movement occurred from the late of Pliocene of Neogene to the early of Quaternary period and lasts to today. Himalayan Movement is characterized by frequently tectonic uplifteding alternated with transitory relatively steady phase and cold climate alternating with warm climate. The landform is not characterized by wide and gentle planation surface of Higher Plateau Phase and Hilly Plateau Phase, but is characterized by river undercutting action. At the beginning of the movement, the wide valleys were formed on the river banks at the region of Three Natural bridges and perfecter drainage systems were formed at the region of Furong River running. The

process occurred at the early of Pleistocene. A strong tectonic movement occurred after the process in Guizhou province which strengthened the large-size and large-range gradient uplifted from west to east and unequal fracture on Guizhou Plateau. The region of Wulong had met with the corresponding tectonic movement. At the process, the landforms formed in Higher Plateau Phase and Hilly Plateau Phase were uplifteded to different altitudes, rivers began to undercut the surface of Hilly Plateau Phase. The depth of undercutting Wujiang River and its reaches is over 500 meter. Because the platation surface that formed in Hilly Plateau Phase has been intermittent uplifted since Quaternary Period, the terraces developed on the banks of surface river, the flow direction of underground river has been changed for several times. Swallet stream and multilayer caves have developed time after time and resulting natural bridges, gorges, karst dolines on the surface and complex configuration caves underground. The climate changed cold and warm by turns, glacial age and interglacial age came forth in Quaternary. It is important to develop geomorphology. Accumulation was happened in rivers and collapse was happened in caves in the cold and dry glacial age. The streams undercut and chemical sedimentation was active in caves in the relative warm interglacial age.

Although the climate changed cold and warm by turns in Quaternary, the climate was not affected by ice cap of Quaternary. The karst geomorphology formed in Neogene (or more archaic) was conserved well. Karst vestige such as natural bridges, caves, karst dolines and gorges developed larger and perfecter by cooperation of surface and underground karstification along with new tectonic uplift in Quaternary.

1.4 Climate

The nominated property area is located mid-subtropical humid monsoon climate region with mild climate，abundant rainfall and obvious four seasons. The average annual temperature is 17.9℃ and the annual average precipitation is 110,5mm. The dry season and wet season are quite distinct from each other. The precipitation is concentrated in May to October, Occupying 70% of the whole year’s. The annual average humidity is 78%.

1.5 Hydrology

In Wulong County the main surface-water system includes the anabranch called Wujiang River, from Yangtze River's south bank, and the other water systems. The rivers associated with heritage-nominated area mainly include Furong River (a tributary of Wujiang River), Yangshui River and Muzong River. Furong River, an incised-gorge river, is the biggest tributary of the lower reaches of Wujiang River, whose source is in Guizhou Plateau. Its drainage basin has the length of 160km in a direction between south and north, fall height of 110,8m, average gradient of 4.79‰, and average discharge of 166m^3/s. Its annual average discharge is 5.23×109m^3,and the high water season is in April to October, whose discharge occupies 84% of the total.

Natural Three- Bridge Karst Gorge System, is situated on Yangshui River, and is 26km long with average runoff depth of 813.3mm. The region where the river flows and limestone distributes becomes dry valley (wadis) owing to groundwater's capture.

Houping Tiankeng Karst System is the water source of Muzong River. At the source there is Mawan Kave Spring, whose high and low discharge is 1-30m3/s.

It is worth pointing out that, all the surface-rivers have the character of deep-cutting in this area, and the situation goes straight to the source, and forms equally thick layer of packing gas in the limestone stratum. The chacteristic has great significance, which promotes in forming many kinds of Karst.

1.6 Biology Species

1.6.1 Plant

In Wulong Karst nominated property area, the animals and plants, especially near Furong Cave and Furong River are the most important. In the area, the rivers cut deep, and the climate is warm and humid, the lithological character landform types are complex and diverse, the population is sparse on the valley. All these create many different kinds of habitats for the growth of the vegetation .Therefore, there are a rich varity of plants, plenty of vegetation type, and a great many of special and decorative plants.

There are vascular plants 139 families, 375 genera and 558 species near Furong Cave and Furong River. Among them, there are 56 species Pteridophyta, belonging to 32 genera, 19 families; 12 species Gymnospermae, belonging to 11 genera, 8 families; 490 species

Angiospermae, belonging to 332 genera, 112 families. It shows that in this area the plants are various, which is rare in the similar natural environment in calcareous rock area.

The vegetation types are diverse, including : warm needleleaf forest, evergreen broadleaf forest, deciduous broadleaf forest, shrub and grass bunch, bamboo forest, bamboo and shrub bunch, grass patch and so on. It dictates that the area has zonal character which evergreen broadleaf forest propers. The variable vegetations produce plant landscapes which have different scenes. In addition, the vegetation's aspection change is obvious. In spring and early summer, the jade green background is embellished with red, yellow and violet flowers, which is a blaze of colour and full of joys of spring. In high summer, it becomes oily green. In autumn and winter, the red maple leaves, the pyracantha fruit, the nandina fruit, the red oranges, the yellow quercophyllum leaves, the gingko leaves and the dark green leaves matches so that the scenery gets gorgeous and exquisite.

In Natural Three- Bridge Karst Gorge Area, the vegetation is classified to mid-subtropical humid evergreen broadleaf forest. The primary vegetation has been destructed because of man's activities, and now mainly the secondary vegetation exists. Most of it is warm needleleaf forest, shrub forest or shrub and grass bunch. The vegetation in spatial change is remarkable, and to some degree, the aspection becomes different. There are some species on National Key Protection Plants List: Ginkgo biloba, Eucommia ulmoides, Taxus chinensis, Handliodendron bodinieri, Liriodendron chinense, Juglans regia, Phellodendron chinese, Fagopyrum dibotrys, Cinnamomum cam phora, Camptotheca acuminata, Actinidia chinensis, Gynostemma pentaphyllum.

1.6.2 Animal

In the valley zone along Furong River, the mountains are high and slopes steep, the forest makes good ground cover, and man's activities have little influence on here so that this area becomes a reservation and shelter for wild animals. In this area, there are abundant animal species, altogether 237 species, among them, fishes 64,bird 108,beasts 47,and ampibitious reptiles 19.

Furong River Area is a key region for protection and research of our country's biodiversity. There are rich varity of rare and valuable animals, including 5 species for

Class protected animals of nation : Manis pentadactyla, Neofelis nebulosa, Trachypithecus francoisi and Aquila chrysaetos ; 19 species for Class protected of nation：such as Macaca mulatta, Manis pentadectyla, Cuon alpinus, Prionodon pardicolor, Viverra zibetha, Viverricula indica, Protelis temmincki, Moschus bereaoskii cavbangis, Lutra lutra, Martes flavigula, Aix galericulata, Milvus migrans, Syrmaticus reevesii, Chrysolophus pictus, etc. There are 18 endangered species of animals in international trade stipulation protection name list, such as Panthera tigris, Manis pentadactyla, thoracica, Paradoxornis webbianu. Some communities has a high value on traveling and sightseeing, like Trachypithecus francoisi, Macaca mulatta and Phasianus Colchicus community, Garrulax canorus, Leiothrix, etc. 64 species of fish distribute in Furong River, including 33 endemic species in China, accounting for 50%. Thus, some birds , such as Chrysolophus pictus, Syrmaticus reevesii, Garrulax poecilorhynchux be rthemyi, Pycnonotus sinensis, Spizixos semitorques, Bambusicola thoracic,and Paradoxornis webbianus , are also endemic species in China.

Trachypithecus francoisi is traditionally named black monkey, orgreen monkey, rare and precious in China, and Class protected animal in our country. Two crowds were discovered twice in Furong River Gorge On Nov 24th, 1993 and Jan 31st, 1994. The number of them is quite small. Each small group has 3- 5monkeys, gathering and becoming a big group also only has 8-10 monkeys or so. The monkeys mainly distribute in Zhuzi Brook and Xianba River on the right bank of Furong River .The monkeys were discovered in Xianba River. The space to seek food is narrow and they live on tender leaves and buds.

Macaca mulatta named yellow monkey is Class protected animal in our country. According to the first investigations, there are approximately 300～400 monkeys in Furong River Valley . The biggest community has about 90 monkeys, generally 30～50. The active space of Macaca mulatta is rather wide, may be divide into 4～5 groups :

from Huaxi Power Plant to Guanyintai to Laohaokou group, Houshan group, Jianzishan to Xuanba to Yanganshan group,Furong Cave to Tianxing Qun ;Sifangjing to Panguhe group.

In Furong Cave and Furong River , 109 species birds are known and they belongs to 14 orders 33 families 78 genera. Aquila chrysaetos is the species of the first class animal for protection in our country. It mostly inhabits and reproduces on the high cliffs near Huaxi Power Plant in Haokou Town. When it is sunny, they soar and hunt down animals like lambs as their food.

In Natural Three - Bridge Karst Area, it has the feature of high mountain steep slope, dense forest, and abundant animal resources. The wild animals has mammals7 orders 17families 47 species, reptiles 2 orders 20 families 28 species, amphibians 2 orders 7 families 20 species, reptiles,birds 15 orders 39 families 174species, fishes 7 orders 8 families 34 species . Spiders, butterflies and other animals are found in QIshiercha Cave. Even bats are found in which the place is about 5,000m far from the mouth of the Fairy Cave. Tadpoles and blind fishes are also discovered in such caves which have water, as Longquan Cave and the Fairy Cave, etc. Living in such dark environment, their eyes have seriously degenerated, the whole body have become transparent, and their body color also get light so that it is easy to see their internal organs and skeletons, etc.

1.7 Population

In the end of the year 2004, the statistic has shown that the number of the residents in the nominated property area is 3,940, 23,993 in the buffer zone, the total 64024.

Table 1-2 Estimated number of population in the nominated property and buffer zone

Nominated area	Number of population in nominated property area			
	Core zone	Buffer zone	Total number of residents	Statistic year
Furong Cave&FuRong River Karst System(section)	1850	9406	11316	2004

Three Natural Three- Bridge karst Gorge System(section)	1680	12037	13717	2004
Houpingtiankeng Karst System(section)	410	2490	2900	2004

2. The principle, basis, object and goal of the protection

2.1 The principle

2.1.1 Protection first

Firstly, we should establish the concept that preservation is the start of the protection. The karst landscape and the precious wildlife are the precious natural heritage, and its integrity and the authenticity must be well protected. It is primise of all works in the inheritance place. Therefore, the relations of the tourism resources exploitation and the ecological environment protection must be correctly treated to guarantee the karst landscape, the vegetation and the ecological environment are not destroyed and the quality of the air and water do not severior.

2.1.2 Sustainable development principle

The sustainable development should harmoney the population, social, the economical, resources and the environment developing in phase, take does not sacrificing the benefit of the offspring as the premise, while guarantee the environment and the resources sustainable using. Any exploitation of Wulong Karst Inheritance nominated area must follow the sustainable development principle, enable the tourism resources obtain the full exploitation and use. Meanwhile, the exploitation can maintain sufficient coordination and uniformity with the environment. Each plan implementation of the nomination is a dynamic system, the plan must be advantageous to gradually constructions and implements, continuously development, and places the protection firstly.

2.1.3 Give prominence to the principle of the keystone and the characteristic

The value and the landscape attraction of the inheritance place is decided by the particularity of the prominent value karst landscape. Consequently, the plan must put

emphasis on well protecting and fully displaying the characteristic and the superiority of the resources.

2.1.4 System coordination, comprehensive planning principle

Each area of the nomination place is a characteristic and integrated karst system and forms the unique comprehensive space respectively. The relations of each part (subsystem) must be coordinate commendably. Specifically, the idea of the entire drainge (surface water and ground water) should be applied during coordinates the relationships between various subsystems and different drainges.

2.1.5 Ecology care principle

The ecological environment is most important natural background of the inheritance place. Good ecological environment and high-grade environment quality is not only one of the important prerequisite of protecting karst landscape commendably, but also the driver that scenic spot maintenance formidable attraction.

2.1.6 the principle of harmony the relationship between the economical development and environment protection

In the nominated property and the buffer zone, the plan must correctly deals with the relationship between inhabitant's economical development and the inheritance protection. From current protection practice, the local community inhabitants participate in protection should be carried out. By guiding them to take part in the protection related works to obtain the source of the life needs income. Meanwhile, raising their protection consciousness will reduce the economy dependence on local biological and land resources, which will benefit to the protection of the nominated property .

2.2 The basis of plan establishment

Founded on the investigation and evaluatuion of the karst landscape of the nominated property place, the plan rest on the Chinese scenic spot and the national geology park related laws and regulations. All the plans should study other country’s national park scientific plan principle and follow the world inheritance protection joint pledge, which will eusure an advance plan.

This plan bases on the following laws and regulations, standard and documents:

《Convention Concerning the Protection of the World Cultural and Natural Heritage》

《Provisional Regulations of People's Republic of China Concerning the Administering of the Places of Scenic and Historic Interest》

《Implementing Measure of the Provisional Regulations of the Administering of the Places of Scenic and Historic Interest》

《Circular of the General Office of the State Council on Enhancing the Protection and Administration of the Scenic Areas》

《Law of the People's Republic of China on the Protection of Water Resource》

《Forestry Law of the People's Republic of China》

《City Planning Law of the People's Republic of China》

《Law of the People's Republic of China on the Protection of Cultural Relics》

《Law of the People's Republic of China on the Protection of Wildlife》

《Environmental Protection Law of the People's Republic of China》

《Land Administration Law of the People's Republic of China》

《Regulations of the People's Republic of China On Nature Reserves》

《National Standard of the People's Republic of China·Universal Regulation of the Tourism Plan》

《Regulations of Protection and Administration of the Geological Relic》

《Regulations of Scenic and Historic Interest Plan》

《Regulations of Chongqing City Concerning the Management of Scenic and Historic Interest》

2.3 Main protection object and protection measures

Due to the advantageous conditions of the climate, the geology and the geography,

various geological forces, such as the fluvial, karstification, gravity, shaped the karst geology and landform, which had very high watching value and scientific research value, during the geological time in the Wulong Karst Inheritance nominated area. They are including: The natural bridge, Karst Cave, Karst canyon, Tiankeng, Shaft sunk, Duochaoquan spring, swallet spring, Karst depression, Funnel, stone hills, columns and so on. There are many extremely precious karst landscapes, which has the international significance or the top class of the domestic, in these leaving behind non-renewable geological relics.

The main protection objects are: The natural bridge group, Furong Cave and Tianxing town shaft sunk and cave group, Furong Jiang canyon, Tiankeng group, Baiguo geologic gap shape canyon, Karst spring and so on. There are different protection missions for the three subareas of the Wulong Karst Inheritance nominated area.

2.3.1 Furong Cave Furong Jiang Section

The important karst landscape in the Furong Karst Cave-Furong Jiang sector, which includes Furong Karst Cave, Tianxing Shaft sunk and Karst cave group (Qikeng cave, Tongba Karst cave, Xinlukou Karst cave, Shuiliandong Karst cave etc), Furong Jiang canyon, and the precious wild life in both of Furong Jiang banks constitute the main protection objects together.

(1) Furong Cave

Furong Cave is a large-scale corridor type limestone cave,there is 2392m cave with huge space,every cave secondary chemic deposit shape is respectively dazzling and colorful, especially the non-gravitational water deposition shape still is rare in the world at present for its widespread distribution, pure quality and perfect shape.It is more rare in the nation and world that the canine shape calcite crystals, raft stalagmite, aragonite crystal frost, gypsum flower and antler helictite which is forming in the basin.So it is a underground artistic palace and scientific museum which is worthy of the name,while it has very high tourism value and scientific research value, so that it may enter into the row of the finest cave in the world. The huge act and fast running waterfall, the origin of life,the coral basin, the greatest gypsum flower, the canine shape calcite crystals and gypsum flower cave which it hasn’t opened to outside at present, which not only is Furong

Cave characteristic representative, also is the most main protection object.

It is noteworthiness, which the cave environment system from original relative close, independent and stable system has changed to receiving the jamming, half opening system along with the opening tourism of Furong Cave, cave environmental factor such as air current, humidity, temperature and so on have been changed ,caused the cave landscape having any degree variation. Moreover there were scattered bedrock collapsing and stalactites falling in the cave.These disadvantageous signs have aroused correlative department notice. It is a actual urgent task that protects Furong Cave practically. Furong Cave protection divides into following several aspects:

First, the stability of Furong Cave. The stability of Furong Cave should be monitored further , and the advance alarming system should be established. Monitors the stability of the cave wall rock and the growed stalactite class around it, the collapsing and the sliding probability of the wall rock, the falling and the collapsing of the stalactite class and so on, consequently guarantees the safe tourism of Furong Cave.

Second, the cave environment protection. In attention to monitors the change of the main environment factor in the hole, including cave air temperature, humidity, CO2, positive and negative ion, wind, niton and its consistency; the essential factor of the water (dropping water, running water, water of basin) such as temperature, PH value, conductance. Based on analyzing the mass obtaining datas, understands space-time change of the various essential factors in the cave environment system; observes and analyses environmental variation and the cave self- cleaning ability cause for the different quantity tourists enter cave, namely observes and analyses the antijamming ability of Furong Cave environment system, determines the maximum quantity of the tourist in the precondition which guarantees the high-quality cave deposit.

Third, the protection of the secondary chemic deposit in the precious cave. Monitors the water quality and the hydrochemistry ingredient change in the main basin in order to keep the water nature.Gets to the bottom of the main cause which the cave landscape degenerates, discusses the protection plan of the cave landscape, does experimental research for repairing Furong Cave landscape, then achieves the sustainable development and continued use forever of the resources.

Fourth, the protection and restoration of the vegetation above the top of Furong Cave, the implementation takes back from agriculture returns the forest.

(2)Tianxing shafts

There are a great deal of shafts (karst pits) inTianxing area, which located at upsteam of supply region of the Furong cave shares the typical hydrology geology setting with Furong cave. Many shaft caves, such as Qikeng cave, Dongba cave, and Xinglukou cave are widely distrituted here. The Qikeng cave, with the total depth is 920m (the top elevation and bottom elevation are 1162m and 242m asl respectively) and total length is 5.88km, is the deepest vertical shapt caves that have been probed. Besides these cave shaft groups, there are many funnels, valleys in this region. They are closely related with Furong cave's formation, evolution process and need special protection. The major protection works include: 1) protection of cave shaft groups; 2) vegatation and envioronment protection. The vegetation condition, water dischage and polluted or not are directly affect the environment and landscape of Furong Karst cave.

(3) Furong jiang gorge

The Furong river canyon is not only important Karst landscape, but also the important tourism resources. In addition to take attention to protect canyon itself, we should pay special attention to geological vestige as follows:

(1) The Cambrian strata, which has been incised nearly 1km, is deposited 0.5 billion years ago. From which many geological phonomon can be found such as strata plane, the crevasse, the fold and the avalanche. Those unique geologic stractures form a significant landscape.

(2) Two special stone hills, which are named as "big stalagmite" and "small stalagmite" respectively, distributed in this region is the symbol of relic corrsion landform. Meanwhile, the small-scale rock sight is formed by microgeomorph landscape, which is constituted by the special rocks in the river or bank.

(3) About dozens of waterfalls, which is formed by the Karst springs and the seasonal surface water on the cliff banks of Furongjiang River, have different discharge and shape. The Longkong waterfall, about 5m widths, is the biggest of them and a subtorrent's exit on the canyon valley wall.

(4) Outside cave stalactite: Under the biological participation, there are the great amounts of tufas on the both cliff banks, which constitute biologic Karst landscape. Some of them hang on the disks; others grow on the rocks with different shapes.

(4) Zoology and botany

We must proect the vegation of Furong river canyon. Generally speaking, vegtation in the Furong Jiang canyon is well, which not only effectively reduces water and soil erosion, but also plays very good role in scenery. It intensed foil and strengthened the karst landscape in this region. In the canyon, the dominated landscape is the cliff, the narrow river valley, and the current of water. The vegetation coverd in the cliff further strengthened the entire canyon’s landscape, which showing not only the magnificent but also the quite and beautiful. The special plant and groups in Furong jiang is characterized by subtropical vegation. There survive many kinds of rare and precious animals, such as Presbytis, Francoisi, Macaca, Mulatta and so on, which take the forest or brush as the dwell and multiplication place. Protection of the canyon area’s plant will also effectively protect these rare and precious animal resources.

2.3.2 Karst Gorge and Three Natural Bridges

The physiognomy landscapes of section area of Three Natural bridges karst gorge are abundance and centralized distributing, from the core of Three Natural Bridges and Tiankeng which locate in, radiating to Middle Stone Yard Tiankeng、Bai Guo earth fissure style gorge、Sanchaoshengshui multi-tide spring, among which the main objects to protect are Three Natural Bridges、tian keng、dry valley、cave、karst spring、earth fissure type gorge, etc.

(1) The Gorge And Natural Bridges

Three natural bridges which featured by giant dimension, distribute one after another and extend 1.5km in Yangshui river valley in the section area of Three Natural Bridges karst gorge, which are the biggest dimension natural karst bridges and very rare、extremely precious karst landscape that have been discovered and reported in the world. In order to utilize the world wonder continuously, we must protect it particularly.

Firstly, protection of ecosystem environment, up to now, not only the tremendous current which shaped the Natural Bridges in the past has filtered into underground by and large, but also the main groundwater stream no longer under the Natural Bridge cluster yet, therefore the surface water flux is scarce, and the whole feature of the whole Natural Bridges landscape would be weakened once without the surface current, so protection of surface current in every possible way appears extremely important. Secondly, protection of Natural Bridges themselves, constructing other more buildings is forbidden, and such destroying behavior as firing an artillery section to dynamite is also prohibited, in order to prevent the Bridge body from collapsing and being destroyed by contrived factors. Thirdly, we should pay attention to the stability of steep cliff of gorge's banks, defend and reinforce the points betimes where danger probably occur, set up precaution signs, make sure they are well protected, and guarantee the tour security.

(2) Tiankeng

The primacy are Qinglong Tiankeng、Shenying Tiankeng、Zhongshiyuan Tiankeng、Xiashiyuan Tiankeng, and the secondary are Dashiyannao Tiankeng 、Goatcave(Sanwangcave) Tiankeng、Hejiatuo Tiankeng, etc. Qinglong Tiankeng and Shenying Tiankeng alternating distribute with Three Natural Bridges, all these together constitute an infrequent landscape of Three Natural Bridges; Zhongshiyuan Tiankeng, whose upside opening area is $27.8\times104m^2$, has been regarded as the second largest in upside opening area in the world at present, and at the bottom of which there are terrace landscape and farmer yards, which are easy for tourists to access and conveniently for tour exploiture. Something must be done to take good care of the original feature and surrounding vegetation. It's not allowed to mine mountain stones near the Tiankeng or to construct any buildings without programming.

(3) Karst Spring

The most important is suspending spring such as Sandie spring、Yixian spring、Pearl spring、Fog spring, etc, and Sanchaoshengshui muti-tide springs. The dynamic variety and water quantity of the spring are directly controlled by status of supply area. Water quantity

of Sanchaoshengshui muti-tide spring follow the rule that varies regularly and periodically, if the vegetation ecosystem environment in the spring's supply area were destroyed, the most important attribute will possibly disappear or being weakened consumedly, thus loses its tourist value. Therefore, it is especially important to protect the vegetation ecological environment of its supply area.

(4) Baiguo Fissure Shaped Karst Gorge

Baiguo fissure type karst gorge include the earth fissure type gorge of Baiguo upstream lurk stream entrance、caves of the lurk stream segment and Longshuixia earth fissure type gorge at the lower reaches of the lurk stream exit, the most important is The 'little Natural Bridges which was made up of Feitian suspending waterfall、downstream gorge、collapsed rock, etc. The key points of protection: firstly, protection of the vegetation ecological environment of gorge's bottom and surrounding, not to add artificial buildings at will; Secondly, we should pay attention to the stability of the steep cliff of gorge's banks, defend and reinforce the points betimes where danger probably occur, set up precaution signs, make sure they are well protected, and guarantee the tour security. Thirdly, protection of water source which include two aspects of water source (water volume) and water quality, water of the fissure type gorge valley is clear enough to see bottom, rill year to year, which adding some nimbus to the gorge, therefore we must pay attention to protect the vegetation ecological environment of supply area.

(5) Cave

Within the section area of Three Natural Bridge gorge karst Xianren cave、Longquan cave、Qishiercha cave, etc are main objects to protect. The key key protection of Xianren cave is its water source and environment, for it is a lurk stream pattern cave, the surface stream which descends to dry ditch from the upper reach flow into cave directly, some rubbish often can be seen in flowing water, being carried into the Xianren cave, causing pollution, we should attach importance to protect the existent problem. There are many cave cultures whose whole body is transparent such as blind loach、toad congener、big tadpole and so on, they must be protected particularly, We should pay attention to protect

the Qishiercha cave, which is an important site to study the ancient hydrology characteristic for its position is higher, the era when it coming into being is comparatively remote, and the loose accumulative deposit at the bottom of the cave is thicker.

2.3.3 Houping Tiankeng Section

Geological vestiges such as Tiankeng cluster of scouring and denudate patter、cave system、karst spring、gorge、stone forest、stone column, etc, which belong to karst section area of Houping Tiankeng are the main objects to protect. As core of karst landscape, the Tiankeng cluster together with surrounding caves、karst spring、gorge, etc, constitute an integrity and various developing phase karst system, which covers from non-karst zone to karst zone、from surface to underground、from upstream to downstream、from supply area to drainage area.

(1) Tiankeng Cluster Of Scouring And Denudate Patter

Tian keng cluster of surface water scouring and denudate patter is made up of five Tiankeng includ Qingkou Tiankeng、Shiwangcave Tiankeng、Tianpingmiao Tiankeng、Daluodang Tiankeng and Niubicave Tiankeng, which is the rare karst landscape in China, even rare in the world dimension. Therefore, we should attach much importance to protect it. Firstly, to protect the rock of the Tiankeng's bottom and cliff wall, strictly to prohibit quarrying mountain stone; secondly, to protect the vegetation inside or outside of the Tiankeng which has scenery-making function, even have it closed to breed it, strictly forbid to deforest; thirdly, not to construct buildings near the Tiankeng so as to keep its original feature.

(2) Cave System

Tian keng of scouring and denudate patter is main site to absorb ground surface water, caves developed under which are centralized channel to collect the flowing water, such as ERwang cave、Sanwang cave、Mawan cave and so on which lie under the Qingkou Tiankeng, they are main carriers that contain such information as the development、evolvement of the Tiankeng and the tectonic uplift movement of the earth's crust, and

possess the significant academic value in scientific research, moreover, some caves(such as Sanwang cave) whose deposit landscapes are abundant, having higher Appreciation value and the exploration value. So the caves of the section area should be well protected, Under the circumstance of haven't being developed at present , we had better seal the cave entrance with iron barrier so as to prevent the secondary speleothemsl from being destroyed.

(3) Karst Spring

Mawan spring, which is the main spring in the section area, classified as big karst spring, which is the total exit of the groundwater in the distribution region of Tiankeng. As a integrated hydrological and geological unit, Mawan cave spring region , which has explicit boundary of drainage basin and conditions of supply、pathway、drainage, play a significant role, for it is the main geological vestige to understand about the dynamic force of the Tiankeng's development. And now, with the completion of hydro-electric power station in Mawan cave spring, rising water have submerged the mouth of the spring, Objectively play a role of protecting the mouth of spring, so it needn't specially protection. The main protection object is the ecological environment, especially vegetation in the spring's region, Intact vegetation is the condition that the spring water can be produced continuously, so the vegetation in spring region's ground surface should be well protected.

(4) Karst Gorge

Yanwanggou karst gorge, whose span and total depth respectively are 2300M and approximately 500m, is the modern gorge type that has single entrance. The surface water in the gorge which is collected in rainy season, gathered into the under-drainage system of Erwangcave from its southern Zaoyanhole. Yanwangditch gorge's growth have experienced two stages: the wide open plaint gorge in early period and the earth fissure-type gorge in the later period. Studying its growth process has vital significance for us to understand the local hydrology and physiognomy's growth and evolution history. Yanwangditch gorge is featured by deep and shady woods, especially the section which approach Zaokonghole, which is featured by deeply incision at the bottom of which, and standing-like at the lower part of the banks, narrow and steep, having certain appreciating

value, We should perform to protect the gorge, not to cleave the mountain or quarry rocks in the gorge section at will, and pay attention to protect forest and vegetation.

(5) Stone Forest

The pagoda-like stone forest which developed in the west of Houping township is a surface karst landscape which has appreciating value, also is a geological vestige to understand the speed and grow-controlled factors of the karst development, they should be protected, such behaviors as mining stone forest should be strictly prohibited, and the mountain、forest and vegetation which have scenery- construct function also should be protected.

2.4 Protection Goal and Protection Significance

2.4.1 Protection goal

Firstly, natural landscape resources in Wulong Karst nominated property should be strictly protected and reasonably developed according to the world inheritance protection joint pledge, the scenery scenic spot area and the national geology park related laws and regulations, to implement the policy of " strict protection, uniform management, reasonable exploitation, continual use", then under the uniform management of management structure in scenic spot. Secondly, it should be strengthened of its scientific research, reasonably used of its scientific value and esthetics value, powerfully enhanced of its use level. Thirdly, the boundaries and all levels of protectorate’s scope about the nominated property and buffer zone should be scientifically determined, to protect the landscape’s integrity and spontaneous’ combustibility, to protect integrity of the surface water system and the underground hydrology system. Finally, the Wulong Karst nominated property should be as far as possible to become the important base in world where we can carry out some spiritual and cultural activities such as the Karst scientific research, the education and enlightens, the tour leisure and so on, to become the landscape to be exquisite and become the natural heritage in world where the environment, social and the economy coordinated develop and become the place where enjoy a good global reputation under the protection premise, as the same time we have the responsibility to turn over the intact scenic spot having the world natural heritage value for the future

generations.

2.4.2 Protection Significance

(1) Guarantee the Karst scenic resources to continual use

The Wulong Karst inheritance nominated property has many Karst landscapes, mainly has: magnificent TianSheng bridge group, grand canyon systematic, multitudinous extraordinary TianKeng Karst, mysterious cavern and among them its secondary biochemistry settling making one exclaim in surprise, FuRong Jiang canyon and many precious zoology and botany resources among them and so on, they all pass through the nature long-term history to evolve, through they we may read out the very many rare natural recorded information, at the same time they are also produced by which the lithosphere - biosphere - hydrosphere -aerosphere affect mutually to form such characteristic. They are the world-class natural marvelous sights which all pass through a long geologic history time; many kinds of powers factor formed the non-renewable geological vestige under the special advantageous condition. Therefore, these natural landscapes have many unique attributes, they are rare, non-renewable, and not relatively duplication and not transportability and so on, usually they are called as the natural resource which universe has altogether. If we establish Wulong Karst landscape as the world natural heritage property, this action enable them to obtain the practical effective protection, thus not only they will be enjoyed for the modern people, moreover they will be shared for the posterity, continue forever to be used too.

(2) Protect ecological environment of Wulong Karst, protect its rare and precious zoology and botany species

The ecological environment in Wulong Karst inheritance nominated property belongs to Karst ecological environment system, moreover because its is quite frail, the vegetation above it mainly has crag natural disposition, dry natural disposition, grows as an attachment natural and happy calcium vegetation and by clears out punctures the brush to be composed, so if once is destructed, and want to obtain the restoration with difficulty. In the scope of already becoming the nomination places, specially ecological environment basic in FuRong Cavern FuRong Jiang piece area is good, there both has exquisite Karst landscapes and has good vegetation and massive rare, precious animals perch in the region,

for example there has 64 kinds of fish distributes in Furong Jiang, in these fish Chinese unique type achieved 33 kinds, occupy 50%. And there extremely have many kinds of birds such as Chrysolophus pictus L·、Symaticus reeresii Gray、Garrulax poecilorhynchux be rthemyi (D·et O·)、 Pycnonotus sinensis (Ome lin)、 Spizixos Semitorques Swihoe、Bambusicola thoracica thoracica Tem·、Paradoxornis webbianus (G·R·Gray) and so on, all of them are the unique type in China. Furong Jiang region is a key area of our country biodiversity's protection and research, so it is especially important to protect this ecological environment.

(3) Provide a high grade place to use for to travel and sightseeing, promote the local economical development

There mainly has a lot of Karst landscapes which they not only are rare in world but also have extremely high esthetics value with its graceful type and its broad in scale to provide advantageous condition to develop travel and sightseeing in Wulong karst nominated property. Tourist can receive a very vivid scientific inspiration and obtain scientific knowledge through their watch to Wulong karst nominated property because many landscapes of the nominated property itself have the very profound scientific connotation. For instance, industrial structure in this county-wide was adjusted, people who live in Wulong town transformed their thought, the self-consciousness of local people to protect environment and resources was greatly enhanced, good economic efficiency, social efficiency and environment benefit came to reality, all these advantage are obtained because of successful development and construct of FuRong Cavern. The rich zoology and botany resources in the nominated property became a organic constituent of the nominated property, these high grade resources of zoology and botany play the role which cannot be substituted for the humanity to return to the nature, to exercise their body and relax their mind, to take vacation and so on. While appreciating and praising them, the idea of treasuring nature and protecting resources can be transmit into the people with a watching and enlightening way to deeply take the idea of sustainable development in people's minds, to build a fine existing space and tomorrow with abundant resources for our generations after generations, if these natural resources have a high level and scientific development.

(4) Scientifically inspect, research into as well as scientifically popularize the base

Many Karst landscapes in the nominated property of Wulong Karst inheritance are rare landscapes, typical and completely Karst landscapes, thus they have the very high scientific research value, many important and significant topics for research are proposed for both domestic and international geographer, for example, the evolution of landform - hydrology system in Karst, the formation of Tiansheng bridge, the caverns' origin of shape at special chemical deposition, the type and evolution of Tiankeng Karst and so on are especially important and significant in research field. But there still have many places that are considered to be extremely weak of research and inspection in the nominated property and buffer zone, certainly there will have more new discoveries and more new tasks for the people to explore, study, solve along with the further scientific inspection.

The Karst landscapes in the nominated property and buffer zone will inevitably cause the people's interest and desire to explore the mystery of nature, become the popular scientific base, become to be the best, the biggest natural classroom to guide the people to enter the gate of the nature and study the nature.

3. Actuality

3.1 Importance and Necessity

Up to 2005 , The international heritage list , mainly in Karst landform and cave or something about Karst are 47, in which the international heritage list of Karst and cavern altogether are 10; In which was nominated by other reasons but including the international heritage list of Karst and cavern altogether are 28; Including the international heritage list of Karst and cavern world culture altogether are 9. In all of the international heritage list above , there aren't any examples like the Wulong Karst nominated property area , which forms and grows under the control of the earth's famous crust rising of Three Gorges of the Yangtze River area but performances in various ways of cavern, the natural bridge ,canyon and Tiankeng Karst system.

The Wulong Karst (Chongqing) Nominated Area satisfies World Natural Heritage criteria (vii) and (viii) among 10 criterion of the world culture and Natural Heritage.

（1）World heritage criteria (vii)

Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

The nominated property is to the Furong Cave, The natural three bridges, Tiankeng Karst and Canyon for representative's three integrated Karst system, which collects home deepest shaft, the esthetics value highest cavern, the world-class scale the natural bridges group, the Grand Canyon whose bottom is dry, the underflow which embezzling the surface river, the world rare natural bridge group and so on each kind of unusual, rare Karst landscape to a body, and the nominated property s Show the multilayer space in the face of land and underground, the collection Karst phenomenon and the nature unusual and wonderful accomplishing, which gives people that cannot take it all in , the strange taste coming up in great numbers and from all sides natural beauty enjoying, is the most unique natural beautiful scene and the important esthetics value area in the areas of South China Karst.

(2)World heritage criteria (viii)

Be outstanding examples representing major stages of earth's evolutionary

history, including the records of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

Three Karst systems formation and the growth of the Wulong Karst nominated property has involved the geologic history up to now about 540 million years from Cambrian period, the geology evolvement before Neogene period, which has provided the basic geological condition for the Wulong Karst, the earth's crust uplifting and the terrain, the landform evolvement since Neogene period, which has become the three Karsts' typical system demonstration the platform of Wulong. They have respective system integrity, which is under the identical earth's crust rise mechanism identical geological rise mechanism common control, under the different concrete geology, the topographical condition the Karst phenomenon different manifestation, which forms the type of different Karst system, thus vividly records and displays the Earth to develop this stage earth's crust ascent characteristic and its concrete characteristic.

The tunnel of Furong Cave system ,takes 450-500 meters elevation as, above 700 meters takes hangs to the growth as a characteristic; Below for hangs to with crosswise takes turn, which explained the earth's crust ascent movement nature by continuing ascent to transform for shakes the type rise.

The cavern channel reversion incline phenomenon of Houping Tiankeng karst system, and it explained the entire Karst system which forms in the earth's crust ascent process.

The natural three bridges Karst gorge system is the best illustration, and it is marvelous sight of the world Karst landform and nowadays the character which retains in the surface and the underground cavern that explained it has the complex formation, the evolution history. Its complex river valley of upstream , the disappearing current of the water-dunnel, upside the width Valley wall and lower part the canyon Valley wall cavern which demonstrated the different time the fluent direction, the natural bridge base approximate wadi present situation, the formation of Baiguo underflow and the capture to surface river system, on the Karst ground water runoff belt nearby many Tiankeng formation, the appearance of Wu River Bend to flow mouth and so on to compose a complete Karst hydrology--landform system and the evolved system, and between them both has the very good spatial distribution rule, and has in the time the successively

production, the development sequence may track down, which is a condition unequalled Karst natural museum and the scientific research natural test base on the Earth.

3.2 Present state of conservation

3.2.1 Receives the protection legally

At present, the Wulong Karst inheritance Nominated Area has been National Scenic and Historic Interest and National Geological Park, it is protected by National Laws and Regulations, such as 《Constitution of the People's Republic of China》、《Forestry Law of the People's Republic of China》、《Environmental Protection Law of the People's Republic of China》、《Water Law of the People's Republic of China》、《Provisional Regulations of the People's Republic of China Concerning the Management of Scenic and Historic Interests》、《Law of the People's Republic of China on the Protection of Wildlife》.

3.2.2 Efficient management system

The management structure of the nominated property area is perfect, its personnel disposes reasonably, and the finance source has the guarantee, in under national construction ministry, Garden Bureau of Chongqing city, the People's government of Wulong county, etc correction organizations management, administration of Furongjiang Scenic and Historic Interest of Wulong county was built. Under this administration are office, planning and construction section, protection section, the labor division with individual responsibility, mutually coordinates, each work marches into the standardization and legal.

3.2.3 Definitely boundary, protection plan has being impended

The three sections of nominated property area have been compartmentalized definitely ,and buffer area provides scenic protection and environmental protection of nominated area ,the area of Furong Cave —Furongjiang is 280 square kilometers, Karst landscape is well protected, Furong cave had been opened on May1,1994,the planning and protection measure are the first-class level among the same kind of caves in china; in 2000,the master plan of Furongjiang Scenic and Historic interest was passed the

evaluation ,and declared to the People’s government of Chongqing city .The people’s government of Wulong county had been announced “about the practical protection of Furong Cave and natural resource of Furongjiang Scenic”. Although the piece area is huge, but the core partial inhabitants are comparatively few, on some steep slope farming of Tianxing area lies in remit water district of Furong Cave first will be returned for farming to forestry.

The section of the natural three bridges gorge Karst canyon covers an area of 62 square kilometers, which has been already considered as "the geological vestige protectorate" by the People's Government of Wulong County, and was sent by the government circular form, which current situation of protection was good. The natual three bridges Scenic area had been opened on May 1, 2000, which was exploited and protected according to 《Scenery Scenic spot Area Act of administration》strictly. Partial land sectors of the main scenic area, have been constructed the stockades, plants in the scenic area were protected together by the scenic area and the local resident, and the operator pays the local farmer for forest compensation to undertake the responsibility of the protection ecological environment together.

The section of Houping Tiankeng Karst covers an area of 38 square kilometers, which takes the Tiankeng group as well as the complex buried river, the cavern system as the main Karst landform landscape. At present the position of this section is remote, few people, and the traffic condition slightly misses, which is precisely because this area has not been developed at present, therefore is apt to impending on protection and scientifically, reasonably exploitation in next step.

3.2.4 Monitor work is relatively complete

Wulong Kasrt nominated property area has been built monitoring indicator systems accordingly, dynamic observation and timely control have been impending on cave environmental, number of visitors, air and quality of water, forest fire, resources population of rare animals and plants.

3.2.5 Complete maintenance very good, and has the certain scientific research foundation.

Kasrt landscape (the cave、the natural bridge group、Tiankeng、canyon) which are the most outstanding value in Wulong inheritance nominated area and the completion of natural environmental are well protected. Since ancient, the natural three bridges (Dragon bridge three holes in ancient times) and Sanchaoshengshuiduochao spring (Three Chaoling water in ancient times) are two places of interests in old Peizhou. In Furongjiang basin, there are few people to live and its traffic is difficult and dangerous. Therefore, the major of nominated areas all remain in the natural condition, and they are influenced very little by human activities. These rare natural heritage have the higher ability to go against wind, such as the Tiansheng bridge groups, Tiankeng groups, then they have been protected very well.

In 1992, the relevant department had inspected the traveling resources and the water resources of Furongjiang. The Southwest normal university had submitted 《Furongjiang of Sichuan Section Traveling Resources and Traveling Development Plan》 in 1995, which provided concerning first material about geology, landform, biology, traveling resources of Furongjiang, The profound recognition about natural background of the Furongjiang canyon section, which has provided a good scientific foundation for Furongjiang's development. The people’s Government of Wulong County had announced, "about practically protects the Furongjiang scenery scenic spot resources the circular" in July 1993.

The Furong Cave was discovered by the farmer of in Jiangkou town nearly, Wulong County nearby on May, 1993, which was received the strict protection immediately .Entrusted the Chinese Academy of Geological Science Karst research institute of geology to carry on the comprehensive inspection immediately, to study and to develop the plan design work."96 Wulong International Caverns Symposia and the China Geological Society Cavern Research Board Third Session of Annual Meeting" was held in Furong Cave in 1996 .It not only deepened Scientific recognition about Furong Cave, but also caused the idea about the protection of Furong Cave into all levels of management thought deeply. Consequently, country union preliminary examination team ,including

China、England、America、Russia arrives at Wulong county many times during 1994 to 2005 to carry on the geological science inspection, and discovered many cavern of significant scientific value, such as Tiankeng groups, the shaft group etc.

At the same time, many scientific research, the teaching and the production unit of the Chinese domestic all have done the massive foundations work in Wulong Karst nomination area successively, and have finished the detailed geological inspection report and the master plan, and many achievements of plan and the research report have been published. So mastered the natural background, the environment condition of nominated area and the quantity and the value of the Karst landscape resources comprehensively, and make nomination land management and protective solid scientific foundation.

3.3 Threaten and Stress

3.3.1 Pressure of Development

The nominated place of inheritance is located in more remote mountain area and canyon district, Population scarcity, Production activitiy of Agriculture lack, About 66 people per square meter of population density, Residents inside the area of buffer are Relativity few at present, About 75 or so people per square meter of population density. Currently many places of buffer area belong to translating from farmland into forest, Agriculture activitis are decreasing little by little, The areas of plant trees in the continuous extension, Which Powerfully promote protection work and ecosystem systems of the scenic area to directly development of positive cycle. Because the reservoir was set up and made residents decrease in Furong river's canyon area, which is advantageous to protection of animals of dying out and habitats.

On the other hand, Because Establishment of the hydroelectric station of Shangjiangkou in Furong river , The lands inside the reservoir area is subjected to drown, A handful of location appears new agriculture to opened up,Plant was certaind estroyed. Some infrastructure construction,such as Highway、 Development of the small town and establishment of the hydroelectric station of Jiangkou results in certain sense of vision influence to nominated place and Buffer landscape area .

3.3.2 Pressure of Environment

Subjected to the influence of tradition produce and life style in the local residents, Plant in the nominated place of inheritance and the Buffer area was once threatened greatly, Along with establishment of the scenic area、consciousness of Protect was rmproved and ecosystem Agriculture was expanded, The kind of environment pressure was already alleviated consumedly now.

There is no Pollute industry enterprises in the nominated place of inheritance and the Buffer area, As a result the total quantity of the environment atmosphere and body of water are relative better, At the same time, The population density is small in the nominated place, the pollution to the atmosphere, soil and body of waters of the place is very small.

Big parts of region in the nominated place belong to protection regions of different property(scenery famous area of National class、National geology park),where have already been protected well, the influence of mankind' activity is small, The nominated place of inheritance is not subjected to pressure of environmental .

3.3.3 Natural disaster and reply to risk

There may appear of Natural disaste in the nominated place of inheritance : Collapse、landslip、Flood、Mudslide、karst collapse、Earthquake、Forest fire and so on, the personnel's training system have already built up , The trains of consciousness and measures against disasters should be Carried on, Prevent and reduce disasters are programmed actually

(1) Collapse

The main natural landscapes are placed in the relatively stable state.but because Caves、Natural bridge and Tiankeng steep are all very big geology body, Function of Collapse is unavoidable. The hole bottom of the Furong cave piles up a great deal of geology body, After 1994 the tour cave were opened to public, There have been 3 times of collapse because of parts of unsteady on top of the cave, In 2003 earthquake was educed because of storing water in the hydroelectric of jiangkou and resulted in pieces of the stalactite fall inside cave. To this circumstance, Investigative valuation of stability of

Furong cave have already carried on, and homologous measures were adopted.

Three Natural bridges and lots of steeps and Tiankeng are more stable, There have not taken place collapse obviously till now, But we should know of, the possibility of collapse still exists. At present measures have already adopted, The person taking charge of safety to strengthen inspection tour and the monitor to the risk rock, The risk rocks appear in parts of body, reinforce, remove danger, and insure the visitor's safety. There is a little amount facilities was set up on top of three Natural bridge region, under which there is river and Tiankeng, Special attention should be payed it , In steep region which may produce the stone of risk and roll and endanger the visitor's safe , The protection net or protection walls must set up to keep stones from falling.At the same time, We Should reduce facilities of service and visitor's activities to insure intact conservancy of the Natural bridge

(2) Mudslide，landslip

Somewhere in the nominated place of inheritance, such as the roads of the Forong cave landscapes were constructed in the region of canyon, mountain High and slope steep, more curved ways, When the natural disasters such as torrential rain or earthquake take place, They probably cause to landslip and mudslides. To prevent from mudslide, Firstly plant trees to forestation 、intercepts to decline water and alleviate volume;Secondly Necessary engineering measures are adopted , such as spray oar to protect 、block, open up a path and so on

(3) Flood

The nominated place of inheritance locates upper reaches of river, the threat of flood is not big, but there are some tour activities, especially the visitors of natural bridge landscapes region (including longshui canyon) carry on in the river valley, there is possibility influence of the flood disaster. The tours of Houping qingkou Tiankeng and Erwangdong exists the same problem. Therefore, in the tour activity of the raining season, we should be on guard flood to come suddenly in order to avoid endangering visitor's safety.

(4) Earthquake

Earthquake is the result of inside motive of geology function, According to《The districts diagram of The Chinese earthquake intensity (1990)》,The basic intensity of earthquake in the nominated place of inheritance is VI degree,Since historical records , there have not taken place big harmful earthquake ,The influence intensity of Earthquake happened around the nominated is all smaller IV degree .After stored water in the hydroelectric Jiangkou, It have induced several small earthquake.in order to guard against the earthquake disastrous, Firstly monitor work is done well, Sencondly in the couse of engineering design and construction, the anti- earthquake strength standard should be above 5 classes.

(5) Forest fireproof

Under the condition of nature (thunder and electricity etc)) and artificial, Forest Fire disaster sometimes is educed, We Should be pay attention to it. Forest fire watch-tower should be constructed in appropriate position area of forest intensive and high topography .Try hard to form strong forecast、watch from a distance、keep apart、communication and the fire prevention system that fire extinguisher mechanize and specialization of extinguishes fire troops ; Efficiently of forest fireproof specialized organization should be established and strengthened, Provided with joint defense troops of the forest firproof to guaranteed Various measures of fire prevention are put into effect.

3.3.4 Pressure of tour

The last ten years, there are about 100 thousand visitors in the Furong cave Furong river's scenic area every year. In the last five years the visitors vary between 70 thousand and 90 thousand in natural three bridge canyon scenic area, fewer than visitor’s capacity value. The visitors of the biggest capacity in a year in these locations are above million people, even in visitor's peak period, Currently visitor's number reach the capacity standard of the day. There is no area of life service established in the nominated place, no accommodation and dining, Visitors linger about 2 hours or so in each scenic area . In the near future the visitor's quantity will not exceed visitor's capacity. But taken from long-term, Because of narrow of tour roads and limited of the Furong cave in natural bridge scenic area, instaneous visitor's quantity must be restricted, we should formulate measures to deal the pressure that the visitors in high peak date bring.

In view of visitor's quantity is lower than visitor's capacity recently.at present there no find soil harden because of such as foot path, The environment inside the hole change importantly, Cherish organism resouces is subjected to threaten, Trave resulted in forest fire and so on .At least in recent few years The suitable tour activity will not give cave, natural bridge, Tiankeng, body of water and mountain bigger effection in the nominated place.

4. Protected Subarea

4.1 Character of the nominated property

The WuIong Karst nominated property have been given the honor of National Scenic And Historic Interest in May 2002 by State Department of China. A year later(2003),it was denominated National Geological Park by Country Resource Department of China.

4.2 The extension of the nominated property and proposed buffer zone

The WuIong Karst nominated propertyt is composed with three parts: the correlative area of Furong Cave-Furong Jiang which is located in the southeast of Wulong County; the area of Three Natural Bridges gorge karst locating in the central section of the county and the correlative area of Houping Tiankeng Karst in the northeast of the county. Each part of them is separated along the north and south bank of Wu Jiang (Attached drawing 4)The area of nominated property is 6000 ha and that is 32000 ha in proposed buffer zone .Total area is 38000 ha(Table 4-1).

Table 4-1 Area of nominated property(ha.) and proposed buffer zone(ha.) of Wu Iong(Chong Qing) Karst

Name	Position	Area(ha)
Furong Cave--- Furong	Jiangkou Town located at southeast of Wulong county,the	Area of nominated property:3000ha Buffer zone:25000ha

Jiang area	area near the entrance of Wu Jiang where a branch of Wu Jiang Furong Jiang flowing.	Total area:28000ha
Three Natural Bridges gorge Karst area	Located at north of Wulong county ,The area of Triassic Perriod calcific rock distributing where a branch of Wu Jiang Yangshui River flow by.	Area of nominated property:2200ha Buffer zone:4000ha Total area:6200ha
Houping karst Tiankeng Karst area	Zhongling Village of Houping Town in Wulong County.	Area of nominated property:800ha Buffer zone:3000ha Total area:3800ha

4.2.1 The correlative area of Furong Cave-Furong Jiang

Total area of this region is 28000 ha .About its extension,the riverway of Furong Jiang within WuIong County will be as the principal axis.South from Haokou Village of Haokou Town in Wulong County ,north to Jiangkou Town,the span is over 31km. Longitude is 107°47′E—107°57′E;Latitude is 29°02′N--29°15′N(Attached drawing 8). The highest mountain in this area is Yang'an Mountain.Its altitude is 1510m by contraries the lowest altitude is180m where is the confluent area of Furong Jiang and Wu Jiang.The maximal relative altitude difference is 1330m.

The extension of buffer zone is south from the district confines of WuIong County ,North to the line of Jiaozi Ding –Erdeng Rock--Yinjia Rock--Bayan Jiao.The mountain standing by both side of Furong Jiang will be as the boundary from east to west with about 10-16km width. The regionalism is include many villages and towns of WuIong County ,Such as Jiang Kou ,Shi Qiao,Jia Jiao,Hao Kou,Tian Xing etc. Besides that ,there also have few villages of Pengshui County , for example ,Longxiang,Ganxi etc.The total area is 25000 ha except the area of nominated property.

The extension of nominated property is 3000ha. Surrounding by the center of Furong Cave,shaft caves of Tianxing and downriver gorge of Furong Jiang is powerstation of Jiangkou---XinLukou---Tianxing---Qi Licao---Shuilian Cave---Sanhekou---Yueliangshan such circle areas.

