



State of Conservation Report of Manas Wildlife Sanctuary (India) (N 338)

RESPONSE TO THE WORLD HERITAGE COMMITTEE DECISION 38 COM 7B.65

Submitted by
State Party: India
to
UNESCO World Heritage Centre, Paris

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TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	1
1. Background	3
2. <u>PARA 3: Welcomes</u> the information provided by the State Party that the delay in fund release has been addressed, and <u>recommends</u> that the State Party provide updates of the financial situation of the property in future reports to the Committee;	3
3. <u>PARA 4: Notes with appreciation</u> the positive results achieved up to 2013 with the reintroduction of Greater One-horned Rhinoceros, as well as the development of a comprehensive Eastern Swamp Deer Translocation Protocol, the implementation of which is anticipated to commence in 2014;	6
4. <u>PARA 5: Notes with serious concern</u> the reported recent poaching of nearly one third of the recovering rhino population, which is a sharp reminder of the fragility of the property's recovering Outstanding Universal Value (OUV), and <u>urges</u> the State Party to ensure that forest guards are adequately equipped and trained to protect the property against poachers and maintain effective patrolling, in order to secure the recovering populations of rhino and other wildlife, and to ensure that the anticipated translocation of Eastern Swamp Deer can be carried out effectively;	9
5. <u>PARA 6: Requests</u> the State Party to take urgent measures to address the reported new encroachment at Bhuyanpara Range within the property, and rehabilitate degraded area;	10
6. <u>PARA 7: Also notes with utmost concern</u> the reported deterioration of the security situation in the property, and <u>considers</u> that a further deterioration of the security situation, associated with the reported surge in poaching and concerns regarding encroachment could create the conditions to re-inscribe the property on the List of World Heritage in Danger;	14
7. <u>PARA 8: Reiterates</u> its request to the State Party of Bhutan to submit a copy of the Environmental Impact Assessment (EIA) of the Mangdechhu Hydro-Electric Project as per Decision 36 COM 7B.10, including an assessment of potential impacts on the property's OUV and cumulative impacts in relation to the existing Kurichu Dam, in conformity with IUCN's World Heritage Advice note on environmental assessment	16
8. Additional information relevant to previous decisions and recommendations	16

List of Tables

Table 1:	Disbursement of funds received from Central and State Government to Manas National Park in the last four years	5
Table 2:	Population status of translocated Rhinos in Manas National Park	7
Table 3:	Status of Rhino mortality and birth in Manas National Park	9
Table 4:	SWOT Analysis for Rhino Conservation in Manas National Park	15
Table 5:	Forest Development Agency and Eco-Development Committees in Manas National Park	20
Table 6:	Tourist visitor records for Manas National Park	23

List of Figures

Figure 1:	Proposed Manas World Heritage Site Transboundary Complex	17
Figure 2:	Resolution of consultative meeting on Indo-Bhutan transboundary biodiversity conservation	18
Figure 3:	Map depicting Tourism zone of Manas National Park	24
Figure 4:	Tourism map and logo designed for Manas National Park	25

List of Annexures

Annexure-I	WHC Decision 36 COM 7B.65
Annexure-II	Manas Rhino Conservation Plan (2014-2024)
Annexure-III	Update on Rhino Monitoring in Manas National Park
Annexure-IV	Media reports on Translocation of Eastern Swamp Deer
Annexure-V	Management Effective Evaluation Report (2013-14) for Manas National Park
Annexure-VI	Transboundary Herpetofaunal survey in Manas landscape.
Annexure-VII	Quarterly meeting for Conservation Partners of Manas Tiger Reserve.
Annexure-VIII	FDA and EDC in Manas National Park
Annexure-IX	Survey report on endangered grassland fauna (Pygmy Hog and Hispid Hare)
Annexure-X	Survey Report on Bengal florican
Annexure-XI	Update on Invasive Species Study
Annexure-XII	Nature Guide Training Programme

EXECUTIVE SUMMARY

State Party	India
State, Province or Region	Assam, Bodoland Territorial Areas District (Baksa)
Name of Property	Manas National Park
Criteria under which property is nominated	<p>Criterion vii: <i>To contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance ;</i></p> <p>Criterion ix: <i>to be outstanding examples representing significant on-going ecological and biological processes;</i></p> <p>Criterion x: <i>To 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.</i></p>
Response to the Committee Decision 38 COM 7B.65	<p>The World Heritage Committee vide its decision no 38 COM 7B.65 in 2014 has sought a few clarifications from the State Party with regards to the annual update on the OUVs of the Property that was taken out of the World Heritage in Danger List in 2011.</p> <p>The Executive Summary of the detailed response is as mentioned below:</p> <ol style="list-style-type: none"> 1) The Property is currently able to meet its financial requirements from the Manas Tiger Conservation Foundation which supports the Park as and when any amount is required and also as a stop gap arrangement during the fund channelization process. The Central Govt has also been able to timely release the funds under Project Tiger in 2014-15 for better management of the property. 2) The Poaching of Rhinos in Manas National Park is currently under control with the implementation of SMART patrolling, increase in forest frontline staff and number of functional anti-poaching camps. This is complemented with an enhanced intelligence network that has led to increase in number of seizures related to wildlife crime in the year 2013-14. 3) Swamp Deer translocation has been undertaken as per protocol and schedule. 19 swamp deer were translocated from Kaziranga to Manas on 28th December 2014. The deer are currently housed in an enclosure (Boma) and shall be released into the wild in phases after acclimatization.