4.2.2 The correlative area of Three Natural Bridges gorge Karst

The area of Three Natural Bridges gorge is located at northeast of Wulong County ,about 20km far from it.Just on the side of the road from Wulong to Fairy

Mountain .And have a distances of 15km far from the South-Grassland Fairy Mountain.Total area is 6200ha . Longitude is 107°45′E—107°51′E;Latitude is 29°23′N--29°29′N(Attached drawing 9).

The extension of buffer zone is east from escarpment on the east side of Shangshiyuan,and along the ridge to the line of Meizitang—Sanchaoshui—Caiba—Baiyanjiao—Jianfeng Mountion. South from Jianfeng Mountion to Boxianglin where is have a distances of 1km far from the south exit of Longshui Gorge.Southwest is arrive at the near of Tunao Mountain, along the road to Old Houses. West to Old Houses—Yuanzibu—Wayaowan—Tangba.It is the north confine and have about a distances of 1km far from north riverbank,along the cliff of lee cave,Mazong Mountain, extend eastward 500m near Shangshiyuan, including all the main sight of Karst in this Gorge Karst system. Total area is 4000ha except the area of nominated property.

The extension of nominated property is 2200ha. Surrounding by the center of Three Natural Bridges, Tiankeng Karst of Zhongshiyan and Longshui Fissure-like Gorge of Baiguo is Houzitao—Dashi Mountain—Hetao—Houtouwan—Sanchaoshui—Wangjiaba—Boxianglin—Dalong Cave such circle areas.

4.2.3 The correlative area of Houping Karst Tiankeng Karst

Houping Karst Tiankeng Karst is located at northeast of Wulong County. Exactly in the drainage area of Mawan Spring in the west of Houping Town.Total area is 3800ha . Longitude is 107°58′E—108°02′E;Latitude is 29°34′N--29°38′N(Attached drawing 10).

The extension of buffer zone is approximately making the watershed in the drainage area of Mawan Spring as the pale. North from Dajin Mountain --Baiyanjiao, south to the headstream of Muzong River and the exit of Mawan Spring.East from government of Houping Town and Tianchiba, west to Dajin Mountain—Hejiawan.Total area is 3000 ha except the area of nominated property.

The extension of nominated property is at the edge of Erwang Cave --Dashi Slope –Tuyu Spring – Liangzishang etc. Including the five top-drawer sight of Karst in Tiankeng-Karst system of Houping: QingKou, Niubizi, Daluodang, Tianping Temple and Shiwang Cave. They are all erosive Tiankeng Karst.Besides that, there are also include

some Cave system that is closely interrelated to the form and evolution of Tiankeng Karst.Such as Erwang Cave,Sanwang Cave and Gorge of Yanwanggou etc. Total area is 800 ha.

The definitely define about the extension of the nominated property and proposed buffer zone in Wulong can make the landscape of karst which have outstanding universal value to keep the integrated natural entironment, hill features and drainage area system. It can also protect the distinctive resources of natural landscape effectively and ensure it to have better visual effect. Furthermore, because the relatively few population and limited human action related to this area, the ecosystem in the extension of this nominated zoon have a better maintenance accordingly. The natural characters meet adequate reflection.

4.3 The partition of functional section

The method to divide functional section in property zone of Wulong Karst operate around the following key principles:

----- UNESCO in 1972‘Convention concerning the Protection of the World Cultural and Natural Heritage’ Article 4: Each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 and situated on its territory, belongs primarily to that State.

----- UNESCO in 1972 ‘Recommendation concerning the Protection, at National Level, of the Cultural and Natural Heritage’General principle:

Article 7: As the ultimate purpose of protecting, conserving and presenting the cultural and natural heritage is the development of man, Member States should, as far as possible, direct their work in this field-in such a way that the cultural and natural heritage may no longer be regarded as a check on national development but as a determining factor in such development.

Article 8: The protection, conservation and effective presentation of the cultural and natural heritage should be considered as one of the essential aspects of regional development plans, and planning in general, at the national, regional or local level.

-----In 2001 ’Regulations of Chongqing City Concerning the Management of Scenic and Historic Interests’General principle:

Article 4: The scenic and historic interest area must stick to the policy of conservation, unified management, rational exploitation, and continued utilization.

Article 7: All the relational administration ought to perform the responsibility of themselves according to the convention and try every possible way to manage the daily job of Scenic And Historic Interest cooperating with the superior department and administrative organization in this area.

Consulting to those documents and according to the actual condition in the nominated property of WuIong (Chong qing) Karst,then can carry out the partition and protection of functional section. Seeing that the main protective section is a geologic sight of Karst with the characteristic of larger dimension, distributing at different section and relative steady, so the nominated property of Wulong Karst can be divided into the core scenic area and the important scenic area.The buffer zone can be divided into ecology conservation and entironment protected areas, service and reception area and regular area.

4.3.1 The core scenic area

This section refer to the distinctive natural landscape area where has the top-drawer grade and according to the standard of World Natural Heritage.

The key point of programming in the core scenic area is :The natural scenic exist in this area must be protected strictly. The most significant protective section is : Furong Cave,Qikeng Cave,Three Natural Bridges and Tiankeng Karst among it ,Tiangkeng Karst of Zhongshiyuan,Gorge of Yangshui River where the Natural Bridges is located,Fissure-like gorge of Longshui ,Qingkou Tiankeng Karst of Houping,Erwang Cave ,Sanwang Cave ,etc. Serious protections shall be given to the natural landscapes of the core area, including valley, gorge, and water quality and quantity of the underground rivers, etc. Both sloping sides of Furong Jiang Gorge is the major room where the valuable and rare animal move around, so the protections of natural entironment in this area must be strictly. It is strictly forbidden to alter the original physiognomic and geological formation caused by human being. It is also strictly forbidden to mine, quarry, and irrigate.

4.3.2 The important scenic area

This section refer to these natural landscape distributing area where have the character of unreproducible and having the value of most science, aesthetics and tourism,but havn't reach to the standard of "World Outstanding".It is close to the core scenic area together with which compose the nominated property.

The most significant protective section is From Furong Jiang—Pangu River to Gorge of Furong Cave including the section upwards both sloping side; Dongba Cave, other shaft caves of Tianxing such as Xinlukou Cave, etc; swallet stream of Baiguo; Xianren Cave, Qishiercha Cave, Longquan Cave, etc; Tiankeng Karst on the east and southwest side of Natural Birdges; some erosive Tiankeng Karst on the upriver of Erwang Cave and Sanwang Cave,gorge of Yanwanggou ,etc.

Although the import of those landscape can not compare with the Three Natural Bridges, Furong Cave,QingKou Tiankeng Karst,Erwang Cave, Sanwang Cave, etc, but they are also infrequent natural landscape,and is a significant section of the whole Karst—hydrology system. They are significant protective section too because they have unsubstitutive function at the aspect of exploring development and evolution history of lithosphere on earth.

The key point of programming in the important scenic area is: the essential of programming in this area is basically be the same with the core scenic area,only slacken off the strict degree appreciably . There are a spot of residential area in the important scenic areas, so it must to control population as many as possible. The existing buildings and constructions that are inappropriate for the scenery ought to be torn down or reconstructed. Strictly control the constructions of the residential area , and develop ecological agriculture.

4.3.3 Ecology conservation and landscape entironment protected areas

This area has a large extension, including the mountains, riverheads around the nominated property. Ecology conservation area is refer to those forestry which biocoenosis and entironment has less disturb from human activity; geomorphy landscape has definite worthiness; consistent to the quondam state or have the potential of renew the quondam entironment.There is habitat of the valuable and rare animal. Ecology conservation area in the buffer zoon is mainly among the Scenic And Historic Interest of

Furong Jiang and Houping area, there are a lot of valuable and rare propagation. Less population lead to a nice ecology conservation.There are also a large range of landscape entironment outside of the Natural Bridges area.

Ecology conservation area ought to inextenso protect the existing ecosystem and zonal vegetation. Close the hills for afforestation especially to the brush-fire secondary forest and human forest according to the programming of vegetation foster and afforest.Striving to recover the quondam zonal vegetation in a mountainous area of calcific rock; protecting all the quondam object and geomorphy. It is forbidden to mine, quarry, fall trees, destroy woods, and hunt animals; constructions are not allowed except for the protection facilities; certain amount of tourism activities are allowed and there are limitations that only planned tour routes are allowed to open to visitors.

The primary role of the scenic and historic interest areas is to protect water quantity and quality of riverheads, especially the upriver water quality and quantity of Natural Bridges scenic area and Furong Jiang.

4.3.4 Service and reception area

The selection of the service and reception center base should be discreet, which shall be constructed in accordance with the conditions of local natural environmental and economic development, avoiding excessive pressure to the local environment which may have negatively impact on scenery resources. The service and reception center shall be set up in Wulong county instead of in the heritage nominated area of Wulong Karst.Jiangkou Town which is located at the confluent area of Furong Jiang and Wu Jiang shall take on the subsidiary function of reception.In the extension of buffern zone ,Jiangkou Town has existed some foundational facilities located at dowriver area of Furong Jiang-- Furong Cave nominated property. It will not bring a negative effect to the environment of nominated property area only through restrict the excessive increase of tour service facilities and population strictly.

4.3.5 Regular area

Regular area is the other region except the above-mentioned function area. It principally includes the rural area and other agricultural land such as farmland and orchard. Although the value of landscape in this area is not very prominent ,but it is still a

significant section of the whole landscape of Karst.Such point hereinafter must take a specially attention: Protect the basal farmland especially in cultivatable land of Karst area where the cultivatable land is comparatively limited; safeguard the natural environment of village, for example, Tiankeng Karst of Zhongshiyuan and its village is a typical landscape having the perfect combination of nature and culture; It is forbidden to directly damage and indirectly disturb to the scenery resources and forbidden to blindly mine, quarry and hunt; land use and construction density and cubdge rate shall be strictly controlled; the dimension,style,color of the construction should have civilian feature and can easily form the rurality harmonious with the local environment ; improve on the structure of agriculture production, develop ecological agriculture actively, improve the economical benefit, strive to assort with tourism of landscape.

5. Monitor System

5.1 Measure indicators

The main natural property of the area of nominated property is composed of the ancient and tough terrane, and have a very high and opposite stability, as long as expel a large-scale sabotage function, all can maintain itself stability basically. The Karst landscape is the special and natural property that the nature gives mankind, and it has the region structure of the multilayer, the on the ground or underground, the all karst landscapes especially can't rebirth. Opposite in other resources and environments, the resources and environment of the special area of karst express a larger flimsiness and sensitivity. As to any changes of forming environmental conditions all may cause the important variety of the landscape.

The most important natural property in the area of nominated property constitutes the karst hydrology-geomorphology system each on the space, and has a relation successively on time. The endogentic that form them is beyond control of the mankind, but the exogenetic mainly is the dissolution function and the erosion function .leaving of the water and the flowing water, there have no the emergence of these natural property, and changing movement path, the water quantity and quality of the flowing will influence the function of the karst hydrology-geomorphology system, to weaken ,to change or to suspend the process of karst function, and make the natural property be injured seriously.

The most obvious example is the Furong Cave, at first we should be sure that the protection of the Furong Cave is highly effective from the ten years, but the speleothem of the Furong Cave is too delicate, so it is sensitive to the environment change specially. After exploiting the Furong Cave, broking through entrance and exit to the cave cause the change of the cave weather condition (such as the air current condition), and have already made the pond water deposition be influenced certainly. The protection of Furong Cave is divided into both sides, one is the environment inside the cave and the rare cave secondary chemical sediment, the other is the hydrology geology unit where the cave locate in, namely ecological environment of the catchment area and the cave (Ponor) protection, the condition of vegetation and the quantity of flowing, and whether to be polluted all influence the change of the cave environment directly. Therefore we have to monitor the factor itself of the cave environment

and the condition of ponor cluster, doline and vegetation in Tianxing village that place on the Furong Cave, and then can protect the natural property availably.

Tab. 5-1 The primary monitoring indicator

Sequence number	Item (indicator)	Period	Location of record
1	Quality and quantity of surface water	Aperiodicity	Environmental Protection Bureau of County, Water Conservancy Bureau of County
2	Quality and quantity of underground water	Aperiodicity	Environmental Protection Bureau of County, Water Conservancy Bureau of County
3	The atmosphere quality (in 5 places)	Aperiodicity	Environmental Protection Bureau of County
4	Dynamic monitoring on community of rare animal (*Presbytis francoisi*)	Aperiodicity	Forest Bureau of County, Administration of Furong Jiang Scenic and Historic Interest of County
5	Ecological environment (Mainly in Furong Jiang)	Every season	Forest Bureau of County, Administration of Furong Jiang Scenic and Historic Interest of County
6	Biodiversity and dynamic change of propagation	Every year	Forest Bureau of County
7	Environment in Furong Cave	Automatic monitor	Administration of Furong Jiang Scenic and Historic Interest of County, Institute of Karst Geology
8	Quantity of visitors	Everyday	Administration of Furong Jiang Scenic and Historic Interest of County, Tourism Bureau
9	Fire disaster	Everyday	Forest Bureau of County, Administration of Furong Jiang Scenic and Historic Interest of County
10	Collapse rocks (Furong Cave and Tianshengsanqiao)	Patrolling on surface, periodic check in major region	Administration of Furong Jiang Scenic and Historic Interest of County, Institute of Karst Geology
11	Population and land Using states in the nominated areas	Two Years	Administration of Furong Jiang Scenic and Historic Interest of

	and buffer zone		County, Territorial resources Bureau of County
12	Monitoring on extent of condominium of the community and participation	Aperiodicity	Administration of Furong Jiang Scenic and Historic Interest of County

5.2 Basic type of monitoring

5.2.1 Regular monitoring

We usually monitor the quantity and quality of surface water, quality of atmosphere, and pollution source in the fixed-point, so as to understand its dynamic change and change regulation, to get the abnormal information and to give a processing in time.

5.2.2 Underground and surface water monitoring

The focal point of monitoring is that the dynamic change of underground river, quality of underground water and level change of underground water in raining season. Surface water mainly is the water quantity and quality change of reservoir, river, rivulet, ponor and underflow.

5.2.3 Rare animal, living environment and vegetation monitoring

Recording to dynamic change on community of rare animal, biodiversity and living environment, and monitoring the dynamic change of living environment and vegetation.

5.2.4 Touring monitor

Evaluating and statistic to the tour environment in scenic area of the nominated property periodically; Analyzing tourist source and dynamic state of tourism market; Analyzing the tour cost-benefit; influence on the tour activity to landscape, water, propagation and ecological environment; monitoring to the integrity and safety of the primary facilities in the scenery spot.

5.2.5 Patrol monitoring

Opening patrol in order to discover, stop and eliminate the hidden danger and disasters of the fire, collapse rocks and so on, and doing an early warning to avoid disasters in time.

5.2.6 Capacity monitoring

When the visitor number exceeds the maximum of capacity, we should adapt the step of canalling, scattering visitors.

5.2.7 Community monitoring

Monitoring the condition of social and economic of the nominated area and peripheral inhabitants, the realization to significance of property protection and the exaltation degree of

participation of self-conscious and conservation consciousness, specially concerning the population of the nominated property and the buffer zone and change of land use, and noticing influence of the project of social and economy development involving the region of the nominated area to resource protection.

5.3 Results of previous reporting exercises

Tab 5-2 Results of previous reporting exercises

Name	Contents	Complete	Publication or Location of records
The integrated planning of Furong Jiang Scenic and Historic Interest	Analyzing completely the condition of natural environment, geomorphology, propagation, physical tourism resources etc. and having a integrated planning to Scenic and Historic Interest	Institute of Gardens and Architectural Planning in Chonging	Administration of Furong Jiang Scenic and Historic Interest of Wulong County
Tourism resources and tourism exploiture and plan in Sichuan part of Furong Jiang (Chongqing)	The type of tourism resources, geomorphology characteristic, propagation etc. are elaborated completely by investigating	The People's government of Wulong County, Department of geography in the southwest Normal University	Administration of Furong Jiang Scenic and Historic Interest of Wulong County, Department of geography in the southwest Normal University
Report on integrated survey of Karst Geology Park in Wulong, Chongqing	Dissertating the geology background and the primary characteristic of geological relic of Karst Geology Park in Wulong, and having a comparison and evaluation both inside and outside the Country, and discussing their form condition and process.	Institute of Karst Geology, Academy of Geology and Science in China	Institute of Karst Geology, Academy of Geology and Science in China
Formation and evaluation of the characteristic of geological relic of Karst Geology Park in Wulong, Chongqing	Expatiating the distribution, basic characteristics, form conditions and process, comparison and evaluation, exploiture and protection.etc, of geological relic of karst geology park in Wulong, and discussing deeply on Furong Cave.	Chen Weihai, etc.	Geology Press, rock in Chinese Institute of Karst Geology, Academy of Geology and Science in China
The integrated planning of Karst Geology Park in	Summarizing the characteristics of tour resources in Geology Park, analyzing deeply the exploiture conditions of	Geology Park of Sichuan province, Survey and	Administration of Furong Jiang Scenic and

Wulong, Chongqing	landscape resources, market analyses and developmental foreground, programming and the trend and direction of development, and have an overall discussion and dissertation to Furong Cave.	Evaluation Center of geological relic	Historic Interest of Wulong County
Investigation and evaluation on the stability of Furong Cave in Wulong County, Chongqing	Analyzing geological conditions, types and characteristics of geology disaster, and overall evaluation to the cave stability, and advising concrete measure of prevention.	Institute of Karst Geology, Academy of Geology and Science in China	Administration of Furong Jiang Scenic and Historic Interest of Wulong County
Report on environmental influence of Jiangkou Power Station in Furong river, Chongqing	Analyzing the influence of Jiangkou Power Station to potential geology disaster (induced earthquake) in Furong Cave.	Science institute for Protection of the Yantze Water Resources	Power limited company of Jiangkou, Chongqing
The exploiture principle of touring cave and exploiture practice of touring Furong cave	Discussing the design idea and supervise principle of touring planning to Furong cave, and presenting the whole planning project; the content of tour facility; basic request of all construction; and environmental protection.etc.	Zhu Xuewen	Karst in China, 1995
The secondary chemical sediment of Furong Cave	Analyzing deeply the characteristics of shape and cave forming, types of secondary chemical sediment, phase of sediment, and the age of form.	Zhu Xuewen	Karst in China, 1994
Yangtze Caves	Introducing explorative results of China-Great Britain ally——exploring the potential scene of the unexploited part in Furong Cave	Andy Eavis etal	Administration of Furong Jiang Scenic and Historic Interest of Wulong County
Implemental project of research on landscape protection of Furong Cave	Analyzing present conditions of atmosphere environment and landscape in Furong Cave, and putting forward protective project of scene in Furong Cave.	Institute of Karst Geology, Academy of Geology and Science in China	Institute of Karst Geology, Academy of Geology and Science in China
Exploration on ponor cluster in Tianxing village and Erwang Cave, Sanwang Cave in	Exploration on decades of ponor cluster and Erwang Cave and Sanwang Cave of Houping in Tianxing village, Qikeng Cave is the first vertical deep Cave in China at present.	Erin Lynch	The red rose Cave Club of Oxford university

Houping			

5.4 Administrative arrangement of property monitor

Administration of Furong Jiang Scenic and Historic Interest of Wulong County is responsible for monitor job in the area of nominated property, Environmental Protection Bureau, Water Conservancy Bureau, Forest Bureau, Tourism Bureau, Territorial resources Bureau of Wulong County open monitor job under the uniform deployment. As to some high-tech and heavy workload projects, such as professional projects of exploration and protection to underground cave, animals and ecological environment monitoring, etc. We usually complete the monitor and research job together with scientific research unit, junior college and academy by the way of science cooperation.

Tab 5-3 Departments Responsible for the Monitoring of the area of Nominated property

Monitor departments	Address	Post Code	Tel.	Fax
Administration of Furong Jiang Scenic and Historic Interest of Wulong County	Gangkou Town, Wulong County	408500	023-77713333	023-77713099
Environmental Protection Bureau of Wulong County	Gangkou Town, Wulong County	408500	023-77722308	023-77722308
Meteorology Bureau of Wulong County	Gangkou Town, Wulong County	408500	023-77723207	023-77723207
Forest Bureau of Wulong County	Gangkou Town, Wulong County	408500	023-77712363	023-77712363
Water Conservancy and Electric Power Bureau of Wulong County	Gangkou Town, Wulong County	408500	023-77722125	023-77722125
Territorial resources Bureau of Wulong	Gangkou Town, Wulong County	408500	023-85619567	023-85619256

County				
Construction Committee of Wulong County	Gangkou Town, Wulong County	408500	023-77724585	023-77724585
Tourism Bureau of Wulong County	Gangkou Town, Wulong County	408500	023-77721248	023-77713307

5.5 Checking and Processing

After establishing the perfect monitor systems and confirming the primary indicators in the nominated property of Wulong karst, the each concerned department will have data collecting and processing strictly according to regulation, obtaining data mainly through observation on the spot, sampling, scientific investigation, indoor analysis, and distilling the macroscopic information on surface and datum of dynamic change by using the modern and advanced science technique means, through the satellite picture and aerial survey data in work.

Checking, accepting and the corresponding amending of the concerned data, are responsible of Administration of Furong Jiang Scenic and Historic Interest of Wulong County. The problems in monitoring are report to Administration committee of international property in Chongqing by Government of Wulong County, so as to obtain accurate processing and solution in time.

6. Management rule of law and safeguard system

6.1 Management rule of law and regulations

6.1.1 Concerned laws

The laws, which is about conserving and managing the legal status of Karst's nominated property zone of Wulong in Chongqing, include mainly :

(1)The Constitution of the People's Republic of China passed by national People's congress in 1982.

Article 9th of the Constitution of 《the People's Republic of China provides》:"The natural resources such as mineral resources, water, forest, mountain ridge, grasslands, wasteland, beach, all of which belong to national possession, as whole people owning."

Article 22th,Section 2 provides:"Nation conservs places of historic intertest and scenic beauty, precious historic relic and other important historic cultural property."

(2) The forest law of the People's Republic of China passed by national People's congress in 1982.

(3)The wildlife protection law of the People's Republic of China passed by national People's congress in 1988.

(4) The environmental protection law of the People's Republic of China passed by national People's congress in 1989.

Article 17th provides: the People's government at different levels ought to take steps to protect the typical and all kinds of natural ecosystem zone, the zone dispersed by rare wild animal and vegetable life generally which are in imminent danger, the zone dispersed by famous cave and fossil , natural historic remains such as glacier, volcane, spring , humanity historic remains and ancient trees, in order to prohibit them from being destoyed.

Article 19th provides: Exploiting and making use of natural resources must take measures to protect ecologic environment.

Article 23th provides: The construction of town and county ought to combine the features of local natural environment to protect vegetation, water area and natural landscape and enhance the construction of city's garden, greenland, and scenic spots.

(5) The historic relics conservation law of the People's Republic of China passed by national

People’s congress in 1982.

6.1.2 Concerned rule of law and regulations

The concerned rule of law about protecting and managing Karst’s naminated property of Wulong in Chonqing effectively include:

(1) The provisional regulation of managing scenic spots issued by the Chinese State Council in 1985.

Article 8th: The lands of scenic spots aren’t seized by every unit and individual. All scenery and natural environment in scenic spots must be conserved rigidly and can’t be destroyed and changed at one’s ease.

Article 10th: In scenic spots important scenery ,historic relic and historic site and ancient famous trees ought to be investigated ,idetified and people make protective measures to organize implementations.

Article 11th: According to plan, scenic spots ought to exploit scenic resources positively and improve traffic and service facilities and tour conditions; according to plan, make sure the admitted tourists’ contain and organize the tour activities in planned way. Don’t receive tourists unrestrictedly.

(2) The means of implementing provisional regulation of managing scenic spots issued by the consruction department in 1987.

Article 9th: The organization of managing scenic spots must rate the work of conserving scenic spots as the most important task.

Article 12th: Scenic spots ought to enhance the water’s conservation and management, prohibit the activities that may cause water to be polluted and damaged and forbid using it excessively.

Article 13th: Scenic spots must defend the animals’perching environment pratically and prohibit people to harm and catch wildlife indistriminatedly.

Article 14th: The landforms of scenic spots must be conserved sternly and people must prohibit activities such as cutting into moutain, quarrying, digging sand and taking soil.

Article 16th: Scenic spots ought to be kept original natural and historic scenes. Prohibit to go in for large-scale construction and go on activities about changing landforms and natural environment in scenic spots. Prevent the scenic spots to have artificial and citified tendency.

(3) The law of forest and the type of wildlife’s natural protection and management issued by

the Chinese State Council in 1985.

(4)The general order about protecting precious and rare wildlife rigidly issued by the Chinese State Council in 1984.

(5)No.21 command─the regulation of protecting and managing geologic historic site by the Chinese land resources department(original geologic minerals department) in 1995.

(6)The regulation of managing scenic spots of Chongqing city issued by Chongqing city in 1998.

Article 4th: The work in scenic spots must insist on the policies of rigid protection, centralized administration, reasonable exploitation, continuous use.

Article 5th: The People's government above county level ought to enhance the leadership of scenic spots' work and organize concerned department, according to laws, to do the protection, plan, construction and management work well in scenic spots in order to realize the integration of economic benefit, social benefit and environment benefit.

(6) According to above laws and regulations, Wulong county's People's government draft a series of rules and systems about protection and administration:

─The management means of Lotus River national emphasis scenic spots in Wulong county issued by Wulong county's People's government in September, 2002.

Article 7th: The management office of Lotus River is in charge of general investigation about the resources in national emphasis scenic spots of Lotus River, with departments such as forestry department, environmental protection department and land resources department. They also set up development files ,and ought to draft special measures for the emphasis protective objectives such as particular geologic historic site, rare animal and vegetable life generally and ancient famous trees ,and implement protection effectively.

Article 9th: Forestry department in county ought to do well work such as closing hillsides to facilitate afforestation, withdrawing cultivated land and returning forest, planting trees to make green, reforming forest. Protect forest and vegetation and the environment of wildlife species' reproduction, growth and perching well.

─The means of managing traffic safety on water of Lotus River national emphsis scenic spots issued by Wulong county's People's government in August, 2003.

─The job responsibility of united enforcing law groups of Lotus River scenic spots issued by

management office of Lotus River scenic spots of Wulong county in September,2003.

6.2 Plans related to nominated property zone

(1)《Chongqing's national economy and social development ninty-five- plan and long-range objective in 2010》

(2)《City integrated plan of Chongqing》

(3)《Tourism development outline of Chongqing》

(4)《Tourism integrated plan of Chongqing》

(5)《The tenth of five-year-plan on tourism development of Chongqing》

(6)《Integrated plan of Wulong county》(2001)

(7)《Tourism development integrated plan of Wulong of Chongqing》(2004-2020)

(8)《Wulong county's national economy and social development ninty-five- plan and long-range objective in 2012》 (1996)

(9)《Wulong county's national economy and social development fifteen-plan and long-range objective in 2017 (2001)

(10)《Tourism exploitation integrated plan of Wulong county, which is worked out by city development research institute of Chongqing's academy of social science (in December,2000)

(11)《Tour resources exploitation plan of the part of Lotus River in Sichuan》, which is worked out by Wulong county's People's government in Sichuan province and the geography department of Southwest Norminal University (in January,1995)

(12)《Tourism exploitation integrated plan of Wulong Tiansheng Bridge》, Isthmus and Sanchao holy water, which is worked out by the center of planning, designing and exploiting cities and towns in Wulong county.(in May,1999)

(13)《Integrated plan of Baiguo isthmus scenic spots in Wulong and detailed plan of park construction》, which is worked out by Chongqing's academy of constructing, planning and

designing garden. (in March,2001)

(14)《Integrated plan of Lotus River scenic spots ,which is worked out by Chongqing's academy of constructing》, planning and designing garden.(in January,2001)

(15)《Integrated plan of Karst geologic park of Wulong in Chongqing》, which is worked out by the center of investigating and evaluating geologic park and geologic historic site in Sichuan.(in February,2002)

6.3 Management system

According to concerned laws and regulations in Chongqing, management committee of world natural legacy in Chongqing city is set up and seventeen government functional departments at provincial level participate in the management committee. The specific managements for property zone are subordinate to Chongqing's public landscaping bureau.

The organization for managing Karst's nominated property zone in Wulong is a management office of Lotus River scenic spots in Wulong county, which is set up by Wulong county's People's government. It is responsible for carrying out macroscopic and comprehensive management in the planning scope of nominated zone. Make sure to implementaring all the laws and regulations comprehensively. Put all sorts of resources' conservation in nominated property zone into the orbit of legal system. Carry out systematic, all-round and comprehensive protection and management for ecology such as geologic substances, cave, water and animal and vegetable life generally in nominated property zone. There are ten full-time administrative personnel in the department. And there are also many part-time administrative personnel who pursue managing community's network in the scope of scenic spots and natural country. They also set up office, planning and construction section and safety protection section, who divide the work, take responsibility and coorperate each other.

Except the management office of Lotus River scenic spots in Wulong county and the working personnel in concerned scenic spots altogether manage and conserve nominated property zone, about ten community inhabitants in the nominated property and proposed buffer zone are employed as part-time managers, who help to conserve landscape and animal and vegetable life generally in every residential area.

Table 6-1 Chongqing city and basic-level administrative setup for Karst's nominated property zone

of Wulong

Order number	Name of setup	Legal basis	Chief duty	Address
1	Administrative committee for world property Of Chongqing government	The regulation of administrating scenic spots of Chongqing city	Make significant policy decision of admionistrating property and overall direction	Chongqing city
2	Construction committe of Chongqing city	The provisional regulations of administrating scenic spots of the People's Republic of China	Take responsible for trades management and routine work of conservation and construction in scenic spots	Chongqing city
3	Bureau of gandening administration of Chonqing	The regulation of administrating scenic spots of Chongqing city	Take responsible for gandening administration of scenic spots	Chongqing city
4	Bureau of forestry of Chongqing	The forest law of the People's Republic of China	Take responsible for administration of provincial natural conservation zone in scenic spots	Chongqing city
5	Administration committee of scenic spots of Chongqing	The regulation of administrating scenic spots of Chongqing city	Take responsible for overall administration of scenic spots	Chongqing city
6	Water conservancy and irrigation bureau of Chongqing	The water law of the People's Republic of China	Take responsible for irrigation and water resources conservation in scenic spots	Chongqing city
7	Land resources and building administration bureau of Chongqing	The mineral resources law of the People's Republic of China, The land law of the people's Republic of China, The regulation of administrating geologic relic	Take responsible for land administration, geologic relic and mineral resources administration and joint administration	Chongqing city
8	Wulong county's People's government	The administrative means of national emphasis scenic spots of Lotus River in Wulong county	Take specifically responsible for conservation,construction and administration of scenic spots of Wulong county	Wulong county
9	Management office	The administrative	Take specifically responsible for	Wulong

	of Lotus River scenic spots in Wulong county	means of national emphasis scenic spots of Lotus River in Wulong county	exploitation,conservation and administration of nominated property zone	county
10	Land resources bereau of Wulong	The mineral resources law of the People's Republic of China, The land law of the People's Republic of China, The regulation of administrating geologic relic	Take responsible for land administration, geologic relic and mineral resources administration and joint administration	Wulong county

7. Bibliography

[1] Chen Weihai,Zhu Dehao,Huang Baojian,Formation and Remark of Karst Geopark Geological relics trait Wulong of Chongqing. Geological Publishing House. Beijing,2004

[2]Chen Weihai,Zhu Dehao,Zhu Xuewen, Fengjie Tiankeng fissure gorge karst landscape and Research on Value of World Natural inheritance . Geological Publishing House. Beijing,2003

[3] Chen Weihai,Huang Baojian, Zhu Dehao.The character、 formation and landscape evaluation of Tiansheng Sanqiao of Wulong Chongqing.《Establishment of Geopark Development of Tourism Resources-tourism geology of the ninth of collected works》,Compiler of Chen Anze,Lu Yunting and Chen Zhaomie,China Forst Press.2003:255-260

[4] Zhu xuewen.China'karst Tiankeng and its value for science and tourism[j].Science & Technology review,2001(10):60-63

[5] Zhu Xuewen,Zhang Yuanhai.The world'largest dolines and great crack gorge in southern Sichuan[J].Carsoloica Sinica,1995,14(suppl.):1-11

[6] Zhu Xuewen,Furong Cave secondary speleothems .Carsoloica Sinica.1994, Vol.22(13):357-368

[7] Zhu Xuewen,Wang Xunyi,Zhu Dehao,Research on karst landforms and karst cave of Guilin. Geological Publishing House,1988, Beijing

[8] Zhu xuewen,Zhu Dehao,Huang Baojian,etc.A brief study on karst Tiankeng[J].Carsoloica Sinica,2003,Vol.22(1):51-65

[9] Zhu xuewen, Huang Baojian, Zhu Dehao,etc.Discover、survey、definition and resrarch of Guangxi Leye Da Shiwei Tiankengquan.The Science Technique Publishing House in Guangxi,2003

[10] Compiler ofYuan daoxian, Carsoloic dictionary. Geological Publishing House,1988. Beijing

[11]Yuan Daoxian,Cai Guihong.The science of karst environment[M]. Chongqing Publishing House, Chongqing,1988

[12] Yuan daoxian,Zhu Dehao,Weng Jintao. Carsoloica Sinica. Geological Publishing House,1994. Beijing

[13] Yuan daoxian,Karst Dynamic systems of china.Geological Publishing House,2002. Beijing

[14]Lu Yaoru,Karst-world of wonderful peaks and grotesque caves.TsingHua University Press,JiNan university Press ,Beijing,2001

[15] Compiler of Ren Meie and Liu Zhenzhong , Carsoloic outline,The Commercial Press,Beijing,1983

[16] Chen Anze,Lu Yunting,Tourism geoscience outline . Peking University Publishing House, Beijing,1991

[17] Chen Anze,Remark on Geopark .《Establishment of Geopark Development of Tourism Resources-tourism geology》

[18]Cuizhijiu,Lidewen,Wuyongqiou eg,About planation Chinese Science Buttetion 1998 Vol.43,No .17,1794-1805

[19]Cuizhijiu, Paleokarst and Uplist of the QinghaiXizang plateau 1981,Beijing,Science Press

[20]Guzhaoyan,Liudongsheng Application of in situ cosmogenic nuclides 10Be and 26Al for studies of formation and evolutionary hitoyies of the Esrth surface Quaternary Sciences, 1997(3)211-221

[21]Tanhaiou,Zhuxuewen,Liyusheng Wonder of the Yangzze Gorges Chongqin:Chongqin Press,2001

[22] SonglinghuaTaohongling, To strength science study ,accelerate our country'sdeclaration of Karst world heritage-the summary of attention IUCN Asia and Pacific Area Karst ecosystem and world heritage's forum Carsologica sinica Vol.20,No.3, 241-246

[23] Yangshishen,The rock sea and the cave homeland Chongqi: Chongqin Press,1989

[24] Shenyuchang , The river valley landforms of Yangzze river upsteam Beijing:Science Press 1965

[25]Yangmingde, Tanming ,Lianghong, Karst drainge basin hydrologic landforms's system Beijing:Geology Press 1998

[26]Kangyanren,Xiangshiju eg Karst subside of China Southern. Nanling:

[27] YangZigeng, LinHemao, WangShengyu. etc. Chinese quaternary strata basic characteristic and contract with Asia-Pacific region. BeiJing: Geology press, 1996,1-30

[28] DingJinghui, physiographic period analysis in West Hubei Plateau. Karst in China, 1987,Vol.6, No.3, 255-262

[29] LiDatong, Luoyan, Measurement of Carbonic Rocks distribution Area in China. Karst in China, 1983,Vol.2, No.2, 147-150

[30] WangXunyi, Cave Exploration. ZhengZ hou: Science and Technology Press of HeNan, 1999

[31] ZhangYuanhai, Erin Lynch, Cave Exploration. ShangHai: Science Prevalence Press of ShangHai, 2004

[32] Panjiang, LuLiyuan, JiShuan, The Chinese Geology vestige and its protection. Geology and human survival, environment, natural disaster, global change——The thirtieth international geology convention collection, 2nd - 3th volume, edited by JiChuanmao, BeiJing: Geology Press, 1999, 202-213

[33] Panjiang, International culture and natural property of China. BeiJing: Geology Press, 1995

[34] Panjiang, The characteristics of geology and landform of international natural property in China. BeiJing: Geology Press, 1995

[35] ChangBingyi, International Culture and Natural Property. BeiJing: Drama Press of China, 2003

[36] TaoWei, Study on tour sustainable development of international property in China. BeiJing: Tour Press of China, 2001

[37] XiaoXing, YanJiang, Tour Resources and exploiture. BeiJing: Tour Press of China, 2000

[38] SuWencai, SunWenchang, Tour Resources, BeiJing: The High Education Press, 1997

[39] Geography Academy of institute of Science in China, Division of Geomorphy in China. BeiJing: Science Press, 1959

[40] Department of Resources exploiture of Country Tour Bureau, Geography Academy of institute of Science in China, Criterion of Tour Resources survey. BeiJing: Tour Press of China, 1992

[41] Mineral Bureau of SiChuan Province, Geology Monograph of Mineral Department of China (NO.23)——Areal geology records of SiChuan Province. BeiJing: Geology Press,1991,552-601

[42] The Records Committee of WuLong in SiChuan Province, records of WuLong County. ChengDu: People Press of SiChuan Province,1994

[43] Geomorphy Committee of Geography Institute, Karst Geomorphy and Cave. BeiJing: Science Press, 1985

[44] Education, Science and Culture Organization of U.N., International Culture Protection and Natural Property Pact.1972

[45] ZhangYingjun, LiaoZhongling, etc. Applied Karstology and Speleology. GuiYang: People Press of GuiYang,1985

[46] Eavis,A.J.(ed), 1981. Caves of Mulu’80. Roy. Geog. Soc., 52-60

[47] Maire, R(ed), 1981. Papua New Guinea, Spelunca, Suppl.3, 48-52

[48] Waltham,A.C.,1995. The giant dolines of Xingwen, Geogr. Journ. 160-162

[49] T.Waltham, D. Brook & S.Bottrell, 1993. The Caves and Karst of Xingwen, China. CAVE SCIENCE Vol.20. No.3, 75-86

[50] Bendetta Castiglioni & Ugo Sauro,2000. Large collapse dolines in Puglia (southern Italy): the cases of "dolina Pozzatina" in the Gargano plateau and of "Puli" in the Murge, ACTA CARSOLOGICA 29(2), LJUBLJANA, 2000. 83-93

[51] Gillieson, D., & Spate, A., 1998. Karst and caves in Australia and New Guinea, in:<Global karst correlation>(eds. by Yuan Daoxian, Liu Zaihua), Science Press

Beijing,New York, 229-256

[52] Ford,D.C., Williams, P.W., 1989. Karst geomorphology and hydrology. Unwin Hyman, London. 1-601

[53] Sweeting, M.M.,1972. Karst landforms. London: Macmillan.

[54] Carol Hill and Paolo Forti, 1997. Cave Minerals of the World, the National Spleological Society of U.S.A.

[55] Jennings,J.N., 1985. Karst Geomorphology, Basil Blackwell Ltd.

[56] Garasic,M., 2000, Speleohydrogeoloska istrazivanja Crvenog jezera kraj Imotskoga u Dinarskom krsu (Hrvatska), Second Croatian Geological Congress, 587-590

[57] Kevin J. Senior, CAVE AND KARST SCIENCE, （The Yangtze Gorges Expedition: China Caves Project 1994）, 1995,Vol.22, No.2, 67-81

[58] Alfred Bogli, 1980.Karst Hydrology and physical speleology. Translated by June C. Schmid, Berlin Heideberg New York

[59] Edited by M. M Sweeting,1981. Karst Geomorphology. Benchmark Papers in Geology Vol.59, Hutchinson Roes Publishing Company

[60] Alexander B.Klimchouk , Derek C. Ford , Arthur N. Palmer , Wolfgang Dreybrodt, 2000.Speloogenesis—Evolution of karst aquifers.SNS inc，USA

[61] David Lowe and Tony Waltham, 2002.Dictionary of Karst and Caves.by British Cave Research Association U.K.

8. Map, Plans, the Boundaries of the Zones

Fig.1 Location of Wulong World Natural Heritage Nominated Area in China

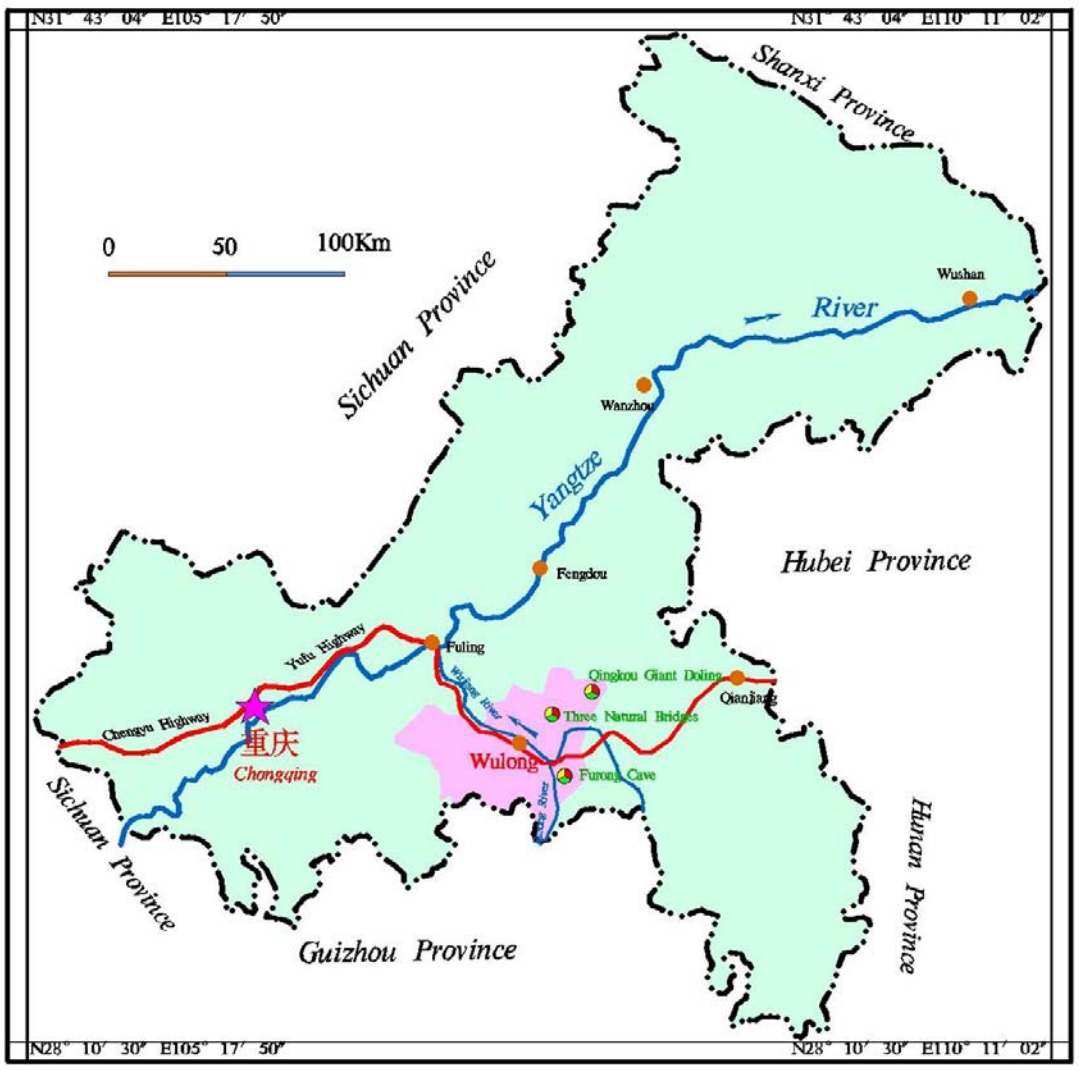


Fig.2 Location of Wulong world Natural Heritage Nominated Area in Chongqing

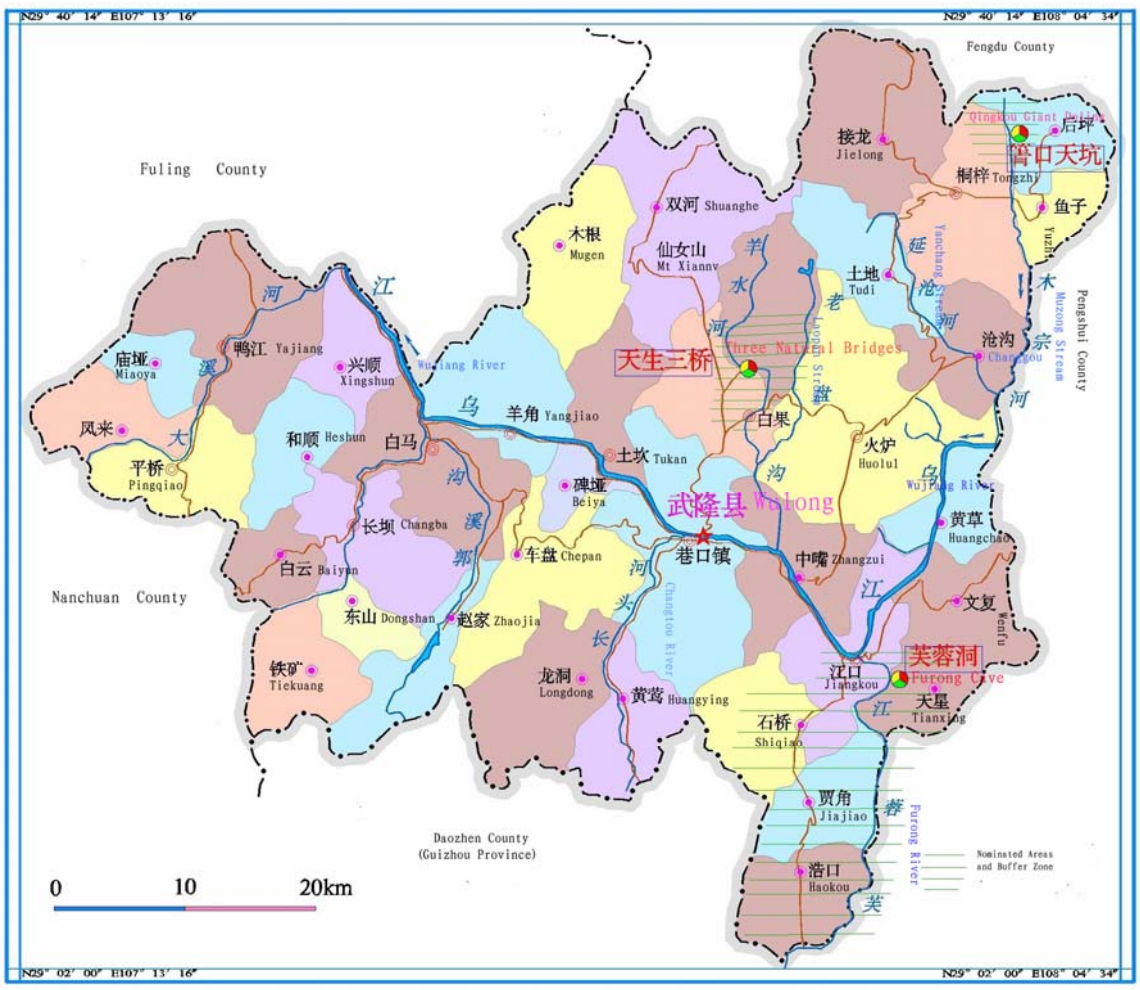


Fig.3 Location of the nominated property in Wulong Country.

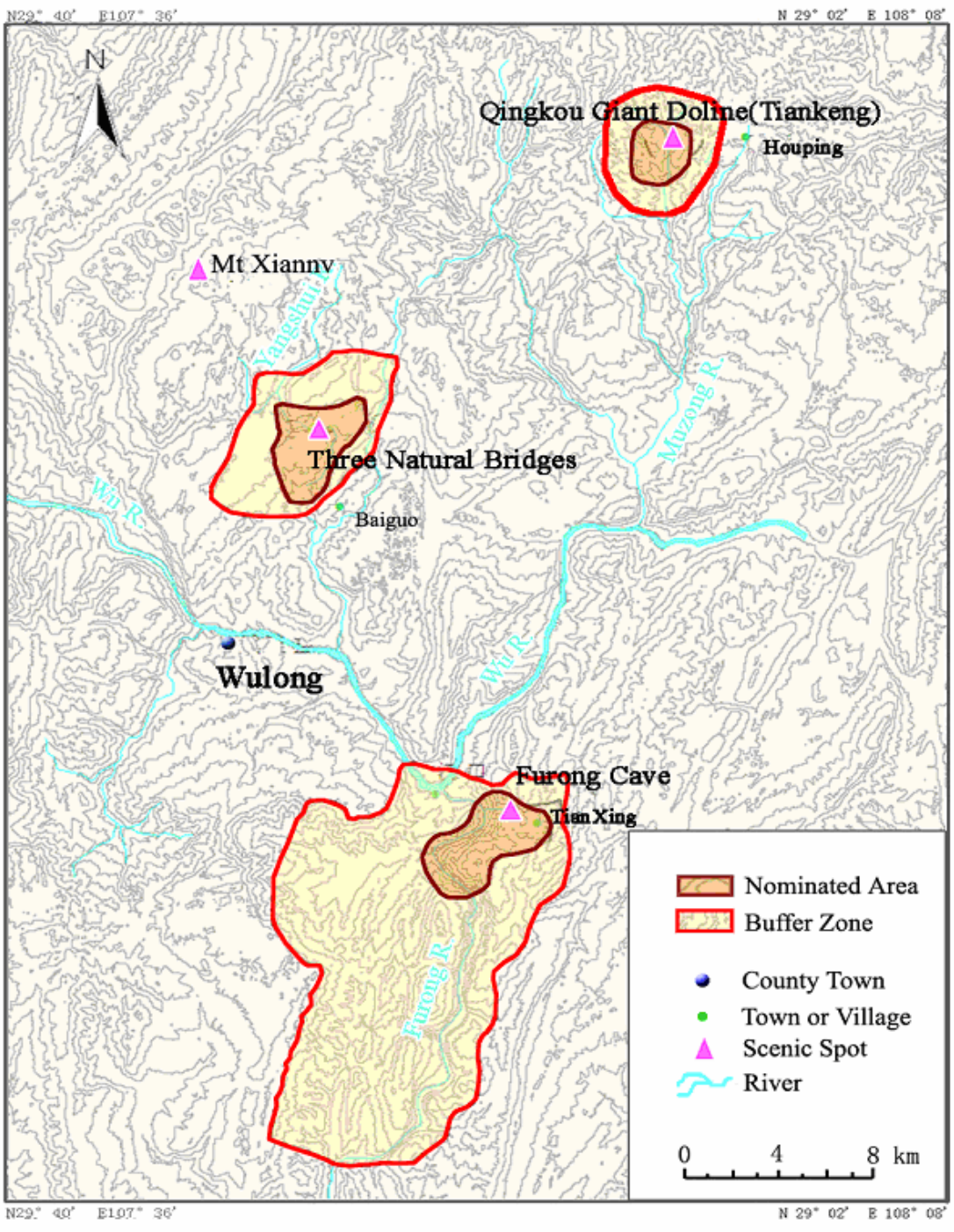


Fig.4 Boundary of the nominated property and the proposed buffer zone

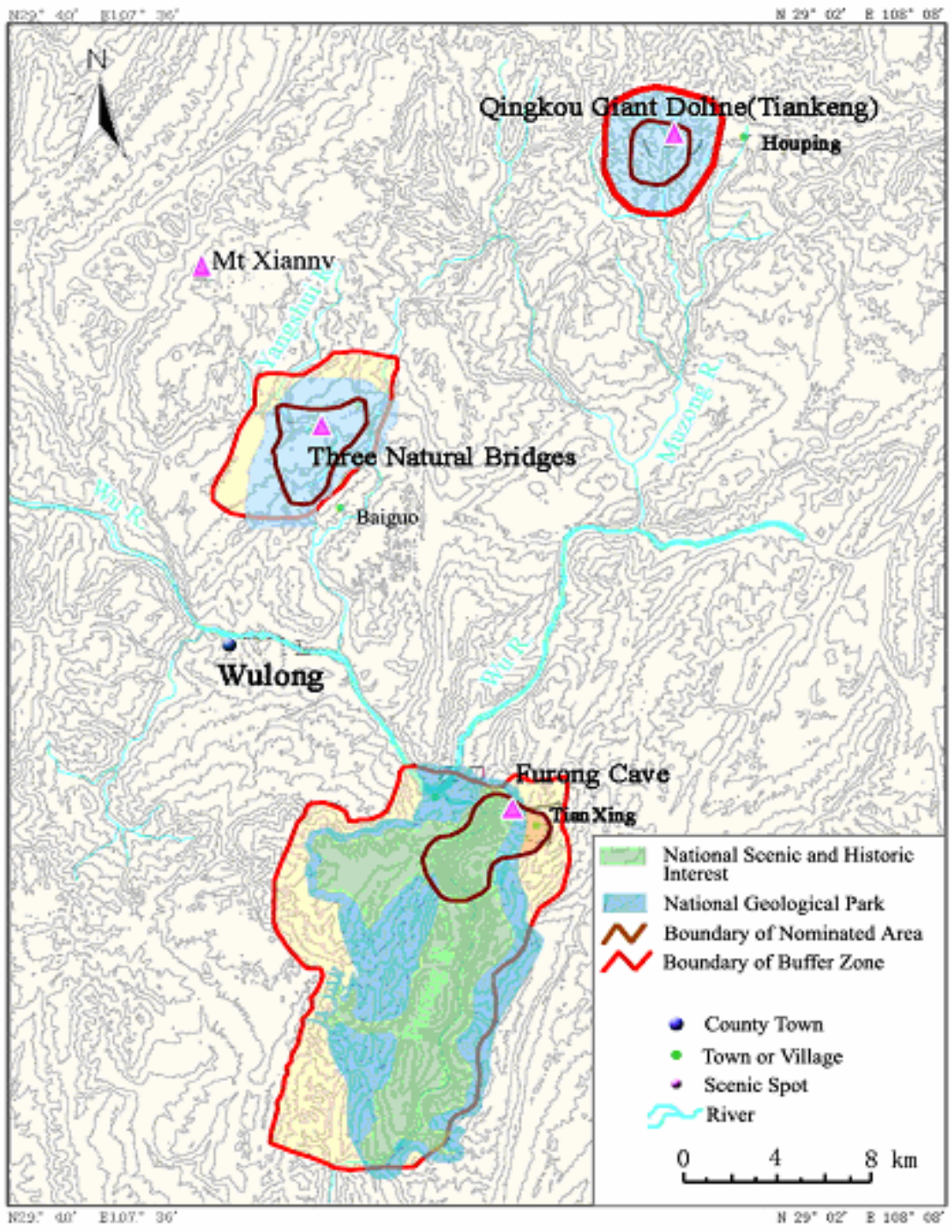


Fig.5 Relationship of Wulong Karst world nominated property and other reserves

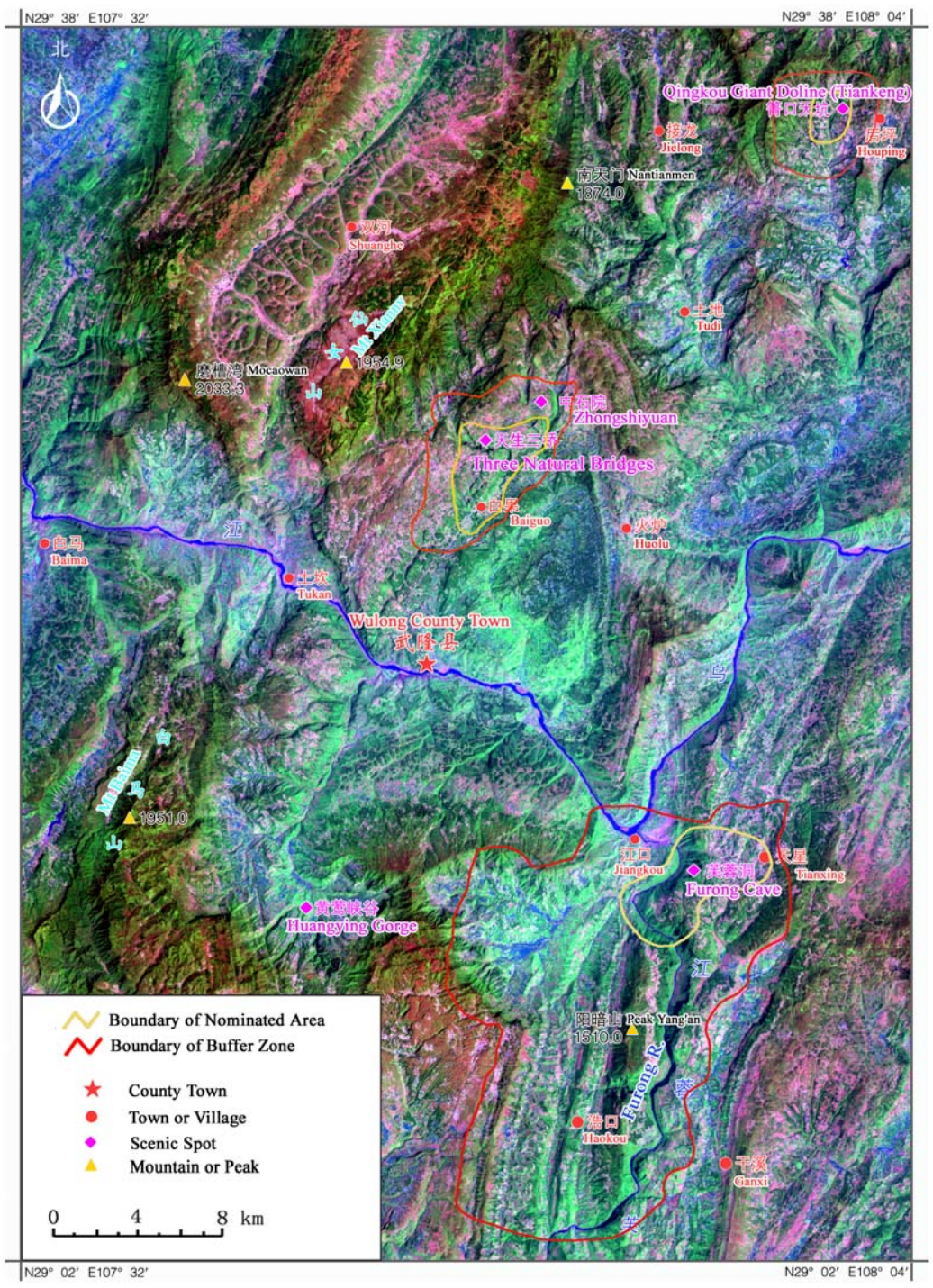


Fig.6 Satellite image of the nominated site of Wulong Karst.

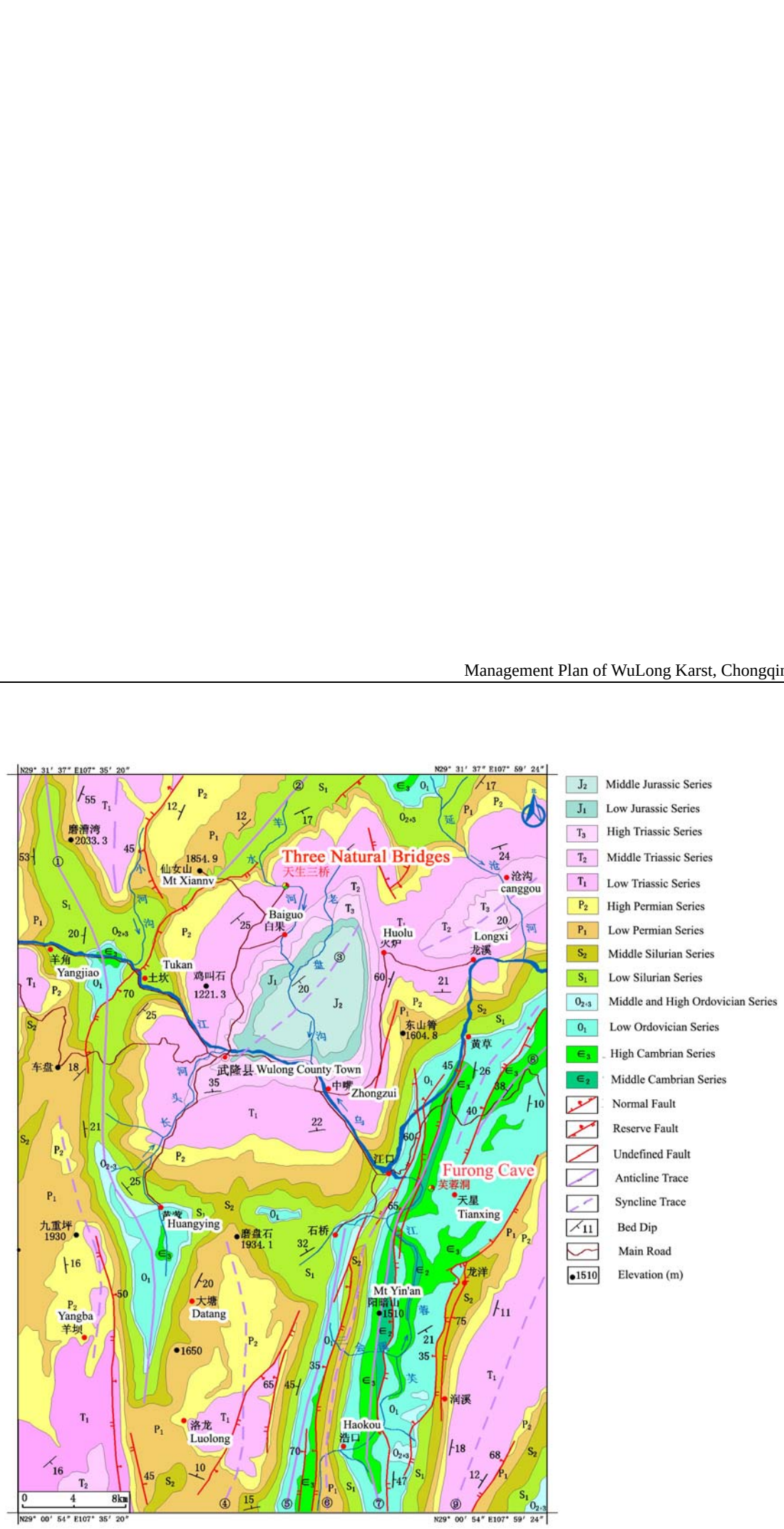


Fig.7 Geology of Wulong Karst nominated area.

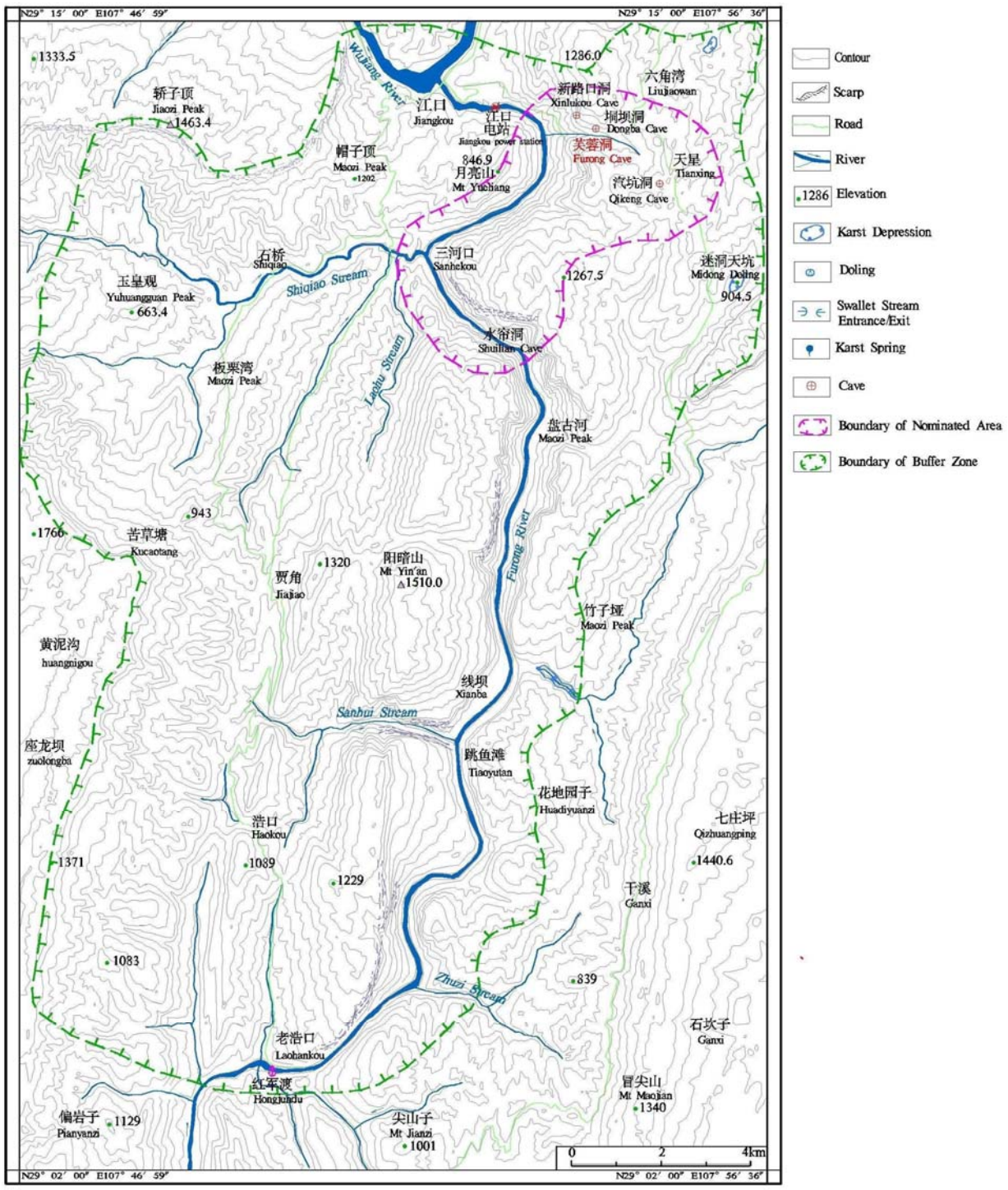


Fig.8 Boundary of the Furong Cave and the Furong River site

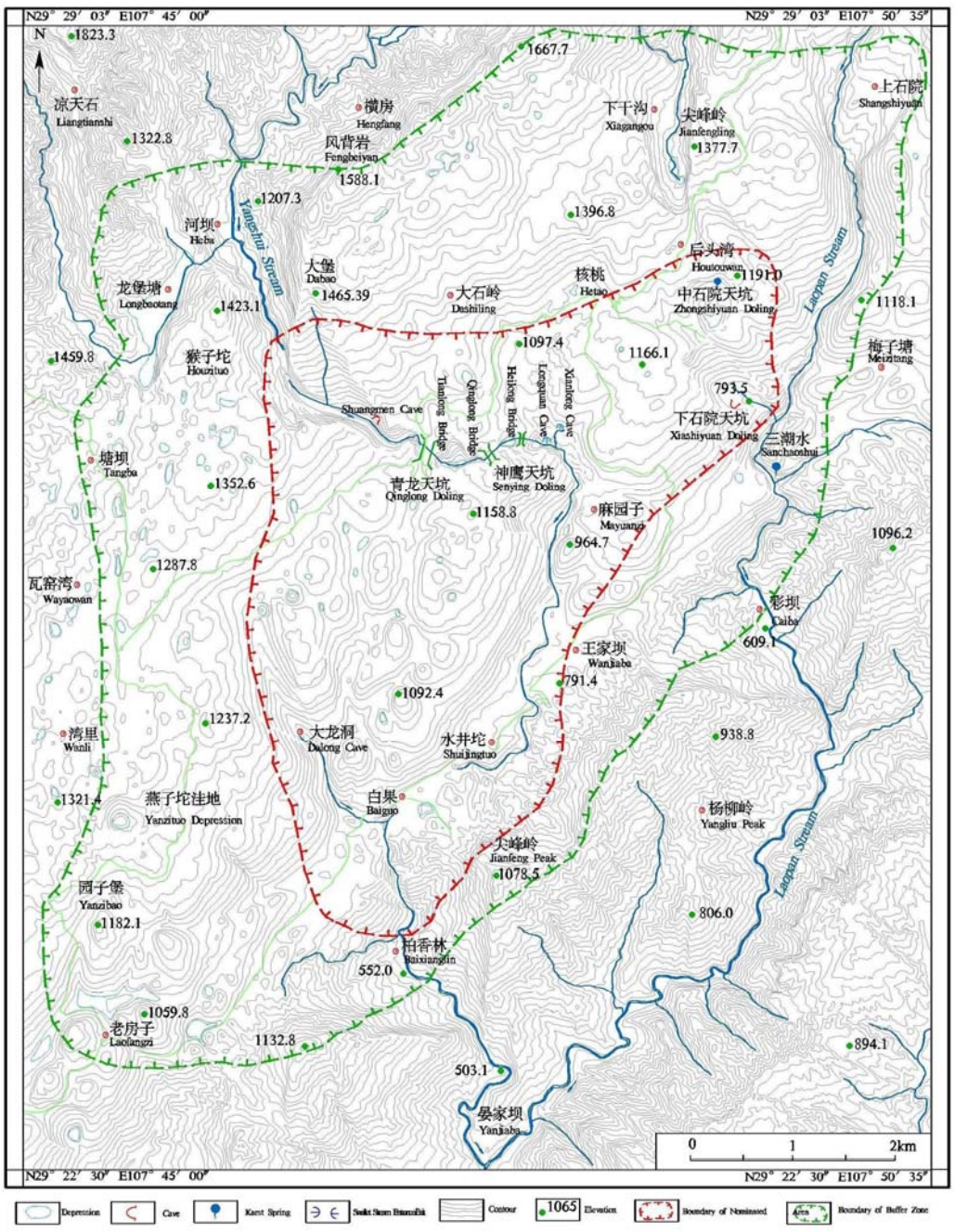


Fig.9 Boundary of Three Natural Bridges site

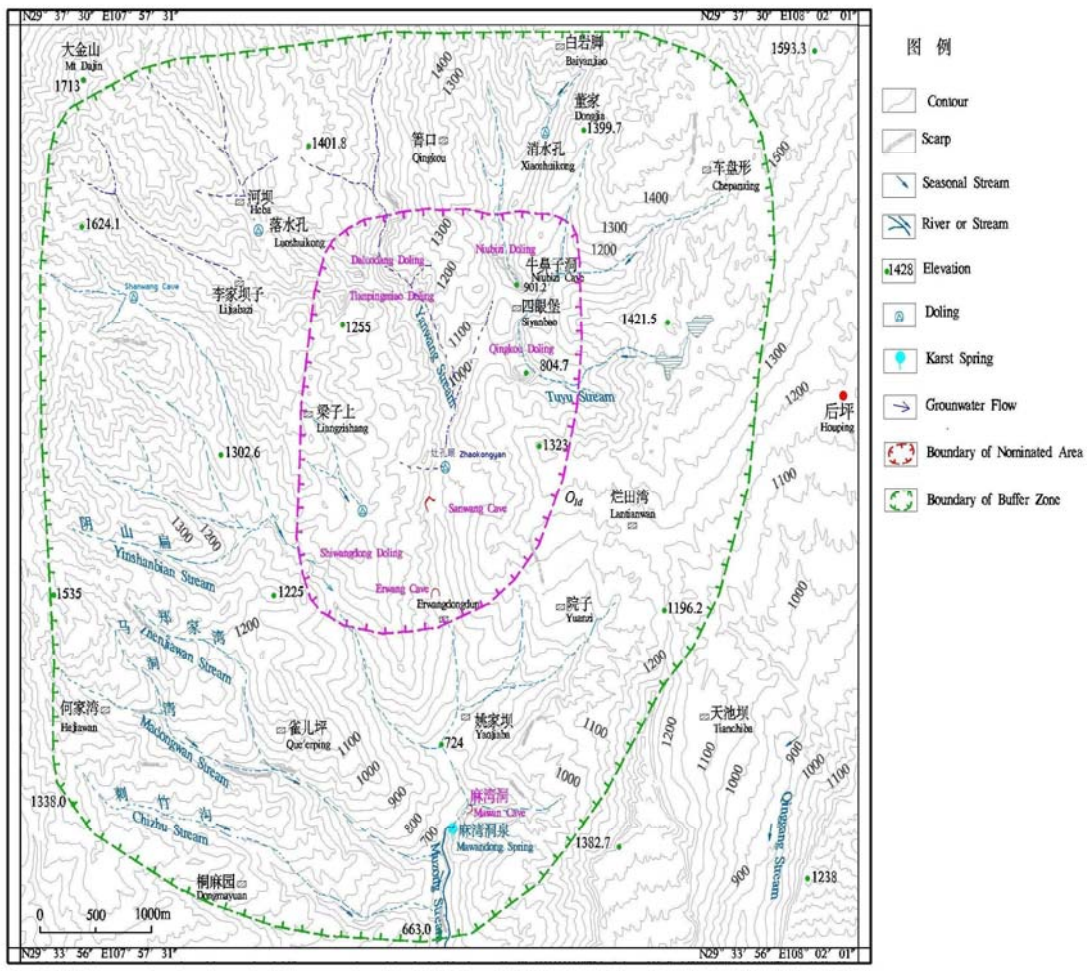


Fig.10 Boundary of Houping Tiankeng (giant doline) site

To the UNESCO World Heritage Centre

More Information on the Serially Nominated World Natural Heritage: South China Karst

Area of Nominated Property and Proposed Buffer Zone

Comparative Analysis

Schedule Suggestion for IUCN Visit to *South China Karst*

Ministry of Construction of People's Republic of China

April 2006

1.f Area of Nominated Property and Proposed Buffer Zone

Table 1-2 Area of the Nominated Property and Proposed Buffer Zones

No.	Name of the area	Region	Province	Core Zone(ha)	Buffer Zone(ha)	Coordinates of the central point
1248-001	Shilin Karst 1 (Naigu Stone Forest)	Shilin Yi County	Yunnan Province	1,746	22,930	N24°54'32" E103°21'13"
1248-002	Shilin Karst 2 (Central Stone Forest)	Shilin Yi County	Yunnan Province	10,324		N24°43'4" E103°20'39"
1248-003	Libo Karst 1 (Da-Xiao Qikong Cone Karst)	Libo County	Guizhou Province	7,834	43,498	N25°16'38" E107°42'51"
1248-004	Libo Karst 2 (Maolan Cone Karst)	Libo County	Guizhou Province	21,684		N25°13'8" E107°59'31"
1248-005	Wulong Karst 1 (Qingkou Giant Doline)	Wulong County	Chongqing City	1,246		N29°33'28" E107°59'10"
1248-006	Wulong Karst 2 (Three Natural Bridges)	Wulong County	Chongqing City	2,202	32,000	N29°24'35" E107°53'28"
1248-007	Wulong Karst 3 (Furong Cave System)	Wulong County	Chongqing City	2,552		N29°12'28" E107°53'28"
	TOTAL			47,588	98,428	

3.c Comparative Analysis

Pursuant to the Operational Guidelines (Paragraph 132), for a nominated property, "A comparative analysis of the property in relation to similar properties, whether or not on the World Heritage List, both at the national and international levels, shall also be provided. The comparative analysis shall explain the importance of the nominated property in its national and international context."

As the serially nominated South China Karst (first phase) is proposed collectively satisfying four world heritage criteria, the following comparative analysis is therefore made respectively from four aspects in relation to the contexts of four criteria at both national and international levels.

3.c-1 Comparative analysis on "Superlative natural phenomena or natural beauty and aesthetic importance (Criterion vii)"

The Chinese Karst contains three internationally renowned surface karst landforms. They are Fenglin karst (Tower karst), Fengcong karst (Cone karst), and Stone Forest karst. The South China Karst contains the type-sites for each of these forms. They are at their most magnificent and diverse there because they have developed in thick carbonate strata that have had a complex geological history since the Paleozoic, a varied topography and a tropical, subtropical monsoon climate since the Cretaceous. The three sites in this nomination all contain excellent examples of Stone Forest karst and Fengcong karst (Cone karst).

All three karst sites in this serial nomination are of natural beauty and aesthetic significance. They have all been designated as China's National Key Scenic Areas. However, only one, the Shilin Stone Forest Karst, is nominated in this application under criterion vii. The following analysis will compare the Shilin karst with similar properties both national and international.

The Shilin Karst: National Comparison

There are four inscribed natural properties in China, which satisfy Criterion vii, of which, three contain karst features. They are:

(1) **Jiuzhaigou Valley Scenic and Historic Interest Area:** Inscribed in 1992, *where the natural beauty is its 108 lakes, numerous waterfalls and forests set in spectacular mountain scenery, the*

site clearly meets the criteria (IUCN report). The major karst features at Jiuzhaigou are travertine dams (terraces), which hold back the clear colorful waters of the lakes. The waters flow over the travertine barriers at the end of the lakes creating spectacular waterfalls.

(2) **Huanglong Scenic and Historic Interest Area:** Inscribed in 1992, *the Huanglong valley with its series of travertine lakes, waterfalls, forest, and mountain scenery is a superlative natural property* (IUCN report). The major karst features are extensive travertine deposits of several kilometers in length and karst lakes of blue green water that are confined by the travertine.

(3) **Three Parallel Rivers of Yunnan Protected Areas:** Inscribed in 2003, *the river gorges are nevertheless the dominant scenic element in the area. High mountains are everywhere, providing a spectacular scenic skyline. The alpine karst is outstanding* (IUCN report). The two major karst features at this site are metamorphosed carbonate mountains and alpine karst.

The Yunnan Shilin karst is the classical example of the extreme karst landform *stone forest*, and is used as an example many geographical and karst textbooks. It features pinnacles and spires of up to 30~50m high and fretted with karren. In South China, there are a number of stone forest karst landscapes for example at Xingwen, Sichuan, Jinfoshan, Chongqing, Xianan, Hainan and various others. The comparison some of them with the nominated Shilin Stone Forest, Yunnan is weak (Table 3-3). The areas covered are small and isolated and do not contain the variety of pinnacles or have pinnacles of the same size (Table 3-3).

The Shilin Karst: International National Comparison

In the South China Karst, many surface landscapes are of scenic significance and have been given national or provincial scenic status. Only two sites, the Shilin, Yunnan (discussed here) and the Guilin karst, Guangxi, are of international significance with respect to natural beauty and aesthetic importance. There is no resemblance between the two karsts as one is designated a Stone Forest and the other a Fenglin Karst (Tower karst). The Guilin karst will be included in a subsequent nomination phase of South China Karst.

Of the current 160 inscribed world natural properties, there are three sites that have stone forests and are inscribed under criterion (vii) (Table 3-1).

Table 3-1 Inscribed World Heritage sites with stone forests

World Heritage Site	Country	Year	Criteria
Puerto-Princesa Subterranean River National Park	Philippines	1999	N iii, iv
Gunung Mulu National Park	Malaysia	2000	N i, ii, iii, iv
Tsingy de Bemaraha Strict Nature Reserve	Madagascar	1990	N iii, iv

(1) Puerto-Princesa Subterranean River National Park: this site features tropical island mountain karst, a subterranean river that flows through, and a large, long and spectacular cave. *The Saint Paul Mountain Range features a spectacular limestone karst landscape. The underground river, flowing into the sea, and its associated tidal influence, make this a significant natural phenomenon* (IUCN report). The stone forest in this park has been named Assegai karst (Table 3-3).

(2) Gunung Mulu National Park: This property *with its deeply-incised canyons, wild rivers, rainforest-covered mountains, spectacular limestone pinnacles, cave passages and decorations, Mulu has outstanding scenic values* (IUCN report). The spectacular limestone pinnacles at Mulu are confined to a small area of a steep mountainside (Table 3-3). The area although visited by tourists has not been modified as it is viewed from the access track. The pinnacles there are smaller but sharper than those in the Shilin Stone Forests in Yunnan (Table 3-3).

(3) Tsingy de Bemaraha Strict Nature Reserve: This site's scenic significance is in *the limestone pinnacles found in Bemaraha that are comparable, on a global scale, only to China's "stone forest". The pinnacles would not merit World Heritage status by themselves but they add an important feature of geological interest to the park. "The limestone pinnacle forest also meets WH criteria (Niii)* (IUCN report). They have not been developed for tourism but pinnacle and area size are comparable with those of the Shilin Stone Forests. In addition, this karst does not have the variety of shapes and the colors of pinnacles that result from complex lithology and a long history of evolution (Table 3-3).

Pinnacle karst areas are also to be found in Papua New Guinea's mountains. These are on Mt Kaijende, the Muller Plateau and the Nakanai Mountains; at present none of these areas has been nominated for World Heritage listing. The most spectacular of these pinnacle karsts is Mt Kaijende. They are developed in thickly bedded Lower Miocene limestone with some interbeds of calcareous mudstones and cherts. Nearly vertical pale grey walls of limestone, sometimes slightly casehardened, rise out of dense moss forest to form sharp ridges (arêtes) with spiky pinnacles. The joint intersections develop into

deep cylindrical depressions, of the order of 100m across, bounded by near vertical walls 50-100m high culminating in the sharply pinnacled arêtes. This landform has a special name "pinnacle and arête karst". The lower walls are densely festooned with lianas, mosses, shrubs and tree ferns. Access to the area is extremely difficult because of the precipitous terrain and dense moss forest. Consequently, it is virtually inaccessible except by helicopter (Ford, Salomon and Williams, 1997). The small area of pinnacles at this site again lacks the variety and color of the pinnacles found in the Shilin Stone Forests.

With respect to Criterion (vii), the natural beauty and aesthetic importance of the Shilin Stone Forests are very different from the above similar properties. The Shilin Stone Forests are outstanding for the following reasons:

1. The geological and geographical settings

The Shilin Stone Forests are continental pinnacle karsts with a complex geo-history of some 270 million years. They are located in on a plateau thus the panorama of individual pinnacles amongst associated karst features is quite distinctive. *Its beauty lies in the combination of limestone pinnacles, eroded into many exotic shapes and toned into a variety of gray shades, placed against a backdrop of red earth and green vegetation* (J.M. James 1997). The pinnacles of the Shilin Stone Forests can be viewed from base to tip, whereas on Gunung Mulu and Mt. Kaijende they are on steep slopes covered in tropical rainforest and only part of the pinnacles stand proud above the forest.

2. The rich geomorphology

The Stone Forest can be classified as a pinnacle karst. The individual pinnacles display greater morphological variation than elsewhere. There are needles, fins, fluted spires, towers, emergent stone teeth and many other forms. Subaerial and subsoil weathering forms are intimately mingled. There is equal variety in pinnacle groupings. There are lone individuals, small clusters and true forests of pinnacles. They may be set alone on hilltops, or march along ridges; they may crowd broad flanks of the hills and floors of dolines. They are found standing like reeds in lakes. Such richness of form and distribution is to be attributed to the combination of their varied limestone, dolomite and dolomitic limestone lithology and complex genetic history (Ford, 1998) (Table 3-3). These forms have such a rich morphology that the Shilin Stone Forests are regarded as a geological museum and art gallery for

pinnacle karst. As the Shilin Stone Forests are the type-site for "stone forest" karst scientists have considered using the name "Shilin" for stone forest.

3. The universal scenic appeal

The Shilin Stone Forests have been accepted as *one of the great natural wonders of the world*. Its universal appeal has been summarized in the following quote by D.C. Ford. *Most of the visitors to the Shilin Stone Forests are attracted by their aesthetic appeal. They generate their own fanciful vocabulary. The countless small stone tops just peeping above the soil are "dragon's teeth", growing in size and number as erosion exposes them over the years. Many larger pinnacles are known individually to the local people, some named for their immediate association with form ("Sword Peak", "Stone Mushroom"), others interpreted more exotically ("Cap leaping up the Dagon Gate", "Sadly Parting"). Many are incorporated into legend or have been inspired by them ("A Shi-Ma", a heroine of the Sani people). The Shilin Stone Forest landscapes are very appealing to foreign visitors. Those from the European cultural background that I share will find plenty of imaginative associations in caves below the vivid black and orange pillars of Naigu Stone Forest; Italian visitors might see St. George fighting the Dragon: the setting has the structure and color of many Renaissance paintings on this theme. Germans will imagine a baronial castle at every hilltop crag; For myself (from England) the stone forests conjure up the fantasy realms of "Lord of the Rings", a famous story of the contest between good and evil; in particular, they are the Barrow Downs, where questing travelers must do battle with ghosts haunting the ruined tombs of long-dead heroes.*

4. The influence on literature and art forms

None of the pinnacle karst sites in the world has had such a long and fundamental aesthetic influence on art forms. The term "stone forest" first appeared some 2000 years ago. The ancient Chinese painter Mi Fu (1051-1107) has described the rocks from the Shilin Stone Forest as *thin, wrinkled, holed and penetrated*. Since, the Yuan Dynasty (600 years ago) there has been numerous poems and paintings extolling this special landscape. The Shilin Stone Forests have had a significant influence on oriental gardening where the rock forms are used as a setting for flowers and shrubs. An excellent example is the Classical Gardens of Suzhou (World Heritage).

Conclusion: The Shilin Karst (Stone Forest) landscape is the type location and classical example of continental pinnacle karst in the world. In addition to containing superlative natural phenomena; it displays exceptional natural beauty. The Stone Forest is of aesthetic importance because relative to any other pinnacle karst site; it has had a vast influence on the art and culture of the Sani and the Chinese Nation. Art and literature inspired by its shapes and colors are found throughout the world.

3.c-2 Comparative analysis on "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 (Criterion viii)"

The Shilin, Libo and Wulong karst are all nominated (Serial nomination for South China Karst, Phase 1) under criterion viii. The three sites all present important features of the diverse South China Karst landforms. On the world scale, the South China Karst is unrivalled in area and depth, karst geomorphology diversity and typicality and biological diversity.

The 47 of World Heritage nominated areas were inscribed containing cave and karst features by 2004. Ten World Heritage areas were inscribed specifically for their cave and karst features; Table 3-2 illustrates that the three sites nominated in this application are outstanding and unique when compared with the other ten sites.

3.c-2-1 The Shilin Karst

There are many countries with various forms of dissected karst landscapes with cones, towers, pinnacles and other karst forms. The Shilin Stone Forests are distinctive in both their evolution and resulting landscapes (see discussion in section 3.c-1). As previously stated the two other pinnacle karsts of world are renown Gunung Mulu (Malaysia) and the Tsingy de Bemaraha (Madagascar). These lack the great diversity of the Stone Forest (Table 3-3). The Shilin karst situated on a continental plateau has developed in four distinct periods extending back into the Permian. No other pinnacle karst has such an extensive history and hence able to provide such detailed information on the earth's geological history. The pinnacle karst evolution is complex and comprises both surface (subaerial) erosion by rainwater and erosion under soil (subsoil) by groundwater; these processes are continuing.

Table 3-2 Comparison of the nominated areas with 10 World Heritage sites inscribed specifically for their caves and karst

Nominated Sites	State Country	Year	Key Features/Justification for Inscription	Criteria after 2005
Shilin Karst	Yunnan		Type location for pinnacle karst, outstanding for towering limestone pinnacles decorated with deep, sharp karren. The pinnacles result from subaerial and subjacent karst processes under Tertiary sandstones and Permian basalts. They are representative of the immense variety of stone forests that are found in the South China Karst. They illustrate the episodic nature of the evolution of such karsts, which spans 270 million years. They are recognised throughout the world as being one of the finest examples of the natural beauty that karst processes bestow upon rock.	N viii, vii
Libo Karst	Guizhou		Type location for cone karst and outstanding for a complete spectrum of gradual change from plateau to lowland karst. They have a combination of numerous cones, deep dolines, sinking streams and long river caves. The landscape contains superlative examples of *fengcong* and *fenglin* karst. It includes fengcong-depression, fengcong-valley (polje), fengcong-gorge, fenglin- depression (polje), fenglin-valley and fenglin-plain (basin). The Libo sites illustrate the stages of evolution between fengcong and fenglin landscapes and vice-versa. This cone karst landscape supports an exceptional vast karst forest ecosystem with great biodiversity. It provides the habitat for numerous endemic species and endangered fauna. The sites provide field study areas for research into karst forest ecosystems.	N viii, ix, x
Wulong Karst	Chongchin g		The sites are outstanding examples of a karst landscape evolved in areas where thick sequences of pure carbonate rocks have been subjected to tectonic uplift. The result is a fengcong karst dissected by deep gorges, a huge cave system (Furong Cave), giant dolines (*tiankeng)* and numerous natural bridges. These classic sites provide rich information concerning a long history of geological evolution in South China.	N viii
10 Inscribed WH Sites		**Year**		**Criteria before 2005**
Puerto-Princesa Subterranean River National Park	Philippines	1999	Spectacular karst landscape, underground river and caves. Primary forest in Palawan Biogeographical Province. Assegi karst.	N iii, iv
Gunung Mulu	Malaysia	2000	295km explored caves. Sarawak Chamber is the world's largest. Speleothems with spectacular aragonite and calcite needles. A 1.5 myr sediment sequence, large collapse dolines, lateral planation and pinnacle karst. Bats and swiftlets transfer energy from forest to cave. Exceptional primary forest and cave biodiversity.	N i, ii, iii, iv
Desembarco del Granma National park and System of Marine Terraces of Cabo Cruz	Cuba	1999	Uplifted marine terraces and ongoing development of karst topography. Aesthetic value of stair-step terraces and cliffs.	N i, iii

To be continued

Table 3-2 Comparison of the nominated areas with 10 World Heritage sites inscribed specifically for their caves and karst

Nominated Sites	State Country	Year	Key Features/Justification for Inscription	Criteria after 2005
Carlsbad Caverns National Park	USA	1995	81 caves, Huge caverns and decorative mineral features, scenic values especially Lechuguilla Cave. Most types of limestone cave formation are found here, including long passages with huge chambers, vertical shafts, stalagmites, stalactites and gypsum "flowers" and "needles". Excellent examples of karstification by sulphuric acid. Rich microfauna.	N i, iii
Mammoth Cave National Park	USA	1981	Continuous cave formation (100 myr-present). Large multi- level passages and domepits. Rich troglobitic fauna.	N i, iii, iv
Plitvice Lakes National Park	Croatia	1979/ 2000	Spectacular travertine barriers and lake systems; forest in excellent condition.	N ii, iii
Caves of Aggtelek and Slovak karst	Hungary /Slovakia	1995/ 2000	712 caves. Variety and concentration of cave types, speleothems and an array of typical temperate zone karst features. (Includes aragonite and sinter formations and an ice filled abyss)	N i
Skocjanske Jame	Slovenia	1986	Awesome river canyons, textbook portrayal of karst Hydrogeology. On-going process; Collapsed dolines and caves.	N ii, iii
Ha Long Bay	Vietnam	1994/ 2000	Most extensive and best-known example of a marine invaded tower karst and one of the important areas of fencong and fenglin karst in the world.	N i, iii
Phong Nha Ke Bang	Vietnam	2003	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.	N i

From Elery Hamilton-Smith (Australia) on the World Heritage Sites Inscribed for Cave and Karst Features

1. Unique geology

The geology of Shilin Stone Forest is unique amongst pinnacle karsts. The gently dipping carbonate rocks are hard, compact, pure and massive. The geological history after limestone deposition in the Permian shows there was regional volcanism, coal formation and periods of denudation. The capping rocks of Permian basalts, Tertiary sandstones, Cenozoic uplift of the Tibet Plateau and the transformation of the planetary winds into a monsoon system following Cenozoic uplift have all had significant influence on the evolution of the Shilin Stone Forests.

In the karst regions of northern Europe and northern America, networks of small pinnacles occur in the hard, compact, pure Carboniferous or Silurian limestone. These areas were scoured by the continental ice sheet during the last ice age (about 12 000 years ago). Consequently, the size of the

recent pinnacles is smaller than those found in the Shilin Stone Forests (Table 3-3). In the Shilin Stone Forests during interruptions in carbonate rock deposition in the late Permian, acidic conditions brought about by extensive volcanism and coal formation were favorable for karst development. Hence, there is a rich inheritance of palaeokarst features that can be used in establishing the geological history of Southeast Asia. In young porous and permeable rocks, extreme karst forms such as huge pinnacles have difficulty developing and persisting. Moreover, deep extreme karst forms, such as gorges and caves, will not form unless the rock mass has been uplifted. In Central America, southeastern USA and Australia, many carbonate rocks are porous and permeable and have experienced only weak uplift and such karsts don't have pinnacles. Furthermore, many of the limestone in Central America are not as pure as those of the Shilin, so that if pinnacles do form they will not sharpened into smooth sharp blades (James, 1997). In all the important karst regions of the world, no stone forests as complex as those of the Shilin have been reported (Yuan Daoxian, 1997). The closest, as has been stated previously, are Gunung Mulu (Malaysia) and the Tsingy de Bemaraha (Madagascar); both are in hard and pure limestone (Table 3-3).

Quartzite rocks have developed landscapes composed of rock pillars in the Wulingyuan Scenic and Historic Interest Area. The pillar appearance is close to that of the pinnacles of the Shilin. However, the process forming them is not, as neither subaerial nor subsoil karst erosion takes place at Wulingyuan. The pinnacles that develop on quartzites and sandstones are pseudokarst features. There is no direct comparison with the geology or karst processes in the Wulingyuan pseudokarst with those in the Shilin Stone Forests.

2. Favorable climate

From a consideration of the data produced for the global karst correlation (Yuan Daoxian, 1997), it is deduced that a humid, hot subtropical monsoon climate is important prerequisite for the formation of the Shilin Stone Forests. There are similar geological environments in the arid or semi-arid karst regions in northern China and Nevada, USA; in northern China, the lower Paleozoic carbonate rocks are usually capped by Permo-Carboniferous coal measures. However, the low annual precipitation does not provide adequate hydrologic or chemical dynamics for karst processes that lead to pinnacles. The combination of heat and water in the monsoon climate, with wet summers and dry winters, this cycle of wet and dry is

Table 3-3 Comparative analysis of the Shilin Stone Forest karst to similar sites

Site	Shilin Yunnan	Non World Heritage Listed										World Heritage Listed		
		Longshan Luota Hunan	Huayuan Xiaopaiwu Hunan	Xi ngwen Sichuan	Chunan Zhejiang	Linyin Fujian	Nidang Guizhou	Montpelier-le-Vieux	Nambung national park	Chillagoe	Mt. Kaijende	Assegai karst Palawan	Tsingy de Bemaraha	Gunung Mulu National Park
Country	China	China	China	China	China	China	China	France	Australia	Australia	Papua New Guinea	Philippines	Madagascar	Sarawak, Malaysia
Area (km^2)	350	2	0.7	10	5	2	8	1.2	~ 40		3	<10	250	<0.5
Altitude range (m)	1720~2203	800~1200	540	600~800	590	250~500	1000~1200	800	Sea-level to 130m	338	2600~3700	700~900	150~700	1200
Terrain	Continental plateau of low to moderate relief	Continental mountain areas	Low mountain areas	Low mountain areas	Continental hill areas	Continental hill areas	Low mountain areas	Mediterranean basin	Coastal plain	Foothills	Island mountain areas	Island	Island plateau	Steep mountain side
Formation	Lower Permian	Lower Permian	Carboniferous	Lower Permian	Carboniferous	Carboniferous, Permian	Triassic	Jurassic		Silurian to Devonian	Lower Miocene	Tertiary	Jurassic to Miocene	Tertiary
Lithology	Limestone, dolomite, dolomitic limestone	Limestone	Dolomite	Limestone	Limestone	Limestone	Limestone	Dolomite	Limestone	Limestone	Limestone	Limestone	Limestone	Limestone
Lithofacies	Hard, compact, pure, massive, gently dipped	Thickly bedded	Thickly bedded	Pure and gently dipped	Thick		Thick	Broken, inhomogeneous	Gently dipped	Vertically bedded	Thickly bedded, gently dipped		Very hard, shattered and pure	Hard, pure and thickly bedded
Climate type	Humid, hot subtropical monsoon climate	Humid, subtropical monsoon climate	Humid, subtropical monsoon climate	Humid, subtropical monsoon climate	Subtropical monsoon climate	Subtropical monsoon climate	Humid, subtropical monsoon climate	Atlantic humid climate	Mediterranean climate	Tropical monsoonal climate	Tropical monsoonal climate	Tropical marine climate	Dry season months and a 4 month wet season	Equatorial monsoonal climate
Annual temperature (℃)	8~20	14	16	16~18	17	10~29		10	13~25	22~33	26~28	22~32	>26	21~27

To be continued

Table 3-3 Comparative analysis of the Shilin Stone Forest karst to similar sites

Site	Shilin Yunnan	Non World Heritage Listed										World Heritage Listed		
		Longshan Luota Hunan	Huayuan Xiaopaiwu Hunan	Xingwen Sichuan	Chunan Zhejiang	Linyin Fujian	Nidang Guizhou	Montpelier-le-Vieux	Nambung national park	Chillagoe	Mt. Kaijende	Assegai karst Palawan	Tsingy de Bemaraha	Gunung Mulu National Park
Country	China	China	China	China	China	China	China	France	Australia	Australia	Papua New Guinea	Philippines	Madagascar	Sarawak, Malaysia
Annual rainfall (mm)	800~850	1740	1430	1310	1500	1400		600~800	600	800	2000~5000	2327~2577	980	Around 5000
Pinnacle shapes	Pillars, towers, needles, pagodas cones, blocks, stone teeth, fins, flutes, and many shapes too irregular to classify.	Pinnacles and stone teeth	Pillar and tower-shaped	Stone teeth, tower-shaped	Castle-shaped and stone teeth	Pillars Towers cones	Pillars-shaped	Bizarre little towers and isolated mushroom-shaped pillars	Towers rising from plain, and columns	Needle-like pinnacles	Spiky pinnacles and arêtes		Needle and blades-like pinnacles	Razor-edged pinnacles
Pinnacle height (m)	Several meters to 40	Mostly 5~7 Some10~15	10~30	5~10	8~15	2~36	5~23	Up to 12	1~5	1 to 5	50 to100	0.5 to 20	Mostly 1~10 Some 10~40	30
Phases of evolution	4 periods since Permian			2 periods					3 periods	Are now in a decay phase	Without burial and exhumation phases		Dissolution by direct precipitation since the Pliocene	Without burial and exhumation phases
Morphogenetics	Subaerial and subsoil erosion	Subaerial and subsoil erosion	Subaerial and subsoil erosion	Subaerial and subsoil erosion		Subaerial erosion	Subaerial and subsoil erosion	Subaerial erosion	Subsoil erosion	Subaerial erosion	Subaerial erosion	Subaerial erosion	Subaerial erosion	Subaerial erosion

important for stone forest development. It is also implicated in the generation of the sharp karren are the microflora which inhabit the surface of the pinnacles are only viable in warm wet conditions. Subsoil karst erosion is also dependent on the soil becoming saturated during the wet season. The Shilin karst only has brief periods of frost and snow. In the high mountain karsts, stone forests even if formed would be destroyed because of frost shattering. Areas with similar high rainfalls are Gunung Mulu (Malaysia), the Tsingy de Bemaraha (Madagascar) and Mt Kaijende (PNG) (Table 3-3).

3. Complicated evolution

Compared with other celebrated pinnacle karsts of the world, the Shilin Stone Forest has a long geological history, which has resulted in long and multi-phased evolution. Pinnacle evolution has been influenced strongly affected by the basalt and basalt tuff lying on the thick and pure limestone and by the Eocene red sediments. These covering rocks have allowed the subjacent karst development. This has not been the case in other pinnacle karsts. Under a humid and hot tropical environment, denudation and planation have taken place (Budel, 1977). The pure and massive carbonate rocks of lower Permian were corroded beneath Eocene "red beds" to develop rounded forms. After the late Neogene, particularly in mid Pleistocene, the area was uplifted and formed the Yunnan Plateau 1,700 to 2,000m above sea level. At present, the stone forests are being exhumed. The first phase of stone forest evolution was as early the early Permian and the last, the fourth phase, still in proceeding (Liang Yongning, 2000). The Madagascar, Malaysian and Papua New Guinea pinnacles have a single-phase evolution (Tables 3-3 and 3-4).

The evolution of Madagascar karst is very much younger and more simple than Shilin Stone Forest; the limestones are younger (Jurassic to Miocene), the modern morphology developed during the Pliocene and Pleistocene, and the geological structures are more simple (faulted monoclinal relief). The Mulu pinnacles in Malaysia and the Mt Kaijende pinnacle arête karst in Papua New Guinea have developed over the last few million years, whereas the Shilin Stone Forests have a multi-phase evolution spanning some 270 million years. The Shilin Stone Forests are therefore of considerably greater geomorphological and geological interest (Ford, Salomon and Williams, 1997).

4. Detail record of a long period of the earth's history

Shilin Stone Forest has been studied to provide the evidence for geo-history and palaeogeographic

environmental changes since the Permian (Song Linhua, 1996). The Shilin Stone Forests were formed in four stages. The formation occurred: in the late stage of the early Permian; from the late Mesozoic to the Eocene; from the Eocene to the Oligocene; from the Miocene to the present. Remnants of all of them can be found today. This is a magnificent record of a long period of the earth's history. The Shilin Stone Forests today record the changes in the landscape that have occurred over 250 myr. The information available today shows that the Shilin karst has changed from ocean to land, from lowland to plateau, from lake basin to plateau basin. Continental drift caused it to move north and its climate changed from a warm and humid tropical to the present monsoon subtropical climate. Such a huge karren and vast karren field on the plateau is unique in the world in its ability to provide evidence for neotectonic movements (Lin Junshu, 1995). No other area of stone forest in the world has had survived for such a long period of the earth's history.

5. Great diversity of morphology and distribution

The other major pinnacle karsts of the world are in the tropics and the climate although wet is very different from that of the subtropical Shilin. Due to weathering and complex evolution, the shape of Shilin stone forest is greatly varied. The Shilin Stone Forest distributed as patches and clusters of various sizes, scattered from hilltop to slope, from ridge to gully, from lakeside to depression. There is an obvious genetic relationship between the stone forests at different elevations. In the upland, due to longer period of weathering and corrosion, the pinnacles are sparse and ruined, while those in the lowland and depressions are numerous and robust. Individually, a stone pillar or column may take the shape of pillar, needle, tower, mushroom and so on. The pinnacles are decorated with karren as fins and flutes. There are emergent pillars called "stone teeth". The Shilin Stone Forests have been the focus of substantial research into stone forest development and are generally accepted to be among the most varied in the world.

The Shilin Stone Forests display pinnacles of highly diverse morphology when with other major pinnacle karsts in the world which are dominated by one main shape (Table 3-3). In addition, Mulu (Malaysia), Palawan (Philippines) and Chillagoe (Australia) are primarily known for their cave systems, and pinnacles form only a small part of these karsts.

Conclusion: The comparison leads to the conclusion that the Shilin Stone Forests are very special pinnacle karsts with distinctive and unique features. This results from its long and complex evolution in hard, compact, gently dipping, pure limestone, a rapid Cenozoic uplift and the humid, subtropical monsoon climate. Global correlation research shows that it is impossible to find another place in the world that enjoys the combination of all the background evolution factors found at the Shilin (Yuan Daoxian, 1997). The Shilin Stone Forests are the most studied subtropical pinnacle karst area in the world and are without rival in terms of karst evolution. The Shilin Stone Forest should be regarded as a treasure that belongs to the world.

3.c-2-2 The Libo Karst

The complex geological history of the Libo sites (see description for the Libo) has resulted in a remarkable diversity of surface landforms that demonstrate a greater variation in cone karst than any other cone karst area in the world (Table 3-4). A full spectrum of gradual change from plateau karst to the lowland karst is found here. The result of these changes is an unusually complex hydrology. The combination of a dissected land surface and a variable groundwater regime has led to a high level of biodiversity. Within the borders of the nominated Libo karsts are the most diverse karst ecological systems in the world. It can be compared with the many forested karst regions of Southeast Asia, but distinguished from all of them by its incomparable levels of geo-diversity and biodiversity. The unique karst forest community preserved in the nominated area provides a valuable natural laboratory for research scientists. Continuing studies include the geo-history and evolution of karst landforms and the diversity and evolution of flora and fauna in a primary karst forest.

1. Unique Setting for the cone karst evolution

In the nominated sites, carbonates some 8600m thick were deposited between the Sinian (late Precambrian) and Triassic. The end of the Mesozoic was marked by general uplift and widespread deposition of Cretaceous and Tertiary red beds (sandstones and clays) took place over the carbonates. Subsequent erosion and removal of the clays and sandstones exposed the underlying carbonates, and this erosion has given rise to the most highly developed karst landscapes in the world.

Table 3-4 Comparative analysis of the cone karst of Libo in relation to similar sites

Site	Libo	Non World Heritage Listed							World Heritage Listed		
		Guilin	Phangnga Bay	Gunung Sewu	Bonito	Arecibo-Manati	Darai Hills	Cockpit Country	Ha Long Bay	Phong Nha-Ke Bang National Park	Desembarco del Granma National Park
State Party	China	China	Thailand	Java	Brazil	Puerto Rico	Papu New Guinea	Jamaica	Vietnam	Vietnam	Cuba
Terrain	Continent plateau	Continent plain	Island	Island	Continent low plateau	Island	Island	Island	Coast lowland	Coast lowland	Island
Average altitude and range (m)	747 (385-1109)	150-300	50-150	200-400	400-700	0-200	427-2896	300	100-200	400-1000	550
Formation	Triassic Permian Carboniferous	Silurian Ordovician Cambrian Precambrian	Ordovician, Permian	Tertiary	Tertiary Cretaceous Jurassic	Tertiary Cretaceous Jurassic	Middle and early Miocene age	Tertiary Cretaceous Jurassic	Permian Carboniferous	Late Permian, Carboniferous	Cretaceous Jurassic
Lithology	Limestone, dolomites and dolomitic limestone	Limestone, dolomites, dolomitic limestone, and mud limestone	Limestone	Limestone	Limestone, dolomites, dolomitic mudstones	Limestone, mud limestone	Limestone	Limestone, dolomites, dolomitic limestone, Mud limestong	Limestone, schist	Limestone, dolomites	Limestone, dolomites
Lithofacies	Hard, compact, thick, homogenous	Hard, compact	Pure but thin	Thick and wide, pure	Horzontal	Thick, pure	Pure, dense	Incontinuous	Pure but not thick	Incontinuous, impure	Pure, thick
Structure location	Axis of anticline trending NNE	NS part of arc Guidong Structure	The axe trending NS or NE-SW		A series of thrust faults trending eastward	The long axis trending NE			Antiquity horst, geosyncline structure	NW Vietbac and subsiding towards Bacbo, folds and faults	
Present climate type	Subtropical monsoon	Tropical monsoon	Tropical monsoon	Tropical rainforest	Tropical maritime	Tropical maritime	Tropical rainforest	Tropical rainforest	Humid tropical monsoon	Humid tropical monsoon	Tropical rainforest
Annual temperature(℃)	15.3°	19.0°	28.0°	26.0°	23.0°	24.0°	26.5°	27.0°	26.0°	24.0°	25.5°

To be continued

Table 3-4 Comparative analysis of the cone karst of Libo in relation to similar sites

Site	Libo	Non World Heritage Listed							World Heritage Listed		
		Guilin	Phangnga Bay	Gunung Sewu	Bonito	Arecibo-Manati	Darai Hills	Cockpit Country	Ha Long Bay	Phong Nha-Ke Bang National Park	Desembarco del Granma National Park
Annual rainfall (mm)	1752	1900	> 2000	>2000	1400	1500	>2000	1974	2200	1880	1200
Karst hydrology	Both autogenic and allogenic water input	Well-developed allogenic water input with some autogenic input	Marine, allogenic and autogenic water input	Both autogenic and allogenic water input	Some autogenic with allogenic water input	Almost entire autogenic water input	Almost entire autogenic water	Well-developed autogenic and some allogenic water input	Marine, allogenic and autogenic water input	Well-developed allogenic water	Autogenic water input
Caves	Long and deep multi-level cave systems	Short cave systems	Many large caves	Few small caves	Many large and long caves	Few small caves	Large and deep cave systems	Few small caves	Short caves	Multi-level cave systems	Multi-level cave systems
Karst type	Cone karst with little towers	Tower karst with some cones	Towers with cones	Cones and towers	Residual hills with some cones	Towers with some cones	Cones and some towers	Cones with towers	Transgression tower karst with cones	Some cones and some towers	Primary cones with mogotes
Karst assembladge	Fengcong-depression, fengcong-valley, fengcong-gorge, fenglin-depression and fenglin-valley	Fenglin-depression, fengcong-depression, fenglin-plain and isolated towers	Feglin-valley, feglin-depression and isolated towers	Fengcong-depression, fengcong–polje	Residual hills, karst plains and fluviokarst	Fenglin-depressio, fengcong-depression and Residual hills	Fengcong-depression	Fengcong-depression and fenglin-valley	Fenglin-valley, fenglin-depression, many small and low and isolate hills	Fengcong-depression, fenglin-depression and fenglin-polje	Fengcong-depression, fengcong-polje, doline fields and mogotes

To be continued

Table 3-4 Comparative analysis of the cone karst of Libo in relation to similar sites

Site	Libo	Non World Heritage Listed							World Heritage Listed		
		Guilin	Phangnga Bay	Gunung Sewu	Bonito	Arecibo-Manati	Darai Hills	Cockpit Country	Ha Long Bay	Phong Nha-Ke Bang National Park	Desembarco del Granma National Park
Cone morphometry	Height range of 100-300m, slope range of 45-47°	Towers with steep slopes of about 60°	Cone show different heights, slope range of 45-60°	Crowded hemi-spherical cones with a height range of 25-100m and a mean slope of about 30°	Heights are variable, the cones are mainly beehive-shaped	Cones with a height range 2.5-55m and a mean slope of about 30°	Heights range of 90-120m and conical shapes	Hemispherical and cone summits and slope range of 20-30°	Tower slope range of 60-90°	Cone height is often less than 10m	Cones are low and their shapes are not symmetrical
Karst surface morphology	Large depressions covered by residuum or soil, within some of them there are dolines	There are many polygonal depressions and their borders are clearly defined minor karren forms and, grikes.	Dry valleys, karren, dolines, small shafts	Advanced dolines, narrow and interconnected valleys, shallow lakes	Some collapse sinkholes covered by lateritic or red soil, springs,	Some enclosed basins or depressions covered by thin soil, and gigantic dolines	Gigantic and deep depressions, and some covered by thick clays. dolines and karren	Gigantic and shallow depressions, valleys, basins and poljes filled with alluvium, dolines and karren	Closed polygonal depressions, karren and grikes	Deep and large dolines, and shafts,	The very shallow and irregular depressions covered by clay
Morphogenetics	Cones on a planed limestone surface; a few cones rising from sloping pedestals an various lithologies	Cones on a planed limestone surface	Cones rising from alluvial plains and massive erosion and corrosion by seawater	Uplifted marine terraces and strong chemical erosion from tropical rain	Residual hills protruding through an alleviated surface	Cones protruding through an alluvial surface	Widespread tectonic uplift, cones on a planed fluvial surface	Favourable geological setting, Cones rise above the polje floors	Massive erosion and corrosion by seawater	Residual hills emerging from limestone inliers, favorable geological setting with a long time for karstication	Uplifted marine terraces and with ongoing development of karst

To be continued

Table 3-4 Comparative analysis of the cone karst of Libo in relation to similar sites

Site	Libo	Non World Heritage Listed							World Heritage Listed		
		Guilin	Phangnga Bay	Gunung Sewu	Bonito	Arecibo-Manati	Darai Hills	Cockpit Country	Ha Long Bay	Phong Nha-Ke Bang National Park	Desembarco del Granma National Park
On going karst landform changes	Fengcong into fenglin, and fenglin to fengcong rejuvenation	Fengcong into fenglin	Fengcong into fenglin	Fengcong into fenglin, and fenglin to fengcong rejuvenation	Fengcong into fenglin	Fengcong into fenglin	Fengcong into fenglin	Fengcong into fenglin	Fengcong into fenglin	Fengcong into fenglin	Fengcong into fenglin, and fenglin to fengcong rejuvenation
Phases of the cone karst evolution	All phases of cone karst	Lack of fengcong-valley	Lack of fengcong-valley	Lack of fengcong-valley	Lack of fengcong-valley	Lack of fengcong-valley	Only fengcong depressions	Lack of fengcong-valley	Lack of fengcong-valley	Fengcong-depression, fengcong-valley and fenglin-polje	Fengcong-depression, fenglin-polje, Fenglin-depression
Ecology	Primary sub-tropical forest, biodiversity and endemic species	Shrub cover	Dense rainforest	Tropical rainforest	Primary tropical forest	Tropical rainforest	Evergreen forest	Tropical rainforest	Hydrophilic species, tropical forest	Tropical forest, biodiversity	Biodiversity and endemic species
Human activities	Traditional agriculture and tourism	Urbanization and tourism	Tourism and agriculture	Tourism and agriculture	Tourism and agriculture	Tourism and radio-astronomy	Agriculture but absence of human activity in some high areas	Tourism and agriculture	Tourism	Tourism	Tourism - tourist numbers limited for park protection

The evolution of the landforms upon these enormous thickness of carbonates has been influenced by five main factors: 1) the tectonic setting of the area in relation to the northward drift of Southeast Asia and the successive the sloping uplifts of Yungui plateau to the west during the Tertiary and Quaternary periods; 2) the largely tropical climate and the climatic changes brought about by the neo-tectonic events referred to in 1); 3) the world-wide changes of sea level and climate that occurred in the Quaternary period; and 4) the great range of lithological types developed within in the limestone sequences; 5) plenitudinous autogenic and allogenic water have extremely been effecting the development of the cone karst.

The setting for cone karst development in Libo differentiates evidently with other karst areas. For instance, Libo nominated sites have been intermittently uplifted owing to their proximity to the Tibetan massif, whereas the Guilin of China have remained tectonically more stable and have to some extent subsided; and in Ha Long Bay, Vietnam, Phangnga Bay of Thailand, there has a marine setting and strong chemical erosion from marine water tropical rain are the crucial factor to the development of karst. Nevertheless, the karst in nominated sites lies in continent plateau and belongs to the result of subtropical monsoon climate combining many other conditions. At the same time, in the many of the major karst areas around the world, the carbonate rocks are younger, characterized by less diagenesis, high porosity and softer lithology and do not develop cone karst. Phong Nha-Ke Bang National Park, Vietnam and the Cockpit Country, Jamaica, and the others in Table 3-4 that do form cone karst are different from Libo in that in some of them the carbonate rocks strata are not continuous.

In short, the unique setting for cone karst development in nominated Libo is characterized by: hard, continuous, compact, pure carbonate rock before late Triassic; strong and unique uplift; on the axis of anticline trending NNE; subtropical monsoon; strong chemical dissolution; and the effect of autogenic water and allogenic water in the areas, etc.

2. Great diversity of the cone karst

Libo cone karst is better developed with larger cones in many diverse environments than those of Jamaica, Cuba or other areas (Table 3-4). This is because of the limestone, dolomite and dolomitic limestone lithology of the area and the long period of time the cones have had to develop. The cone karst

of the wet tropics has evolved in a simpler way to that of Libo, which has been subjected to a subtropical monsoon climate that has a distinct wet season since the late Cretaceous.

In the Chinese cone karst, high, pointed cones seem to predominate, Sweeting wrote (1989). Certainly, the height of cones in Libo varies from 100 to 300m, their slope ranges from 45° to 47° and cone symmetry is outstanding. Whereas, the majority of cones in other areas are mainly hemispherical, with slopes about 30° and heights are less than 100m (Table 3-4). Specific examples are the cone karsts of Gunung Sewu of Java and the Arecibo-Manati region of Puerto Rico. The hills of the Goenoeng Sewoe are strikingly domed mounds, whose relative height, measured from the lowest point of the adjacent depression, seldom exceeds 75m; hemispherical cones are found not only in the limestone areas of Java, but also in south Celebes, and in the Phillippines. In the Cockpit Country of Jamaica, the slopes are 20-30° (Sweeting, 1989) and the height of the cones is even smaller. The height differential between the Libo cones and those of the world is a result of the greater tectonic uplift that has taken place at Libo. The cone karst is the dominant landform at Libo, but in many sites in Table 3-4 with similar conditions and in the subtropics cones are mixed with towers in varying proportions.

The nominated sites contain many generations of cones in the following karst assemblages fengcong-depression, fengcong-valley and fengcong-gorge. This universal distribution of cone karst assemblages is not common. In most cone karst areas, not all of them exist. For instance, the fengcong-valley phase does not develop in the majority of cone karst regions in comparison Table 3-4. The presence of all the assemblages of cone karst at Libo provides supporting evidence for the geo-history of the area, evidence that is often not available in other karst areas in the world.

3. Abundance of karst features other than cone karst

The Libo karst surface as well as having superb cones has numerous other karst features. They are karren, dolines, polygonal depressions, dry valleys, blind valleys, canyons, karst basins (poljes), karst plains, stone teeth, towers, isolate peaks, natural bridges, sink holes, shafts, karst windows, karst springs, karst lakes and waterfalls. What beneath the surface are caves, subterranean rivers that from lakes, and waterfalls. The caves contain a great variety of speleothems, such as stalactites, stalagmites, columns, and helictites, cave pearls, cave shields, cave coral, rim stone dams and rare lily pads. In other cone karst

sites, this integration of a complex surface karst with extensive and mature underground development is rare as usually one or other dominates. For example, Gunung Sewu in Java has a complex surface karst as has Phangnga and Phuket Island in Thailand and Ha Long Bay in Vietnam. Others have only a rich cave systems such as the Nullarbor Plain in Australia, Bonito in Brazil, Skocjanske Jame in Slovenia and Phong Nha-Ke Bang National Park in Vietnam.

4. Complex assemblages of the cone karst

Karst landform assemblages in the Libo sites because of its lengthy geo-history are also diverse and complex. At Libo, almost all of the typical cone karst landform assemblages are represented. That is fengcong-depression, fengcong-valley, fengcong-gorge, fenglin-depression, fenglin-valley, fenglin-plain. They have developed in continuous sequences with all assemblages being currently present at the site.

5. Special leveled distribution of the cone karst

The horizontal leveled distribution: from the watershed near Mawei in the east to the Zhangjiang valley in the west, the linear distance and landform elevation difference are approximately 50km and 720m respectively. Xiaoqikong subterranean river runs beneath the whole area. In the upstream catchment, the cone summits of less than 100m are isolated in wide and flat valleys and basins and the side slopes of the cones are 42°~48°. To the southeast, from Huanghou to Yuanyang Lake, the cones are mostly clustered, and exhibit an increased height and slope gradient (52°~58°). From Yuanyang Lake to the lower reaches of the Xiaoqikong River, the fengcong-depression karst has deeper depressions and fengcong-gorge karst. The height difference here between cones tops and depression bottoms increases to 300~450m.Cone karst characteristics on the eastern bank of the Zhangjiang are different. From the western catchment to the eastern Sanchahe valley; the height difference is 250~400m from cone tops to depression bottoms, with a slope angle of 55°~58°. In the middle and lower reaches (Yaosuo Areas), the cone heights of 150~250m and average slope angles of 42°~48°.

The vertical levels: There are numerous types of closed depression at Libo and dolines feature amongst these. The doline diameters range from 10 to 200m and with width/height ratios of less than 0.5. Three-classes of dolines are found within the nominated sites. In the first class, the dolines are relatively wide and shallow and they are the most ancient. Because of late karstification strong breakage, they only

exist in part of area such as Dongduo. In the second class, the dolines have relatively steeper sides than those of the first class. These dolines with their large and irregular shapes are mature and their distribution is the most extensive. In the third class, the dolines are deep with narrow bottoms: these are the youngest. The dolines of different ages are located at different levels in the Libo karst and thus are able to provide evidence to assist in unraveling the complex geo-history of Libo.

Above the levels the evidence becomes even more difficult to recognize and interpret but they hint at the possibility of two points at least: ①Uplift had taken place in very large areas in tectonic movement, and in the uplifted process, there had times transitory deadlock. ②The tectonic movement threw strong or weak, obvious difference pressures to different sites. More considerable work is required to confirm these impressions.

The horizontal and vertical multi-level structure is extremely rare to have generations of cone karst to assist in this process. It is believed that is yet another unique aspect of the Libo karst.

6. All phases of cone karst development with significant on-going processes

Cones and towers often incorporating all kinds of negative especially closed depressions emerge from a common bedrock base between the clusters of cones and form a spry organic system. Tower karst is often interpreted as representing an advanced stage of evolution, resulting from the widening of cockpit bottoms once they have eroded down to the water table (Sweeting, 1958). In humid areas, the combination shallow water table with strong surface water is a prerequisite condition for cones evolving towards towers (Xiong, 1994). In nominated Libo, those areas that satisfy the two basic conditions above mentioned verified the conclusion.

The nominated Libo karst is mostly cone karst, from plateau watershed to valleys there has not only the positive development but also abnormal evolution sequence. Extending from the watershed near Mawei in the east to the Zhangjiang valley in the west, any types of the cone karst at any stage to evolve in rejuvenation development sequence: fenglin plains→fenglin basins→fengcong valleys→fengcong depressions. However, the evolution on the eastern bank of the Zhangjiang is a positive sequence: fengcong depressions→fengcong valleys→fengcong gorges→fenglin plains→peaks plain. The most important transition that takes place here is the change of a cone into a tower.

This and other changes at Libo represent a globally significant example of ongoing karst geological processes. In Ha Long Bay in Vietnam, Guilin in China, Phangnga and Phuket Island in Thailand, the Cockpit Country in Jamaica and numerous other areas, there is only one ongoing process that is the positive change of fengcong into fenglin. The integrated and the complex evolving karst processes taking place in the Libo cone karst are unique.

7. Unique primary karst forest and hydrology

Many of the karst areas of the world are devoid of vegetation especially tall trees. Forests are unable to grow on the karst in harsh climates and where the karst has poor soil. On other karsts, the forests have been harvested and a bare karst is left. In the nominated Libo, sites especially at the Maolan site there are primary forests. Maolan karst forests provide an environment for research into reforestation and sustainable use of the karst forests. This is unique in same latitude karst forests of the world.

The Maolan karst forests have a special hydrology. It has a dualistic structure consisting of surface water storage in lakes and swamps and underground water in the karst. In ordinary karst regions, drought and flood can alternate. In the Libo karst forests because there is a dynamic equilibrium between surface and underground water these natural disasters can be avoided.

Conclusion: Compared with those similar karst sites, nominated Libo cone karst is distinctive and unique. The complex setting of the Libo sites has resulted in a remarkable diversity of surface landforms; Great cone karst diversity; the typical cones and richest karst assemblages. In the cone karst landforms, there contain the special leveled distribution; the positive evolution and abnormal rejuvenation development sequence. At the same time, unique primary karst forest and hydrology contrast with most of those karst areas which altitude is same as nominated Libo sites. Therefore, the cone karst in nominated sites probably has been demonstrating one of greater variation than any other karst area of similar size in the world.

3. c-2-3 The Wulong Karst

The South China Karst has tiankengs (giant of dolines) at Wulong. They are amongst the largest of these extreme karst features in the world. The tiankengs when coupled with gigantic bridges and arches in a

gorge setting are both aesthetically pleasing and provide a great deal of evidence to enable a geo-climatic history to be established for the Wulong area. This is supplemented by the evidence from Furong Cave sediment and speleothem deposits. The Wulong nominated sites fulfill the criteria of N viii from a consideration of the following:

1. The extensive geo-history

The exposed strata in the cliffs at Wulong display limestone and other sedimentary rocks that range in age from Paleozoic to Mesozoic. Amongst the strata there are approximately 2000m soluble rocks formed during Permian, Ordovician, Devonian and mid-to-lower Triassic Periods. These consist of hard and pure limestones that have low porosity and primary permeability. These old, massive and hard limestones were folded and fractured during the numerous tectonic uplifts that occurred at Wulong and raised the area as part of the Yangtze massive. The fracturing of limestone increased secondary permeability of the carbonate rocks allowing penetrating waters to establish underground routes that with time resulted in extensive cave systems and deep river gorges. The last uplift took place in the Quaternary and the limestones were uplifted over a 1000m.

2. The rich surface geomorphology

At Wulong, the nature of the limestone, the lowering of the hydrologic base as the Yangshui River deeply incised the karst plateau and the humid temperate monsoon climate all have combined to enhance corrosion and erosion leading to the development of extreme karst forms in the area. These karst features have been imposed on an older but still evolving fengcong karst (cone karst), which is a fine example of this karst feature in its own right. Others are the deep river gorges.

Giant dolines (tiankengs) are exceptionally large collapse dolines (over 1 million m^3 in volume, the largest are over 100 million m^3) that form as the cave roof stopes upward until it reaches the surface. The Qingkou tiankeng with its vertical cliffs of bare rocks is one of the largest, most impressive and aesthetically pleasing of these features in the world. The giant dolines of the Nakanai Mountains and the Muller Plateau, Papua New Guinea are inferior. The majority of these giant dolines are in China, the largest being the Xiaozhai in Fengjie County, Chongqing. Outside of South China, only 22 similar features exist (Waltham, in press *Caves and Karst Science*, 2006). No giant dolines have yet been World

Heritage listed. The South China Karst is the type location for these extreme karst features and hence *tiankeng* is being considered for adoption into the lexicon of karst terminology for this feature.

Natural bridges The Three Natural Bridges nominated site contains the most splendid of these features in China (Table 3-5). In height, width and thickness the Wulong bridges are outstanding and they are only such succession of such large bridges in a single gorge in the world (J.M. James, pers. comm.).

Table 3-5 Dimensions of the Wulong and other Chinese Natural Bridges

Name	Height (m)	Thick (m)	Width (m)	Average height of arch (m)	Average span (m)
Tianlong Bridge in Wulong, Chongqing	235	150	147	96	34
Qinglong Bridge in Wulong, Chongqing	281	168	124	103	31
Heilong Bridge in Wulong, Chongqing	223	107	193	116	28
Xianren Bridge in Leye, Guangxi	145	78	19	67	177
Xianren Bridge in Jiangzhou, Fengshan, Guangxi	64.5	18.5	38	46	144
Natural Bridge in Zhijin, Guizhou	128	35	55	93	85
Natural Bridge in Shuicheng, Guizhou	136	15	35	121	55
Natural Bridge in Zhongdian, Yunnan	70	--	10	--	200
Natural Bridge in Midu, Yunnan	30	--	17	--	7
Natural Bridge in Lipin, Guizhou	77	40	118	37	138
Xiang Bridge in Luzhai, Liuzhou, Guangxi	55	15	48	40	45

Karst gorges In the Wulong area, the Yangshui River drops 1415m over a distance of 26km, producing the steep gradient required to incise the limestone plateau and form a gorge. Its tributary rivers have also incised the karst. Thus in the nominated sites, there are many canyons and gorges. These illustrate that the gorges form from the combination of processes, they are mechanical erosion, chemical solution and the opening of cave passages by collapse of the bedrock. These gorges provide protection

for rare and endangered species of flora and fauna.

Caves Furong Cave system at Wulong is an essential addition to the South China Karst serial nomination. It is required to complete the sequence of important karst features necessary to clarify the recent geo-history of the Yangtze Massive. It would not stand-alone for World Heritage listing (see Table 3-2). It is a beautiful cave with a complete suite of speleothem types and has a large range of secondary minerals one of which is the evaporite mineral gypsum. This mineral is rare in caves in humid climates and its origin is unknown. Because the cave is long and deep and is developed on several levels all of which contains sediments and speleothems that can be dated and provide evidence for the evolutionary model of the cave and associated karst.

A second cave that has minimal development for tourism but is of great geomorphic significance is the 10 km long cave that connects the Qingkou Tiankeng to the Mawan Dong Spring of Muzong River. This cave contains nitrate minerals and within the cave are well-preserved remains of nitrate extraction vats similar but the same as those found in Mammoth Cave in the USA.

Other caves of geomorphic significance are located within the Three Natural Bridges site. These exist at various levels within the site and contain important palaeo-sediments.

3. The contribution to the understanding extreme karst landform evolution

A sequence of karst evolution is excellently displayed at the Three Natural Bridges site. The Tianlong, Qinglong and Heilong Bridges together with the Qinglong Tiankeng and Shenying Tiankeng and the associated caves illustrate how a deeply incised large river can form a series of natural karst features. The river first forms a cave by mechanical erosion and chemical corrosion, then collapse processes form large cave chambers, which may evolve into tiankengs. Wall retreat of these giant dolines further opens the cave into a gorge in which small remnants of the cave roof remain as bridges. The final stage will be the collapse of the bridges and only a gorge or canyon remains. It is extremely rare to see all these evolution stages of a gorge karst in one area. The only comparable site would be the surroundings of Skocjanske Jame in Slovenia (Table 3-2). However, the Three Natural Bridges site is considerably more accessible than the Slovenian site and has been sensitively developed to enable all these processes to be observed. The Qingkou Tiankeng site illustrates an earlier incomplete stage of this process and Furong

Cave system is the just emerging from the first stage.

The cone karst has been developed, modified and preserved over a planation surface on the plateau. The new karst landforms are the deep caves, tiankengs and gorges. Throughout the Wulong sites research in the caves containing sediments and speleothems has assisted in dating when changes in the karst took place.

Conclusions: Both old and young karst features exist together at all sites of Wulong. This is a result of the special conditions of rapid uplift and competent rock. Particularly important is the 2000m depths of limestone and the up to 1000m diffential between streamsinks and cave springs. The distribution and combination karst features at the three sites reflect the evolution history of karstification that has taken place for million of years. Therefore despite, the Wulong nominated sites, being as yet little known in karst literature, will provide in the future some of the best examples of how multiple generations of karst landforms persist at the same site.

3.c-2-4 General conclusions

The sites of Shilin, Libo and Wulong in this first phase of the South China Karst serial nomination are unique in the world because they have benefited from the combination of large, intermittent uplifts since the Cenozoic coupled with the heat-moisture matched Asian Monsoon. These three nominated sites demonstrate many of the geological, ecological and biological processes taking place in a continental subtropical karst.

- They have the rich karst landform diversity and provide an environment where it is possible to develop models for many forms of karst landform development. All areas contribute substantial evidence to assist in establishing the geo-history of the South China Karst. The karsts display the regional geological and physiognomic evolutionary processes that have taken place over 270 million years.
- They have high geo and bio diversity, all sites and especially Libo provide habitat protection for numerous endemic, rare and endangered species.
- They display exceptional natural beauty and contain world-class scenery.

3.c-3 Comparative analysis on "Outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals (Criterion ix)"

Of the three nominated sites, the Libo karst is nominated as an example that fulfills criterion ix. That is, the Libo karst displays the outstanding universal values of "on going ecological and biological processes".

Table 3-6 makes a comparative analysis with both national and international karst sites that also may fulfill these criteria. In China, comparable sites include: Guangxi Longgang National Nature Reserve, Guangxi Mulun National Nature Reserve, Yunnan Xishuangbanna National Nature Reserve, and Chongqing Jinfoshan Nature Reserve.

The Libo karst vegetation falls into two overlapping vegetation zones; they are the Udvardy China Subtropical Forest Province and the Oriental Deciduous Forests Province of the Palaeartic realm. It contains well-preserved subtropical coniferous and broad-leaved mixed forests, deciduous and evergreen broad-leaved mixed forests in 500m altitudinal range. Representative forest types include subtropical evergreen broadleaved forest with *Sapium rotundifolium*, *Carpinus lipoensis* and *Platycarya longipes*; subtropical evergreen and deciduous broadleaved mixed forest with *Pseudotsuga brevifolia*, *Tsuga tchekiangensis* and *Pinus kwangtungensis.* The Libo forests are believed to represent an ancient subtropical plant kingdom. The Libo karst forests are primary a feature which is rarely observed today in the subtropics. Against this background information, the other Chinese areas will be compared in the following paragraph and in table 3-6.

Longgang Nature Reserve and Xishuangbanna Nature Reserve fall into tropical seasonal rainforests belonging to the South China rainforest province of the Indomalayan realm. Being in a different climate zone to Libo, the similarity between their ecologies is minimal. The Mulun karst reserve is in the same plant geographical region as the Libo karst. That is in the middle subtropical evergreen and deciduous broadleaved mixed forests zone. In addition, both areas are developed on plateau cone karst. Because of the management problems at Mulun, it has not been included in this nomination (Phase 1) South China

Karst. Chongqing Jinfoshan Nature Reserve has a different topography to the Libo karst. It is a mountain and gorge karst and has middle subtropical evergreen broad-leaved forest that houses a different ecosystem to the Libo karst.

Also in China, the three inscribed World Heritage Sites contain karst vegetation, however, they belong to different bio-geographic regions to the Libo Karst. For example, the Three Parallel Rivers of Yunnan have alpine karst vegetation and belong to the Udvardy Sichuan Highlands province of the Palaearctic realm. Jiuzhaigou and Huanglong contain cold temperate vegetation and belong to the Udvardy Oriental Deciduous Forest Province of the Palaearctic realm. Their ecosystems are substantially different to that of the Libo karst. The Wulingyuan World Natural Heritage site is on Devonian quartzite and falls into the Udvardy Oriental Deciduous Forest Province of the Palaearctic realm. Its ecosystem has few similarities with that of the Libo forests. In the global context, there are 7 inscribed World Heritage sites noted for their karst ecology (Table 3-6). All of these karst ecosystems are developed either in temperate zones (Europe and America) or in tropical zones (Madagascar, Malaysia and Philippines). It is not possible to compare the ecosystems at these sites in different biogeographical zones with the Libo karst ecosystem. It is concluded that the Libo karst has typical continental subtropical vegetation types and important on-going ecological and biological processes. The Libo ecosystem has not been represented in other karst world karst sites especially those on the World Heritage list.

3.c-4 Comparative analysis on "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 (Criterion x)"

Of the three nominated sites, the Libo karst that is also nominated under criterion x: the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species and/or authenticity. The habitats and species must have an adequate protection and management to ensure to their protection.

Table 3-6 Some World Heritage Sites inscribed specially for their karst biodiversity

NO.	World heritage site	State party	Year	Criteria	Biogeography province/realm	Global 200 ecoregions (Terrestrial, Freshwater, Marine)	Biodiversity CI Hotspot	EBAS (Endemic Bird Areas)/CPD (Plant diversity center)
1	Puert-princesa Subterranean river national park	Philippines	1999	Ⅶ, Ⅹ	Philippines/Indomalayan	(28) Palawan Moist Forests	Philippines	156palawan(urgent)/SEA60 PALAWAM
2	Gunung Mulu	Malaysia	2000	ⅦⅧⅨⅩ	Borneo/Indomalayan	(31)Borneo Lowland and Montane Forests	Sundaland	157Bornean mountains (urgent) SEA33 Gunung Mulu NP/Labi Hills/Batu Patam/Sungei Ingei
3	Plitivice Lakes National Park	Croatia	1976/2000	ⅦⅨ	Mediterranean Sclerophyll/Palaearctic	77Eurapean-Mediterranean Montane Forests		
4	Skocjan Caves	Slovenia	1986	Ⅶ,Ⅸ	Mediterranean Sclerophyll/Palaeartic	123 Mediterranean Forests, woodlands and scrub		
5	Australian Fossil Mamal Sites	Australia	1994	ⅧⅨ	Southern Sclerophyll/Australian	120 Southern Australia Mallee and Woodlands		184 South-east Australia (Critical)
6	Tasmanian Wilderness	Australia	1994	ⅧⅨ	Tasmanian/Austrlian	65 Tasmanian Temperate Rainforests		185 Tasmania (urgent)/Au9 Western Tasmania Wilderness
7	Greater Blue Mountains	Australia	2000	Ⅶ Ⅹ	Eastern Sclerophyll/Australian	64 Eastern Australia Temperate Forests		183 eastern Australia (critical)/Au8 Sydney Sandstone Region
8	Lord Howe Island	Australia	1982	Ⅶ Ⅹ	New Caledonian/Oceanian	19 Lord Howe and Norfolk Island Forest		204 Lord Howe Island (critical)/Au5 Lord Howe
9	Pirin National Park	Bulgaria	1983	Ⅶ,Ⅷ,Ⅸ	Mediterranean Sclerophyll/Palaearctic	77 European-Mediterranean Montane Forests / 180Balkan Rivers and Streams		/Eu14 Balkan and Rhodope Massifs
10	Canadian Rockies	Canada	1984	Ⅶ,Ⅷ,Ⅸ	Rocky Mountains/Nearctic			

To be continued

Table 3-6 Some World Heritage Sites inscribed specially for their karst biodiversity

NO.	World heritage site	State party	Year	Criteria	Biogeography province/realm	Global 200 ecoregions (Terrestrial, Freshwater, Marine)	Biodiversity CI Hotspot	EBAS (Endemic Bird Areas)/CPD (Plant diversity center)
11	Nahanni National Park	Canada	1978	Ⅶ,Ⅸ	Canadian Taiga, Yukon Yaiga/Nearctic	82 Canadian Boreal Taiga		
12	Pyrenees-Mount Park	France/Spain	1997/1999	Ⅶ,Ⅷ,Ⅸ,Ⅹ	Iberian Highlands/Palaearctic	77 European-Mediterranean Montane Forests		/Eu10 Pyrenees – Mont Perdu
13	Lorentz National park	Indonesia	1999	Ⅶ,Ⅷ Ⅸ,Ⅹ	Papua/Oceania	14 Southern New Guinea Lowland Forests, 15 New Guinea Montane Forests/165New Guinea Rivers and Streams		178 Central Papuan mountains(urgent),179 South Papuan lowlands/
14	Tsingy de Benmaraha	Madagascar	1990	Ⅶ,Ⅹ	Malagasy Woodland/Savanna/Africo -tropical	51 Madagascar Dry Forests	Madagascar & Indian Ocean Islands	93 West Malgasy Dry Forests(high)
15	Sian Ka'an	Mexico	1987	Ⅶ,Ⅹ	Campechean/Neotropical	235 Mesoamerican Reef	Mesoamerica	
16	Te Wahipounamu	New Zealand	1980	Ⅶ,Ⅷ, Ⅸ,Ⅹ	Neozealandia/Antarctic	66 New Zealand Temperate 21Forests, 207 New Zealand Marine		207 South Island of New Zealand(urgent)/
17	Western Caucasus	Russian Federation	1999	Ⅶ,Ⅷ Ⅸ,Ⅹ	Caucaso-Iranian Highlands/Palaearctic	77 European-Mediterranean Montane Forests	Caucasus	122 Caucasus (high)/CA2 Caucasus
18	East Rennell	Solomon Islands	1998	Ⅸ	Papua/Oceania	16 Solomons-Vanuatu-Bismark Moist Forests; 219 Bismarck-Solomon Seas		199 Rennell and Bellona (high)
19	ThungYai Hua Kha Khaeng	Thailand	1991	Ⅶ,Ⅸ,Ⅹ	Indochinese Rainforest/Indomalayan	29Kayah-Karen/Tenasserim Moist Forests	Indo-Burma	/EA59 ThungYai Hua Kha Khaeng World Heritage sites
20	Henderson Island	UK: Pitteairn Island	1988	Ⅶ,Ⅹ	Southeastern Polynesia/Oceania	49 Southern Pacific Islands Forests	Polynesia & MIcronesia	215 Henderson Islands(urgent)
21	Grand Canyon	USA	1979	Ⅶ,Ⅷ Ⅳ,Ⅹ	Rocky Mountains/Nearctic	145 Colorado River		

To be continued

Table 3-6 Some World Heritage Sites inscribed specially for their karst biodiversity

NO.	World heritage site	State party	year	Criteria	Biogeography province/realm	Global 200 ecoregions (Terrestrial, Freshwater, Marine)	Biodiversity CI Hotspot	EBAS (Endemic Bird Areas)/CPD (Plant diversity center)
22	Canaima National park	Venezuela	1994	Ⅶ,Ⅷ Ⅳ,Ⅹ	Campos Limpos/Neotropical	45Guayanan Highlands Moist Forests,152 Upper Amazon Rivers and Streams		64Tepuis(urgent)/SA2Pantepui Region
23	Dumitor National Park	Serbia &Montenegro))	1980	Ⅶ,Ⅷ,Ⅹ	Balkan Highlands/Palaearctic	77 European-Mediterranean Montane Forests;180 Balkan Rivers and Streams;199 Medeterranean Sea		
	South China Karst (Libo)	**China**			**2.1.2Chinese Subtropical Forest,2.15.6 Oriental Deciduous Forest/Palaearctic**	**170 Xijiang Rivers And Streams and 191 Yunnan lakes and Streams**	**Mountains of S.Central China**	**/EA31 Limestone Region, South-West Zhuang Autonomous Reg(not occurring in WHS)**
24	Desembarco del Granma National park and System of Marine Terraces of Cabo Cruz	Cuba	1999	Ⅶ,Ⅷ	Cuban/Neotropical	(37)Greater Antillean Moist Forests	Carribean	25Cuba (critical)
25	Carlsbad Caverns National Park	USA	1995	Ⅶ,Ⅷ	Chihuahuan/Nearctic	131Chihuahuan-Tehuacan Deserts		
26	Caves of Aggtelek and Slovak Karst	Hungary/ Slovakia	1995/2000	Ⅷ	Middle European Forest/Palaearctic	77Eurapean-Mediterranean Montane Forests		
27	Phong Nha-Ke Bang National Park	Vietnam	2003	Ⅷ	4.5.1 Indochinese Rainforest largest areas of intact forest habitat remaining in Vietnam	25 Annamite Range Moist Forests	Indo-Burma	143 Annamese Lowlands(critical)
28	Ha Long Bay	Vietnam	1994/2000	Ⅶ,Ⅷ	South China Rainforest/Indomalayan	23 Southeast China-Hainan Moist Forests	Indo-Burma	
29	Purnululu National Park	Australia	1998/2003	Ⅶ,Ⅷ	Northern Savanna (6.11.10)/Australian	167 Kimberley Rivers and Streams		187North-West Australia (critical)

The Libo karst ecosystem demonstrates high biodiversity, with 1,532 plant taxonomic species, belonging to 225 families and 687 genera, making up 35% of South China Karst flora. The Libo karst region has been identified as the evolutionary and differentiating center of global karst flora. Libo also contains 314 species of vertebrate fauna, including 59 species of mammals (24 families, 8 orders), 137 species of birds (40 families, 15 orders), 43 species of reptiles (10 families, 3 orders), 32 species of amphibians (8 families, 2 orders) and 43 species of fish (10 families, 5 orders). Besides, there are recorded 1,282 species of insects (Li Zizhong and Jin Daochao, 2002), 140 species of land snails, 146 species of arachnids and 10 species of myriapods.

The Libo karst shows high biological endemism. Many plant and animal spices are endemic to this area due to the combination result of geographical location, climate and topography. There are 17 ancient coniferous species belonging to 12 genera and 6 families, of which, *Pinus keangtungensis*, *Pseudotsuga brevifolia*, *Calocedrus macrolepis* and *Keteleeria davidiana* var. *calcarea* are especially abundant. The rare *Tetrathyrium* is abundant at Libo.

It is hard to make a complete comparison on biodiversity and biological endemism of important karst sites in both China and the world because of the unbalanced and incomplete investigations and research. Notable sites in China that are possible comparisons include: Guangxi Longgang National Nature Reserve (7,710 ha, with 1,282 taxonomic plants species and 123 animal taxonomic species); Guangxi Mulun National Nature Reserve (8,969 ha, with 915 plant species and 260 animal species); Yunnan Xishuangbanna Nature Reserve (360,000 ha, 1,394 plant species including 117 non endemic, Zhu Hua, 2002) and Chongqing Jinfoshan Nature Reserve (16,667 ha 2,643 plant species and 201 vertebrate animals).

Other World Heritage sites in China also display high biodiversity and contain habitats of endangered plant and animal species such as the Three Parallel Rivers of Yunnan, Jiuzhaigou and Huanglong. The specific plant and animal species protected in the Libo karst and the habitat provided them is very different to other Chinese sites because of Libo's different biogeographic location. Internationally, there are 8 inscribed World Heritage karst sites with great biodiversity (Table 3-6). The high biodiversity at these sites reflects tropical island or temperate environments whilst the Libo karst is the subtropical and

continental karst. It is unique in both China and the world.

Protection

In Libo karst area there are 112 national level protected plant species, 8 of which are class I protected species: *Handeliodendron bodinieri*, *Mussaenda anomala*, *Taxus chinensis* var. *mairei, Taxus chinensis*, *Orchidaceae Paphiopedilum emersonii*, *Paphiopedilum barbigerum* and *Paphiopedilum micranthumna, Kemria septentrioolata;* 104 class II protected species such as *Pinus kwangtungensis*, *Pseudotsuga sinensis*, *P. brevifolia*, *Calocedrus macrolepis*, *Tetrathyrium subcordatum, Trachycarous nana*, *Emmenopterys henryi*, *Liridendron chinense*, etc.

There are 8 Chinese endemic genera in the nominated site, namely *Fokienia*, *Handeliodendron*, *Emmenoperys*, *Pteroceltis*, *Eurycorymbus*, *Tetrathyrium*, *Eucommia* and *Zenia, there are* 41 endemic species (that is, confined to Libo karst) belonging to 33 genera and 25 families, including 14 species of tree, 12 species of brush, 7 species of liane and 8 species of herb, such as *Carpinus liboensis, Indosasa liboensis, Chirita liboensis, Camellia rubimuricata, Amentotaxus argotaenia* var. *brevifolia, Cryptecarya austro-kweichowensis, Zanthoxylum liboensis* and *Rubus liboensis*

In terms of fauna, 45 taxa have been listed in protected inventory, 35 of which are nationally protected, including 3 class I animal species, namely *Panthera pardus, Python molurus* and *Symaticus ellioti* and 32 class II animal species. Some of the protected animals are endemic to Libo such as *Sinocyclocheilus longibarbatus, Sinocyclocheilus marcrolepis,* etc. Besides, in terms of IUCN system, there are 3 CR species, 4 EN species and 38 VU species, 48 species are endemic to the region, many of them are found only in China. For instance, there are 3 endemic bat species, namely *Myotis altariu m*, *Myotis daubentoni* and *Ia io.* Since the establishment of the Reserve, 124 new species have been discovered, such as *Rhopatopsote sinensis*, *Onukia flaoopunctata* and *Conwentzia yunguiana.*

There are 174 species of cave fauna, including 13 species of bats (5 families), 37 species of fish (9 families), 58 species of land snails (12 families), 42 species of spiders (21 families) 10 species of myriapods (6 families) and 14 other species of invertebrates (8 families). There are 3 endemic genera, i.e. *Sinaphaenops*, *Libotrechus* and *Uniclavellus*, and 17 endemic species such as *Chamalycaeus libonensis*.

In summary, the Libo karst area is the sanctuary to many indigenous and threatened plant and animal species. There are 121 plant species (from 67 genera and 27 families) included in *IUCN Species Red List* and *China Species Red List*, including 7 CR species, 26 EN species, 50 VU species, 32 NT species, 6 LC species, 83 seriously endangered endemic plant species such as *Carya Kweichowensis*, *Michelia angustioblonga*, *Camellia rubimuricata*, *Paphiopedium emersonii.* etc. Of the endangered species, 18 are included in the World Species Red List, including the CR species (*Dipentodon sinicus*), 9 VU species, 7 NT species and 1 DD species. There are also 45 species of fauna are listed in *China Species Red List*, including 3 CR species, 4 EN species and 38 VU species.

Bibliography and References

[1] Ford, D.C, Salomon, J-N and Williams, P.W. 1997.The Lunan Stone Forest as a potential world heritage site [A]. Stone Forest --A Treasure of Natural Heritage [C]. Beijing: China Environmental Science Press. 107-123.

[2] James Julia. 1997. A Comparison of the Stone Forest of Lunan with Pinnacle Karsts of the World [A]. Stone Forest --A Treasure of Natural Heritage [C]. Beijing: China Environmental Science Press.22-29.

[3] Trimmel Hubert. 1997. Karst Forms Comparable to Stone Forests with the Mediterranean Basin [A]. Stone Forest --A Treasure of Natural Heritage [C]. Beijing: China Environmental Science Press. 46-51.

[4] Waltham Tony. 1997. Pinnacle Karst of Gunung Api, Mulu, Arawak [A]. Stone Forest --A Treasure of Natural Heritage [C]. Beijing: China Environmental Science Press. 53-55.

[5] YUAN Daoxian. 1997. A Global Perspective of Lunan Stone Forest [A]. Stone Forest --A Treasure of Natural Heritage [C]. Beijing: China Environmental Science Press. 68-70.

[6] ZHANG Shouyue. 1997. Stone Forest in China and Pinnacle Karst in Madagascar [A]. Stone Forest --A Treasure of Natural Heritage [C]. Beijing: China Environmental Science Press. 78-80.

[7] Ford, D.C and Williams, P.W, 1989. Karst Geomorphology and Hydrology [M]. London: Chapman & Hall.

[8] Liang Yongning. 2000. Morphological characteristic and Geological Evolution of the Lunan Stone Forest Karst, China [J]. Yunnan Geology. 19(2).

[9] Li Yuhui, Liang Yongning and Geng Hong. 1998. The ages of Development of the Lunan Stone Forest in Central Yunnan. China Regional Geology, 17(1).

[10] Li Yuhui, Yang Yiguang, Liang Yongning, Ren Jian and Geng Hong. 2001. Study of Palaeo-environment of Shilin karst (Stone Forest) Development, Yunnan, China. Carsologica Sinica. 20(2).

[11] Li Yuhui. 2002. Morphological types and their Features of Shilin Karst in Yunnan, China. Carsologica Sinica, 21(3).

[12] Day, M.J. 1978. Morphology and distribution of residual limestone hills (mogotes) in the karst of northern Puerto Rico. Geological Society of American Bulletin, v. 89. 426-432.

[13] Williams, P.W. 1987.Geomorphic inheritance and the development of tower karst, Earth Surface Processes and Landforms.v.12.453-465.

[14] Xiong K.N. 1992. Morphometry and evolution of fenglin karst in the Shuicheng area, western Guizhou, China. Z. Geomorph. N.F, 36: 227-248.

[15] Sweeting, M.M. 1992. Tectonics and fluvial denudation in the formation of cone karst, with particular reference to south China. Proceedings of the Karst-Symposium.S.45-56.

[16] Zhu Xuewen. 1990. General situation of karst in Cuba. Carsologica Sinica. v.9.176-179.

[17] Lehmann, L. 1982.Morphological studies in Java. Karst geomorphology. 320-328.

[18] Sweeting, M.M. 1982.The karst of Kweilin, southern China. Karst geomorphology. 410-416.

[19] Yuan Daoxian and Liu Zaihua, 1998, Global karst correlation. 1-32,167-171,179-189,239-257.

[20] Xiong Kangning, 1994, Hydrodynamic Genetics of Cone Karst and Tower karst. Carsologica Sinica. v.13 (3).237.

[21] Kevin Klernan, 1994, The Coastal Tower karst of Phangnga Bay. Earthquake Press.9-19.

[22] Ford, D. and Willimas, P.W. 1989. Karst geomorphology and hydrology. 4-9.

[23] Sweeting, M.M. 1989.Cone and tower karst of south China. Geography review, 3(2): 2-6.

[24] Sweeting, M.M. 1958. The karstlands of Jamaica, Geogr. J., 101-114.

[25] Zhou Zhengxian, 1987. Scientific survey of the Maolan karst forest. Guizhou people's press. 42-70.

[26] Waltham, A.C. and Smart, P.L. etc. 1985. Exploration of caves for rural water supplies in the Gunung Sewu karst, Java.

[27] Peter, K.H. 1983.Queen of Spains valley, maroon town, Jamaica: a cross-section of different types of tropical karst .New Directions In Karst.

[28] Sweeting, M.M. 1986.Limestone landscapes of south China. Geology today.

[29] Zhu Xuewen 1988.Study on karst geomorphology and caves in Guilin. Geological publishing house.8-49.

[30] Zhou Zhengxian. 1987. Scientific Survey of the Maolan Karst Forest. Guizhou People's Press.

[31] Xu Zhaoran.1993. Studies on the Conservation of limestone Forests in China: Final Report to WWW-international for the project of conservation of limestone forests in China. Guihaia, Suppl.4: 1-4.

[32] Xu Zhaoran.1993. A study of the Limestone Forest Flora of Southern and Southwestern China. Guihaia, Suppl.4: 5-54.

[33] Wen Hequn & Xu Zhaoran. A Preliminary Study on the threatened Limestone Plants in South and Southwest China. Guihaia, Suppl. 4.55-90.

[34] Xu Zhaoran. 1993. A species list of limestone plants in China. Guihaia. Suppl. 4:155-258.

[35] Wang Xianbo.2005.Basic characteristics of Maolan reserve of Libo County, Guizhou province and its role in promoting the local economic development. Letters of Man and Biosphere in China, No.86: 7-12.

[36] Zhu Hua. 2002. Ecology and Biogeography of the limestone vegetation in Southern Yunnan, SW China. Yunnan Science & Technology Press.

[37] Chris Magin & Stuart Chape.2004.Review of the World Heritage Network: Biogeography, Habitats and Biodiversity. UNEP World Conservation Monitoring Centre IUCN- The World Conservation Union.

[38] Miklos D.F.Udvardy. 1975. A classification of the Biogeographical Province of the World. IUCN Occasional Paper No.18.

[39] Tim Wong et al. 2002. Proceedings of the Asia-Pacific Forum karst Ecosystems and World Heritage. IUCN, UNESCO.

[40] Daoxian Yuan, Hai Cheng, R. Lawrence Edwards, et al.2004, Timing, Duration, and Transitions of the Last intergalacial Asian Monsoon. Science, 304 (23): 575-578.

[41] Yonglin Wang, Hai Cheng, R. Lawrence Edwards et al. 2005. The Holocene Asian Monsoon: Links to Solar Changes and North Atlantic Climate. Science, 308(5): 854-857.

Schedule Suggestion for IUCN Visit to *South China Karst*

Nominated Sites for the World Natural Heritage

(During 18 August～18 September, 2006)

Date		Content	Lodging
1st day	Whole day	Welcome at Kunming Airport, Kunming → Shilin, Registration	Shilin, Yunnan
2nd day	Morning	Visit to the Wild Stone Forest (Shilin Nominated Site 1248-002)	Shilin, Yunnan
	Afternoon	Visit to the Liziqing Stone Forest (Shilin Nominated Site 1248-002)	
3rd day	Morning	Visit to the Da-Xiao Stone Forest (Shilin Nominated Site 1248-002)	Shilin, Yunnan
	Afternoon	Visit to the Naigu Stone Forest (Shilin Nominated Site 1248-001)	
4th day	Morning	Shilin → Kunming	Wulong, Chongqing
	Afternoon	Kunming → Wulong	
5th day	Whole day	Visit to the Tree Natural Bridges and Gorge (Wulong Nominated Site 1248-006)	Wulong, Chongqing
6th day	Morning	Visit to the Furong Cave and Furong River (Wulong Nominated Site 1248-007)	Chongqing
	Afternoon	Wulong → Chongqing	
7th day	Whole day	Chongqing → Guiyang→ Libo	Libo, Guizhou
8th day	Whole day	Visit to the cone karst of Maolan (Libo Nominated Site 1248-004)	Libo, Guizhou
9th day	Morning	Visit to the cone karst of the Da-Xiao Qikong (Libo Nominated Site 1248-003)	Libo, Guizhou
	Afternoon	Free day with recreation on Shuichun River of the Zhangjiang Scenic Area	
10th day	Morning	Libo → Guiyang	Guiyang, Guizhou
	Afternoon	Seminar with comments and suggestions for IUCN visit to South China Karst nominated sites	
11th day	Whole day	Seeing off at Guiyang Airport, Delegation Departure	

China side prearranges schedule for IUCN visit to *South China Karst* nominated sites for the World Natural Heritage from 18 August to 18 September, 2006. Please inform us after IUCN confirm the final schedule. The upper table is an arrangement for the visit order.

Additional Information for the South China Karst WH Nomination

Site 1: Shilin Karst (Stone Forest) of Yunnan

Question 1: What activities are undertaken inside the core area?

- **Subsistence agriculture?**

The nominated core area of the Shilin Karst is 12,070ha; there is still some 150ha farmland inside the core area, accounting for 1.2% of the total. Because of the rugged local karst relief, these farmlands are mostly small patches scattered in the vicinity of some villages. The farmlands are typical subsistence agriculture because the local villagers use them to grow corn, broad bean and potato for their own food, usually a relatively low output.

According to the Management Plan, most of the farmland inside the core area will be reverted to grassland and forest in five years. In 2004 and 2005, 60ha farmland was reverted to wildness through natural restoration.

- **Cash crops?**

Inside the core area, part of the farmland (less than 20%) is used by the villagers to grow tobacco leaf for family income.

In the buffer zone, besides the tobacco leaf, cash crops also include fruits such as peach, pear, orange and so on.

- **Grazing?**

The Shilin County is a traditional goat and cattle raising county, grazing was a commonplace in the past. At present, grazing is strictly prohibited in the core zone. In the buffer zone, grazing is also much less than before since traditional grazing has gradually been replaced by rearing livestock in pens.

- **Small scale industrial activities?**

The Shilin County is a traditional agriculture county, compared with other counties, industry is less developed. In the buffer zone the small scale industries the local people involved include 1. Tobacco leaf processing (baking); 2. food processing; 3. handicraft making (embroidery, etc.).

- **Population growth or decline?**

Currently there are three villages in the nominated area (core zone) with a total population of 961 (2004), the annual increase is 6.7‰.

Village	Population	Year	Rate of increase (1995-2004)
Suoyishan	381	2004	6.7‰
Suogeyi	357	2004	
Weiboyi	223	2004	

In the buffer zone there are 7 villages with a total population of 4632 (2004), the annual increase is 7.5‰.

Village	Population	Year	Rate of increase (1995-2004)
Wukeshu	734	2004	7.5‰
Hemocun	482	2004	
Zhantun	597	2004	
Douhe	686	2004	
Qingshuitang	645	2004	
Shuitangpu	728	2004	
Hemozhan	760	2004	

■ **Use of pesticides, herbicides?**

Pesticides and herbicides are widely used nowadays around the world, the Shilin County is no exception in this respect, but it is not a serious problem locally as attested by the periodical air and water qualities monitoring results. The reasons are: 1.for subsistence agriculture, the farmers can not afford the cost of much pesticide and herbicide; 2.the strengthened quality standards for agriculture products, particularly the chemicals remained, prevent the growers from using much pesticide and herbicide; and 3.the local county government's development strategy to establish a "strong ecological county", the use of pesticide and herbicide are discouraged in the headwater area.

Question 2: Final boundary delimitation on maps: are there any changes in boundaries and sizes?

For the Shilin Karst site, there are no changes to the boundaries and sizes of the core zone and buffer zone, all remain the same as shown in the nomination document.

Additional Information for the South China Karst WH Nomination

Site 2: Libo Karst of Guizhou

Question 1: What activities are undertaken inside the core area?

- **Subsistence agriculture?**

The nominated core areas of the Libo Karst are 29,518 hectares. The boundaries of the core areas almost keep coherence with those of Maolan National Nature Reserve and Da-xiaoqikong Scenic Spot of Libo Zhangjiang National Scenic and Historic Area.

Now, there are no residents in the Da-xiaoqikong Scenic Spot of Libo Zhangjiang National Scenic and Historic Area, and hence no agricultural activities inside, with all the farmlands being reverted to wildness through gradual natural restoration. Agricultural activities exist mainly in Maolan National Nature Reserve. The farmlands inside the core area cover about 1,350 hectares, accounting for 4.57% of the total core areas. They are mostly small patches scattered near villages of the Buffer Zone and Experimental Area of the Maolan Nature Reserve. Rice, corn, bean, rape are grown for own food of farmers. The agriculture of the core area is traditional subsistence agriculture which gives rise to almost no impact on the outstanding universal value of the nominated sites.

According to *the General Planning of the Maolan National Nature Reserve of Guizhou*, the projects of Reverting Farmlands to Forests, Systematic Construction of Zhujiang R. Protective Forests and the Construction Projects of Key Ecologic Commonweal Forests, financed by the State, have been carrying out. Slope farmlands over 25° within the nominated sites, particularly all slope farmlands inside the core area shall be reverted to grasslands and forests. All wild rocky mountain area suitable for forests shall be reforested with ecological or economical forests. All these measures have been making the farmlands revert to forests gradually and are especially good for the recovering and improving of the ecological quality of the Libo Karst.

■ **Cash crops?**

The cash crops inside the Core Areas are mainly some traditional economic trees, which have no impact on the outstanding universal value of the nominated sites.

- Sour plums near the villages of Banzhai, Jicai, Yaosuo, Pobao and Lapa. There are about 667 hectares distributed. 1/4 of them are wild and the rest is planted on wild rocky mountain area demanded for reverting to forests. Sour plums are not widely distributed in China. There are not large areas that are suitable for their growing. However, they have a great market requirement and the demand exceeds the supply with both high and stable profit. With the growing of the sour plums, wild rocky mountain area become green, soil and water have been kept and some villagers get more incomes.
- Qian bamboos *(Dendrocalamus tsiangii)* near the villages of Banzhai and Dongduo. The bamboos have flat rings, long internodes, and thin bamboo walls. It is easy to get the bamboo skins which are soft and flexile. Most of the bamboo skins are used for weaving productive tools and handicrafts such as bamboo mats. Most of them are used for farmers` own use and some are sent to village markets for sale. In addition, *Dendrocalamus tsiangii* is a fast growing plant, and the cutting of them will not affect the regeneration. As a result, the use of the bamboo is in a sustainable way.
- Some peaches, plums and pears around the villagers' houses and mulberries, cassavas and sugarcanes grown by some villagers for one year. They are planted in small patches in existing farmlands (less than 20%).

The growing of economic trees and cash crops brings not only evident ecological benefit but also economic increasing of the communities inside the nominated sites. It is exactly a good way to mitigate the contradictions among the protection, development and management of the nominated sites.

■ **Grazing?**

There are no special grazing and pastures inside the core areas of the Libo Karst. There are only some farm cattle for ploughing fields. Before the establishing of the Nature Reserve, farm cattle were sent to shrubs and wild rocky mountain area. After the Nature Reserve in

1988, excess grazing was forbidden and measures were taken to enclose mountains for forests growing. Some shrubs that were used for cattle have been recovered and reconstructed. Now, more and more young people go out to get jobs and the number of farm cattle is decreasing. Therefore, fields are enough for the farm cattle and they will not go to forests. Moreover, it is popularized to raise the cattle in pens.

■ **Small scale industrial activities?**

The population density in the Libo Nominated Sites is quite low and there is no industrial activity. The atmosphere, soil and water are not polluted and the environmental quality is in good condition.

■ **Population growth or decline?**

In general, the population of the Libo Karst Nominated Sites is growing, in an average annual growth rate of 1.88‰ from 2000 to 2004. However, there were only 5,751 people in the nominated core areas in 2004 (see table below). The density is 19 people / km^2. In recent years, some young farmers have gone to city for job, which makes the population pressure smaller.

No.	Village	Township	Year	Population	Rate of increase (2000-2004)
1	Yaogu	Yongkang	2004	912	1.88‰
2	Yaolan	Yongkang	2004	647	
3	Dongnai	Yongkang	2004	570	
4	Jicai	Dongtang	2004	992	
5	Banzhai	Dongtang	2004	1279	
6	Yaosuo	Dongtang	2004	1351	
Total				5751	

■ **Use of pesticides, herbicides?**

Pesticides and herbicides are used in some of the farming activities in the Libo Karst Nominated sites. However, according to the monitoring results of the qualities of water and

atmosphere inside, it is discovered that the utilization of pesticides and herbicides inside the core areas has almost no impact on the outstanding universal value of the Libo Karst. The reasons are as the following:

First, the villagers have very low incomes and they grow crops for their own food. So it is impossible for them to pay much on the pesticides and herbicides;

Second, Libo County is a National Ecological Demonstration Area and also one of the National Scientific Demonstration counties; hence the local government attaches great importance to the eco-protection and eco-constructions when they develop the economy. Under the guidance of relevant planning, they take measures to control and limit the use of pesticides and herbicides or look for some replacements, which make the dosage in the lowest point. For example, according to *the General Construction Planning of Libo County National Ecological Demonstration Area*, all the county is using organic fertilizer, planting green manure, returning the straw to fields, and decreasing the dosage of pesticides and herbicides;

Third, technical experts on vegetation protection and farming technology are often organized to the townships, villages, and fields to give the farmers different types of training, technical guidance and publicity on fertilizing and pests prevention and cure. They tell the farmers how to prevent and cure pests correctly, to fertilize scientifically and reasonably, to control the blind use of pesticides and herbicides, and to take the advantage of dung to produce nonpolluting organic fertilizer. About the pests, they teach the farmers to combine the bio-prevention with the integrated-prevention. Therefore, the use of pesticides and herbicides becomes quite limited.

Question 2: Final boundary delimitation on maps: are there any changes in boundaries and sizes?

There is no any change in the sizes of both the buffer zone and core areas of Libo Karst Nominated Sites. The boundary of the buffer zone has not been changed. There are some changes in the boundary of the core area of Da-xiaoqikong Scenic Spot (see the maps below).

The primary boundaries of the core areas almost keep coherence with those of Maolan

National Nature Reserve and Da-xiaoqikong Scenic Spot of Libo Zhangjiang National Scenic and Historic Area. We re-surveyed the boundaries of the core areas in May 2006, and found that some management problems exist in vicinity along the boundary of the Da-xiaoqikong Scenic Spot. So, we had the boundary adjusted. The principles of adjusting the boundaries are 1) to keep the integrality of cone karst geomorphology development and distributing, karst forest ecosystem and habitat of rare and endangered species; 2) that all human activities with negative impacts on the outstanding universal value of the nominated areas are forbidden in the core areas.

A) It is a non-karst area near the Bantan in the northern part of Da-xiaoqikong Scenic Spot and there is a big village with a lot of modern buildings. The villages near Bantan have been lined out the core area in the new map;

B) In the northeastern Part of Di'egong, the cone karst landforms develop very well and the eco-environment is in a good condition, so it is added in the core area;

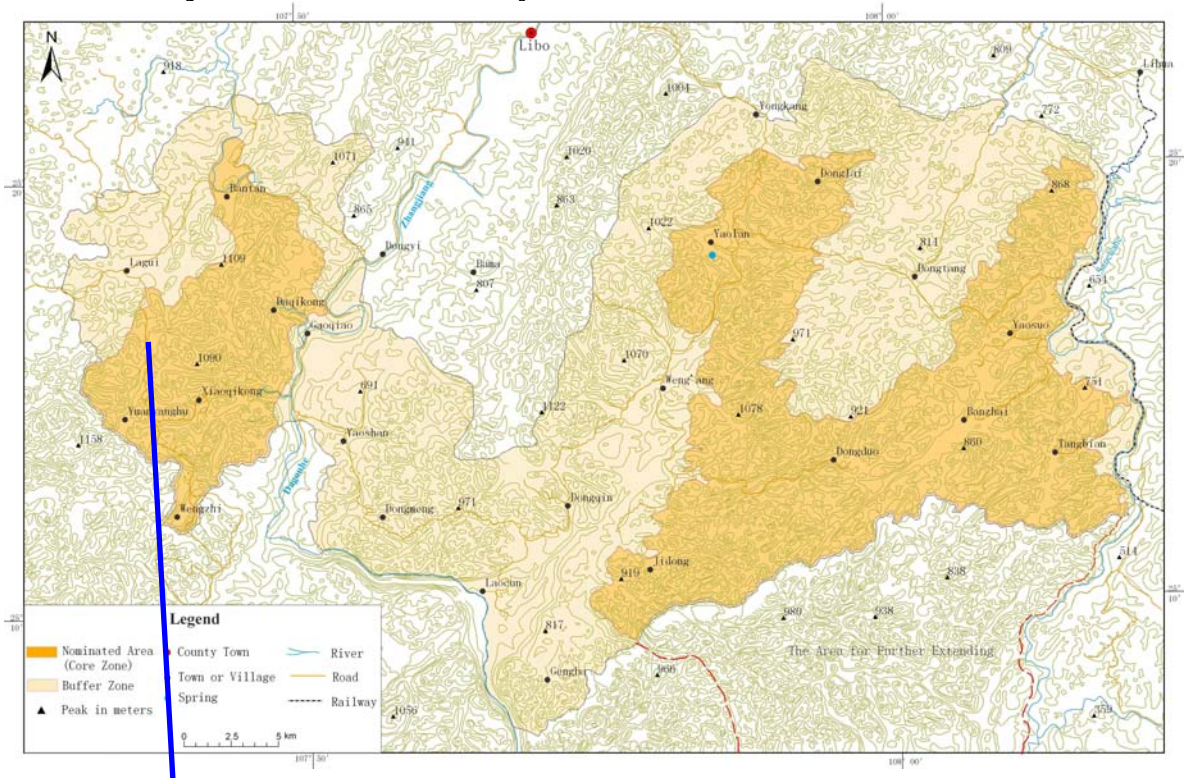
C) There was no buffer zone in the southern Da-xiaoqikong Scenic Spot nominated site before the adjustment, as it is located in the border area of Guizhou Province and Guangxi Zhuang Autonomous Region. There are some farmlands and relatively frequent human activities along the zone of YuanYang Hu -- TianZhongdong -- YeZhulin -- FeiYundong -- GuiBeishan. Therefore, it is lined out from the nominated core area as part of the buffer zone.

During the adjustment of the boundaries, the decreased size is almost equal with that of increased, so the size of the core area has not been changed despite of the adjustment.

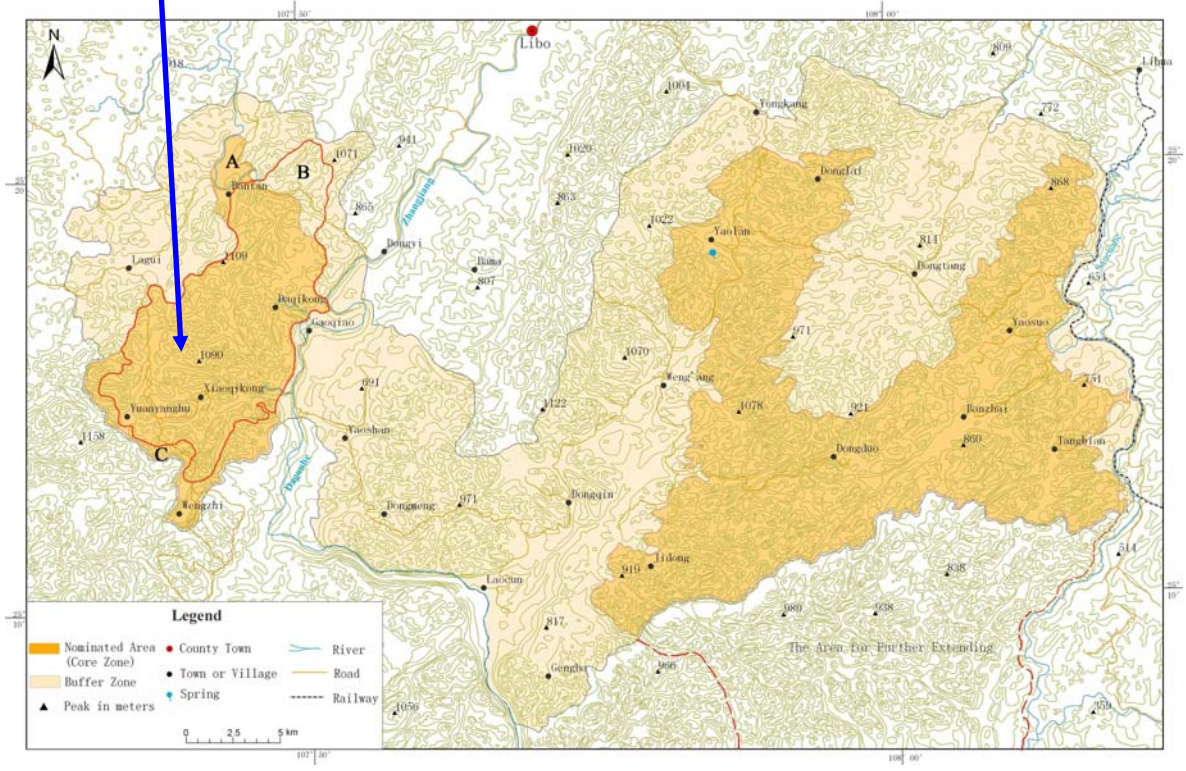
Details of the Nominated Libo Karst Sites of South China Karst

World Natural Heritage Nomination

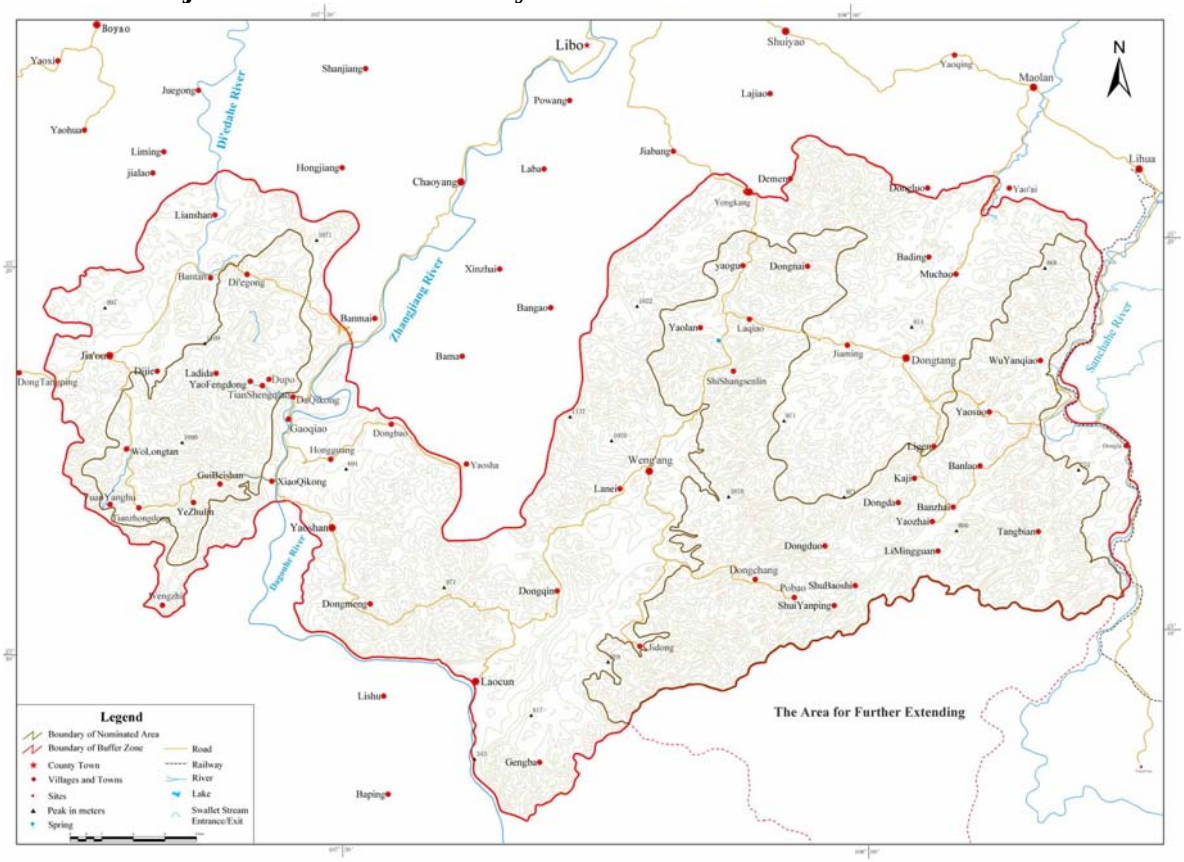
Before the adjustment of the boundary



On the adjustment of the boundary



After the adjustment of the boundary



Additional Information for the South China Karst WH Nomination

Site 3: WuLong Karst (Chongqing)

Question 1: What activities are undertaken inside the core area?

1. Subsistence agriculture?

The nominated Wulong Karst site (core zone) is 6,000ha. There are some small patches of farmland inside the core zone, the local farmers run classical subsistence agriculture with this lands by growing vegetable, corn, potato, ect.

In order to safeguard the integrity of the nominated area (both core zone and buffer zone), the government of Wulong County has worked out the "Environment Protection and Ecological Restoration Plan", most residents will be relocated to the outside and most farmland will be reverted to forest and grassland in three phases:

a. People relocation goal:

- Near future: (2006-2010): Relocate 1795 households, account for 40%;
- Middle future: (2011-2015): Relocate 1347 households, account for 30%;
- Far future: (2016-2020): Relocate 1347 households, account for 30%.

b. Land revert goal:

- Near future: (2006-2010): Revert 77.1232 ha farmland, account for 40%;
- Middle future: (2011-2015): Revert 57.8424 ha farmland, account for 30%;
- Far future: (2016-2020): Revert 57.8424 ha farmland, account for 30%.

2 Cash crops?

In both core zone and buffer zone, the cash crops include tobacco leaf and fruits. Some 20% of the farmland is used to grow tobaco leaf, and fruits include walnut, gingko, peach and so on.

3 Grazing?

Goat and cattle are the main grazing animals reared by the local farmers. At present grazing is strictly prohibited in the core zone, and in the buffer zone grazing is also a less common phenomenon since goats and cattle are largely reared in pens.

4 Small scale industrial activities?

The Wulong County is an agricultural county, no large scale industry. In the buffer zone, small scale industries include tobacco leaf processing, wine-making, hand-made weaving, etc.

5 Population growth or decline?

Currently, in the core zones there are a total of 917 residents (Furong Cave area: 81 prople, 17 households; Three Natural Bridges area: 56 people, 15 households; Houping area: 780 people, 200 households). Of the sparsely scattered households in the core zone, the annual population increase rate is less than 3‰. In some villages the population decline due to the young people's exodus to work in cities in recent years.

6 Use of pesticides, herbicides?

For the farmland in the core zone and buffer zone, the dominant fertilizer is still farmyard manure, in particular, some farmland have been designated as the vegetable base for the Chongqing City, and harmful pesticides and herbicides are restricted. Also, the Wulong County's agriculture development strategy is to build a strong ecological county, harmful chemicals are discouraged.

Question 2: Final boundary delimitation on maps: are there any changes in boundaries and sizes?

Currently, for the first nomination phase, there is no change to the proposed sizes and boundaries.

In order to ensure the integrity of the "Three Natural Bridges" sub-area witch developed along the Yangshui River, based on international experts suggestion, this sub-area's buffer zone will be enlarged to include all the upper reach catchment area from current 20,000 ha to 60,000 ha. This buffer zone extension will be submitted in the second nomination phase in the next four years.

CONTENT

1 Ask: What integrity issues that are known to exist? And what plans are in place to mitigate those issues?

1.1 Shilin Nominated Site

1.1.1 Management for the nominates Site's Integrity

（1） The Shilin Nominates site is one of the old scenic areas which very early had finished Master Plans in China. In 1942, it had its first development plan and revised the development plan respectively in 1950, 1960 and 1965.The first Master Plan of the Shilin Scenic Area started to make in 1979 and was sent to the Ministry of Construction of P. R. of China. In 1987, the State Council of P.R. of China approved this Master Plan which effective period was twenty years from 1982 to 2002. In 2001, the Master Plan of the Shilin Scenic Area was revised and updated by the management Bureau of Shilin Scenic Area. In 2004, the Master Plan (updated) was finished, and was argued by experts invited by Construction department of Yunnan Provincial Government, and sent to the Ministry of Construction of P. R. of China for approval. The principles of coordination of development with conservation and protection have been carried out in the updated Master Plan, and all protected land of the Shilin Scenic area has been anew classified and zoned with protection and management strengthened. The three level protected zoning in the old Master Plan was changed to four level

protected zoning together with newly delimiting their scopes, particularly newly defining a specially protected zone. Now, the updated Master Plan has been sent to the Ministry of Construction of P. R. of China for approved. The integrity of the Shilin Scenic Area has been guaranteed through managing the hydrogeological systems, Shilin karst (pinnacle karst) and associated landforms, vegetations and zoning-and-classification management.

(2) The four-level protected zones defined in the updated Master Plan provide enough space for conserving and protecting Shilin nominated site which includes special protected zone and first-class protected zone with area of 12, 070 hm^2 and buffer zone of 22, 930 hm^2;

(3) Complete protected features including Shilin karst and associated landforms, local vegetations, hydrogeological systems and complete drainage catchments with the clear and complete inventories of resources in the Shilin nominated site;

(4) Activities limited in Buffer Zone are clearly and completely explained and strictly controlled, including no chemicals, no pesticides for subsistence agriculture and encouraging farm manure, no quarrying, no unearthing, controlling grazing and fire, and encouraging farm-raising livestock, and commercial activities controlled;

(5) "the rules of the Shilin Yi Nationality Autonomous County for management of rock resources being effective since 2002 by the

Government of Shilin Yi Nationality Autonomous County";

(6) Feasible managing system and strong scientific research foundation for conserving and protecting the Shilin scenic areas. Since 1984, four level managing system coming into action ranking down order: County government, management bureau, villages committee, rangers for Shilin karst and Forests; the Stone Forest Study center formed in 1999 jointly by Stone Forest Management Bureau and Geography Science and Natural Resources Institute of China Academy, its members both from national and international institutes and universities including Dr. D. Ford (Canada), Dr. P. Williams (New Zealand), Dr. J. James (Australia), Prof. Yuan Daoxian, Prof. Lu Raoru and late Prof. Song Linhua(China), and providing international technical supports for managing the Stone Forest Park; more fifteen million Yuan each year invested into management and restoration of the integrity of the Shilin Scenic areas by the local government; and further improving the ecological restoration of the scenic areas;

(7) Reasonable and successive monitoring including hydrogeological water, Shilin karst sites and Shilin Karst evolutional relics, investigating species of plant and animal, as well as plant community investigation in fixed period and special event phase, all these activities taken by local authorized organisms including environmental protection department, Forestry management one and Land resources management one of

Shilin County and Kunming Municipal level;

(8) Progressed Mass consciousness for protection and conservation of naturalness with effective traditional custom. The residents in the Scenic Area are mainly Sani ethnic group of Yi Nationality and keep their tradition for protecting wild plant and animal, and village committees further form their own rules for protecting and conserving their environment, for examples, closing mountain and restoring forest, no grazing, no farming and no felling with no fire in protected land and punishing measures for those who do against the rules, which further provide grass-roots level security for the Shilin Scenic Area.

(9) The modern and advanced scientific and technical efficiency for improving the management of Shilin Scenic Area. First, under the guidance of the Ministry of Construction of P. R. of China, the monitoring and managing information system of National Key Scenic Areas has been put into action with 37,500 hm^2 of systematic remote sensing information map (Quickbird System) including Major and Minor Stone Forest, Liziyuan Stone Forest, Naigu Stone Forest, Shixiangzi-Qingshuitang Stone Forest, and Changhu lake, Grand Waterfall, which are very useful for the Construction Ministry's monitoring any new constructions in the scenic area; second, on the basis of systematic, integral and extending requirement for managing the Shilin Scenic Area, the 80 wick's optical cable network has been

built up in Major and Minor Stone Forest, Liziyuan Stone Forest, which provides better basis for using digital communication techniques for improving the management of the Shilin Scenic Area; third, along with the main trails in the scenic areas, the video monitoring system has been set up for managing resources and security, preventing artificial destroying scenic resources and against fire disaster, and guaranteeing visitors security; fourth, with considering of tour trails' complication, IP emergency calling system has come into use for better service and convenience to visitor and residents, as well as resource-damage events could be controlled at time; fifth, using large screen wall-connecting technology, the digital demonstrating hall and large screen demonstrating of Stone Forest museum have been set up for providing detailed information about Stone Forest for both tourist and scientific interests as well with promoting locals' enthusiasm for protection of resource and environment;

(10) Feasible and effective Plan for Ecological and landscape Restoration for damaged spots coming into action. Some special plans for Shilin development and protection has been finished like as the development Plan for Stone Forest Tourist Industry, Ecological Construction Plan for the Shilin Scenic Area, Conserving development for Changhu Lake and Grand Waterfall scenic site. And, some new plans for protecting the integrity of the Shilin Scenic Area are being

made, like the Shilin's conceptual plan and Strategy Plan for Shilin Tourist Industry, Shilin Ancient City's Integral Plan, and Study on Shilin County's Tourist Industry Development Strategy.

1.1.2 Strategy and Measures for Controlling Tourist flow

(1) The received tourist visitors in the Shilin Scenic Area in the past five year was increased by over 5% each year, and touched 2.05 millions in 2005. Strategy and Actions have been taken for controlling increasing tourist flow through strictly carrying out protecting and managing plans; and zoning function, by reasonably arranging tourist routes and touring period with tourist infrastructure improved for minimizing the negative impact from tourists and tourist industry.

(2) Tour and visiting activities strictly confined in the special areas like as in Major and Minor Stone Forest, Changhu lake and Grand waterfall with scientific tour in the nominated site carefully controlled;

(3) Improved tourist infrastructure including to build up new tourist service area, tourist center and Stone Forest museum, and centralize Stone Forest tourist services, and control vehicles into the tour area and construct battery-car route with aims of both controlling environmental pollution and better serving tourist visitors;

(4) Improved facilities for controlling waste and sewage from tourists and

locals, and realizing the centrally dealing with those waste into reality and reaching requirements of environmental protection;

(5) Reasonably arranging tour time, and adjusting touring trails arrangement and training tourist guides, and changing touring period from over-centered in the morning to all day;

(6) Monitoring Water, Air and Noise on schedule by authorized units related to environmental protection and maintaining local environmental quality;

(7) Strictly controlling new constructions and architecture in the Buffer Zone and some spots in the nominated sites, and guaranteeing their harmony to environment with no constructions which spoils environment and integrity;

(8) Improving rural infrastructure and basic conditions for traditional production, developing rural energy construction by building up rural methane energy and saving energy facilities; adjusting agricultural industry structure and developing fruit industry, and strictly controlling chemicals, pesticides in subsistence production and cash industry near to the nominated site and encouraging farm manure;

(9) Controlling grazing and encouraging farm-raising livestock in the buffer zone; no quarrying and unearthing sands; controlling spreading of original settlements in the nominated site and near zones, and guiding locals to maintain and conserve traditional architecture and

colors; strengthening popularization of fire-against knowledge; preventing fire disaster and controlling commercial activities with guidance of ecological and cultural sustainability.

1.2 Libo Nominated Site

1.2.1 Property and Management Integrity

The boundary of the Libo nominated site is delimited mainly according to the integrity of fengcong karst and associated forest ecosystem and habitat of rare and endangered species. The core boundary corresponds with that of the Maolan National Nature Reserve and the Daqikong and Xiaoqikong Scenic Spots in Libo Zhangjiang National Scenic and Historical Area. The delimitation of the buffer zone boundary not only considers the integrity of fengcong development and distribution, but also the factors necessary for protection of the nominated site, such as avoiding or minimizing the influence of modern human activities.

①Maolan Nature Reserve including core area, buffer zone，experimental zone and periphery protection zone is well protected according to the Article 18 in *Regulations of the People's Republic of China on Nature Reserves* promulgated by Decree No. 167 of the State Council of the People's Republic of China on October 9, 1994. The intact natural ecosystems and the areas where the rare and endangered animals or plants are concentrated distributed

within nature reserve, shall be included in the core area into which no units or individuals are allowed to enter. Scientific research activities are generally prohibited in the core area except for those approved according to Article 27 of the Regulations. Certain amount of area surrounding the core area may be designated as the buffer zone, where only scientific observations and other research activities are allowed. The area surrounding the buffer zone may be designated as the experimental zone, where may be entered for various activities such as scientific experiment, educational practice, visit and investigation, tourism, and the domestication and breeding of rare and endangered wild animal or plant species. If the people's government responsible for the approval of the establishment of the nature reserves thinks it necessary, certain amount of area surrounding the nature reserve may be designated as a periphery protection zone.

②Daqikong and Xiaoqikong Scenic Spots of Zhangjiang Scenic and Historical Area including all protected areas and periphery protection zone are well protected according to the Article 8 in *Provisional Regulation on Management of Scenic and Historic Areas* promulgated by the State Council of China on June 7, 1985. All units and individuals are not allowed to occupy the land of scenic and historic areas. All sceneries and natural environment of scenic and historic areas must be protected strictly without damaging or randomly changing. All constructions located in scenic and historic areas and periphery of the zone of protection should harmonize with the landscape.

Facilities that damage landscape, pollute environment and hamper the sightseeing should not be built. The hotels, rest houses and sanatoriums should be forbidden to construct in the tourism areas with concentrated visitors. Other project facilities shall be prohibited to be built in the rarity scenery and important sight spot, besides necessary protection and affiliated facilities.

③The Libo nominated site is recognised as the finest sub-tropical karst rainforests in the world. This is primarily because the minority people have consistently managed it (and continue to manage it) for sustainability over many hundreds of years. We believe that their village within the Maolan Nature Reserve should remain in place. Some of the villages are also the base of an IUCN sponsored action program for sustainability development.

1.2.2 Visitor/Tourism Pressure Control Integrity

Apply the relevant laws and regulations strictly; demarcate the boundaries of scenic areas and nature reserves; establish a set of protective regulations, such as regulations for core areas of scenic areas, fire prevention regulations for forests in scenic areas and resource protection in scenic areas.

In the Maolan Nature Reserve area only low numbers will be permitted and access will only be by walking. The Scenic Reserve area is able to carry relatively large numbers but all impacts on both the environment and the visitor experience will be regularly assessed, which make sure that the careful

monitoring of visitor numbers will be carried out to enable visitor number limits and management to be established.

These will provide that cutting or destroying forest, clearing land and damaging wildlife are forbidden; improve public health conditions in the nominated areas by providing dustbins, health administering organization and health administering staff.

Establish ecological parks and control entry to core areas of scenic spots and to the periphery of tourism villages; prohibit vehicles which do not meet *the motor vehicle emission standard* from entering scenic spots. Vehicles entering scenic areas are to be energy-conservative, environment- protective and highly efficient; Strictly control scenic areas and items exploited for tourism; reduce ecological impacts of tourism; establish mechanisms to administer tourism; implement capacity controls;

Demarcate ecological recovery areas and scenic recovery areas, reafforest by using indigenous flora, helping ecological communities and natural scenic qualities to recover; Demarcate scenically protected areas; Establish a research station to investigate karst hydrology and biology.

1.2.3 Drainage area integrity

There are boundary and drainage integrity issues at Libo nominated sites. The drainage systems associated with the nominated site involve the Huanghou

Underground River in Xiaoqikong Spot and Fangcun River in Daqikong Spot all comprising an area 1012 km^2. Traditional farming is practiced in these drainage areas, so the threats from upstream involve mostly silt from soil erosion by water and soluble agricultural chemicals. If the boundary were to follow the watershed then the area of the buffer zone would be too large a ratio for effective management. Instead we will promote integrate catchment management, including planning for environmental rehabilitation and effective control of threats from the exterior area for 45 years which is corresponding with the period of *Ecological Environment Construction Planning of Guizhou* promulgated by the People`s Government of Guizhou Province in 1999.

(1) *Planning, Formulation of the Complicated Design and Monitoring Evaluation on Effects of Environmental Integrated Management for Huanghou underground Drainage of Libo Nominated Site* indicates that: the drainage area is at the upstream of Xiaoqikong Spot, one core area of the nominated site, with an area 445km^2, and has low vegetation coverage rate and slight-moderate soil erosion and 30% area of this zone have been weathered into rock desertification to slight or medium intensive sensitivity. This zone acts an important water conservation area. Reforestaion and soil conservation in this zone are very important for protecting the water quality of the nominated site.

2)Environmental Protective Planning for the Libo Cone Karst Site in

South China Karst Nomination for World Natural Heritage(Fangcunhe Drainage Basin of Daqikong) indicates that: the drainage basin, with an area 567km^2, is the water source area for Daqikong Spot, one core area of the nominated site. Soil erosion in this zone is in medium or intensive sensitivity, and 20%area has been weathered into stone desert to slight or medium sensitivity. This drainage basin is the main commercial forest base for Libo County. Ecosystem has deteriorated largely due to the human disturbance. Reforestaion and soil conservation in this zone are also very important for protecting the water quality of the nominated site.

Integrated environmental rehabilitation planning of Libo nominated site in relation to the drainage areas upstream

No.	Construction Project	Unit	Total	2005-2010	2010-2030	2030-2050
一	**Ecological rehabilitation project**					
1	Closing hill for afforestation	hm^2	22431.6	9326.2	13105.4	0.0
2	Forbidden agriculture for afforestation	hm^2				
2.1	Ecological forest	hm^2	535.6	535.6	0.0	0.0
2.2	Economical (fruit) forest	hm^2	73.0	73.0	0.0	0.0
3	Other afforestation	hm^2				
3.1	Ecological forest	hm^2	12006.0	4952.4	7053.5	0.0
3.2	Economical (fruit) forest	hm^2	19651.0	7988.7	11662.3	0.0
4	Management and protection of woodland	hm^2*a	——	46703.7	81018.7	81018.7
5	Grass planting	hm^2	14590.1	2812.8	5339.8	6437.6
二	**Water conservancy and basic agricultural field construction**					
(一)	Basic agricultural field construction					
6	Terrace changed from slope	hm^2	3156.4	1104.7	2051.6	0.0
7	Field adjustment	hm^2	1773.6	661.8	1111.8	0.0
8	Agricultural land road construction	km	353.84	88.48	123.85	141.51
9	Agricultural land trail construction	km	1932.07	438.08	631.29	862.70
(二)	Agricultural water conservancy					
10	Irrigation reform	km	114.61	58.60	41.01	15.00
11	Saving water for irrigation	hm^2	2773.3	0.0	973.3	1800.0

(三)	Flood control					
12	Flood control dam	km	120.39	38.89	33.50	48.00
13	flood draining channel/gully	km	118.80	39.80	35.50	43.50
(四)	Water and soil conservation					
14	Water collection channel on slope	site	398	61	142	195
		km	1181.00	191.00	458.00	532.00
15	Sand deposition dam	site	448	38	68	342
16	Pools for sand deposition	site	9384	1069	4157	4158
17	valley dam for sand deposition	site	576	170	258	148
三	**exploration and utilization of karst water**					
18	Water pumping	site	106	52	48	6
		kw	2073.00	1008.00	990.00	75.00
19	Key irrigation channel	km	211.50	63.00	84.50	64.00
20	Water minor inducing	km	176.00	35.00	57.50	83.50
21	Small pond on slope	site	33	2	12	19
22	Small water pool	site	15274	4430	6109	4735
23	Drinking water supply	1000 persons	16.50	2.35	9.55	4.60
四	**Rural energy**					
24	Biogas construction	site	35091	9826	14036	11229
25	Extension of straw biogas stove	site	11844	1971	7216	2657
26	Extension of energy saving stove	site	6214	4722	1492	0
27	Reform of small hydropower	site	11	11	0	0
		kw	5820	5820	0	0
六	**Others**					
28	Technological training of agricultural production	Persons/ times	196500	39100	78700	78700
29	Technological training of labor exportation	Persons/ times	58500	11700	23400	23400
30	Ecological integrated monitoring station	site	11	4	4	3
31	Village road construction	km	480.00	30.00	160.00	290.00

Quality of water will be assessed at key locations in the buffer zone so that if special action is necessary it can be taken within the buffer zone and hopefully will not be allowed to cause problems in the core area.

1.3 Wulong Nominated Site

1.3.1 Karst Drainage Area

Sanqiao Natural Bridges Karst System lies in the interfluves of the Yangshui He, a tributary of the Wu Jiang. Originally its buffer zone area was 40km^2, and did not including the headwaters of the Yangshui He, and it was recognized that changes in water use, land use and vegetation patterns in the headstream area could impact the integrity of the Sanqiao Natural Bridges Karst System.

Wulong County People's Government accordingly established a plan to protect the integrity of Sanqiao. Following expert suggestions, the integrated Sanqiao karst system buffer zone was extended to include the entire Yangshui He drainage area, an increase of 20 km^2, and making 60 km^2 of buffer zone area in total.

1.3.2 Agriculture Impact

It was recognized that agriculture in the nominated area and in buffer zone could cause soil erosion and lead to karst desertification.

Wulong County People's Government therefore established an environmental protection and ecological construction plan: the "Grain for Green" reforestation project has been implemented and there are relocation plans for some of the inhabitants of the nominated areas.

- First stage(2006-2010) goal, 40% of arable land , 77.1232 hectares will be reforested;
- Second stage(2011-2015) goal, 30% of arable land , 57.8424 hectares will be reforested;
- Third stage (2016-2020) goal, 30% of arable land, 57.8424 hectares will be reforested.

1.3.3 Tourism Impact

Excessive exploitation of tourism resources would produce pressure on the nominated area and its integrity. Wulong County People's Government has therefore established strict measures to control tourism development. A management plan and an overall plan for environmental protection in the nominated areas have been established.

- Only half of the cave passages of Furong Dong are open to the public; the remaining sections are closed to preserve the exquisite speleothems and the cave's special environment.
- Only 2.5 kilometers of the Sanqiao gorge has been opened to tourism and measures are in place to protect the remaining areas so as to not disturb the delicate eco-system.
- Houping has remained an isolated farming community and it is rarely visited by tourists. Plans have been drawn up for its protection.

In order to reduce the impact of tourism facilities, a management office building, two units of staff living quarters, a guesthouse, a cable car and all restaurants have been removed from the Sanqiao Natural Bridges area.

In order to strengthen the protection of Furong Dong, the 400m-long exit tunnel from the far end of the showcave to the surface has been closed; additionally the lighting system has been reduced in power from 70 KW to 20KW to help reduce lampenflora and coloured lights have been replaced with white ones to show the cave in its natural colours.

1.3.4 Impact of tourists

Large numbers of tourists could have an impact on the integrity of the nominated areas. In the past 10 years, the number of tourists was about 100,000 per year in Furong Dong; in the past 5 years, it was about 70,000-90,000 in Sanqiao, which is less than the planned capacity of 500,000 per year. The construction of any living service facilities, including accommodation and restaurants, is not permitted, and the time that tourists stay in the nominated area is about 2 hours. Wulong County People's Government has established tourism development plans to limit tourist numbers to 200,000 per year, in order to reduce the influence of tourists in the nominated areas.

1.3.5 Monitoring

An integrated system has been established to perform comprehensive monitoring of the mountain and cave environments, including air and water quality, the health of the eco-system and rare flora and fauna populations. Monitoring systems include:

(1)Normal monitoring: 15 sites have been equipped for surface, ground water and atmospheric environmental monitoring; every 15 days data on water volume, water level, water quality and air quality are recorded, enabling analysis of dynamic changes and promoting scientific research.

(2)Cave environmental monitoring: Cave environmental monitoring stations have been set up in Furong Dong, including two automatic monitoring points and 12 manually operated monitoring sites which record temperature, humidity, CO_2 concentration at fixed times for each site.

(3)Monitoring of rare fauna and flora and the ecological environment: The populations of rare fauna and flora, the biodiversity and the habitat are recorded regularly (6 monthly) in order to analyze dynamic changes in the ecological environment.

(4)Monitoring of tourist capacity: To evaluate the impact of tourism on the environment in the nominated area, tourist capacity is strictly monitored during peak holidays. When tourist capacity surpasses the maximum capacity, measures for leading and dispersing tourists are implemented at once.

(5)Monitoring patrols: Monitoring foot patrols have been established to discover and prevent fires, rockfalls and other disasters, and to eliminate damage and other dangers.

(6)Community monitoring: Social and economic development and population changes and changes in land use are monitored to alleviate their impact on nominated properties.

1.3.6 Scientific Research

The government has established close cooperation with more than 20 domestic and foreign research institutes, including the Institute of Karst Geology of the Ministry of Land and Resources; the Karst Research Institute of Slovenia; Southwest University of China; Chongqing Normal University, and the Institute of Environment and Resources of the Chinese Academy of Sciences.

During the past two decades more than 150 experts have conducted research near Wulong and over 100 papers have been published.

This research has improved the understanding of the natural resources of Wulong Karst.

Since 1994 cavers from more than 10 countries have explored and mapped caves in Tianxing, Sanqiao and Houping. A total of over 120km of cave passage has been surveyed.

A 100 million Yuan scientific foundation has been established by Wulong County People's Government, funded by 5% of tourist attraction ticket sales, and a karst sub-institute in co-operation with the Institute of Karst Geology will be set up so as to improve the understanding of Wulong Karst and to

research management plans for improved environmental protection.

2 Ask: Could further management details for sites (particularly Maolan) be provided including budget estimates?

The protection and management planning, including details and budgetary estimates of the South China Karst (Phase I) Nomination have already been completed.

2.1 Shilin Nominated Site

2.1.1Formulating and Responsible Organizations

The Management Plan of the Park is formulated on the basis of the updated Master Plan of Shilin National Park (2003-2020) of 2004 and The Operational Guidelines for the Implementation of the World Heritage Convention (2/2005) and guidelines for protection of Caves and Karsts(IUCN, 1997), to be implemented by The Management Bureau of Shilin National Park.

2.1.2 Brief summary of the Management Plan

（1）Identifying values of interest in Shilin National Park, and ensuring the required space for protection of the park

（2） Arguing matters threatening the values of the park, and defining its development and the corresponding aims of management

（3） Putting forward an effective strategy for zoning and classifying the

park management and implementing aims for the protection of the values of the park and its basic space

（4） Providing the various zones and special places' plans of management and executing points for the integral development of the park and the realization of the social and economic aims of the local region.

2.1.3 Zoning of Shilin Nominated site

On the basis of zoning, values and integrity of the Shilin Scenic Area in the updated Master Plan of ShilinScenic Are, zoning and scopes of Shilin Karst Nominated Site was proposed and defined (Tab.2-1-3-1).

Tab. 2-1-3-1 Zoning of Shilin Park and Heritages Spots			
Zone	Names of Heritage sites	Values	The Part of the Park
Core Zone	Naigu Stone Forest, Baiyun Cave, and subterranean rivers	Typical Shilin karsts qualified for ***Criterion VII*** and ***Criterion VIII.*** Of the World Heritage and Natural state	Naigu
	Major and Minor Stone Forest, Ashima Pillar, Bushaoshan Stone Forest, and Stone Forests of Liziqing, Tiankongling, and Luomadong		Major Stone Forest-Liziqing
	The Stone Forests respectively at Shuangjian Mountains, Fairy Lake, Gaoshitou, Leidashi, Daoshitou, Wangchengshan, Shixiangzi , Grandpa expecting Grandma, Yingpan, Daqingpo, Laohuqing, Liuyingtang, and Shihuangniu.		Qingshuitang —Shixiangzi
	Stone Forest respectively at Wenbi Mt., Suoyishan, Dawanqing and their vegetation		Wenbi Mt. -Suoyishan
Buffer Zone	Stone Forest respectively at Hemo, Zhantun, Pudoucun, Heiqingtou, and Tuanjie Reservoir.	Protects the Core Zone and the integrity of Shilin Park and Structure of the Karst hydrologic system and water reserves	Naigu
	Lake Bimutan, Wannianlingzhi Pillar, Shilin Lake, Lufangtang Pond, Stone Forests respectively at Sifangtang Shuangtangzi, New Tourist Center and vegetation, and the zonal vegetation in Wukeshu Village.		Major Stone Forest-Liziqing
	Stone Forests respectively at Shangpucao, Heilongtan, Qingshuitan Village, Shuitangpu and Mizhi forests		Qingshuitang—Shixiangzi
	Shuijinshan Stone Forest, Douhei Stone Forest, and Geyihei Stone Forest.		Wenbi Mt. -Suoyishan
Proving Zone/Tourist serving zone with protected farmland	Stone Forests at Heishitou, Shibanshao, Sibeihou, Baozidong, Huoshipo, Ayilin, Majianshan, Shaorenchang, Daqingshan, Railway Station, Wanyaoshan, Guweishan, Stcokbreeding field, Sanjia Village, and Daqing.	Provides the spaces for the integrity of the park and the attractions of Shilin cultures, and protects scattered stone forest and geologic relics.	Naigu
	Zhiyun Cave, Jibailong Cave, natural bridge, New Tourist Center, Stone Forests at Daxiao- Jianshan, and Jialianshan.		Major Stone Forest-Liziqing
	Zumo Stone Forest.		Qingshuitang —Shixiangzi
	Suoyishan Stone Forest.		Wenbi Mt.-Suoyishan
	Lake Changhu and Grand Waterfall.		Lake Changhu, and Grand Waterfall
	Stone Forests at Laohuangshan and Laoguanshan.		The third class protected zone.
	Qifengdong Cave, Lake Yuehu and vegetation, Huaishidu Stone Forest, Dalaowa Ponds, Mopanshan vegetation, and Sheshan Stone Forest.		The third class protected zone.

2.1.4 Management Plan of Zoning and Classifying

Shilin National Park will be managed on the basis of Zoning and Classifying. The defined zones are the Core Zone, Buffer Zone and Proving Zone/tourist serving zone with protected farmland. The details of the zones are mentioned above in section 3.2.

2.1.4.1 Management Plan for the Core Zone

Definition and area: The Core Zone of the Park here is those parts which join in South China Karst World Heritage, and includes the Specially Protected Zone and The First Class Protected Zone defined in the revised Master Plan of Shilin National Park, contains all heritages of interest for protection of the naturalness, uniqueness, integrity, diversity and beauty of the stone forest. Human activities are fewer, and there are some patches of natural vegetation, especially patches of climax communities characteristic of subtropical karst plateau zonal vegetation, with rich endemic species and dense forests. The area of the zone is 12,070 hm^2, including four patches.

（1） Naigu Stone Forest

（2） Wangchenshan-Qingshui Pond

（3） Wenbi Mt.-Suoyishan with an elevation range from 1800 to 2203m a.s.l

（4） Major and Minor Stone Forest, Liziyuanqing Stone Forest.

Management measures: fairly and justly readjust the land tenure and its management in the Core Zone for the purpose of effective protection of the relics in Shilin National Park in accordance with the laws and regulations

（1） combine legal protection with traditional conservation according to local customs in order to maintain natural conditions for evolution of the local vegetation and stone forest

（2） perfectly preserve the geological relics and conserve the natural conditions and the diversity of Stone Forest along with local biodiversity in the Park

（3） prohibit construction and production, such as mining, quarrying, tree felling; avoid fire disasters

（4） create habitats suitable for the evolution of artificial forests so that they may resemble local vegetation, especially fostering and replanting local seedlings

（5） forbid illegal hunting and water pollution in the zone

（6） allocate lands for monitoring and studying and limit the number of people allowed into the zone

（7） strictly control transportation and prohibit certain motor vehicles and animal-driven carts

2.1.4.2 Management Plan for the Buffer Zone

Definition and area: The Buffer Zone refers to the areas peripheral to the

Core Zone together with the Lake Changhu and Grand Waterfall sites and including:

（1）Northern part and boundary: from the north to Hemo Stone Forest, south to the Nanning-Kunming railway track, east to the Ba river, and west to Pudou Stone Forest

（2）Southern part and boundary: from the north to Lufang Pond and Shuangtangzi Pond, south to the Suoyishan, east to Shuitangpu-Suogeyi road, and west to the border of the special–class protected zone; involving Major Stone Forest and Small Stone Forests, Bushaoshan Stone Forest, Geyihei Stone Forest, Shihuangniu Stone Forest, Tiankonglin Stone Forest, etc.

（3）Lake Changhu: with the lands north to Zumo Road, south to Shuangjian Mountains, east to Xiaotuanshan, and west to Jiuxiang-Shilin-Aluguodong Road; including Mopanshan Fengcong, Lake Changhu, and Dushishan Fengcong

（4）Grand Waterfall: comprising the Ba river, Dakehe River and Qingshuihe Valley

The Functions of Management:

（1） strictly protect the natural conditions of Stone Forest and prohibit any activities that would damage the landforms and relief, except for building basic tourist walking routes and sightseeing facilities

（2） prohibit the construction of any facilities that are of no interest to sightseers, and control the amount of motor vehicles allowed into the Zone

（3） control any facilities which would spoil the beauty of Stone Forest and its wilderness, and keep in mind those visitors who just want to experience Stone Forest

（4） Landscape the borders of transportation routes such as roads and railways with seedlings of local and attractive exotic species both for appearance and to disperse local species

（5） strictly confine expansion of rural housing and maintain the traditional styles of architecture while improving rural infrastructure

（6） restore the natural environment of water reserves by returning the farming and grazing land beside the waters to vegetation

（7） forbid tree felling, mining, quarrying, and illegal hunting, and protect the zone from fire disasters

（8） control sewage

2．1．4．3 Management Plan for the Proving Zone/Tourist Serving Zone

Definition and area: The proving Zone/Tourist Serving Zone with protected farmland is part outside of the Buffer Zone, and includes part of the second-class protected zone and the entire third-class protected zone designed to reduce the impact on the Buffer Zone and protect the important geological

relics, the local vegetation, and significant cultural attractions as well as water reserves, with a total area of 13, 573 hm^2, including Shilin Town, Beida Village, Weize Village and Lake Yue and other places of importance.

Management measures: all buildings, construction and tourist facilities should be characteristic of the local nature and history, and not interfere with the natural beauty.

（1）strengthen reforesting and improve the environment, construct domestic energy bases and control the use of chemicals

（2）prohibit all activities that will do harm to attractions, the environment, geologic relics, water and local vegetation; and avoid fire disasters

（3）reconstruct damaged lands with local plant communities and some exotic species adapted to the Shilin region

（4）promote scientific knowledge and techniques, and make full use of local skills for protecting biodiversity and water reserves; develop distinctive agriculture, forestry and animal husbandry by readjusting planting and raising structures in pastoral restored landscapes

（5）speed up construction of the rural infrastructure and improve environmental sanitary conditions in villages and towns, control human wastes

2.1.5 Management for protection of the established classification

2.1.5.1 The protection of the landscapes and geological relics/sites

The landscapes defined here refer to all stone forests, stone teeth fields, hills and depressions, fengcong, waterfalls and caves in the park. The geologic relics defined here are those relics of the stone forest's evolution, geological events, hydrogeology, including strata, fossils, geologic structures, etc. All of those stimulate significant interest in the Park; therefore it is necessary to carry out strict protection. The main measures include:

（1）prohibit quarrying and excavating, and implant an efficient means of avoiding fire disasters

（2）prohibit transporting of the stone pillars to places outside the park

（3）Return farming and grazing lands to vegetation and control the use of chemicals in the following areas: the peripheries of Stone Forest within the range of one stone pillar's height or the range of 100 meters away from Stone Teeth field and fengcong, and the catchment areas of the underground rivers.

（4）encourage using local species for afforestation and promote natural restoration of local vegetation with suitable artificial aids

（5）publicize the lists, plans, skills for protecting Stone Forest, geologic relics/sites, species and vegetation within the area of Shilin National Park

2.1.5.2 **Protection of ethnic cultural attractions and local plant communities**

The ethnic cultural attractions refer to those characteristic of local history, customs, arts, religions, living ideas, and relics of the Yi nationality in the park, including traditional housing, architectural styles and materials used, costumes, arts and crafts, spoken and performing arts, festivals, producing styles and tools, and nature worship idols. The local plant communities refer to the vegetation characteristic of habitats of the Shilin region, especially the climax communities in Mizhi Mountain. The measures of protection are:

（1）publicize the ethnic cultural relics in the park with signs marking sites and significances and the protection required

（2）Rationalize the local producing structure for the Park and help wealthy locals by enriching the local cultural tourist products of folk song, dancing performances, folk arts and crafts to foment ethnic rural tourism, eco-tourism, cuisine tourism, etc.

（3）publicize the lists and icons of the places of the Mizhi Forests, local climax plant communities, rare and endangered species, famous and ancient trees, as well as invasive species and their distribution and possible danger

（4）combine the protection of the local architecture styles, the settlements, and surroundings with improvement to the infrastructure and sanitary facilities in rural areas

（5）keep in mind that any new construction and buildings should be in harmony with the integrity of the Park and local traditional

architecture; and the materials used for decorating the outer architectural design of the buildings and construction should not spoil the surroundings of the zone

（6） strengthen management of livestock raising, both in fields and in the pen, and protection of waters and water scenery in villages

（7） make and publicize the plans and strategies for rejuvenating local ethnic cultures and restoring local vegetation with the prospects of the villages and towns in mind

2.1.5.3 Protection of Waterscapes and Hydrographic Relics

Lakes, waterfalls, reservoirs, the Ba River, subterranean rivers and karst springs are included here, and the main measures for protection are the following:

（1） mark the characteristics and significance of each attraction and relic

（2） preserve the natural beauty, and control soil erosion around all water, and carry out plans for ecological and landscape restoration with the main goal of reestablishing local vegetation and the integral structure of hydrological systems

（3） protect the Park from pollutants

（4） coordinate necessary building and architecture with the waterscapes and natural conditions

2.1.5.4 Restoration and Protection of Landscapes beside Railways, Highways and Tourist Routes

The landscapes beside routes of transportation into the Park are considered as the windows to the Park and they should be protected and repaired if any damages may occur. The main measures include:

（1） prohibit construction of any new path or roads in the Core Zone, and control any new roads and railways across the Buffer Zone

（2） carry out the plans for ecological restoration and landscape restoration beside transportation routes mainly by natural selection in the Park under the principle of taking advantage of good scenery and eliminating unpleasant vistas

（3） cultivate dispersing networks of local species along the sides of transportation routes, the land tenures of which are state-owned and collective, by landscape localization; and avoid the urbanization of landscapes

（4） use ecologically benign materials for construction and ecology-friendly friendly vehicles for the Park's transportation, such as battery-run vehicles

（5） mark significant attractions along the routes, such as landscapes, species and relics

2.1.5.5 Construction of the Entrances of Shilin Park and Protection of Natural

Surroundings

The main entrances to the Park are the final stop of the Kunming-to-Shilin highway, where the Ashima Cultural Ecological Garden is found and leads to the new tourist serving center; the entrance to Naigu Stone Forest, the entrance to the Major Stone Forest sightseeing areas, the entrance to the Grand Waterfall, and the entrance to Lake Changhu. All of these are gateways showcasing the identity and image of the Park, and should inspire visitors. The main measures for construction and protection are:

（1）mark the attractions explaining of their scientific significance, and clearly mark tourist routes

（2）protect the surroundings of the natural attractions by safeguarding the natural scenery, and give prominence to both the natural and the cultural characteristics

（3）conserve or cultivate a distinctive atmosphere in the areas open to tourists

（4）keep in mind that any construction and building for parking, any tourist reception center, should not spoil the natural beauty and environment

2.1.5.6 Construction of the Infrastructure of the Villages and Tourist Service Base

The construction of the infrastructure should occur mainly in the residential areas, villages, tourist service areas in the Buffer Zone and Proving Zone/Tourist serving zone. The main measures for managing the construction include:

（1） protect the local residences and the surroundings characteristic of the local ethnic and natural beauty

（2） not damage the intrinsic landforms, and not disturb the natural evolution of Mizhi forests

（3） plant trees next to all architecture

（4） improve infrastructures and sanitary conditions, and properly dispose of all waste materials

2.1.5.7 Management of the sizes and styles of construction and building

(1) Controlling the sizes and styles of architecture in the areas open to tourists

1) the height of all buildings in areas open to tourists kept to one story and not over two stories
2) materials for construction being local and ecological, instead of modern ones such as ceramic tiles, colored glaze, glasses, etc
3) the styles of new architecture being characteristic of ethnic and local flavor, and generally with the required sloped-roof

4) architectural colors, preference for white, gray, green, blue and yellow, not red

(2) Controlling of sizes and styles of architectures in other areas

The areas defined here are those outside of the areas visited by tourists, including the villages in the Park and the integral area of tourist service

1) the stories of the buildings will normally be only two and absolutely not over three, except for special buildings
2) materials for architecture should be local and ecological, instead of modern ones such as ceramic tiles, colored glaze, glasses, etc
3) architectural styles characteristic of the ethnic and local, generally with the required sloped-roof
4) the colors for architectures preference for white, gray, green, blue and yellow, not red
5) keep afforesting coverage over 40% of the constructed areas
6) buildings density preferably less than 40% of the constructed areas
7) volume density of buildings less than 0.8

2.1.5.8 Management of planting and creating forests

Reference here is to the controls on planting and creating forests in the Park, especially in the Core Zone and Buffer Zone.

（1）begin with the principle that the biodiversity and local vegetation are part of the integral identity of Shilin National Park

（2）publish and publicize the plans and the prospects of expected plant communities in Shilin National Park, together with planting skills and lists of species for afforestation

（3）publish and publicize the lists, icons, cultivation methods and techniques for the suggested species, especially endemic species, for local afforestation

（4）publish and publicize the lists, icons, and eradicating methods and techniques for dealing with harmful and invasive species

（5）set up a mechanism and an effective organization for checking introduced species and monitoring and controlling invasive species in the Park

（6）allocate duty areas for afforestation to organizations having interest in the Park and county, with defined aims of afforestation on the basis of land tenure, managing and running rights, and coordination of vegetation with functions of the Park

（7）specify a leading role for the Management Bureau of Shilin National Park and the related departments of the county government in afforestation

（8）set up and improve seedling gardens of local species in Shilin National Park

（9）finance biodiversity protection and restoration and set up a fund for the purpose

2.1.6 Funding Sources and the Budgets

The management funding for the Shilin Park comes from government fund allocation and from the Shilin tourism income. In 2005, the annual entrance fee income into the Park was 160 million Yuan. Since 2002, Ministry of Construction of P. R. of China, The Ministry of Land and Resources P. R. of China, the Yunnan Provincial Government and the Shilin Yi Nationality Autonomous County Government has being imputed gigantic sums for resource protection, ecological rehabilitation, environmental control and rural development, as well as improvement of tourist infrastructure. By June of 2006, the accumulated protection and rehabilitation funding input has exceeded 300 million Yuan. Conversion of farming land to zonal forests and removed the buildings that obstruct sight-seeing and natural appearances, are continuing in the Park. More than 1500 hectares of land have been ecologically restored, and the conditions required for ecologically sustainable evolution of the Park's processes have basically become realities in the nominated areas. Thanks to the Yi Minority Nationality's customs, village culture and ethics, some natural forest fragments have been protected and conserved, which have become an important gene bank for ecological rehabilitation of the Park and for biodiversity protection. Since 2005, the Shilin County government has stipulated that 15 million Yuan each year should be used for nature protection and environmental control in the Park. At the same time, some money from entrance fee income will be used as a development fund for villages/communities around the Park to strengthen ecological agriculture and increase the tourist appeal of the countryside and traditional customs, as well as to improve the local residents role in the Shilin tourist industry, and finally to increase their income.

2.1.7 Recent Projects

Some projects undertaken since 2002 for protecting and restoring natural

conditions and improving the integrity of the park are listed in the following table.

Recent Projects in Shilin nominated Site

No	Project Title	Budget (unit: One Million Yuan)	Period
1	Karst Geological Heritage and Landscape Rehabilitation Project	100	2002-2010
2	Ecological Rehabilitation and Biodiversity Protection Project	250	2002-2010
3	Shilin Visitor's Center	30	2004-2006
4	Environmental improvement project of the Stone Forest Lake	200	2006-2010
5	Environmental controlling project of the Five-Trees Village and Naigu Stone Forest Natural Villages	300	2006-2008
6	Construction of special tour road run by environment-friendly tram car in Major and Little Stone Forests	150	2002-2007
7	Sanitation facilities and infrastructure reconstruction in the scenic sites	150	2004-2008
8	Rural basic infrastructure rebuilding projects in the scenic sites	150	2005-2010
9	Landscape rehabilitation projects on demolished building sites	300	2005-2010

2.2 Libo Nominated Site

We already have a first draft management plan. However we are currently being advised on its further development by Elery Hamilton-Smith, Professor of Karst Management at Charles Sturt University, Australia and Chairman of the IUCN/WCPA Task Force on Caves and Karst.

2.2.1 Direction and strategy of Management

2.2.1.1 Direction for Management of the Libo Nominated Sites

The key principle in forming a management plan will be the sustainable

management of the site in perpetuity and hence maintenance of its remarkable aesthetic, geological and biological values. All staff and visitors will be encouraged to treat the site as a sacred sanctuary demanding appropriately careful and thoughtful behaviour at all times.

The strategies for management of Libo World heritage nominated site are: first, management by zoning of the sites and classification of protected resources and environment; and second, clearly defining the function of each zone with setting protection level and allowed activities; third, carrying out the integrity management and jointly management through the promoting neighboring communities' development, and strengthening scientific study with aims of realization of permanent protection of the karst landforms, virgin forests and habitats, and ethnical culture, and make biological and cultural resources into sustainable use.

The protected objectives in the Libo nominated sites are: karst forests, karst biotic community succession, rare and endangered species, special endemic species and their habitats, conical karst landform, and their evolutional relics, karst scenery and ethnical cultural landscapes.

2.2.1.1.1 Classification for management and Objectives

(1)Protect conical karst and its evolutionary features: Protect conical karst and its evolutionary features, including fengcong, fenglin, depressions,

basins, underground rivers, underground runoffs, caves and valleys. According to the protection level, any activity are forbidden that might do harm to all these natural resources.

(2)Protect karst virgin forest ecosystems: Protect subtropical karst forest vegetation and its biological elements. According to the protection request, any activities are forbidden that might do harm to the forest vegetation and its evolution process. Restoration of the damaged forests goes into the action with maintaining their natural process.

(3)Protect rare an endangered species with their habitats: Circle the space for rare and endangered species, and improve monitoring the network for observing dynamic state of species, and establish special base for raising rare and endangered species.

(4) Protect scenery resources: To protect five kinds of scenery: karst landscapes, forest, rivers and waterfalls, places of historical interest and ethnical culture. To protect their naturalness, authenticity and compatibility, Quarry and digging is forbidden; building activity is limited, and buildings and business activities that have spoilt/will spoil atmosphere of protected items will be demolished/ relocated; and maintain of scenery and sound environment should become into fact.

2.2.1.1.2 Strategy of classification protection and management

(1)Protection of Karst landscapes

- Forbid any quarrying, digging and burrowing activity
- Reduce or limit human activity and restore the damaged landforms in the protected zones
- Repair key karst scenery, and prevent water and soil erosion.
- Limit human activities to protect air quality in caves
- Monitor the quality of underground water and keep the caves for tourist clean
- Establish monitoring system for karst landforms and hydrogeology, and make clear the range of underground waters.
- Conserve local plant communities and scenic forest, control exotic species.

(2) protecting karst forest ecological system and wild plants and animals

- Push local policy making into process, and make "Regulations for management protection of Maolan Nature Reserve" and enforce it.
- Strictly execute rules and regulations for every protected zone and investigate any species that would be brought into the reserve.
- Improve infrastructures and strengthen inspecting and protecting.
- Effectively promote protection information and encourage communities and villagers to participate in the protection.

- Forest fire prevention and build special fire prevention channel
- Extermination of disease and insect in the forest
- Scientific research and monitor, complete catalogue of biodiversity of this place and monitor important species.
- Restore degenerated specie habitats and populations mainly naturally as well as planting and raising local plant species and composed species.
- Carrying out species management, and controlling exotic species as well as establishing local species nursery base.

(3)Protection of ethnical culture

- Protect the authenticity and originality of the ethnic culture
- Keep the original look of the ethnical villages
- To control rural environment and improve rural infrastructure
- Enforce village's replanting and cultivate local plants' scenery around villages

2.2.1.1.3 Strategy of protection zoning and aims

(1) **Core area:** The Core Areas defined here include the Maolan Nature Reserve (Core Zone, Buffer Zone and Experiment Zone) and Big Qikong Scenic Area and Small Qikong Scenic Area of the Libo Zhangjiang River Scenery Site. Protecting aims: (1)conical karst landscape and its evolutionary relics; (2)subtropical plateau karst virgin forests (sink forest, depression forest

and valley forest) and forest communities (12 kinds of subtropical karst deciduous and evergreen broad-leaved mixed forest); (3)habitats for various rare and endangered species; (4)karst landforms, forests, caves, waterfalls and valleys; (5)ethnical cultural landscapes: culture, art and architecture of Buyi, Yao and Shui people with their atmosphere.

(2) **Buffer area:** The outside circle area of Libo karst nominated site with size of 43,498 hectors. Protecting aims: Maintain the integrity of all these elements including rare and endangered species, karst virgin forest system, karst hydrogeology system, and karst pastoral scene.

Management zoning and present situation of the Libo Karst Nominated Sites

Area	Type of protection	Division of the reserve	Size hm^2	Items of protection	Measurements	Threats
Nominated site	Maolan Nature Reserve	Core area 1 (Maolan Core Zone)	8305	Karst forest , rare and endangered species and their habitats, conical karst landforms , caves, etc	strict protection, established protection network	Natural fire
		Core area 2 (Maolan Buffer Zone)	8130	Karst forest, local species, conical karst landforms, rivers, waterfalls and caves. To restore the natural scenery	Limited scientific research, restore plants and scenery, and establish management network	Scattered villages, slight cultivated land, natural fire
		Core area 3 (Maolan experimental area)	4850	Cone karst landforms, waterfalls, rivers, forest, villages of ethnic groups, and restore the natural scenery	Scientific research, ecotourism and limited producing activities	Villages, plant and animal raise, natural fire and disaster
	Libo Zhangjiang River Scenery Site	Da Qikong Scenic Spot	7834	Karst forest, conical karst landforms , waterfalls, river and caves	Carrying out four level protections. Establish management network	Moderate tourism, natural fire and disaster, soil erosion upstream
		Xiao Qikong Scenic Spot		Karst forest, conical karst landforms , waterfalls, river and caves	Carrying out four level protections. Establish management network	Moderate tourism, natural fire and disaster, soil erosion upstream
Buffer Zone	Libo Zhangjiang River Scenery Site	Outside protected zone	43 498	Natural scenery, underground river	Limitation for business and producing activities	Water and soil erosion, buildings
	Maolan Nature Reserve	Outside protected zone		Natural scenery, underground river	Limitation for business and producing activities	Water and soil erosion, buildings

2.2.1.1.4 Strategy for protecting the integrity of the nominated site

Libo Nominated Site's integrity including: complete structure of Libo karst hydrogeology, subtropical karst forest , rare and endangered species and their habitats, conical karst landforms , quality of karst soil, organism, water and atmosphere and healthy environment that influence all the above elements. The concrete measures including:

- Water condition protection: strictly control the standard of surface water and domestic sewerage discharge，control all kinds of water that would go into the nominated site.
- Soil and vegetation: establish list of soil resources, forbid cutting of trees in the protected forest, close mountains for forest restoration along the rivers, and prevent water and soil erosion and natural disaster.
- Protect atmospheric environment：control air pollution from coal smoke, improve energy use , establish monitor system for atmosphere and control the number of vehicles
- Control of construction environment, and control construction projects, any project in the area has to be evaluated on its influence on the environment, any construction and building that might destroy the scenery and environment is forbidden.
- Restore ecological system：plant forest for protecting karst ecosystem,

river and valley, economical fruit trees and establish seedling nursery for local plants

- Monitor karst hydrogeological process, forest and special specie, underground water flood season and have experiments on water, forest and specie protection.
- Control exotic species and invasive species
- Set up the regional protection network of hydrogeological system and ecological environments, including Dushan County, Mawei County, Sandu County by making plan for protecting regional hydrogeological environment and regional ecological environment.

2.2.1.1.5 Assessment and management of all projects for construction and development

These projects refer to tourist service facilities, public infrastructure, local housing construction, ecological restoration and landscape restoration. Whether from the government, enterprises, groups or individuals, domestic or foreign, the projects and their feasibility must be assessed and proved not only in terms of benefits and values, but also in terms of potential risks which may be serious to the reserve and scenic area. So there must be strict standards and procedure for assessment and inspection of projects, which must correspond to national and local laws and regulations, as well as to international management practices.

(1) Criteria for assessing contents of construction and projects

- impacts on the Libo heritages, karst landforms, hydrogeological systems, virgin forests, rare and endangered species, scenic landscapes and local cultures
- impacts on the pastoral scenery
- impacts on surface and underground waters, and hydrologic systems
- impacts on local biodiversity and the climax plant communities
- impacts on the stakeholders involved in the reserve and the scenic area and the protection of the two protected areas, especially on improvement of local communities, both farming and residential
- impacts on traditions and cultures
- the need to carry out strict environmental assessment standards with a veto system for environmental impacts management

(2) The assessment system for construction projects: components

- inspection of assessment procedures for proposal of the projects, forms of relating units' assessment, qualification according to ordinances and regulations, to integral consultation from stakeholders, experts arguments and public noticing, and follow-up
- assessment of the project plan; involvement in public bidding of planning, plan assessment and public notification of the plan, and inspection by the units of interest in the government and legal

limitations

- supervision of the project's construction, including the public bidding for construction, materials used, and construction progress and quality
- Checking for acceptance of the constructed project; referring to the corresponding technique criteria, environment criteria, attraction criteria, security criteria, etc.

2.2.1.1.6 Strategy for rural development and jointly management

- Construct and reform rural energy: biogas, energy-saving kitchen range, and cultivate firewood forest
- Cultivate bases for wood and commercial forest and fruit forest
- Improving industrial structure
- Population control and community development
- Capacity building for rural residents

2. 2.1.1.7 Strategy for economical development

- Develop ecotourism: establish Huangyanggou Scenery Site, Wangpai Mounhtain Virgin Forest Scenery Site, Banzha, Big and Small Qikong area bio-tourist area to improve tourist quality and income of Zhangjiang River and Shuichun River areas
- Develop multiple investment on: plum plantation, raw material processing base for bamboo products and Chinese herb base

- Processing industrial and the third industry: develop special local products

2.2.1.1.8 Scientific study and monitoring

(1)Aims

- Libo Karst hydrogeological structure and its borders
- Structure, processes, and functions of Maolan karst pristine forests with their evolution
- Structure, processes and functions of karst secondary vegetations, and mechanism of restoring karst degenerated vegetations, and techniques of ecological reconstructions
- Techniques of management of rare endangered species of both plants and animals as well development of these species and promoting these species populations to increase.
- Techniques for development of species of animal and plants
- Techniques for assessment of developing and utilizing of karst landscapes
- Local Ethnic culture and biodiversity, communities' development and reserve's own development
- Actively promote scientific popularization, environmental profession education with realization of sound development of both reserves and rural communities

(2) Contents of research projects

- Investigating and monitoring of karst hydrogeological catchments
- Fixed Succession monitoring and studying of karst forests ecosystem in field including forest water resource and carbon cycles,
- Fixed investigation and monitoring of key species and their populations
- Completely systematical and succession investigation of karst bioresources including birds, insects, spiders and soil animals
- Study the migrating protection of rare and endangered species
- Methods and techniques for forecasting and preventing of karst forest fire
- Monitoring of caves and underground ecosystems
- Karst dynamics of karst forests
- Make experiments of restoring degenerated karst ecosystems and biorepairing
- Integrated model of eco-agriculture development for karst mountain land
- management model of Maolan Nature Reserve jointly by the reserve bureau and related communities
- Karst forest ecotour and make demonstration of ecotour
- Set up the data base of the Libo protected areas' biodiversity including bioresources and their dynamic, geographic information and management information

- Ethnic culture diversity and biodiversity in Libo karst protected areas
- Investigating exotic species, and specially invasive species

2.2.1.1.9 Strategy for awareness raising and exhibition

- Complete the border and illustration system: Terminus boundary marker, signs, limitation signs, explanation board and gate.
- Effective awareness raising activities: establish Maolan Nature Reserve environment training center, make pamphlet, photos and video materials to train the community members and school students.
- Establish tourist center and Libo nature museum: establish tourist centers respectively in Maolan and Xiaoqikong area, Natural museum in County Town, to exhibit protection information and the scenery and natural heritage of the nominated area and promote knowledge and skills of protection and management

2. 2.1.1.10 Regional coordination for protection and management

With regarding of that Libo nominated sites are basically located at middle and lower section of regional karst hydrogeological catchments, regional activities must be controlled which will impact the integrity of the nominated sites. The concrete measures for that are to make plan for monitoring regional hydrogeological systems and carrying out regional eco-restoration and eco-protection, and keeping the integrity of whole

hydrogeological catchments in related counties, especially in Dushan County, Mawei County, and Sandou County. The main concern should be given to the south side of the nominated sites where is the Mulun national reserve of Huanjiang County that is key part of complete subtropical karst virgin forests system although it doesn't join in the first of South China Karst World Natural Heritage Nomination because of border considerations from management perspective. Finally, we have a confidence that the Mulun national reserve would become the key component of South China Karst World Heritage. The two national natural Reserves should keep the same step for management of the karst forest resources and karst habitats and preventing from fire disasters, disease and pest.

2.2.1.2 Strategy for land use

According to national laws and regulations, the land and forest of Maolan Nature Reserve belong to the country. The government would supervise the management of it. However, the agricultural land and village can be used by person and collectives. The use right of some forest belong to individual or collective, but all mountains belong to the country. The Administrative Bureau of Maolan Nature Reserve have ownership of 1.76km^2 land in the reserve, and Zhangjiang River Scenery Site only have use right for the land in its boundary. Thus, all usage of the land in Libo Karst Nominated Site should be registered on basis of state laws and regulations.

2.2.2 Management by zoning the Nominated sites and near-term projects

Under guidelines for Cave and Karst Protection (IUCN WCPA, 1997) and the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO, 2005), the zoning and classification for managing the nominated sites should been enforced with combination of status quo of heritage resource and managing situation for realization of managing direction. Attention should be paid to basic engineering projects which would control the management of the whole nominated sites. The key measures for ecological and cultural sustainable development of Libo heritage's resources should be taken. The self own abilities of local agencies for management should be continuously promoted and the agencies should play key role in development of region and communities.

2.2.2.1 Management of various zones of the nominated sites

The areas of the Libo nominated sites include two national protected lands: Maolan National Nature Reserve and Libo Zhangjiang River Scenic Area.

2.2.2.1.1 Range and protected objectives

(1)Maolan Nature Reserve

① Core Zone 1:Range: South boundary (temporary) of the Nominated

Sites is the border between two Counties of Libo County of Guizhou Province, where Maolan Nature Reserve falls into, and Huangjiang County of Guangxi Zhuang nationality Autonomous Region where the Mulun Nature Reserve is. The space of the nominated sites ranges from Gengcha, Gengdu, through Wanlika, Sibeidong, Bailishan, Limingguan to Luojiadong, ganshua, dongwa, including Dongyangshan, dongduo, and the total area is 8305hm^2. Protected Objectives： Intact and distinctive pristine Karst forests, karst plant communities, abundant rare and endangered species of plants and animals, rich species endemic to Libo and their habitat, serial conical karst landform and other associated karst landscapes.

②Core Zone 2:Range:： Core zone 2 is outside part of the first core zone with area of 8130 hm^2.Protected objectives： Nearly intact karst forest ecosystem, abundant biodiversity, some communities of scrubs, liana, mixed communities of brushes and grass, all of which display a complete of karst vegetations evolutions; serial conical karst landforms, hydrogeological systems.

③Core Zone 3:Range:including four patches with area of 2935 hm^2： Raogu and Raolan of Yongkang Village; Bagong, Mogan, Dongchang of Wengang village; Banzhai, Jichai of Dongtang village; Yaosuo, Tangbian, Dongma and Mengzhai.

Protected objectives： Serial conical karst landforms and associated karst

landforms, hydrogeological systems, and restoring karst forests. In the eco-tour area, area special for ecotour development, and located at the northeast part of the Maolan Nature Reserve with total area of 1915 hm^2, main attractions including qinglongtang pool, Golden Lion Cave, Jiudongtian, karst sink forest, and Huangyang groove, brook scrubs and Laya Waterfall, and etc.. Protected objectives is karst forest landscapes and their environment, and ethnic culture and villages, Karst landforms, etc..

(2) Zhangjiang River Scenic Area

①Xiaoqikong scenic area:Range and location: The south part of the Libo Zhangjiang River Area and located at Yaoshan Villages of Libo County, area being 4640 hm^2. Protected objectives: Karst gorges, brooks and water landscapes, caverns and waterfalls, tufa landscape, and karst forest landscapes.

② Daqikong scenic area: Range: from Daqikong Cove to Di-E-DongCave, and area being 3620hm^2.Protected objectives: Karst gorge forest, cave and gorge, natural bridge, and conical landforms.

2.2.2.1.2 Measure for management of core zones

(1) For management of the Core zone 1 of Maolan Nature Reserve and the special protected zone of the Libo Zhangjiang River Scenic Area

- Fairly and justly readjust the land tenure and its management in the core

zones for the purpose of effective protection of the heritages in two National protected lands in accordance with the laws and regulations

- combine legal protection with traditional conservation according to local customs in order to maintain natural conditions for evolution of the local vegetation and conical karst landforms
- perfectly preserve the serial conical karst landforms, karst virgin forests, numerous rear and endangered species of plants and animals with their intact environment, and conserve the natural conditions of hydrogeological systems, and the diversity of fengcong, fenglin and other associated landforms along with karst vegetations in the two protected lands
- prohibit construction and production, such as mining, quarrying, tree felling; avoid fire disasters
- create habitats suitable for the evolution of artificial forests so that they may resemble local vegetation, especially fostering and replanting local seedlings
- forbid illegal hunting and water pollution in the zone
- allocate lands for monitoring and studying and limit the number of people allowed into the zones
- strictly control various trails to the core zones, including animal-driven carts
- Replanting along the present roads with local trees

- Strictly protect secondary forests and take effective measures for natural restoration of them
- Investigate exotic species and control invasive species

(2) For management of other core zones in two protected lands

- strictly protect the natural conditions of serial conical karst landforms, and prohibit any activities that would damage the landforms and relief, except for building basic tourist walking routes and sightseeing facilities
- prohibit the construction of any facilities that are of no interest to sightseers, and control the amount of vehicles allowed into the Zones, and demolish those buildings which are obstacle for natural scenery viewing
- control any facilities which would spoil the beauty of conical karst landscapes and its wilderness, and keep in mind those visitors who just want to experience conical karst wildness
- Landscape the borders of transportation routes such as roads with seedlings of local and attractive exotic species both for appearance and to disperse local species
- strictly confine expansion of rural housing and maintain the traditional styles of architecture while improving rural infrastructure
- restore the natural environment of water reserves by returning the farming and grazing land beside the waters to vegetation
- forbid tree felling, mining, quarrying, and illegal hunting, and protect the

zone from fire disasters

- control sewage
- Carefully protect secondary forests and promote them towards to local climax communities
- Investigate exotic species and control invasive species

2.2.2.2 Protection and management of the buffer zones

The buffer zones defined here include the outside protected zones of the Maolan Nature Reserve and the Da-Xiao Qikong Spots of the Libo Zhangjiang River Scenic Areas.

2.2.2.2.1 Range and objectives

(1)The Maolan Nature Reserve: Rang: Boundary protected zone of the Maolan Nature Reserve; Objectives: Serial conical karst, Hydrogeological systems, and pastoral scenery

(2) The Da-Xiao Qikong Spots of the Libo Zhangjiang River Scenic Areas: Range: Boundary protected zone of the spots; Objectives: Karst gorge, brooks, karst landforms, hydrogeological systems, Ethnic cultures, Buyi nationality village, Shui nationality village, Zhangjiang River, and Pastoral Scenery.

2.2.2.2.2 Measures for the buffer zones

- Strictly protect the natural conditions of conical Karst and prohibit any

activities that would damage the landforms and relief, except for building basic tourist walking routes and sightseeing facilities

- Prohibit the construction of any facilities that are of no interest to sightseers, and control the amount of motor vehicles allowed into the Zone
- Control any facilities which would spoil the beauty of natural landscapes and its wilderness, and keep in mind those visitors who just want to experience Libo karst, and karst forest landscapes, etc.
- Landscape the borders of transportation routes such as roads and railways with seedlings of local and attractive exotic species both for appearance and to disperse local species
- Strictly confine expansion of rural housing and maintain the traditional styles of architecture while improving rural infrastructure
- Restore the natural environment of water reserves by returning the farming and grazing land beside the waters to vegetation
- Forbid tree felling, mining, quarrying, and illegal hunting, and protect the zone from fire disasters
- Control sewage
- Investigate exotic species and control spreading of invasive species

2.2.2.3 Construction of the administrative network and scientific monitoring station

- Continue to improve 11 administrative stations and one orientation

station: Sancha River Station, Banzhai Station, Dongtang Station, Mengzhai Station, Gaowang Station, Yongkang Stationn, Weng'ang Station, Huada Station, Jidong Station, Small Qikong Station and Liangzaixin Maolan Karst Forest System Orientation Station.

- Plan to construct a karst orienting observing station, 20 permanently monitored sample places, one natural museum, a rescue center for rare animals, arboretum for rare plants' and one foster center for Maolan Nature Reserve.
- Continue to improve a scientific research and education base

2.2.2.4 Scientific Popularization and Exhibition

2.2.2.4.1 Exhibition Improvement Program

(1) **Terminus:** Terminus would mainly used on the boundary of each function area, like mountain ridge, river turn, border crossing with high way, path and river. Totally, there would be 3000 terminus.

(2) **Signs:** 12 signs would be put on the crossings, borders and entrances of main roads in the nominated site.

(3) **Limitation Signs:** 18 limitation signs would be put on crossings of the boundary and highway, stations and main entrance of the mountains.

(4) **Explanation Signs:** 32 explanation boards would be put on the

crossings pf the reserve and communities, main crossings in the nominated area, tourist sight and main entrances of each administrative station.

(5) **Gates:** Gates are buildings that show the architecture of the nominated site as well as signs to remind people to protect the natural resources. 4 gates are planned to build in Liangshuijing, Sancha River, Bage and Gaowang, which need to be elegant and harmonious to the surrounding natural and forest scenery.

2.2.2.4.2 Visitor Center or Natural Museum

It would be a place that concentrate on exhibit Libo karst landforms, forest system, rare and endangered species and their scientific and economical values and at the same time raise people's awareness of protection, demonstrate natural and cultural history.

Set up a natural museum at County town and improve two visitor centers respectively in Maolan Nature Reserve and Xiaoqikong Scenic Spot, and the displaying items as following:

- natural history and regional geology of the two protected lands
- Conical karsts: types and shapes, evolution and relics, scientific and aesthetic significance, and modeling demonstration
- hydrological systems and water reserves
- Virgin Forests and biodiversity in the reserve and scenic area

- history of local nationalities and their cultures
- new ways for protection and sustainable utilization of the protected area's resources
- displaying other karst landforms around the globe
- outline the prospects of the two protected areas in both protection and development

2.2.2.4.3 Improvement of books, albums, tourist maps and booklets, VCD and DVD

- heritages and their sites in the protected and their resources
- ethnic cultures and cultural attractions
- the protective ordinances and regulations related to the protected areas
- touring and recreational maps in the protected areas and the county
- natural history and wilderness of the Libo County
- biodiversity of the protected areas and outlines of ecological restoration
- publications about the protected areas, for example, study of achievements, biological, geological, cultural and historical
- a variety of VCDs and DVDs about the protected areas

2.2.2.4.4 Scientific popularization and training residents

- Information for tourist visitors: set up a Maolan karst center of environmental education, edit publications, for example of books, periodicals, pictures, films and TV programs; erect signs for karst and protection on the tour routes..
- Educating residents of villages near to the nominated sites: Scientific popularization about karst, Nature Reserve and Scenic Areas, regulations related, and provide practical skill training for residents, erect popularization signs along the border of the nominated sites.
- Vocational training: Provide vocational training for local residents, and make each family have one or two practical skill for improving family income, train the youth in skill and knowledge for exporting skilled workers, and also train staff and residents for tour guiding and ethnic tourist souvenirs;
- Establish base for teaching and field practices: open the fixed-field stations and research projects to universities/schools and scientific institutes and invite experts and scholars for management of the protected areas.

2.2.2.5 Road Construction

The main tasks here are to construct tourist road, fireproofing line and footpaths in the reserve. And build fireproofing high way and patrol road.

2.2.2.6 Communication Program

The main strategy here is to combine lineate and wireless communication in the area. The administrative stations of Sancha River, Gaowang, Mengzhai and Banzhai would use wireless communication and the other farther places would still use lineate communication.

2.2.2.7 Community-participated managing program

The aims of the programs here are to provide agricultural technique and skill trainings to the villagers and establish bio-agricultural model households and villages. To develop court yard economy, plant trees and revegetate the wasteland and slopes. To promote participatory managing work to push rural industrial structure adjustment. To control the growth of the population and improve the community environment so as to better protect the forest resources and biodiversity and finally push the community's social and economical sustainable development.

2.2.2.7.1 Capacity building project for community members

(1) **Protection awareness raising for nearby inhabitants**

- Awareness raised in the communities and schools. Give 2 batches of trainings to 60 students in middle and primary schools every year.
- Build board for awareness raising information

(2)Vocational education

- Give vocational education to the community members and give them trainings on useful techniques and skills. Let the local community people at least can learn one to two useful techniques per household.
- To give trainings on labor migration and quality trainings
- Capacity building training for administrative staff to improve their self-developing ability
- Tour guide training
- techniques trainings for developing tourist and tourist products(like local handicrafts, dancing and singing and clothing)

2.2.2.7.2 Rural energy project

(1) **Biogas:** To build 1000 biogas pools

(2) **Energy-saving kitchen range:** To take measurement to save firewood and energy for 500 households in 61 natural villages of 12 administrative village's experimental area, Buffer Zone and area near the nominated site and build 1000 energy-saving kitchen range.

(3) **Establish firewood base:** 133.33km^2 firewood will be planted in the proper waste and uncultivated land.

2.2.2.7.3 Establish shelter belt

Close 2333.33km^2 forest, plant 666.67km^2 forest and return 333.33km^2 to forest.

2.2.2.7.4 Establish base of wood forest and economical fruit trees

(1) **Wood forest base:** Establish 200 km$^{2\ wood}$ forest bases

(2) **Economical fruit tree base:** To plant peanut, pear, peach, plum, grape and bamboos on the slope and land that is above 25°for about 133.33 km^2

2.2.2.7.5 The best industrial structure model for the surrounding area

Deep develop producing potential of grain, animal raising, economical fruit trees and Chinese herb production. Take market information as guide of production and depend on high techniques to push the development of the rural economy for reducing villagers' activities' harm to the natural resources.

2.2.2.7.6 Population control and community development

Relocate residents of the core zones, especially in the core zone of the Maolan Nature Reserve and the Special protected Zone of the Libo Zhangjiang River Scenic Area; control size of population and settlements in the Buffer Zones; to guide the labors in the nominated site to the third industry (service industry) and take local labors' migration. The planned resettlements include the following four types.

- Relocated settlements: those villages which will impact the karst virgin forests and their integrity, and planned ecological and landscape restoration;
- Reduced size of settlements: those villages which are in the buffer zone of Maolan Nature Reserve and the first-class and second–class protected zone and lager size of populations, such as Banzhai, Bantang. Measures for these villages are control the spreading of villages, and reduce the size of settlement, and modify the village' industries' structure, and local labors immigration, and maintain natural restoration of damaged forests, and cultivated pastoral scenery.
- Controlled settlements: Those villages which are in the buffer zone of the Maolan Nature Reserve and the first-class protected and second-class protected zones, such as Raolan, Raogu, Laguan, the measures for these villages include controlling size of population, and developing local special industries, and modify family energy structure.
- Developing settlements: Those villages which are in the buffer zone and outside zone of the Maolan Nature Reserve and the third zone and outside protected zone of the LiboZhangjiang River Scenic Area, such as Jiaou, Dongtang,; the measures for such villages include develop present industries, forbid activities and factories which will result in polluting events; control and embellish appearance of the villages, and

maintain ethnic architecture and cultivate local trees outside family.

2.2.2.8 Projects for Ecological and Landscape Restoring

- Stop any commercial activities that would do harm to the completeness of the scenery and to demolish buildings in the nominated site to restore the natural scenery.
- To restore the forest and vegetation on both sides of Zhangjiang River and roads in Maolan Reserve.
- Solve water and soil erosion problem in the Buffer Zone and plant trees in the surrounding mountains and forbid woodcutting.， cultivate and restore pastoral scenery
- Transforming circuitry of electricity and information underground instead of overhead ones.
- Establish local species seedling base

2.2.2.9 Program for economical development

2.2.2.9.1 Tourist program

In the Maolan Nature Reserve, the area around Sancha River would be developed as bio-tourist zone with wonderful scenery in karst forest and colorful ethnical culture. It would be a base for promoting information of karst forest protection. This area would also include Huangyanggou Scenery Site, Wangpai Mountain Virgin Forest Site and Banzhai Site inside. The receiving

capacity of Sancha River Zone would be 1890 people per day and totally 472,500 people yearly.

In Libo Zhangjiang River Scenery Site, we plan to develop more products and interest from tourist products in Big Qikong, Small Qikong, Shuichun River and Zhangjiang River. The big and small Qikong can receive 1,500 people per day, Shuichun River 700 people and Zhangjiang River 1200 people per day. The whole Zhangjiang River Scenery Site can receive 2,040,000 people yearly.

2.2.2.9.2 Program for multiple business development

① **Planting:** build 1333.33km^2 plum plantation; Build 333.33km^2 raw material processing base for bamboo products; Chinese Herb plantation:

- *Dendrobium candidum* Wall plantation: perennial herbage, build a plantation of 333.33 hm^2。
- *Radix isatidis* plantation: Isatis indigotica Fort., It's an important material of China medicine。Build 200 hm^2。
- *Korjac* plantation: korjac, health-care food, is a nessray part for many Chinese medical products. Build a plantation of 200 hm^2.

② **Processing industry and the Third Industry**

(1) **Plum processing project**

(2) **Tourist products developing project**

Developing bamboo products, which including bamboo mat, pillow, cushion and cany basket, hat, plate and particular ethnical products like clothing and silver.

2.2.3. Improving Management Network and Staff abilities

On the basis of laws and regulations related, the strategy for improving management network and staff abilities include: leading by Government, Supervising by Experts, and carrying out by special organizations qualified for management of the Reserve and Scenic Area, jointly participate by all stakeholders of Communities (town and Villages), residents and enterprises and other related. The aims are to establish a sound management network and improve management organ, create a mechanism coordinated for the management, and training staff abilities and finally realize the ends of the nominated sites management.

2.2.3.1 Management network

- Though Libo Karst Nominated Site is composed of two protected areas (Maolan Nature Reserve and Libo Zhangjiang Scenery Site), which belongs to different administrative system, Libo government is the actually direct supervisor of the place, please see the management chart of the nominated site in the follow set up

management organizations and supervision systems matching Libo National scenic area on the basis of the laws and regulations

- perfect the duty system and operational mechanism for all levels of management from the government of Libo Yi Autonomous County, the Management Bureau of the Libo National Scenic Area, down to villages and towns, social communities, staff and all of its employees
- establish an efficient internal organ of the Management Bureau for Libo National scenic Area and Nature Reserve to effectively carry out the duty system of the two protected areas
- improve the group of scientific and technical advisors and perfect the technical aid system for the two protected areas' management
- perfect the negotiating system for dealing with complaints and conflicts among the related departments of the governments, the bureau, communities, enterprises and investors, local inhabitants and the qualified units
- reform the management mechanism and improve the conditions of the bureau to ensure the effective protection of the values and integrity of the two protected areas

2.2.3.2 Supervising organization and personnel

2.2.3.2.1 Staff

There are 102 full-time staff and more than 500 part-time ones in the

nominated site. The proportion of the professional now bellows 30%. In the future, staff for scientific research and technical support would take 52% of the total number of staff; staff for protecting work would be 32%. The professional staff would include people working on biology (zoology and botany), geology, management, forestry, gardening, natural heritage management, tourist management, computer and information. The nominated site would actively seek for cooperation with international organizations, professional staff, scholars and consultants.

2.2.3.2.2 Supervising organization

Though Libo Karst Nominated Site is composed of two protected areas (Maolan Nature Reserve and Libo Zhangjiang Scenery Site), which belongs to different administrative system, Libo government is the actually direct supervisor of the place, please see the management chart of the nominated site in the following picture: The management organizations and educating and training of staff, including partners

(1) Management organizations: their functions

- set up management organizations and supervision systems matching Libo National Park on the basis of the laws and regulations
- perfect the duty system and operational mechanism for all levels of management from the government of Libo Yi Autonomous County, the

Management Bureau of the Libo National Park, down to villages and towns, social communities, staff and all of its employees

- establish an efficient internal organ of the Management Bureau for Libo National Park to effectively carry out the duty system of the Park
- improve the group of scientific and technical advisors and perfect the technical aid system for the Park management
- perfect the negotiating system for dealing with complaints and conflicts among the related departments of the governments, the bureau, communities, enterprises and investors, local inhabitants and the qualified units
- reform the management mechanism and improve the conditions of the bureau to ensure the effective protection of the values and integrity of the park.

(2) Management and educating and training of staff: steps

- set up an efficient staff team qualified for carrying out the management of Libo National Park for both professionals and specialists (70% of the staff consists of professionals and specialists)
- clarify the responsibilities for each post and carry out a comprehensive quality assessment
- continue the post management system consisting of the post qualification, post achievement, training in advance of taking post, scheduled post

examination and on-the- job training

- set up an efficient education and training system for all the staff, from on-job training to off- work training for improving the employees' ability
- edit a training text book about the values, protection and development of the Park, from techniques to related laws and regulations, for staff, local people and all stakeholders
- set up a mechanism for communicating experiences and skills, and discussing the Park's management

2.2.4. Financing the Park and distribution of management resources

The resources for the Park's management include professionals, funds and devices, information and land.

2.2.4.1 Funds and allocated lands from all-levels

- the central government, provincial government, and municipal and local government, to the donations of persons, groups and enterprises
- income from the tourist industry in the Park
- donated devices and volunteers' service

2.2.4.2 The distribution resources

- all the resources are distributed under the plan as a whole by the government and managed directly by the Management Bureau of Libo

National Park

- all of the resources must be controlled and partitioned by the Management Bureau of Libo National Park on the basis of reasonable mechanisms accepted by all stakeholders
- the resources must only be used in protecting, restoring, engineering and monitoring, staff training, scientific popularization and education for the Park
- resource use must be strictly supervised and self management of the Management Bureau of Libo National Park improved, with scheduled publishing of the resources to the public and the stakeholders

2.2.4.3 Budget for recent important projects

The recent projects here mean the projects would be done from 2005 to 201. The total investment for the projects would be 267,538,200 Yuan.

- 40% of the protection project;
- 17 % for scientific research and exhibition;
- 6% for community development;
- 8% for construction of infrastructures;
- 9% for bio-tourist projects。
- 12% for restoring the ecological system and natural scenery
- 8% administrative management

2.3 Wulong Nominated Site

2.3.1 Related Plans, and Laws and Regulations

The nominated properties have been designated as a National Park and a National Geopark. This status confers protection under the law.

Planning documents relevant to the protection of the nominated areas

(1) Tourism resources exploitation plan of the part of Furong Jiang in Sichuan, China Southwest University, January 1995

(2) Wulong County's national economy and social development for the ninth Five-years plan and long-range object of 2012, Reformation Committee of Wulong County , 1996

(3) The overall plan of land use in Wulong County, Bureau of Land and Resources of Wulong County, 1999

(4) The tourism exploitation overall of Sanqiao, Difeng and Sancao, City Plan Center of Wulong County, May 1999

(5) The Wulong County tourism exploitation overall plan, Institute of city development, Chongqing Social Academy, December 2000.

(6) Wulong County's national economy and social development for the tenth Five-years plan and long-range object in 2017, Reformation Committee of Wulong County, 2001

(7) The overall plan of Wulong County, Wulong County People's Government, 2001

(8) The overall plan of Furong Jiang National Park, Chongqing Park and Building Plan Institute, January, 2001

(9) The overall plan and detail plan of Baiguo Karst Fissure Gorge in Wulong, Chongqing Park and Building Plan Institute, March, 2001

(10) The overall plan of Wulong Karst National Geopark, Chongqing by

Evaluation Center of Geopark and Geological Heritage Investigation of Sichuan Province, February 2002.

(11) The overall plan of Furong Jiang of Wulong National Park, Institute of Planning and Design of Chongqing University, May 2006.

(12) The overall plan of Karst Geopark in Wulong, Chongqing, Evaluation Center of Geopark and Geological Heritage Investigation of Sichuan Province, June 2003

(13) The development overall plan on tourism industry in Wulong County, Urban Planning and Design Center of Beijing University, December 2004.

(14) The overall plan of Mount Xiannü National Forest Park (revised), Chongqing Institute of Forest Planning and Design, July 2004.

(15) The overall plan of Sanqiao Natural Bridges of Wulong National Park, Chongqing Renhao Urban Planning Design Co. Ltd, August 2004.

(16) The plan of ecological construction (forest) (2006-2020), Administration of Forest of Wulong County, July 2005.

(17) The Eleventh Five-year Plan and the planning outline of 2020 of Environmental Protectio, Administration of Environmental Protection of Wulong County in October, 2005.

(18) The protection and management plan of Wulong Karst, Institute of Karst Geology, Ministry of Land and Resources, November 2005

(19) The management plan of Furong Dong Protection, Institute of Karst Geology, Ministry of Land and Resources, March 2006

(20) The plan for environmental protection and ecological construction in the nominated area of Wulong Karst（2006－2020）, Wulong County People Government, April 2006

(21) The overall plan of Houping National Park, Administration of Historic

and Interest of Wulong County, August 2006

Laws relevant to the protection of the nominated areas

(1) The provisional regulation of National Park management, State Council, June 1985
(2) The managed regulations of National Park construction, Ministry of Construction, December 1993.
(3) The penalized regulations of National Park construction, Ministry of Construction, November 1994.
(4) The managed regulations of geological relics protection, Ministry of Land and Resources, May 1995
(5) The managed regulations of National Park of Chongqing Municipality, Chongqing Municipal People's Government, 1998
(6) The policing method of Furong Jiang National Park in Wulong County, Wulong County People's Government, September 2002
(7) The policing method of aquatic traffic safety in Furong Jiang National Park, Wulong County People's Government, August 2003
(8) The responsibility of union law enforcement agency in Furong Jiang National Park, Administrative Department of Furong Jiang, September 2003
(9) The decision on strengthening practically tourism resources conservation, The 14th session of the Standing Committee of the National People's Congress 38th conference of Wulong County
(10) The provisional regulations of Wulong karst natural heritage protection, Wulong County People's Government, July 2005
(11) The circular on protecting practically resources of Furong Jiang tourism site, Wulong County People's Government
(12) The circular by union law enforcement agency in tourism site of Wulong

County

2.3.2 Delimited Boundaries

The nominated properties are well protected because the core and buffer zones of the three karst systems have been clearly defined.

Systems	Nominated Area(km^2)	Buffer Zone(km^2)
Furong Dong – Furong Jiang	30	250
Sanqiao Natural Bridges	22	60
Houping Erosional Tiankengs	8	30

2.3.3 Organizations

Wulong County People's Government has established administrative organizations at county, town, village, and community levels with a total of 1228 staff. These organizations are managed by the Ministry of Construction and Chongqing Municipal Bureau of Parks.

An effective management system has been established. The Administration of Scenic and Historic Interest of Wulong County has established a Heritage Management Office, a Planning and Construction Office, a Security and Protection Office and a United Law Enforcement office, as well as three management sections for Furong Jiang, Sanqiao and Houping, with a combined staff of 101.

Local residents have been invited to be conservators, and to assist in monitoring and protecting the nominated properties and the buffer zone.

2.3.4 Guaranteed Resources for Funding

Since the discovery of Furong Dong in 1992 the People's Government of Wulong has invested significant funds into protecting its natural resources.

Each year the Chongqing People's Government budget allocates 13 million Yuan for the protection of Wulong Karst. These funds, together with 6 million Yuan budgeted annually by the Wulong People's Government and 1 million Yuan received from tourist tickets, the annual budget for the protection of Wulong Karst reaches 20 million Yuan.

Budgeted projects include,

- Ecological construction of forest land
    - Conservation of water and soil
    - Grassland protection
    - Thin forest transformation
    - Forest protection
    - Fire prevention
    - Biodiversity
    - Dynamic monitoring
    - Grass irrigation

- Soil erosion prevention
    - Logging prohibition
    - Tree protection
    - Water and soil conservation

- Ecological migration project
    - Relocation of residents from ecologically sensitive areas
    - Promotion of non-polluting energy sources

- International cooperation
    - Resources investigation
    - Scientific research

2.3.5 Community Participation

Local communities are generally environmentally conscious and have a deep-rooted desire to protect their scenic resources, as these are regarded as sacred and precious. These areas have been protected for generations without government involvement due to the inhabitant's civic sense.

Local folk culture includes many songs, ballads, myths, and fables which express respect for the natural landscape. For example, blind transparent fish are thought to be the soul of the naughty little son of the god of thunder. Area inhabitants hold geomantic beliefs, that by living in harmony with the forces of nature they will be protected and blessed with peace and happiness.

Local inhabitants have spontaneously formed a conservation party to compile local records, to construct informational stone tablets and to distribute pamphlets. They further organized inspections to prevent deterioration of the natural landscape

2.3.6 Next Steps

This area has been planned under Chinese rural planning laws and guidelines and within the regulations of the National Parks and National Geoparks that have been established by central government as mentioned above.

If the application for World Natural Heritage succeeds a whole new level of media exposure is anticipated and tourist numbers are bound to increase; plans implemented at present must be revised to take account of this. For example, development pressure from investors eager to cash in on an expected increase in tourism is well controlled within the core zone and buffer zone areas of the site, but additional planning may be required to ensure that such development is not allowed to sprawl throughout areas adjacent to the buffer zone, devaluing the entire area; to protect the nominated areas and the communities within, a planning system will have to be implemented that acknowledges the significance and uniqueness of the area, balances protection and development and caters for an increased number of visitors; covering design, land-use planning and environmental impacts. Therefore, a range of planning studies will be undertaken to continue the protection of these sites in anticipation of increased visitor numbers. The following studies are to be carried out:

- A tourism management plan including forecast of expected tourist numbers, and capacity considerations.
- An environmental impact plan including solid waste disposal, freshwater and wastewater management plans.
- A social development and social impact plan.
- A zoning plan for the allocation of tourism development zones for hotels, restaurants and other tourist infrastructure as well as a location

plan for interpretation centers and souvenir shops

- A transport management plan including alignment of access roads, parking, footpaths and sightseeing spots.
- A design plan concerning visual impacts, street furniture and signboard design as well as urban design of building/hotel clusters.

3 Ask: What is the ppossibility of extending boundaries of some buffer zones to include fuller catchments and to extend Maolan into Guangxi?

3.1 Extending boundaries of some buffer zones to include fuller catchments

There are boundary and drainage integrity issues at the nominated sites of Libo in Guizhou. The drainage systems associated with Libo nominated site involve the Huanghou Underground River, Fangcun River in Daqikong， and the Maolan River all comprising an area 1012 km^2. Traditional farming is practiced areas in these drainage areas, so the threats from upstream involve mostly silt from soil erosion by water and soluble agricultural chemicals. If the boundary were to follow the watershed then the area of the buffer zone would be too large a ratio for effective management. Instead we will promote integrate catchments management, including planning for environmental rehabilitation and effective control of threats from the exterior area fro 45 years.

At present, the serial ecological environmental recovery and protective measures, such as closing mountains for afforestation, retiring arable land for afforestation and grass planting, management and protection of the woodlands, partial ecological immigration and rural energy constructions which reduce demands on timber resource, have been developed.

3.2 Possibility of Extension of Maolan into Guangxi

A typical ecological system of evergreen deciduous mixed forest of mid-subtropical Fengcong karst extends from the Libo Nominated Site, Guizhou Province, into Guangxi Zhuang Autonomous Region. In Guangxi Zhuang Autonomous Region, it belongs to the Mulun National Nature Reserve, located in the northwestern parts of Maonan Autonomous County of Huangjiang. This has a common boundary with the Maolan National Nature Reserve in the northern part. The Mulun National Nature Reserve is 19.80 km from east to west, 10.75km from south to north and covers 89.690km^2 (8969 ha) of which 84.997km^2 is forest.

The karst of the Mulun National Nature Reserve is well developed with a variety of karst landforms. Fengcong karst is dominant. Its special landscape is complex and provides a variety of habitats with rich biodiversity. And the karst forest is perfectly protected with up to 94.8%of the forest cover still intact. The special karst forest ecology here is very rare in the world with high conservation value and research value. There are a total of 915 species (173 families, 522 genera) belong to tracheophyta in the nature reserve. Among the plants, there are 64 species of pteridophytes, 11 species of gymnosperms and 840 species of angiosperms. Within the reserve, 21 species of flora are listed as national key protected species, including Pseudotsuga brevifolia, Manglietia aromatica, *Eurycorymbus cavaleriei, Handeliodendron bodinieri*

and *Heteroplexis vernonioides* etc. About 13 new species have been discovered. The communities with the edificators of *Calocedrus macrolepis*, *Kmeria septentrionalis* and *Phoebe kwangsiensis* etc. are scattered throughout the area. There are 260 species of vertebrate fauna, including 48 species of mammal (70 families, 26 orders), 148 species of birds, 47 species of reptiles, and 17 species of amphibians. Among these, 29 species are listed as the national key protected wild animals, such as leopard, boa, macaque, pangolin and black bear.

The sites to be nominated in Phase II of "South China Karst" in 2008 or 2009will include the Mulun Natural Reserves of Guangxi Zhuang Autonomous Region. The Local government of the Mulun nature reserve has invited experts to write the report for World Natural Heritage Nomination and management plan. The People's Government of Hechi City administrating the nature reserve has recently made an application to the leading group of *South China Karst* Nomination for World Natural Heritage for the extension or nomination of *South China Karst* Phase II.

4 Ask: What is the plan for the next phase of the nomination? When and what further sites might proposed? What additional features and values will they bring to the overall nomination? Are the local governments willing to include these sites in a World Natural nomination?

4.1 Nominated Sites for Phase 2 and the Timing

It is planned to nominate Phase II sites in 2008 or 2009. The nominated sites in the Phase II of "South China Karst" include Yangshuo in Guangxi, Xingyi in Guizhou, and Jinfeshan in Chongqing and Mulun in Guangxi. The local governments of these nominated candidates have invited experts to write reports for World Natural Heritage Nomination and make Management Plans. The additional features and values that can be brought to the overall nomination of "South China Karst" are as below:

Yangshuo Karst (Guangxi): Yangshuo karst is located in Yangshuo County of Guangxi Zhuang Autonomous Region. It demonstrates perfection of the karst landform *fenglin tower karst*. This most dramatic karst landscape has isolated, steep-sided towers rising 50 to 100m above the surrounding countryside. *Fenglin* is regarded as an extreme karst type that is restricted to areas in the wet tropics that have a history of tectonic uplift. *Fenglin* are features of long and uninterrupted karst development. Guilin-Yangshuo is the typical location for this karst landform. It is the *fenglin,* standing isolated on

plains that have given the Guilin-Yangshou karst its international reputation for scenic beauty. Without doubt Guilin-Yangshuo karst is one of the World's most dramatic karst landscapes and has always been an outstanding inspiration for China's artists. These karst landforms have been observed, recorded and studied by karst scientists since the 16th century, beginning with the Chinese scientist Xuxiake (1587-1641). In recognition of the great importance of this site for karst research it was chosen as the location for the Chinese Institute of Karst Geology.

Xingyi Karst (Guizhou): This site lies in Xingyi City, south Guizhou Province. At this site the *fengcong* karst landscape is exceptional and diversity and within its 49 km^2 there can be found three cone karst type: pyramid cones, island cones and cluster cones. In a valley within the *fengcong* there is excellent illustration of the transition from *fengcong* karst to *fenglin* karst which has the unique importance of cone karst landscape and aesthetics and also illustrated the tropical-subtropical continental karst evolution. This is the location where Guizhou Dragon fauna fossils have preserved paleobiological evidence of evolution for 230 million years and it exhibits a continuous evolutional history from the Cenozoic to the present.

Jinfoshan Karst (Chongqing): The site lies in Nanchuan City, south Chongqing. Because of the special geomorphology and climate, it is isolated and almost unaffected by human activities. It contains pristine natural

environments with a large area of virgin forest, a range of vegetation types and complex floral communities. It provides a safe habitat for rare and protected endemic fauna. Because of its special geology and climate it has developed highly unusual terrain. The site is exceptional for research programs in the fields of vegetation evolution, paleobiology, paleoclimate and paleogeology.

Mulun Karst (Guangxi): it is the extension zone of the Libo Nominated Sites and is located in the northwestern part of Maonan Autonomous County of Huangjiang, Guangxi Zhuang Autonomous Region, where joints to the Maolan National Natural Reserve in its northern part. It is 19.80km from east to west, 10.75km from south to north and covers 8969 ha. It belongs to the ecological system of the subtropical limestone the evergreen deciduous mixed forest. The karst geomorphology of the Mulun National Nature Reserve is well developed with a variety of karst landforms. There the Fengcong karst is dominant with special landscape, complicated and various habitants, rich biodiversity. And the karst forest, covering 84.997km^2, is perfectly protected with coverage up to 94.8%. In addition, the shrub forest cover 0.611km^2 with coverage up to 95.4%.

4.2 Nominated Sites for Phase 3 and the Timing

It is planned to nominate sites in the III phase of "South China Karst" in 2011 or 2012. These will include Zhijin Dong in Guizhou, Fengjie in

Chongqin, Xingwen in Sichuan and Nonggang in Guangxi. The local governments of these nominated candidates have organized the experts to investigate the nominated candidates and make preparation for World Natural Heritage Nomination and management plans. The additional features and values that can be brought to the overall nomination of "South China Karst" are as below:

Zhijin Cave (Guizhou): The cave is in Zhijin County, Guizhou Province. The cave caverns and passages have unusual shape and form, and contain complex sedimentary sequences. The abundant calcite speleothems in this cave are of great beauty and with the beautiful landscape forms the rare subtropical scene. The multi-level character of Zhijin Cave and its multiphase sediments makes it an extremely fine example of cavern evolution and source of paleoenvironmental information. In this cave, there are 184 *Cyanophyta* preserved.

Fengjie Karst (Chongqing): This karst lies in Fengjie County, Chongqing, and comprises of Xiaozhai Tiankeng, Tianjinxia Gorge and their associated karst landscapes. Xiaozhai *Tiankeng* is the Chinese term for a giant collapse doline and Xiaozhai Tiankeng is the largest of these in the World. These features are of immense scientific importance and aesthetically spectacular. Xiaozhai Tiankeng and Tianjinxia Gorge are fine examples of Quaternary landform evolution and have provided invaluable natural refuges for

vegetation during the Quaternary glaciations. The isolated environment developed within Xiaozhai Tiankeng is of special value for ecological research.

Xingwen Karst: (Sichuan): The site lies in Xingwen County, southeast Sichuan Province. It is considered to be a natural karst landscape museum because there are many kinds of major karst features within only several hundred square kilometers. The complex karst landscape has developed from an integrated hydrogeological system comprised of surface water and groundwater drainage which is of significance of karst geomorphology and hydrogeology. Here there are 17 species of protected native plants of national importance and 30 species of protected animals of national importance. The site was the habitat of a fossil plant, *Sinopteris grevilleoides,* and the fossil fish, *Megalobatrachus davidianus* which make it to be the outstanding representation of subtropical karst ecosystem in upstream of Yangtse.

Nonggang Karst (Guangxi): it is located in the southwestern China, in Longzhou County and Ningming County of the Chongzuo City in Guangxi. It is a long terra block from WN-ES with 33.53km from west to east including Longhu, Nonggang and Longshan. The area covers 10077km^2. Towards south, it merges with the karst evergreen seasonal rainy-forest of the North Vietnam. Main objects or protection include the ecological system of evergreen seasonal rainy-forest in the northern tropical limestone mountainous areas, the rare

animals, such as *Trachypithecus poliocephalus*, *Trachypithecus francois,* and special plants, such as *Burretiodendron hsienmu, Garcinia paucinervis, Camellia chrysantha* (Hu) Tuyama, etc.

5 Ask: Would a transboundary proposal with Vietnam would be possible? (Vietnam recently found the last population of *Black Gibbons* in karst close to the Guangxi border.)

There is a northern tropic Fongcong karst evergreen seasonal rainy-forest ecosystem at the joint zone of China and Vietnam. In China, the parts belong to Nonggang National Natural Reserves, and are located in Longzhou County and Ningming County of the Chongzuo City in Guangxi. And it is the long earth block in the distribution from WN-ES with 33.53km from west to east including Longhu, Nonggang and Longshan, covering 10077km^2.

The karst landscapes of Nonggang Natural Reserves are various including steep Fenglin and Fengcong landscapes with cone shape widely and sharp distributing. The most of the base are connective. There are large underground rivers, and the partial underground river outcrops the earth surface to form the karst windows because of the filling erosion and collapse of the rock beds on the ceiling. The "the first beautiful woman lake" and "the second beautiful woman lake" around the habitants of *Trachypithecus poliocephalus* in Longrui were formed by the widows of the underground rivers.

The timber forest stock is about 5.925×10^5 m^3. The area of forest is about 10285.2 hm^2, the forest coverage is 98.8%. There are abundant plant species in the nature reserve. The sites have an extremely rich biodiversity on plants

that incorporates a total of 1454 species of advanced plants (709 genera and 172 families), among them, there are 91 species of pteridophytes (40 genera, 23 families), 5 species of gymnosperms (3 genera, 3 families) and 1358 species of angiosperms (497 genera, 137 families). Among the plants, *Cycas micholitzii*, *Cycas ferruginea* belong to species of National Key Protected Wild Plants, Class I; 8 species belong to species of National Key Protected Wild Plants, Class II, such as *Burretiodendron hsienmu, Cyathea spinulosa, Deutzianthus tokinensis* and *Horsfieldia hainanensis* etc., 862 species (528 genera, 153 families) belong to economic plants and medical plants. There are many big trees in the reserve, the biggest tree is "king *Burretiodendron hsienmu*" with diameter of 2.99m, height of 48.5m, and lumber bulk of 106 m^3, more than 1.0m of the trees with DBH such as *Garcinia tiactoria, Aphanamixis grandifolia, Cephalomapppa sinenesis* and *Garcinia paucinervis* are a common sight here.

Within the nature reserve, there are 139 species (57 families, 22 orders) of wild animals. 6 protected animal species of National Key Protected Wild Animals, Class I, including *Trachypithecus poliocephalus*, *Trachypithecus francoisi*, *Macaca assamensis, Python molurus* and *Moschus berezovskii*. 21 species belong to species of National Key Protected Wild Animals, Class II, such as *Macaca mulatta*, *Ursus thibetanus, Manis pentadactyla* and *Viverra zibetha* etc. As well some academic and economic species like *Rousettus leschenaulti*, *Harpactes erythrocephalus* etc. are north-tropic representative

species. Medical animals including *Naja naja*, *Ophiophagus hannah*, *Bungarus fasciatus* etc. *Paguma larvata* and *Sus scrofa* etc. are meat animals. Among the animals, including 34 species of mammal (20 families, 7 orders), 74 species of birds (27 families, 11 orders), 23 species of reptiles (7 families, 3 orders), 8 species of amphibians (5 families, 1 order). The richest assemblage of hexapod, number of the species is 565 species (101 families, 14 orders), and the most abundant group is butterfly with 201 species based on the research.

As a new mode encouraged by the World Heritage Committee, the trans-boundary proposal with Vietnam for the World Heritage is not only feasible from the point view of management, but also active for the conservation of world heritages. China and Vietnam, jointed by mountains and waters, have long standing traditional friendships between two countries' people. In recent years, with the intercommunion and cooperation in various fields becoming wider and wider, the cooperation between the two countries get delightful progress in fields of economy and trade, science and technology, agriculture, tourism, etc. Enterprises of both countries have favorable starts in the cooperation aspect of large projects. The people on the frontier of the two countries live in harmony, and the frontier trade develops in order. All of these aspects provide favorable diplomacy guarantee in the course of trans-boundary proposal with Vietnam for the World Heritage.

We shall carry on actively the cooperation of world heritage conservation with Vietnam, and make the coterminous karst areas of Guangxi Zhuang Autonomous Region and Vietnam as trans-frontier proposal world heritage nominated planning in timing. Main protective objects include the eco-system of evergreen seasonal rainy-forest of the northern tropical karst Fengcong, the rare animals, such as *Trachypithecus poliocephalus*, *Trachypithecus francois,* and special planting, such as *Burretiodendron hsienmu, Garcinia paucinervis, Camellia chrysantha* (Hu) Tuyam, etc.

SOUTH CHINA KARST

Table 1-2 Coordinates and superficies (property and buffer zone) of the Nominated South China Karst

No.	Name of the area	Region	Province	Core Zone(ha)	Buffer Zone(ha)	Coordinates of the central point
1248-001	Shilin Karst 1 (Naigu Stone Forest)	Shilin Yi County	Yunnan Province	1,746	4,586	N24°54′32″ E103°21′13″
1248-002	Shilin Karst 2 (Central Stone Forest)	Shilin Yi County	Yunnan Province	10,324	183,44	N24°43′4″ E103°20′39″
1248-003	Libo Karst 1 (Da-Xiao Qikong Cone Karst)	Libo County	Guizhou Province	7,834	8,479	N25°16′38″ E107°42′51″
1248-004	Libo Karst 2 (Maolan Cone Karst)	Libo County	Guizhou Province	21,684	35,019	N25°13′8″ E107°59′31″
1248-005	Wulong Karst 1 (Qingkou Giant Dolinc)	Wulong County	Chongqing City	1,246	3,000	N29°36′09″ E108°00′13″
1248-006	Wulong Karst 2 (Three Natural Bridges)	Wulong County	Chongqing City	2,202	4,000	N29°26′15″ E107°47′50″
1248-007	Wulong Karst 3 (Furong Cave System)	Wulong County	Chongqing City	2,552	25,000	N29°13′48″ E107°54′12″
	TOTAL			47,588	98,428	

ASIA / PACIFIC

SOUTH CHINA KARST

CHINA

WORLD HERITAGE NOMINATION – IUCN TECHNICAL EVALUATION

SOUTH CHINA KARST (CHINA) – ID No. 1248

Background note: The IUCN Technical Evaluation of the Lunan Scenic Area of the Stone Forest, nominated by China as a natural property in 1991, and now part of one of the three components of the current serial nomination (Shilin Karst), was not discussed at the 16th session of the World Heritage Committee (Santa Fe, 1992) because the State Party had requested that this nomination not be examined. IUCN's evaluation noted a number of deficiencies in the nomination including the lack of comparative analysis and demonstration of the outstanding universal value of the site. The State Party submitted on 16 January 2006 the current serial nomination of three clusters as Phase 1 (with two more to come) which is the subject of this evaluation.

1. DOCUMENTATION

i) **Date nomination received by IUCN:** April 2006

ii) **Dates on which any additional information was officially requested from and provided by the State Party:** IUCN requested supplementary information on 18 August 2006 before the IUCN Evaluation Mission. The State Party responses were received in October and December 2006, including responses to all the issues raised by IUCN.

iii) **UNEP-WCMC Data Sheet:** 3 references (including nomination)

iv) **Additional literature consulted:** IUCN (1997). **Guidelines for Cave and Karst Protection.** IUCN WCPA Working Group on Cave and Karst Protection. IUCN (2005). **Geological World Heritage: A Global Framework.** IUCN.

v) **Consultations:** 19 external reviewers. Extensive consultations were undertaken during the field visit with: representatives of the State Ministry of Construction and Ministry of Foreign Affairs in Beijing; Yunnan and Guizhou Provinces; Chongqing City; local government including local mayors; Chinese National Commission for UNESCO; Chinese Academy of Sciences and Kunming Technical University; and Communist Party of China.

vi) **Field visit:** Jim Thorsell, September 2006

vii) **Date of IUCN approval of this report:** April 2007

2. SUMMARY OF NATURAL VALUES

The South China Karst region extends over 500,000 km^2 – an area approximately 1,380 km from west to east, and 1,010 km from north to south, lying mainly in Yunnan, Guizhou and Guangxi Provinces, but also extending into parts of Chongqing, Sichuan, Hunan, Hubei and Guangdong. The South China Karst displays a series of karst landforms in a variety of humid, sub-humid, tropical and sub-tropical climate conditions, and geographical settings.

The nominated property contains a cross-section of key features of the regional geology of the area including the deposition of carbonates up to the Triassic period (250 million years ago) and the subsequent tectonic evolution of the area including three phases of evolution during the Quaternary period (about 2 million years). The geological histories of the mature karst landscapes of the present and the palaeokarst landscapes of the past are "intact" as they were little affected by glaciation. The great variety of karst landscapes in the South China Karst is attributed to 1) the age of the thick accumulations of limestone which has resulted in relatively hard limestone and, in turn, in more stable and massive landforms, and 2) the influence of several phases of tectonic uplift (including a major recent phase associated with the Himalayan orogeny, or mountain building, and associated with the uplift of the Tibetan plateau) causing folding and faulting of the rocks and, in turn, promoting the access of water to corrode and erode the limestone to the current karst forms.

The nominated property of the South China Karst comprises seven protected areas in three separate clusters: the Shilin Karst (2 sites), Libo Karst (2 sites) and Wulong Karst (3 sites) as shown in Table 1. The current serial nomination is intended to be the first phase of a comprehensive series comprising the most outstanding of the sites within the South China Karst (see section 5.2 below). Although the State Party considers

Table 1: Name and size of the nominated core zones and their surrounding buffer zones

Name of the site, county and province	Core zone (ha)	Buffer zone (ha)
Shilin Karst 1 (Naigu Stone Forest), Shilin Yi, Yunnan	1,746	4,586
Shilin Karst 2 (Central Stone Forest), Shilin Yi, Yunnan	10,324	18,344
Libo Karst 1 (Da-Xiao Qikong Cone Karst), Libo, Guizhou	7,834	8,479
Libo Karst 2 (Maolan Cone Karst), Libo, Guizhou	21,684	35,019
Wulong Karst 1 (Qingkou Giant Doline), Wulong, Chongqing City	1,246	3,000
Wulong Karst 2 (Three Natural Bridges), Wulong, Chongqing City	2,202	4,000
Wulong Karst 3 (Furong Cave System), Wulong, Chongqing City	2,552	25,000
Total area (ha)	**47,588**	**98,428**

each site of the series as worthy of World Heritage listing in its own right, the rationale for the series is that a serial approach appears to ensure that site selection is carried out within a coherent framework and that the landscape diversity across the South China Karst region as a whole is reflected in the nomination.

The nomination notes four landscape types as outstanding. These have considerable internal landscape diversity, but can be summarised as:

- Fengcong karst (cone karst) – characterised by linked conical hills and depressions, valleys and gorges;
- Fenglin karst (tower karst) – comprising isolated cones or towers on broad plains;
- Stone forests – with a wide diversity of closely spaced pinnacles and towers; and
- Tiankeng karst (giant dolines) – massive circular collapse structures often in close proximity to spectacular gorges, decorated caves and where cave/doline collapse can create natural rock bridges.

Each of the three clusters nominated in this first phase of the nomination has a different set of natural features, as follows:

Shilin Karst (Yunnan): The two core zones of this cluster, which share a single buffer zone, contain examples of “stone forest” karst landscapes noted for high limestone pinnacles and towers decorated with deep, sharp karren. They have been selected as classic examples of the variety of stone forests that are found within the South China Karst. The Shilin stone forests illustrate the episodic nature of the evolution of these karst features, which span 270 million years.

Libo Karst (Guizhou): The two core zones of this cluster, which share a single buffer zone, illustrate the geomorphological exchange and evolution between fengcong landscapes and fenglin landscapes. They provide classic examples of a diverse variety of cone and tower karst landscapes and contain a combination of numerous tall karst peaks, deep dolines, sinking streams, and long and large river caves. This cluster is also noted for its biodiversity values, which include the presence of over 314 vertebrate species, 1,532 plant species, including several endemic species and a number of plants and animals that are globally or nationally endangered.

Wulong Karst (Chongqing): The three core zones of this cluster, each with its own buffer zone, provide an example of a karst landscape that has evolved in areas where thick sequences of pure carbonate rocks have been subjected to tectonic uplift. The Qingkou Giant Doline, some 200-250 m in diameter, represents tiankeng karst. The Three Natural Bridges, which are 223, 235 and 281 m in height, illustrate the development of karst gorges and valleys. This area also includes further giant dolines. The Furong Cave System illustrates how tectonic processes lead to the formation of large caverns and chambers that subsequently become decorated by speleothems.

Minority peoples, including the Yi (Shilin) and the Shui, Yao and Buyi (Libo), comprise the majority of residents in two of the nominated areas and in others that are being considered for future nomination within the series. There is a strong relationship between karst and the cultural identity and traditions of these minority groups. In Shilin, the Yi people have developed a lifestyle adapted to the karst environment, and the stone forests are reflected in every aspect of their culture. In Libo, the Shui people have been given special recognition in the creation of the Maolan Biosphere Reserve. They have managed their lands for at least a thousand years and provide an exemplary example of sustainable forest management. It has been suggested

that they may be authors of a manuscript that may be the earliest written manual on sustainable forest management.

3. COMPARISONS WITH OTHER AREAS

The nomination is accompanied by a comprehensive global comparative analysis that has been developed with an extensive dialogue within the international karst community, and provides an exemplary standard for other nominations. It also includes a volume that can be regarded as a reference statement for karst areas in relation to the World Heritage List.

Karst areas cover an estimated 12% of global continental areas, mainly in the Mediterranean, Eastern Europe, Middle East, Southeast Asia, Southeast America, and Caribbean. With an area of about 500,000 km^2 the South China Karst is unrivalled in its area, depth, and diversity of karst forms. It can be considered as one of the two great karst regions of the world: the other is the 'classical karst' of the eastern Adriatic region of Europe, extending through Slovenia, Croatia, Bosnia-Herzegovina and Montenegro. This is the type site for temperate karst and its values are reflected on the World Heritage List by the Škocjan Caves, Slovenia and Plitvice Lakes, Croatia. It is therefore clear that the phenomenon of the South China Karst as a whole can be accepted, in principle, as providing a strong basis for identifying outstanding universal value. One area of reservation in relation to the current selection of properties across the three anticipated phases of the nomination is that the South China Karst region extends into Viet Nam, and that the significant karst landscape in North Viet Nam is coterminous with the Guangxi Karst. The State Party of China has confirmed its willingness to work with Viet Nam to examine possible transnational cooperation.

Comparisons are considered for each of the three clusters within this phase of the nomination. This is an appropriate approach as the stated intention is that each of the nominated clusters should be of sufficient significance to stand alone as a World Heritage property. It is also important as the series is proposed in a number of phases, and the relative merits of sites in Phase 1 need to be considered in the context of other sites that may be put forward in the future.

The Shilin Karst can be compared with stone forests already on the World Heritage List such as in Gunung Mulu National Park, Malaysia and Tsingy de Bemahara Strict Nature Reserve, Madagascar. Based on the evidence provided by the nomination and a number of experts, it can be concluded that the Shilin cluster is regarded as the world's best example of stone forests – it is considered the type site for this feature and is distinguished by having the longest geomorphological history, spanning 270 million years. It is the best example of this landform within South China. Reviewers have however noted that there is significantly greater human impact on this area than on either Gunung Mulu or Tsingy de Bemahara, and in particular that disturbance has resulted in a significant loss of biological values.

The Libo Karst is nominated because of its cone karst, and is also considered by reviewers to display unrivalled features, although exceptional karst cones are found in other humid tropical landscapes, the most famous ones being those of Gunung Sewu on Java. Cone karst is also a prominent feature in three existing World Heritage properties: Gunung Mulu National Park, Phong Nha-Ke Bang National Park, Viet Nam and Puerto-Princesa Subterranean River National Park, Philippines. On the other hand, Purnululu National Park, Australia is an outstanding example of cone karst formed in sandstone. Mulun Nature Reserve in Guangxi, which is adjacent to the Libo cluster and considered to be less disturbed and of complementary value to this cluster, is proposed for inclusion within the next phase of the nomination. Both the Libo Karst on its own, and in combination with the proposed future extension into Mulun, can be regarded as the world type site for cone karst. The Libo cluster is also nominated for its biodiversity values, although a number of large and rare mammals are either absent or very limited in their abundance. While the overall biodiversity of the Libo cluster is comparable with the forested karst regions of Southeast Asia, other World Heritage properties in Southeast Asia, being more tropical, generally contain a larger number of species (see Table 2).

The Wulong Karst is nominated because of its giant dolines, natural bridges and caves. However, the case for the outstanding universal value of the Wulong cluster is less convincing than for the other two nominated clusters, and there is no consensus amongst reviewers on the values put forward. It appears that all the features in this cluster are also found in other areas in China and/or in other World Heritage properties. The nomination claims that the giant collapsed dolines in Wulong are features generally not found in other World Heritage properties in Asia, but they are part of the values of Gunung Mulu, and extensive dolines can also be found at the Škocjan Caves as well as in other areas in China. Approximately 50 giant tiankeng dolines are known within China, many of which have greater dimensions than those found in Wulong. A number of reviewers have therefore questioned the selection of these dolines, as opposed to others such as the dolines in Leye (Guangxi). Giant natural bridges can also be found in the Chinese Wulingyuan World Heritage property – the height of the highest natural bridge in Wulingyuan (357 m) even exceeds that of Wulong (281 m). Wulingyuan's natural bridges, however, are considered pseudo-karst, are not composed of limestone, and are the result of a different geological process. Wulong's bridges thus appear to be the largest such bridges in a limestone karst. China has also a number of larger and scientifically more important caves than Furong cave. Although valuable in the study of the evolution of karst in the Yangtze basin, the Furong cave does not have the extensive dimensions or decorations found in the caves of other World Heritage properties (Gunung Mulu, Škocjan Caves, Caves of Aggtelek Karst and Slovak Karst in Hungary and Slovakia, and Carlsbad Caverns and Mammoth Caves in the USA).

In summary, comparative analysis provides clear support for the outstanding universal value of the Shilin and Libo clusters, however the case for the Wulong cluster is not convincing at this time, and it is noted in particular that many reviewers have suggested that other Chinese sites exceed it in value.

Table 2: Comparison of biodiversity (species numbers) between the nominated property and some comparable existing World Heritage properties

Name and size of World Heritage property	Criteria	Plants	Mammals	Birds	Reptiles and Amphibians	Fish
Shilin Karst (China) 12,070 ha	*vii, viii*	*889*	*42*	*87*	*44*	*12*
Libo Karst (China) 29,518 ha	*viii, ix, x*	*1,532*	*59*	*137*	*75*	*43*
Wulong Karst (China) 6,000 ha	*viii*	*558*	*46*	*174*	*48*	*64*
Huanglong (China) 70,000 ha	vii	1,500	59	155	10	2
Wulingyuan (China) 26,400 ha	vii	3,000	34	53	29	?
Gunung Mulu (Malaysia) 52,864 ha	vii, viii, ix, x	3,500	81	270	131	48
Dong Phayayen-Khao Yai (Thailand) 615,500 ha	x	2,500	112	392	200	?
Thungyai-Huai Kha Khaeng (Thailand) 622,200 ha	vii, ix, x	?	120	400	139	113
Phong Nha-Ke Bang (Viet Nam) 85,754 ha	viii	876	113	302	81	72

4. INTEGRITY

4.1 Legal status

The nomination clearly identifies the provisions and relevant articles that govern the legal status of the nominated property. The laws and regulations of the People's Republic of China provide the legal basis for conservation and management planning of heritage areas. Legal provisions for protection are written into the Constitution of the People's Republic of China, and there are national laws for environmental protection, wildlife protection, forestry and water. There are also provisional regulations concerning management of scenic and historic areas, and regulations on nature reserves. The Shilin, Libo and Wulong karsts have protective designations dating back to 1982, including National Scenic and Historic Areas, National Geological Parks, National Nature Reserve, UNESCO Geopark and UNESCO Biosphere Reserve. Each nominated cluster has formulated relevant regulations and management measures.

Supplementing these national and provincial legal measures, there are basic protective regulations at the village level in Shilin (e.g. the Mizhishan Culture tradition of protecting natural vegetation among the Yi people) and Libo (e.g., rules of the Laqiao Group, Raolan Village, Yongkang Town). In Libo, for example, poaching of protected species is punishable by group leaders or by fines ranging from 10 to 500 Yuan (US$ 1 to 65). Serious cases are reported to the reserve administration. Such village rules are beneficial because they not only raise local conservation awareness, but also help to inspire a sense of autonomous stewardship on South China Karst's natural resources.

4.2 Boundaries

The boundaries of the nominated core zones generally follow accepted boundaries of previously established legal entities (although the original Biosphere Reserve boundary in Libo was modified to define a more manageable core zone for World Heritage purposes). Also in Libo, a 20 km stretch of cone karst covered with primary forest extends beyond Guizhou into the Mulun Nature Reserve in Guangxi. The planned inclusion of Mulun in Phase 2 of this nomination as an extension of the Libo cluster will address this issue. In Libo and Shilin, each pair of separate core zones is connected by its surrounding buffer zone, with the buffer zones providing a certain level of catchment protection. In Wulong, each of the three separate core zones is small (although sufficient to encompass the main feature), and the three surrounding buffer zones are not connected. The importance of appropriate buffer zones is further discussed in section 4.4 below.

4.3 Management

The State Ministry of Construction has the overall responsibility for the management of the South China Karst, with assistance from the Ministry of Land Resources and State Forestry Bureau, and the provinces concerned have also set up their own management departments. A total of 20 agencies have management responsibilities in the South China Karst. This is a fairly large group of

stakeholders and during the nomination process regular dialogues were held between them to ensure a coordinated approach.

Protocols for conservation and management planning, site management, monitoring, and preserving local traditions are outlined in the nomination. Management plans are in place for those municipalities, counties and regions in which the South China Karst is located. These include 5-year and longer term Social and Economic Plans, Environmental Protection Plans, Integrated Tourism and Historic Area Plans, Ecological Construction and Demonstration Area Plans. Site management plans have been developed for all nominated clusters, and all clusters appear to have sufficient financial resources to ensure effective implementation of these management plans.

Traditional management by minority peoples is an important feature of the nominated areas. IUCN welcomes the clear recognition of the rights of minority groups to retain control over their traditional lands at the outset of the nomination, and the clear recognition of their contribution to the values of the nominated areas. For management to be effective, minority groups in the South China Karst, including the Yi and Shui people, need to continue to be empowered as stakeholders and involved in site management, especially as they have managed their forests successfully as protected areas for thousands of years. IUCN understands that some villages within the Libo cluster have been relocated recently with compensation provided. IUCN notes the sensitivity of such issues, and in general considers that relocation for conservation should always be carried out with the consent of the population concerned. This is particularly the case where traditional management is an essential part of the maintenance of the forest system, such as at Libo.

4.4 Threats and human and use

Three issues have the potential to affect the long term integrity of the property: downstream effects of upstream runoff, local human impact and tourism growth.

One of the major problems associated with karst regions is the potential downstream effects of runoff from upstream regions, which can transport pollution from those regions into and through the karst. Such problems occur at Libo and to a lesser extent at Wulong and Shilin (as well as in many other karst regions around the world). At Libo, the catchment area is difficult to manage because of the large size of some of the river basins involved, and the Zhangjiang River for example passes through Libo City before entering the buffer zone of the Libo cluster, so management for water quality is crucial. At Shilin, there is a problem of waste water disposal from the tourist township. Waste water from villages and livestock in the buffer zone also requires attention, because it disperses into the groundwater. At Wulong, domestic waste has been observed in an underground stream, emphasizing the need for stricter waste disposal enforcement in the catchment area. Enlargement of buffer zones to include entire small catchments is desirable but may be impracticable in the case of the larger catchments. To reduce the danger that water pollution poses to the nominated property it will be essential to strictly enforce effective water quality management in the catchments of streams and rivers flowing into the protected karst. Untreated waste water from cities, towns and industries should not be allowed to enter waterways that ultimately drain into the South China Karst, especially their core zones. High water quality standards must be set and regular monitoring (as is underway and explained in the nomination) must be undertaken.

In all of the areas nominated in Phase 1 there are clear signs of local human impact. These are most evident in parts of Shilin, less in Wulong and least in Libo, and are even more evident in the buffer zones. Current population levels in the core zones of the nominated areas are 961 residents in Shilin; 5,751 in Libo, and 3,940 in Wulong. Annual population increases of between 1.8-6.7% have been recorded over the past five years. Management plans for each of the sites note that much agricultural land, especially on steep slopes, is being reverted to natural vegetation. In Wulong, the Environmental Restoration Plan calls for relocation of most residents outside the core zones. Economic activities by residents are mostly traditional agriculture with some cash crops (e.g. tobacco), small-scale food processing, and handicrafts. As part of the policy for promotion of “ecological farming”, chemical fertilizer and pesticide use is very limited and discouraged.

This human impact in the South China Karst makes it difficult to find large areas with essentially intact ecosystems both above and below ground. Consequently, the best conservation option is to save the least damaged sites and to actively encourage the existing plans for environmental restoration. This will provide bridges between secondary forest and scattered patches of primary forest, improving wildlife habitat and providing corridors for wildlife movement. In order to promote environmental restoration in nominated areas, special attention is being given by regional authorities to retiring land from agriculture (especially in rocky areas) and to planting shrubs along riparian zones, particularly along river banks. As well as providing habitat, thickly vegetated riparian zones will also be very important for shading streams and treating diffuse runoff from farmed land. The Chinese authorities should be commended on recognizing the impact of water pollution on the property and encouraged in their efforts.

Experience has shown that substantial increases in tourism levels occur at all natural and mixed World Heritage properties in China following their inscription. The large numbers of visitors to Shilin are already a management issue, while in Libo and Wulong tourism numbers are still low. One response to this has been the provision of well-equipped and informative visitor centres in the cluster, and the development of tourism management plans to control the impact of future growth in tourism (e.g. using zoning, monitoring and access control). Measures are also in place to increase indigenous resident and community participation in the tourism sector.

IUCN considers that the nominated property meets the conditions of integrity as required under the Operational Guidelines.

5. ADDITIONAL COMMENTS

5.1 Justification for serial approach

When IUCN evaluates a serial nomination it asks the following questions:

a) What is the justification for the serial approach?

The South China Karst is a coherent region, universally recognized by science as significant, and with a wealth of nationally, regionally and internationally significant karst sites. A serial approach at this stage is justified as the South China Karst is too large (over 500,000 km^2) to identify a single site that would be fully representative of the evolution and diverse variety of its karst landforms. Although the State Party considers each site of the series as worthy of World Heritage listing in its own right, the rationale for the series is that a serial approach appears to ensure that site selection is carried out within a coherent framework and that the landscape diversity across the South China Karst region as a whole is reflected in the nomination.

b) Are the separate components of the property functionally linked?

Although the nominated areas provide a range of separate and contrasting landscapes and landforms, they are united in their tectonic and regional geological setting, and, crucially, they all contribute to the representation of a region that is renowned for its distinctive and exceptionally diverse karst features of global importance. The inclusion of a variety of sites within the series is supposed to demonstrate the range of landscapes and landforms of the South China Karst, and although the separate clusters of the nomination are not connected, they can therefore be considered as functionally linked. Moreover, in Libo and Shilin, each pair of separate core zones is connected by its surrounding buffer zone, providing landscape connectivity at the cluster level. In Wulong, however, such landscape connectivity does not exist among the three separate core zones and buffer zones.

c) Is there an overall management framework for all the components?

This is the first trans-provincial serial property that China has proposed, and a major effort in coordinating the preparation of the nomination was required. As noted in section 4.3 above, there are 20 agencies involved in the management of the sites though the umbrella is provided by the State Ministry of Construction (with assistance from the State Forestry Bureau in Libo). There is some variation in regulations between the three nominated clusters in Phase 1 but a general consistency in management plans and activities does exist. There is no overall South China Karst management agency or administrative framework but once the next phase(s) of the nomination are submitted the need for this will be considered. IUCN considers that there is a need to strengthen the overall coordination of management of the South China Karst as part of any further phase(s) of the nomination, but that there are sufficient arrangements to support the serial nomination of three clusters at the present time.

5.2 Next phases of the nomination

The State Party intends to submit two more phases to complete the nomination of the South China Karst:

- Phase 2 (planned in 2008 or 2009): Yangshuo Karst (Guangxi), Xingyi Karst (Guizhou), Jinfeshan Karst (Chongqing), Mulun Karst (Guangxi); and
- Phase 3 (planned in 2011 or 2012): Zhijin Cave (Guizhou), Fengjie Karst (Chongqing), Xingwen Karst (Sichuan), Nonggang Karst (Guangxi).

IUCN suggests that sites chosen to complete the serial nomination should between them illustrate 1) the various natural features and landforms (above and below ground) that are integral elements of karst in South China; 2) the history of evolution of karst in southern China; and 3) the ongoing natural processes that have led to the development of the physical and biological attributes of the karst. The ecosystem as a whole should be considered, above and below ground, and not just the physical aspects. Noting the concerns regarding Wulong in the current nomination, IUCN considers that further work is required to confirm whether the scale of the serial nomination currently contemplated by the State Party is justified, as IUCN considers that there may be a case for a reduced scale to the future plans with a total of 4-5 clusters being sufficient to present a 'complete' property. The State Party may therefore wish to consider whether the extent of subsequent phases of the entire series could be rationalized into a smaller number of sites and a single phase of nomination rather than two phases. As the South China Karst region extends across the border into Viet Nam, the Chinese authorities have indicated their intentions to will consider transboundary cooperation in future.

6. APPLICATION OF CRITERIA / STATEMENT OF OUTSTANDING UNIVERSAL VALUE

The property has been nominated under all four natural criteria; however each of the three clusters of the serial property has been nominated under different criteria. All have been nominated under criterion (viii), while the Shilin cluster is also nominated under criterion (vii) and the Libo cluster is also nominated under criteria (ix) and (x). However, IUCN considers that the same criteria should be applied across the entire series of sites of serial nominations and has made the following assessment.

IUCN considers that the **Shilin and Libo clusters** of the nominated property meet criteria (vii) and (viii) and proposes the following Statement of Outstanding Universal Value:

South China is unrivalled for the diversity of its karst features and landscapes. The property includes specifically selected areas that are of outstanding universal value to protect and present the best examples of these karst features and landscapes. South China Karst is a coherent serial property comprising two clusters, Libo Karst and Shilin Karst, and each cluster comprises two components.

Criterion (vii): Superlative natural phenomena or natural beauty and aesthetic importance

South China Karst represents one of the world's most spectacular examples of humid tropical to sub-tropical karst landscapes. The stone forests of Shilin are considered superlative natural phenomena and the world reference site for this type of feature. The cluster includes the Naigu stone forest occurring on dolomitic limestone and the Suyishan stone forest arising from a lake. Shilin contains a wider range of pinnacle shapes than other karst landscapes with pinnacles, and a higher diversity of shapes and colours that change with different weather and light conditions. The cone and tower karsts of Libo, also considered the world reference site for these types of karsts, form a distinctive and beautiful landscape.

Criterion (viii): Earth's history, geological and geomorphic features and processes

Both Shilin and Libo are global reference areas for the karst features and landscapes that they exhibit. Major developments in the stone forests of Shilin occurred over some 270 million years during four major geological time periods from the Permian to present, illustrating the episodic nature of the evolution of these karst features. Libo contains carbonate outcrops of different ages that erosive processes shaped over millions of years into impressive fengcong (cone) and fenglin (tower) karsts. It contains a combination of numerous tall karst peaks, deep dolines, sinking streams and long river caves.

Conditions of Integrity, Protection and Management

The property is well managed, with clear management plans in place and the effective involvement of various stakeholders. There are strong international networks in place to support continued research and management. Continued efforts are required to expand and refine buffer zones to protect upstream catchments, and in particular to ensure the necessary long-term protection and management of the catchments. Traditional management by minority peoples is an important feature of both clusters, and the relationship between karst and the cultural identity and traditions of minority groups including the Yi (Shilin) and the Shui, Yao and Buyi (Libo) requires continued recognition and respect in site management. Potential for further extension of the property requires development of a management framework for effective coordination between the different clusters.

IUCN considers, however, that the **Wulong cluster** of the nominated property does not meet criteria (vii) and (viii) at this time, and that none of the clusters of the nominated property meets criteria (ix) and (x) at this time based on the following assessment.

Criterion (vii): Superlative natural phenomena or natural beauty and aesthetic importance

In Wulong, neither Furong cave nor the Tiankeng landscapes appear to meet this criterion, although further consideration of Tiankeng landscapes is anticipated in later stages of the nomination. The three natural rock bridges could be considered as superlative; however in the context of the rather small size of the area, the further consideration needed of Tiankeng landscapes, and the number of other rock arch sites, IUCN considers it would be premature to inscribe them as part of the series at this stage.

IUCN considers that the **Wulong cluster** of the nominated property does not meet this criterion. IUCN acknowledges, however, that the **Wulong cluster**, or parts thereof, might have the potential to meet this criterion.

Criterion (viii): Earth's history, geological and geomorphic features and processes

The case for this criterion is not as strong for Wulong as for Shilin and Libo, and at present there are significant questions over the inclusion of parts of this cluster, such as Furong cave, and also the relative values compared to other parts of the South China Karst that are considered by many reviewers to be superior. The features in this area are also rather more specialized than in Libo and Shilin, and there are concerns regarding its integrity due to both the small size of the area and the discontinuous nature of the cluster.

IUCN considers that the **Wulong cluster** of the nominated property does not meet this criterion.

Criterion (ix): Ecological and biological processes

Libo is the only one of the three clusters nominated under this criterion. South China Karst contains an outstanding example of a continental tropical / sub-tropical karst ecosystem that evolved due to climatic and edaphic gradients. For example, the karst forests of Libo demonstrate a progression from evergreen broadleaf forest to evergreen mixed broadleaf-conifer forest. Ecological and biological processes are evident in the adaptation of plants to drought, rocky terrain, and calcium-rich soils. Once the adjacent area to Libo, Mulun Natural Reserve in Guangxi, is nominated in Phase 2 of the nomination considerably more justification could be given to this criterion. Moreover, inasmuch as karst is not just a physical process but a holistic merging of dynamic biological processes, this criterion could well be justified for the South China Karst as a whole if restoration efforts are successful.

IUCN considers that none of the clusters of the nominated property meets this criterion. IUCN considers, however, that the **Libo cluster**, in combination with the future proposed extension to include the Mulun Natural Reserve, has the potential to meet this criterion.

Criterion (x): Biodiversity and threatened species

Libo is the only one of the three clusters nominated under this criterion. Due to its climatic conditions, karst landscapes and altitude, the biotic communities in Libo generally exhibit high diversity and endemism. Some 41 plant species and 48 animal species are endemic to the karst landscapes of Libo, while around 17 species are endemic to karst caves. The karst forests of Libo were also formerly suitable habitats for a number of threatened species, but populations are either non-existent or small and thus no longer considered viable. While Libo's biodiversity compares favourably to other sub-tropical karst regions and is comparable with the forested karst regions of Southeast Asia, it cannot compete with other

more tropical karst regions. Despite the high biodiversity values of the forests of Libo, its karst features and processes are thus the predominant ones that stand out at the global level and are consistent with the values of the other clusters in the nomination.

IUCN considers that none of the clusters of the nominated property meets this criterion.

7. RECOMMENDATIONS

IUCN recommends that the World Heritage Committee **inscribe** the **Shilin and Libo clusters** of the South China Karst, China, on the World Heritage List on the basis of criteria (vii) and (viii).

IUCN recommends that the State Party be requested to consider this as Phase 1 of a larger World Heritage nomination, and to consider whether the extent of subsequent phases of the entire series could be rationalized into a smaller number of sites and a single phase of nomination rather than two phases (see section 5.2). The potential application of criterion (ix) should be considered in relation to the entire series that is eventually proposed.

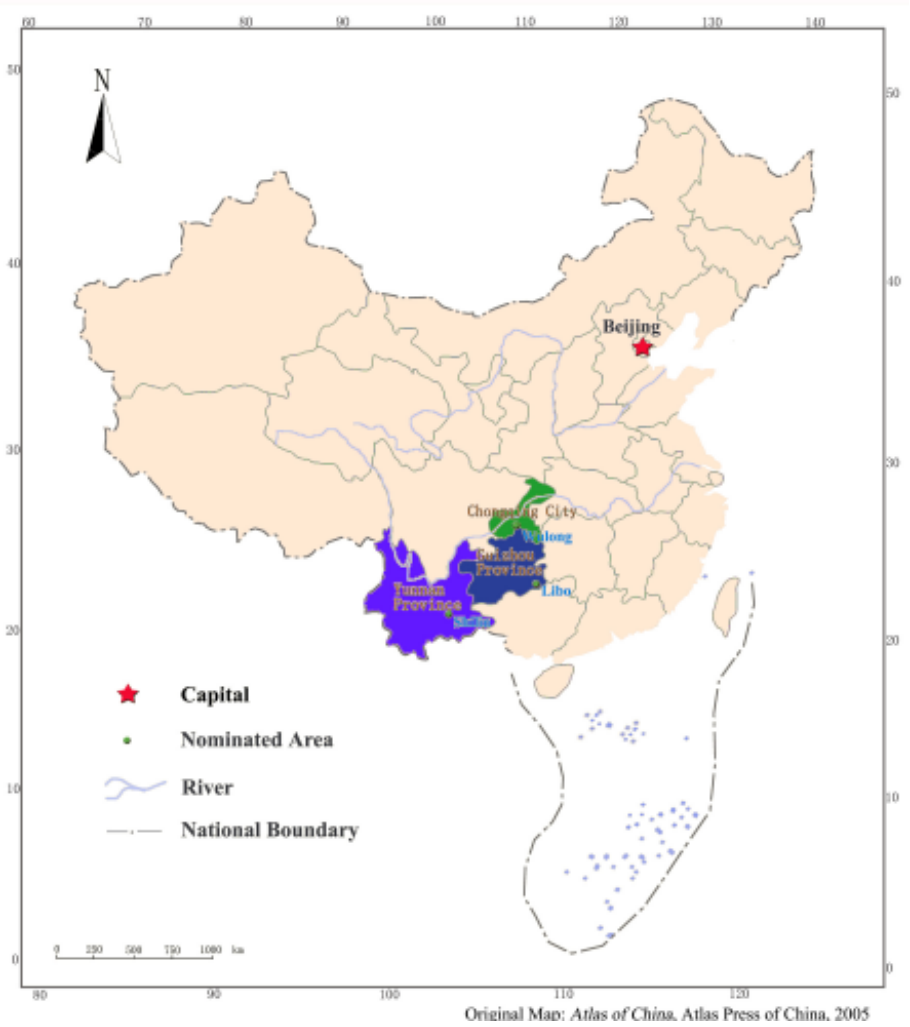
IUCN recommends that the World Heritage Committee **defer** the examination of the nomination of the **Wulong cluster** of the South China Karst, China, to the World Heritage List on the basis of criteria (vii) and (viii) to Phase 2 of the nomination to allow the State Party to further consider whether it is of sufficient significance relative to other future extensions and – if so – to reconsider its boundaries.

IUCN also recommends that the World Heritage Committee urges the State Party to continue its efforts to expand and refine buffer zones to protect catchments upstream of the nominated property, and in particular to ensure that the necessary long-term protection and management of catchments be put in place.

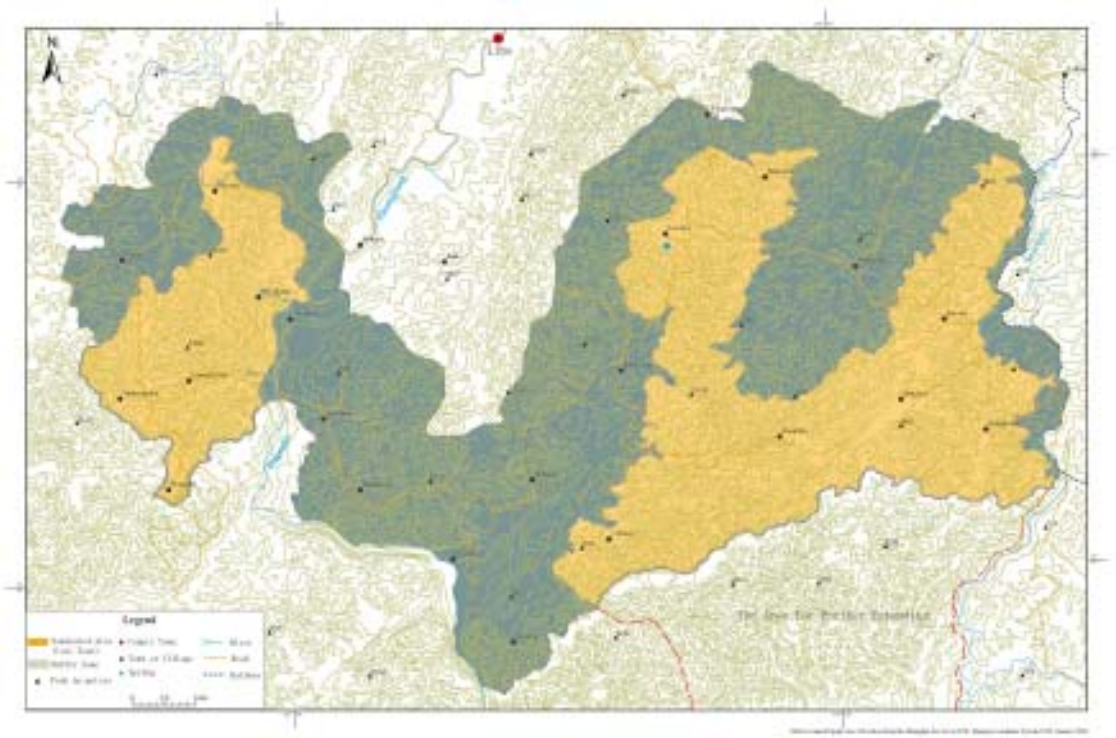
IUCN further recommends that the World Heritage Committee welcomes the recognition of the importance of the meaningful involvement of local people in the management of the nominated property, and requests that particular consideration and attention is given in developing Phase 2 of the nomination to the further involvement of local people and the maintenance of the traditional practices of the indigenous communities concerned.

IUCN finally recommends that the World Heritage Committee welcomes the intention of the State Party of China to discuss transnational aspects of the nomination with the State Party of Viet Nam, and urges the States Parties to ensure that this is considered prior to any further phase of nominations.

Map 1: Location of nominated property

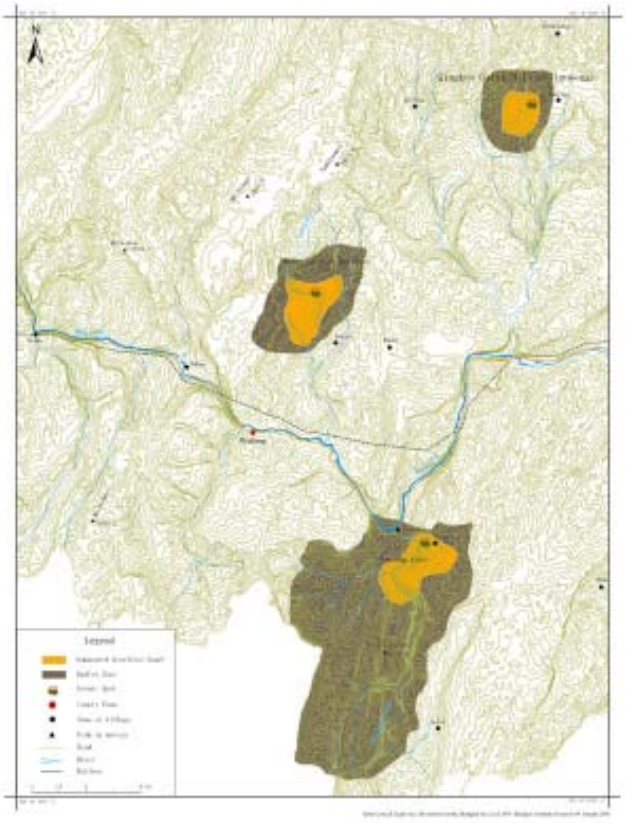


Map 2: Details of the nominated Libo cluster



Map 3: Details of the nominated Shilin cluster

Map 4: Details of the nominated Wulong cluster



ASIE / PACIFIQUE

KARST DE CHINE DU SUD

CHINE

CANDIDATURE AU PATRIMOINE MONDIAL – ÉVALUATION TECHNIQUE DE L'UICN

KARST DE CHINE DU SUD (CHINE) – ID No. 1248

Note d'introduction : l'évaluation technique de l'UICN concernant la Zone panoramique de la forêt de pierres de Lunan, proposée pour inscription par la Chine en tant que bien naturel, en 1991, et qui fait aujourd'hui partie de l'un des trois groupes de la proposition sérielle actuelle (karst de Shilin), n'a pas été examinée à la 16e session du Comité du patrimoine mondial (Santa Fe, 1992) à la demande de l'État partie. L'évaluation de l'UICN notait plusieurs insuffisances dans la proposition, y compris l'absence d'analyse comparative et de démonstration de la valeur universelle exceptionnelle du site. Le 16 janvier 2006, l'État partie a soumis, en tant que première phase (deux autres phases étant prévues), la proposition contenant trois groupes qui fait l'objet de la présente évaluation.

1. DOCUMENTATION

i) **Date de réception de la proposition par l'UICN :** avril 2006

ii) **Informations complémentaires officiellement demandées puis fournies par l'État partie :** l'UICN a demandé des informations complémentaires le 18 août 2006, avant sa mission d'évaluation. Les réponses de l'État partie, reçues en octobre et décembre 2006, comprenaient des réponses à tous les points soulevés par l'UICN.

iii) **Fiches techniques PNUE-WCMC :** 3 références (y compris la proposition)

iv) **Littérature consultée :** IUCN (1997). **Guidelines for Cave and Karst Protection.** IUCN WCPA Working Group on Cave and Karst Protection. IUCN (2005). **Geological World Heritage: A Global Framework.** IUCN.

v) **Consultations :** 19 évaluateurs indépendants. De vastes consultations ont eu lieu durant la mission d'évaluation avec : des représentants du Ministère d'État de la construction et du Ministère des affaires étrangères à Beijing; des provinces du Yunnan et de Guizhou ; de la ville de Chongqing ; du gouvernement local y compris les maires locaux ; de la Commission nationale chinoise pour l'UNESCO ; de l'Académie chinoise des Sciences et de l'université technique de Kunming ; et du Parti communiste chinois.

vi) **Visite du bien proposé :** Jim Thorsell, septembre 2006

vii) **Date à laquelle l'UICN a approuvé le rapport :** avril 2007

2. RÉSUMÉ DES CARACTÉRISTIQUES NATURELLES

La région du Karst de Chine du Sud s'étend sur 500 000 km^2 – mesurant environ 1380 km d'ouest en est, et 1010 km du nord au sud – essentiellement dans les provinces du Yunnan, de Guizhou et de Guangxi mais aussi dans certaines parties des provinces de Chongqing, du Sichuan, du Hunan, de Hubei et de Guangdong. Le Karst de Chine du Sud présente une série de formations karstiques dans des conditions climatiques variées, humides, subhumides, tropicales et subtropicales et milieux géographiques variés.

Le bien proposé contient une coupe transversale des éléments clés de la géologie régionale, y compris les dépôts de carbonate jusqu'au Trias (250 millions d'années) et l'évolution tectonique ultérieure de la région, comprenant trois phases de l'évolution durant le Quaternaire (environ 2 millions d'années). L'histoire géologique des paysages karstiques matures d'aujourd'hui et des paysages paléo karstiques du passé est « intacte » car elle a été très peu affectée par la glaciation. La grande diversité des paysages karstiques du Karst de Chine du Sud est attribuée 1) à l'âge des accumulations épaisses de calcaires qui ont produit un calcaire relativement dur et, en conséquence, des formations plus stables et plus massives, et 2) à l'influence de plusieurs phases de relèvement tectonique (y compris une grande phase récente associée à l'orogenèse (édification des reliefs) de l'Himalaya, et au relèvement du plateau tibétain) qui ont provoqué le plissement des roches et la formation de failles et, en conséquence, favorisé l'arrivée de l'eau qui a corrodé et érodé le calcaire pour donner les formations karstiques actuelles.

Le bien proposé du Karst de Chine du Sud comprend sept aires protégées, en trois groupes séparés : le karst de Shilin (2 sites), le karst de Libo (2 sites) et le karst de Wulong (3 sites), comment le voit dans le tableau 1. La proposition sérielle actuelle est conçue comme première phase d'une série complète qui comprendra les sites les plus exceptionnels du Karst de Chine du Sud (voir paragraphe 5.2 ci-après). Bien que l'État partie considère que chaque site de la proposition mérite, en soi, d'être inscrit sur la Liste du patrimoine mondial, la raison d'être de la proposition sérielle est que cette approche semble garantir que le choix des sites s'effectue dans un cadre cohérent et

Tableau 1 : Nom et superficie des zones centrales proposées et de leurs zones tampons

Nom du site, comté et province	Zone centrale (ha)	Zone tampon (ha)
Karst de Shilin 1 (Forêt de pierres de Naigu), Shilin Yi, Yunnan	1746	4586
Karst de Shilin 2 (Forêt de pierres centrale), Shilin Yi, Yunnan	10 324	18 344
Karst de Libo 1 (karst à pitons de Da-Xiao Qikong), Libo, Guizhou	7834	8479
Karst de Libo 2 (karst à pitons de Maolan), Libo, Guizhou	21 684	35 019
Karst de Wulong 1 (Doline géante de Qingkou), Wulong, Chongqing	1246	3000
Karst de Wulong 2 (trois ponts naturels), Wulong, Chongqing	2202	4000
Karst de Wulong 3 (Réseau de grottes de Furong), Wulong, Chongqing	2552	25 000
Superficie totale (ha)	**47 588**	**98 428**

que la diversité des paysages de la région du Karst de Chine du Sud dans son ensemble se reflète dans la proposition.

La proposition considère quatre types de paysages comme exceptionnels. Leur diversité interne est considérable mais on peut la résumer ainsi :

- karst fengcong (karst à pitons) – caractérisé par des collines coniques reliées et des dépressions, des vallées et des gorges ;
- karst fenglin (karst à tourelles) – comprend des cônes ou des tours isolés sur de vastes plaines ;
- forêts de pierres – avec une immense diversité de pinacles et de tours très rapprochés ;
- karst tiankeng (dolines géantes) – structures d'effondrement circulaires et massives, souvent en étroite proximité avec des gorges spectaculaires, des grottes décorées et où l'effondrement des grottes/dolines peut créer des ponts de pierre naturels.

Chacun des trois groupes proposés pour la première phase de cette proposition présente un ensemble différent des caractéristiques naturelles :

Karst de Shilin (Yunnan) : les deux zones centrales de ce groupe, qui partagent une seule zone tampon, contiennent des exemples de paysages karstiques de « forêts de pierres », remarquables pour leurs pinacles et leurs tours de calcaire de haute taille, décorés de lapiés profonds et acérés. Ils ont été choisis en tant qu'exemples classiques de la variété des forêts de pierres du Karst de Chine du Sud. Les forêts de pierres de Shilin illustrent la nature épisodique de l'évolution de ces caractéristiques karstiques qui s'étend sur 270 millions d'années.

Karst de Libo (Guizhou) : les deux zones centrales de ce groupe, qui partagent une seule zone tampon, illustrent l'échange géomorphologique et l'évolution entre les paysages de fengcong et les paysages de fenglin. Elles fournissent des exemples classiques de la grande variété des paysages karstiques à pitons et à tourelles et contiennent une association de nombreux pics karstiques de haute taille, de dolines profondes, de cours d'eau encaissés et de grottes longues et larges creusées par les cours d'eau. Ce groupe est aussi remarquable pour sa biodiversité : plus de 314 espèces de vertébrés, 1532 espèces de plantes dont plusieurs espèces endémiques et plusieurs plantes et animaux en danger au plan national ou mondial.

Karst de Wulong (Chongqing) : les trois zones centrales de ce groupe, qui ont chacune une zone tampon, sont un exemple de paysage karstique qui a évolué dans des régions ou des séquences épaisses de roches carbonatées pures ont été soumises à un relèvement tectonique. La doline géante de Qingkou, qui mesure environ 200 à 250 mètres de diamètre, représente le karst tiankeng. Les trois ponts naturels, de 223, 235 et 281 mètres de haut, illustrent le développement des gorges et des vallées karstiques. Cette région comprend aussi d'autres dolines géantes. Le réseau de grottes de Furong illustre comment les processus tectoniques ont entraîné la formation de vastes cavernes et chambres qui ont ensuite été décorées par des concrétions.

La majorité des résidents de deux des sites proposés et d'autres sites dont l'intégration dans une phase future de la proposition est envisagée sont des minorités Yi (Shilin) et Shui, Yao et Buyi (Libo). L'identité culturelle et les traditions de ces groupes minoritaires sont étroitement liées au karst. Dans le groupe de Shilin, les Yi ont élaboré un mode de vie adapté au milieu karstique et les forêts de pierres se reflètent dans chaque aspect de leur culture. Dans le groupe de Libo, les Shui ont obtenu une reconnaissance spéciale à travers la création de la Réserve de biosphère de Maolan. Depuis au moins 1000 ans, ils gèrent leurs terres selon des méthodes qui

pourraient servir de modèle exemplaire de gestion durable des forêts. On dit qu'ils seraient les auteurs d'un manuscrit qui est, peut-être, le plus ancien manuel de gestion durable des forêts.

3. COMPARAISON AVEC D'AUTRES SITES

La proposition est accompagnée d'une analyse comparative mondiale exhaustive qui a été réalisée dans le cadre d'un dialogue approfondi avec la communauté internationale de spécialistes du karst et qui constitue une norme exemplaire pour d'autres propositions. Elle comprend aussi un volume que l'on peut considérer comme une référence pour les régions karstiques dans le cadre de la Liste du patrimoine mondial.

On estime que les zones karstiques couvrent 12% des régions continentales du globe, essentiellement en Méditerranée, en Europe de l'Est, au Moyen-Orient, en Asie du Sud-Est, dans le sud-est de l'Amérique et dans les Caraïbes. Avec une superficie d'environ 500 000 km², le Karst de Chine du Sud n'a pas de rival, tant du point de vue de sa superficie et de sa profondeur que de la diversité de ses formations karstiques. On peut le considérer comme une des deux grandes régions karstiques du monde, l'autre étant le 'karst classique' de la région adriatique orientale d'Europe qui traverse la Slovénie, la Croatie, la Bosnie-herzégovine et le Monténégro. C'est le site-type pour le karst tempéré, représenté sur la Liste du patrimoine mondial par les Grottes de Škocjan, en Slovénie et le Parc national Plitvice, en Croatie. Il est donc clair que le phénomène du Karst de Chine du Sud dans son ensemble peut être accepté, en principe, comme offrant une base solide d'identification de la valeur universelle exceptionnelle. Une des réserves que l'on peut émettre concernant le choix actuel de sites par rapport aux trois phases prévues de la proposition est que la région du Karst de Chine du Sud se prolonge au Viet Nam et que le paysage karstique important du nord du Viet Nam est contigu avec le karst de Guangxi. L'État partie Chine a confirmé sa volonté de travailler avec le Viet Nam pour examiner la possibilité d'instaurer une coopération transnationale.

Les comparaisons sont examinées pour chacun des trois groupes dans cette phase de la proposition. C'est une approche pertinente car l'intention déclarée est de prouver que chacun des groupes proposés est suffisamment important pour mériter, à lui seul, le statut de bien du patrimoine mondial. Cette approche est aussi importante parce que les sites sont proposés en plusieurs phases et le mérite relatif des sites de la première phase doit être étudié dans le contexte des sites qui pourraient être proposés ultérieurement.

Le karst de Shilin peut être comparé avec les forêts de pierres qui sont déjà inscrites sur la Liste du patrimoine mondial, par exemple dans le Parc national du Gunung Mulu, en Malaisie et dans la Réserve naturelle intégrale du Tsingy de Bemahara, à Madagascar. D'après les arguments contenus dans la proposition et l'avis de plusieurs experts, on peut conclure que le groupe de Shilin est considéré comme le meilleur exemple de forêts de pierres au monde – il est considéré comme le site-type pour cette caractéristique et se distingue parce que son histoire géomorphologique, qui s'étend sur 270 millions d'années, est la plus longue. C'est le meilleur exemple

Tableau 2 : Comparaison de la diversité biologique (nombre d'espèces) entre le bien proposé et certains biens comparables inscrits sur la Liste du patrimoine mondial

Nom et superficie du bien du patrimoine mondial	Critères	Plantes	Mammifères	Oiseaux	Reptiles et amphibiens	Poissons
Karst de Shilin (Chine) 12 070 ha	***vii, viii***	***889***	***42***	***87***	***44***	***12***
Karst de Libo (Chine) 29 518 ha	***viii, ix, x***	***1532***	***59***	***137***	***75***	***43***
Karst de Wulong (Chine) 6000 ha	***viii***	***558***	***46***	***174***	***48***	***64***
Huanglong (Chine) 70 000 ha	vii	1500	59	155	10	2
Wulingyuan (Chine) 26 400 ha	vii	3000	34	53	29	?
Gunung Mulu (Malaisie) 52 864 ha	vii, viii, ix, x	3500	81	270	131	48
Dong Phayayen-Khao Yai (Thaïlande) 615 500 ha	x	2500	112	392	200	?
Thungyai-Huai Kha Khaeng (Thaïlande) 622 200 ha	vii, ix, x	?	120	400	139	113
Phong Nha-Ke Bang (Viet Nam) 85 754 ha	viii	876	113	302	81	72

de cette formation en Chine du Sud. Les évaluateurs ont toutefois noté que les impacts des activités anthropiques sur cette région sont nettement plus marqués qu'au Gunung Mulu ou au Tsingy de Bemahara et, en particulier, que les perturbations ont causé des pertes importantes dans les valeurs biologiques.

Le karst de Libo est proposé pour son karst à pitons et les évaluateurs considèrent également qu'il présente des caractéristiques sans égal bien que l'on puisse trouver un karst à pitons exceptionnel dans d'autres paysages tropicaux humides, dont les plus célèbres sont ceux du Gunung Sewu, à Java. Le karst à pitons est aussi une caractéristique dominante dans trois bien actuels du patrimoine mondial : le Parc national du Gunung Mulu, le Parc national de Phong Nha-Ke Bang, au Viet Nam et le Parc national de la rivière souterraine de Puerto Princesa, aux Philippines. Par ailleurs, le Parc national de Purnululu, en Australie, est un exemple exceptionnel de karst à pitons formé dans le grès. La Réserve naturelle de Mulun, dans la province de Guangxi, adjacente au groupe de Libo et considérée comme moins perturbée et de valeur complémentaire à ce groupe, est proposée pour inscription lors de la prochaine phase de la proposition. Le karst de Libo, en soi ainsi que associé à l'extension future proposée de Mulun, peut être considéré comme le site-type mondial pour le karst à pitons. Le groupe de Libo est aussi proposé pour sa diversité biologique, bien que plusieurs mammifères rares et de grande taille soient absents ou très peu abondants. La biodiversité globale du groupe de Libo est comparable à celle des régions karstiques couvertes de forêts d'Asie du Sud-Est mais d'autres biens du patrimoine mondial d'Asie du Sud-Est, parce qu'ils sont plus tropicaux, contiennent généralement plus d'espèces (voir tableau 2).

Le karst de Wulong est proposé pour ses dolines géantes, ses ponts naturels et ses grottes. Toutefois, la justification de la valeur universelle exceptionnelle du groupe de Wulong est moins convaincante que celle des deux autres groupes proposés et les évaluateurs n'ont pu trouver de consensus sur les valeurs décrites. Il semble que toutes les caractéristiques de ce groupe se trouvent également dans d'autres sites chinois et/ou dans d'autres biens du patrimoine mondial. La proposition prétend que les dolines géantes effondrées de Wulong sont des caractéristiques que l'on ne trouve, généralement, pas dans d'autres biens du patrimoine mondiale d'Asie, mais elles font partie des caractéristiques du Gunung Mulu et on trouve aussi de vastes dolines dans les Grottes de Škocjan ainsi que dans d'autres sites de Chine. On connaît environ 50 dolines tiankeng géantes en Chine et beaucoup sont plus grandes que celles de Wulong. Plusieurs évaluateurs ont donc remis en question le choix de ces dolines plutôt que d'autres telles que les dolines de Leye (Guangxi). On trouve aussi des ponts naturels géants dans le Bien du patrimoine mondial de Wulingyuan (Chine) – le plus haut pont naturel de Wulingyuan (357 m) dépasse même celui de Wulong (281 m). Toutefois, on considère que les ponts naturels de Wulingyuan sont du pseudo-karst, qu'ils ne sont pas composés de calcaire et qu'ils sont le résultat de processus géologiques différents. En conséquence, les ponts de Wulong semblent être les ponts les plus grands de ce type dans un karst calcaire. La Chine possède aussi plusieurs grottes plus grandes et plus importantes pour la science que les grottes de Furong. Bien qu'elles soient utiles à l'étude de l'évolution du karst dans le bassin du Yangtze, les grottes de Furong n'ont ni les dimensions ni les décorations qui lui permettraient de rivaliser avec les grottes d'autres biens du patrimoine mondial (Gunung Mulu, les Grottes de Škocjan, les grottes du karst d'Aggtelek et du karst de Slovaquie, en Hongrie et en Slovaquie et les grottes de Carlsbad et de Mammoth Cave aux États-Unis d'Amérique).

En résumé, l'analyse comparative confirme clairement la valeur universelle exceptionnelle des groupes de Shilin et de Libo, mais pour le groupe de Wulong, l'analyse n'est pas convaincante pour le moment et L'UICN note, en particulier, que de nombreux évaluateurs sont d'avis que d'autres sites chinois ont plus de valeur.

4. INTÉGRITÉ

4.1 Statut juridique

La proposition identifie clairement les dispositions et les articles pertinents qui gouvernent le statut juridique du bien proposé. Les lois et règlements de la République populaire de Chine prévoient la base juridique de la conservation et de la planification de la gestion des zones du patrimoine. Les dispositions juridiques concernant la protection sont inscrites dans la Constitution de la République populaire de Chine et il existe des lois nationales pour la protection de l'environnement, la protection des espèces sauvages, la foresterie et l'eau. Il existe aussi des règlements provisoires sur la gestion des zones d'intérêt panoramique et historique et des règlements sur les réserves naturelles. Les karst de Shilin, Libo et Wulong sont protégés depuis 1982 dans le cadre de Zones nationales d'intérêt panoramique et historique, Parcs géologiques nationaux, Réserve naturelle nationale, Géoparc de l'UNESCO et Réserve de biosphère de l'UNESCO. Chaque groupe proposé dispose de règlements et de mesures de gestion pertinents.

Pour compléter ces mesures juridiques nationales et provinciales, il existe des règlements de protection de base au niveau du village, à Shilin (p.ex. la tradition de la Culture de Mizhishan qui protège la végétation naturelle, chez le peuple Yi) et à Libo (p.ex., les règles appliquées par le groupe Laqiao, le village de Raolan et la ville de Yongkang). À Libo, par exemple, le braconnage d'espèces protégées est passible de punitions infligées par les chefs de groupe ou d'amendes de 10 à 500 Yuan (USD 1 à 65). Les cas les plus graves sont signalés à l'administration de la réserve. Ces règles, appliqués par les villages, sont bénéfiques car elles n'éveillent pas seulement les consciences locales à l'importance de la conservation mais contribuent aussi à inspirer un sens de responsabilité autonome vis-à-vis des ressources naturelles du Karst de Chine du Sud.

4.2 Limites

Les limites des zones centrales protégées suivent généralement les limites acceptées d'entités juridiques préexistantes (bien que les limites originelles de la réserve de biosphère de Libo aient été modifiées pour définir une zone centrale plus gérable aux fins du patrimoine mondial). À Libo, également, une étendue de karst à pitons de 20 km de long, couverte de forêts primaires, se prolonge au-delà de Guizhou, dans la réserve naturelle

de Mulun de la province de Guangxi. L'intégration prévue de Mulun, dans la phase 2 de la proposition, en tant qu'extension du groupe de Libo résoudra ce problème. À Libo et à Shilin, les zones centrales séparées sont reliées par la zone tampon environnante qui assure une certaine protection du bassin versant. À Wulong, chacune des trois zones centrales séparées est petite (elles sont cependant de taille suffisante pour comprendre les caractéristiques principales) et les trois zones tampons environnantes ne sont pas reliées. L'importance de zones tampons appropriées est discutée de manière plus approfondie au paragraphe 4.4, ci-après.

4.3 Gestion

Le Ministère d'État de la construction est globalement responsable de la gestion du Karst de Chine du Sud, avec l'aide du Ministère des ressources du territoire et du Bureau d'État des forêts. Les provinces concernées ont également mis sur pied leurs propres services de gestion. Au total, 20 agences exercent des responsabilités de gestion dans le Karst de Chine du Sud. C'est un groupe assez grand d'acteurs et, lors du processus de préparation de la proposition, des discussions régulières ont eu lieu entre eux pour garantir une approche coordonnée.

La proposition décrit des protocoles de planification de la conservation et de la gestion des sites, de suivi et de sauvegarde des traditions locales. Les municipalités, comtés et régions où est situé le Karst de Chine du Sud appliquent des plans de gestion. Il s'agit de plans économiques et sociaux quinquennaux et à plus long terme, de plans de protection de l'environnement, de plans intégrés pour le tourisme et les zones d'intérêt historique, des plans de zones de démonstration et de construction écologique. Des plans de gestion des sites ont été rédigés pour tous les groupes proposés et tous les groupes semblent disposer de ressources financières suffisantes pour garantir une application efficace de ces plans de gestion.

La gestion traditionnelle pratiquée par les minorités est une caractéristique importante du bien proposé. L'UICN se félicite de la reconnaissance claire qui est accordée aux droits des minorités de conserver le contrôle sur leurs terres traditionnelles, à l'extérieur de la proposition, ainsi que de la reconnaissance claire de leur contribution aux valeurs des sites proposés. Pour que la gestion soit efficace, les groupes minoritaires du Karst de Chine du Sud, notamment les Yi et les Shui, doivent continuer d'être considérés comme des acteurs et participer à la gestion du site, d'autant plus qu'ils gèrent leurs forêts en tant qu'aires protégées depuis des milliers d'années. L'UICN sait que certains villages du groupe de Libo ont récemment été réinstallés et ont reçu des compensations. L'UICN tient à faire remarquer le caractère sensible de ces questions et considère, en général, que la réinstallation à des fins de conservation devrait toujours se faire avec le consentement de la population concernée. C'est tout particulièrement le cas lorsque la gestion traditionnelle est une partie essentielle du maintien des forêts comme à Libo.

4.4 Menaces et activités anthropiques

Trois problèmes pourraient affecter l'intégrité à long terme du bien : les effets en aval du ruissellement en amont, les impacts anthropiques localisés et l'expansion du tourisme.

Un des problèmes les plus graves dans les régions karstiques est l'effet potentiel en aval du ruissellement en amont qui peut être une source de pollution pénétrant et traversant le karst. Le problème existe à Libo et, dans une moindre mesure, à Wulong et Shilin (tout comme dans beaucoup de régions karstiques du monde entier). À Libo, la zone du bassin versant est difficile à gérer vu les dimensions importantes de certains des bassins hydrographiques concernés. Par exemple, le Zhangjiang traverse la ville de Libo avant d'entrer dans la zone tampon du groupe de Libo : la gestion de la qualité de l'eau est donc cruciale. À Shilin, il y a un problème de déversement d'eaux usées d'un quartier touristique. Il faut aussi surveiller les eaux usées des villages et des élevages de la zone tampon parce qu'elles pénètrent dans les eaux souterraines. À Wulong, on a observé des déchets domestiques dans un ruisseau souterrain, ce qui souligne la nécessité d'une élimination plus stricte des déchets dans la zone du bassin versant. Il est souhaitable d'agrandir les zones tampons pour inclure entièrement les petits bassins versants mais cette mesure n'est probablement pas pratique pour les grands bassins versants. Pour atténuer les risques que la pollution de l'eau fait courir au bien proposé, il sera essentiel d'appliquer rigoureusement des mesures efficaces de gestion de la qualité de l'eau dans les bassins versants des cours d'eau qui pénètrent dans le karst protégé. Il faut empêcher que les eaux usées non-traitées des villes et des industries pénètrent dans les cours d'eau qui drainent dans le Karst de Chine du Sud, et en particulier dans les zones centrales. Il est impératif de fixer des normes de qualité de l'eau élevées et d'exercer un suivi régulier (comme celui qui est en cours et expliqué dans la proposition).

Tous les sites choisis pour la première phase présentent des signes clairs d'impacts locaux d'origine anthropique. Ces signes sont particulièrement évidents dans certains secteurs de Shilin, moins à Wulong et encore moins à Libo mais ils sont encore plus évidents dans les zones tampons. Dans les zones centrales des sites proposés il y a actuellement 961 résidents à Shilin ; 5751 à Libo, et 3940 à Wulong. Depuis cinq ans, on calcule une augmentation annuelle de la population de 1,8 à 6,7%. Les plans de gestion de chaque site notent qu'une bonne partie des terres agricoles, en particulier sur les fortes pentes, est rendue à la végétation naturelle. À Wulong, le plan de restauration de l'environnement prône un déplacement de la plupart des résidents vers l'extérieur des zones centrales. Les activités économiques des résidents sont surtout l'agriculture traditionnelle avec quelques cultures de rapport (p.ex. le tabac), la transformation alimentaire à petite échelle et l'artisanat. Dans le cadre de la politique de promotion de « l'agriculture écologique », le recours aux engrais chimiques et aux pesticides est très limité et dissuadé.

Compte tenu des impacts d'origine anthropique sur le Karst de Chine du Sud, il est difficile de trouver des zones de grandes dimensions contenant des écosystèmes essentiellement intacts, tant au-dessus qu'au-dessous du

sol. En conséquence, la meilleure solution du point de vue de la conservation, consiste à préserver les sites les moins dégradés et à encourager activement les plans actuels de restauration de l'environnement. Cela permettra d'établir des passerelles entre la forêt secondaire et les parcelles éparses de forêt primaire, et d'améliorer l'habitat des animaux sauvages tout en fournissant des corridors pour leur déplacement. Du point de vue de la promotion de la restauration de l'environnement dans les zones proposées, les autorités régionales accordent une attention particulière à la reconversion des terres agricoles (en particulier dans les zones rocheuses) et à la plantation d'arbustes dans les zones riveraines, en particulier le long des cours d'eau. Les zones riveraines à la végétation épaisse ne fourniront pas seulement un habitat mais seront aussi très importantes pour ombrager les cours d'eau et traiter le ruissellement diffus provenant des terres agricoles. Il convient de féliciter les autorités chinoises qui ont pris conscience des impacts de la pollution de l'eau sur le bien et de les encourager dans leurs efforts.

L'expérience a prouvé que l'on constate une augmentation importante du niveau du tourisme dans tous les biens du patrimoine mondial naturels et mixtes de Chine dès leur inscription. Le grand nombre de visiteurs à Shilin pose déjà un problème de gestion. À Libo et à Wulong, il y a moins de touristes. Pour résoudre ce problème, des centres d'information pour les visiteurs bien équipés ont été ouverts et des plans de gestion du tourisme ont été préparés en vue de contrôler les impacts d'une croissance future du tourisme (p.ex. : zonage, suivi et contrôle de l'accès). Des mesures sont également en place en vue de renforcer la participation des résidents autochtones et des communautés dans le secteur du tourisme.

L'UICN considère que le bien proposé remplit les conditions d'intégrité requises par les Orientations.

5. AUTRES COMMENTAIRES

5.1 Justification de l'approche sérielle

Lorsque l'UICN évalue une proposition sérielle (un groupe) elle se pose les questions suivantes :

a) Comment l'approche sérielle se justifie-t-elle ?

Le Karst de Chine du Sud est une région cohérente, universellement reconnue par les scientifiques comme importante et qui possède des trésors de sites karstiques importants au plan national, régional et international. À cette étape, l'approche sérielle se justifie car le Karst de Chine du Sud est trop vaste (plus de 500 000 km2) pour que l'on puisse identifier un site unique entièrement représentatif de l'évolution et de la grande diversité des formations karstiques. Bien que l'État partie considère que chacun des sites de la série mérite, en soi, d'être inscrit sur la Liste du patrimoine mondial, la raison d'être de la proposition sérielle est que cette approche semble garantir que le choix des sites s'effectue dans un cadre cohérent et que la diversité des paysages de la région du Karst de Chine du Sud dans son ensemble se reflète dans la proposition.

b) Les éléments séparés du site sont-ils liés sur le plan fonctionnel ?

Bien que les zones proposées exhibent une gamme de paysages et de formations distincts et contrastants, ils sont unis par leur cadre tectonique et géologique régional, et surtout, ils contribuent tous à la représentation d'une région renommée pour ses caractéristiques karstiques d'importance mondiale, distinctives et exceptionnellement diverses. L'intégration d'une diversité de sites dans la série a pour objet de démontrer toute la gamme des paysages et des formations du Karst de Chine du Sud et, bien que les groupes séparés de la proposition ne soient pas reliés, on peut considérer qu'ils sont liés sur le plan fonctionnel. En outre, à Libo et Shilin, les deux zones centrales séparées sont reliées par leur zone tampon ce qui assure la connectivité dans le paysage au niveau du groupe. À Wulong, cependant, il n'y a pas de connectivité dans le paysage entre les trois zones centrales séparées et les zones tampons.

c) Existe-t-il un cadre de gestion global pour toutes les unités ?

Il s'agit de la première proposition sérielle trans-provinciale proposée par la Chine et il a fallu un effort considérable pour coordonner la préparation de la proposition. Comme noté au paragraphe 4.3 ci-dessus, 20 agences participent à la gestion des sites sous la direction du Ministère d'État de la construction (avec l'aide du Bureau d'État des forêts à Libo). Il existe quelques différences dans les règlements entre les trois groupes proposés dans cette première phase mais il y a une cohérence générale dans les plans de gestion et les activités. Il n'y a pas d'agence de gestion ou de cadre administratif général pour le Karst de Chine du Sud mais lorsque la proposition entrera dans sa(ses) prochaine(s) phase(s), il sera nécessaire de réfléchir à cette question. L'UICN considère qu'il est nécessaire de renforcer la coordination globale de la gestion du Karst de Chine du Sud dans le cadre de toute nouvelle phase de la proposition mais que pour le moment, les dispositions qui soutiennent la proposition sérielle de trois groupes sont suffisantes.

5.2 Prochaines phases de la proposition

L'État partie a l'intention de soumettre deux autres phases pour compléter la proposition du Karst de Chine du Sud :

- Phase 2 (prévue pour 2008 ou 2009) : karst de Yangshuo (Guangxi), karst de Xingyi (Guizhou), karst de Jinfeshan (Chongqing), karst de Mulun (Guangxi) ; et
- Phase 3 (prévue pour 2011 ou 2012) : Grotte de Zhijin (Guizhou), karst de Fengjie (Chongqing), karst de Xingwen (Sichuan), karst de Nonggang (Guangxi).

L'UICN suggère que les sites choisis pour compléter la proposition sérielle illustrent, à eux tous 1) les différentes caractéristiques naturelles et les différentes formations (au-dessus et au-dessous du sol) qui font partie intégrante du karst dans le sud de la Chine ; 2) l'histoire de l'évolution du karst dans le sud de la Chine ; et 3) les processus naturels en cours qui ont conduit au développement des caractéristiques physiques et biologiques du karst. C'est

l'écosystème en entier qu'il faut prendre en compte, en surface et sous la surface, et pas seulement ses aspects physiques. Rappelant les réserves émises à propos de Wulong dans la présente proposition, l'UICN considère qu'il faut approfondir les études pour confirmer si l'échelle de la proposition sérielle actuellement envisagée par l'État partie est justifiée. En effet, l'UICN estime que l'on pourrait justifier une échelle réduite dans les futurs plans, avec un total de 4 à 5 groupes qui suffiraient pour constituer un bien 'complet'. L'État partie pourrait peut-être envisager de rationaliser l'étendue des phases suivantes de la série pour retenir un plus petit nombre de sites et procéder à une seule phase de proposition plutôt qu'à deux. Comme la région du Karst de Chine du Sud s'étend aussi sur le Viet Nam, les autorités chinoises ont indiqué leur intention d'envisager, à l'avenir, une coopération transfrontière.

6. APPLICATION DES CRITÈRES / ATTESTATION DE VALEUR UNIVERSELLE EXCEPTIONNELLE

L'inscription du bien est proposée au titre des quatre critères naturels ; toutefois, chacun des trois groupes du bien sériel est proposé au titre de critères différents. Tous sont proposés au titre du critère (viii) mais le groupe de Shilin est aussi proposé au titre du critère (vii) et le groupe de Libo est aussi proposé au titre des critères (ix) et (x). L'UICN considère que les mêmes critères devraient s'appliquer à l'ensemble des sites d'une proposition sérielle et présente l'évaluation suivante

L'UICN considère que les groupes de **Shilin et de Libo** du bien proposé remplissent les critères (vii) et (viii) et propose l'Attestation de valeur universelle exceptionnelle suivante :

Le sud de la Chine est sans égal pour la diversité de ses formations et paysages karstiques. Le bien comprend des zones spécifiquement choisies qui sont de valeur universelle exceptionnelle et qui présentent et protègent les meilleurs exemples de ces formations et paysages karstiques. Le Karst de Chine du Sud est un bien sériel cohérent qui comprend deux groupes, le karst Libo et le karst Shilin, chacun englobant deux éléments.

Critère (vii) : phénomène naturel ou beauté et importance esthétique exceptionnelles

Le Karst de Chine du Sud est un des exemples les plus spectaculaires au monde de paysages karstiques tropicaux humides à subtropicaux. Les forêts de pierres de Shilin sont considérées comme un phénomène naturel extraordinaire et la référence mondiale pour ce type de formation. Le groupe comprend la forêt de pierres de Naigu, sur calcaire dolomitique et la forêt de pierres de Suyishan qui surgit d'un lac. Shilin contient une plus grande gamme de pinacles que tout autre paysage karstique à pinacles et une plus grande diversité de formes et de couleurs qui changent selon les conditions météorologiques et la lumière. Les karsts à cônes et à tourelles de Libo, également considérés comme la référence mondiale pour ces types de karst, forment un paysage unique et superbe.

Critère (viii) : histoire de la terre, caractéristiques et processus géologiques et géomorphologiques

Shilin et Libo sont des sites de référence, à l'échelon mondial, pour les formations et paysages karstiques que l'on y trouve. Les principaux développements des forêts de pierres de Shilin se sont produits sur une durée de 270 millions d'années environ, au cours de quatre périodes géologiques, du Permien à l'époque actuelle, illustrant la nature épisodique de l'évolution de ces formations karstiques. Libo contient des affleurements carbonatés de différentes époques auxquels les processus d'érosion ont donné, au fil de millions d'années, la forme de fengcong (cônes) et fenglin (tourelles) karstiques impressionnants. On y trouve un mélange de nombreux pics karstiques de haute taille, de dolines profondes, de cours d'eau encaissés et de longues grottes creusées par des rivières.

Conditions d'intégrité, protection et gestion

Le bien est bien géré, dispose de plans de gestion clairs faisant intervenir efficacement les différents acteurs. Des réseaux internationaux solides sont en place pour soutenir la continuité de la gestion et des travaux de recherche. Les efforts devront se poursuivre pour agrandir et affiner les zones tampons en vue de protéger les bassins versants d'amont et en particulier, de garantir la protection et la gestion indispensables des bassins versants, à long terme. La gestion traditionnelle pratiquée par des minorités est une caractéristique importante dans les deux groupes et la gestion du site doit garantir la reconnaissance et le respect des relations entre le karst et l'identité et les traditions culturelles des minorités telles que les Yi (Shilin) et les Shui, Yao et Buyi (Libo). Le potentiel d'expansion future du bien appelle la mise au point d'un cadre de gestion pour une coordination effective entre les différents groupes.

L'UICN considère, cependant, que le **groupe de Wulong** du bien proposé ne remplit pas les critères (vii) et (viii) pour le moment, et qu'aucun des groupes du bien proposé ne remplit les critères (ix) et (x) pour le moment, sur la base de l'évaluation suivante.

Critère (vii) : phénomène naturel ou beauté et importance esthétique exceptionnelles

À Wulong, ni les grottes de Furong ni les paysages de Tiankeng ne semblent remplir ce critère bien que l'on prévoie un nouvel examen des paysages de Tiankeng dans les étapes ultérieures de la proposition. Les trois ponts de pierre naturels pourraient mériter le qualificatif 'exceptionnel' ; toutefois, compte tenu des dimensions plutôt petites de la zone, du nouvel examen qui sera fait des paysages de Tiankeng et du nombre d'autres sites contenant des arcs rocheux, L'UICN considère qu'il serait prématuré, pour le moment, de l'inscrire dans le bien sériel.

L'UICN considère que le **groupe de Wulong** du bien proposé ne remplit pas ce critère. L'UICN reconnaît, toutefois, que le **groupe de Wulong**, ou des parties de ce groupe, pourrait avoir le potentiel de remplir ce critère.

Critère (viii) : histoire de la terre, caractéristiques et processus géologiques et géomorphologiques

Ce critère ne se justifie pas autant pour Wulong que pour Shilin et Libo et il y a, actuellement, des doutes importants sur l'intégration de parties de ce groupe, par exemple les grottes de Furong, ainsi que sur ses valeurs relatives en comparaison avec d'autres secteurs du Karst de Chine du Sud considérés supérieurs par de nombreux évaluateurs. Les caractéristiques de cette zone sont également plus spécialisées que celles de Libo et Shilin, et il y a quelques soucis concernant son intégrité, tant en raison de sa petite taille que de la nature discontinue du groupe.

L'UICN considère que le **groupe de Wulong** du bien proposé ne remplit pas ce critère.

Critère (ix) : processus écologiques et biologiques

Libo est le seul des trois groupes qui soit proposé au titre de ce critère. Le Karst de Chine du Sud possède un exemple exceptionnel d'écosystème karstique continental tropical/ subtropical qui a évolué sous l'influence de gradients climatiques et édaphiques. Par exemple, les forêts de karst de Libo démontrent une progression de la forêt de feuillus sempervirente à la forêt mixte feuillus-conifères sempervirente. Les processus écologiques et biologiques sont évidents dans l'adaptation des plantes à la sécheresse, aux terrains rocheux et aux sols riches en calcium. Lorsque la zone adjacente à Libo, la Réserve naturelle de Mulun dans le Guangxi, sera intégrée dans la phase 2 de la proposition, l'inscription au titre de ce critère sera beaucoup plus justifiée. En outre, le karst n'étant pas seulement un processus physique mais aussi une fusion holistique de processus biologiques dynamiques, l'inscription du Karst de Chine du Sud dans son ensemble, au titre de ce critère, pourrait bien être justifiée, si les efforts de restauration sont couronnés de succès.

L'UICN considère qu'aucun des groupes du bien proposé ne remplit ce critère. Toutefois, l'UICN considère que le **groupe de Libo**, avec la future extension proposée en vue d'inclure la Réserve naturelle de Mulun, a le potentiel de remplir ce critère.

Critère (x) : diversité biologique et espèces menacées

Libo est le seul des trois groupes qui soit proposé au titre de ce critère. Vu les conditions climatiques, les paysages karstiques et l'altitude, les communautés biotiques de Libo présentent, généralement, un taux élevé d'endémisme et de diversité. Environ 41 espèces de plantes et 48 espèces d'animaux sont endémiques des paysages karstiques de Libo tandis qu'environ 17 espèces sont endémiques des grottes karstiques. Les forêts du karst de Libo étaient autrefois des habitats adaptés à plusieurs espèces menacées, dont les populations sont cependant aujourd'hui inexistantes ou petites et, en conséquence, ne sont plus considérées comme viables. Certes, la biodiversité de Libo se compare favorablement à celle d'autres régions karstiques subtropicales et elle est comparable avec celle de régions karstiques boisées du Sud-Est asiatique, mais elle ne peut rivaliser avec d'autres régions karstiques plus tropicales. Malgré l'intérêt important des forêts de Libo pour la biodiversité, ses caractéristiques et processus karstiques sont les éléments dominants qui se distinguent au niveau mondial et qui sont cohérents avec les valeurs des autres groupes de la proposition.

L'UICN considère qu'aucun des sites du bien proposé ne remplit ce critère.

7. RECOMMANDATIONS

L'UICN recommande que le Comité du patrimoine mondial **inscrive** les **groupes de Shilin et de Libo** du Karst de Chine du Sud sur la Liste du patrimoine mondial, sur la base des critères (vii) et (viii).

L'UICN recommande que l'État partie soit prié de considérer cette inscription comme la première phase d'une proposition d'inscription d'un bien plus vaste sur la Liste du patrimoine mondial, et d'étudier la possibilité de rationaliser l'étendue des phases suivantes de la série pour retenir un plus petit nombre de sites et procéder à une seule phase de proposition plutôt qu'à deux (voir paragraphe 5.2). L'application éventuelle du critère (ix) devrait être examinée dans le contexte de la série entière qui sera finalement proposée.

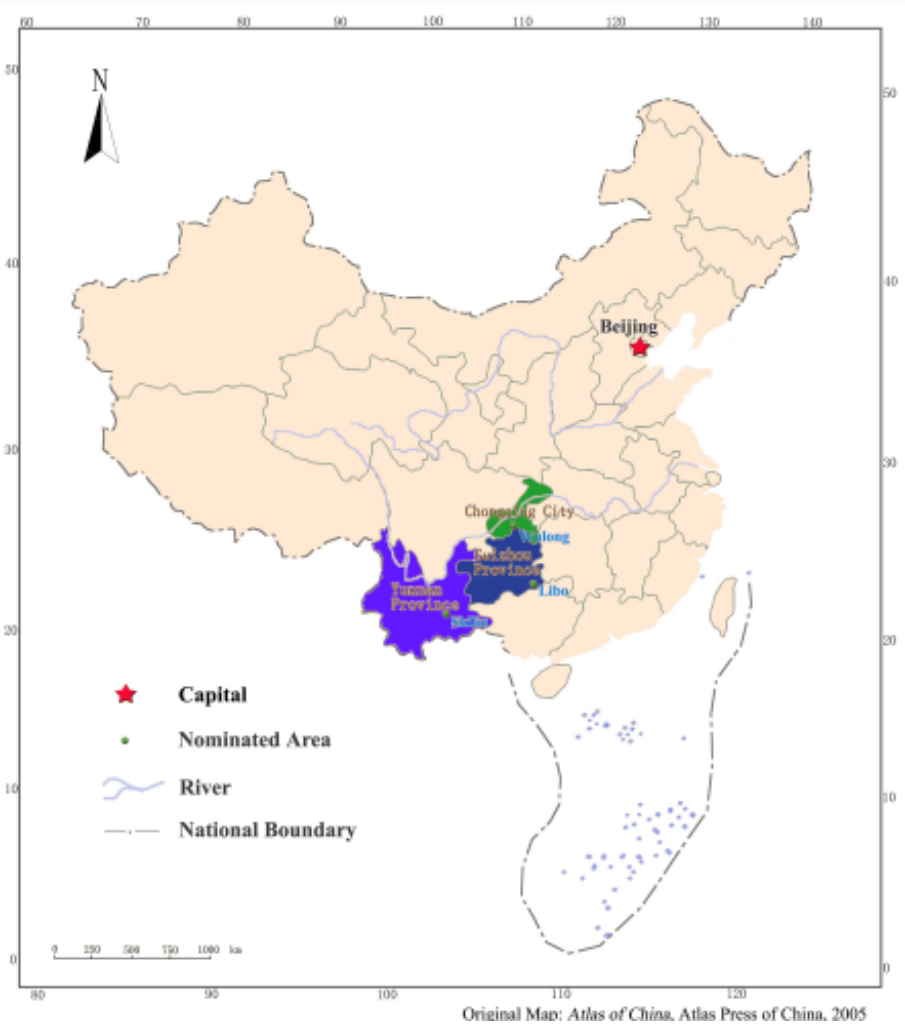
L'UICN recommande que le Comité du patrimoine mondial **diffère** l'examen de la proposition d'inscription du **groupe de Wulong** du Karst de Chine du Sud sur la Liste du patrimoine mondial, sur la base des critères (vii) et (viii) jusqu'à la phase 2 de la proposition pour permettre à l'État partie de déterminer, au moyen d'un examen plus approfondi, s'il a une importance suffisante par rapport à d'autres extensions futures et – si c'est le cas – de revoir ses limites.

L'UICN recommande aussi que le Comité du patrimoine mondial prie l'État partie de poursuivre ses efforts en vue d'agrandir et d'affiner les zones tampons pour protéger les bassins versants d'amont du bien proposé et, en particulier, pour veiller à ce que soient mises en place la protection et la gestion à long terme des bassins versants.

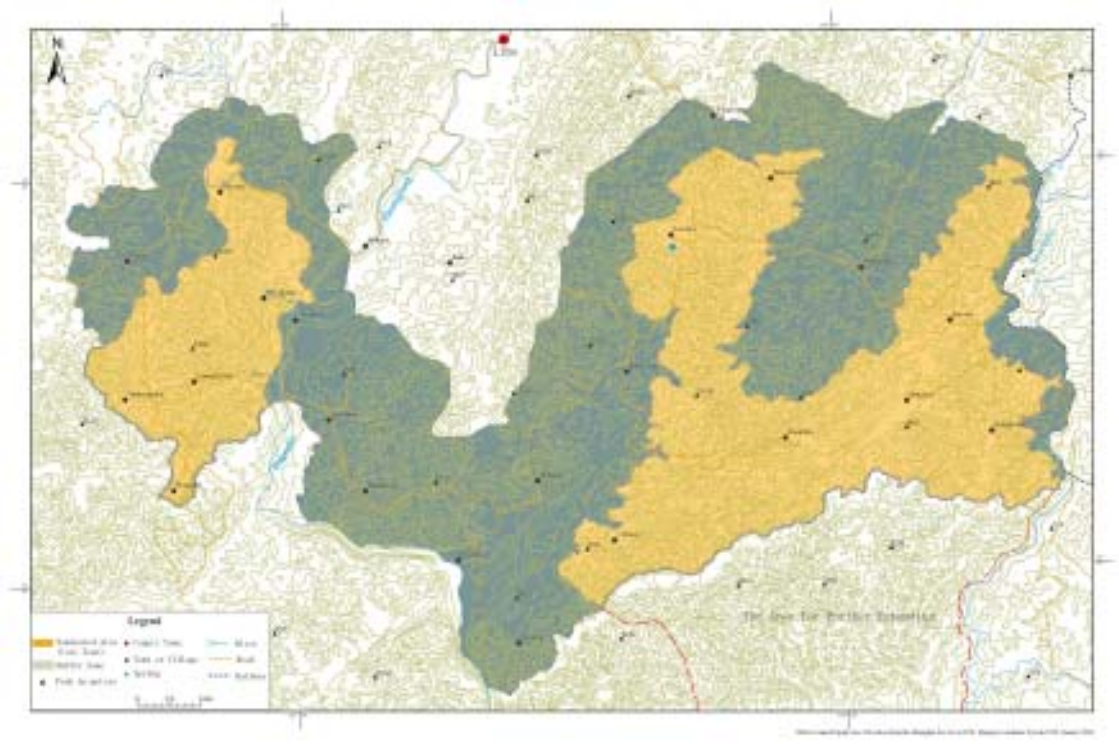
L'UICN recommande en outre que le Comité du patrimoine mondial se félicite de l'importance donnée à une participation réelle de la population locale à la gestion du bien proposé ; et demande qu'une attention et un soin particuliers soient accordés, lors du développement de la phase 2 de la proposition, à la participation accrue de la population locale et au maintien des pratiques traditionnelles des communautés autochtones concernées.

L'UICN recommande enfin que le Comité du patrimoine mondial accueille favorablement l'intention de l'État partie Chine de discuter des aspects transnationaux de la proposition avec l'État partie Viet Nam, et prie les États parties de faire en sorte que ces discussions précèdent toute nouvelle phase de proposition.

Carte 1: Localisation du bien proposé



Carte 2: Détails du Groupe nominé de Libo



Carte 3: Détails du Groupe nominé de Shilin

Carte 4: Détails du Groupe nominé de Wulong