	<p>4) The encroachment at Bhuyanpara is currently under control with no new clearing of forests for cultivation. A systematic long term and short term eviction and habitat restoration plan has been suggested under the Rhino Conservation Plan (2014-2024) and has been submitted to the State Govt for further approval. As per this plan, eviction shall be carried out followed by boundary demarcation and bringing in the Army led Eco-Task Force for protection and habitat restoration activities.</p> <p>5) The overall law and order situation in the region has been stable at the time of writing this report. Army operations are currently underway as counter-insurgency operations wherein a number of wanted militants have been arrested and their illegal camps in the vicinity of forests have been destroyed.</p> <p>6) The property has achieved several other milestones such as the formation of manas Forest Development agency and launch of 8 Eco-development committees with the forest fringe villages. Thirty per cent of the Manas Tiger Conservation Foundation funds are also earmarked for support to the local community by participation, microplanning and stakeholdership in the conservation planning.</p> <p>7) Transboundary cooperation with Royal Manas National Park (which is on the tentative World Heritage Site list) has been formalized and collaborative surveys on research and monitoring of flagship species such as tigers have been carried out</p> <p>In conclusion, the property has complied with all the recommendations made by the World Heritage Committee and the State Party has been able to maintain the OUVs of the property.</p>
Name and contact information of official local institution/agency	<p>Organization: Assam Forest Department</p> <p>Address: Field Director, Manas Tiger Project. Barpeta Road. Assam. India 781315</p> <p>Tel: +91-3666-261413 (O)</p> <p>Fax: +91-3666-260253</p> <p>Email: fd.manastp@gmail.com</p> <p>Web address: www.worldheritagemanas.com</p>

1. BACKGROUND

The World Heritage Committee on the basis of decision, adopted at the 38th Session in 2014 requested the State Party India vide decision 38 COM 7B.65 (**Annexure-I**) to submit to the World Heritage Centre by 1st February, 2015 ‘a detailed report, including a 1-page executive summary, on the state of conservation of the property, on the implementation of the above and updates of the financial situation of the property, for examination by the World Heritage Committee at its 39th session in 2015’. Accordingly, the response of the State Party to decision 36 COM 7B.65 is given below.

2. PARA 3: WELCOMES THE INFORMATION PROVIDED BY THE STATE PARTY THAT THE DELAY IN FUND RELEASE HAS BEEN ADDRESSED AND RECOMMENDS THAT THE STATE PARTY PROVIDE UPDATES OF THE FINANCIAL SITUATION OF THE PROPERTY IN FUTURE REPORTS TO THE COMMITTEE

The property also forms the core area of Manas Tiger Reserve. As per section 38 X of the Indian Wildlife (Protection) Amendment Act, 2006 and guidelines of Govt of India, a repository fund under Tiger Conservation Foundation has been set up and is operational since 2012-13. The Manas Tiger Conservation Foundation (MTCF) primarily facilitates and supports the Park management for conservation of tiger and biodiversity and eco-development initiatives. It also has other objectives which are as follows:

- to facilitate ecological, economic, social and cultural development in the tiger reserve;
- to promote eco-tourism with the involvement of local stakeholder communities and provide support to safeguard the natural environment in the tiger reserve;
- to facilitate the creation of, and or maintenance of, such assets as may be necessary for fulfilling the above said objectives;
- to solicit technical, financial, social, legal and other support required for the activities of the Foundation for achieving the above said objectives.

- to augment and mobilize financial resources including recycling of entry and such other fees received in a tiger reserve, to foster stake-holder development and eco-tourism;
- to support research, environmental education and training in the above related fields

MTCF funds have been used in the last one year for maintenance of patrolling paths and anti-poaching surveillance roads along with infrastructure support. Funding has also been sanctioned for carrying out feasibility of eco-development studies in Manas and subsequently the Manas Forest Development Agency has been registered under the Indian Societies Registration act, 1860. Eight numbers of Eco-Development Committees have been formed along the forest fringe villages in the pilot phase.

Funding has also been utilized as a loan from the foundation for payment of wages etc to casual workers engaged in anti-poaching surveillance. The loan also acts as a 'stop-gap' arrangement, incase there is any delay in the process of sanctioning and channelling the funds recieved from the Central and State Government. Similarly sanctioned funds have also been earmarked for carrying out annual population monitoring of flagship species and also for carrying out a systematic plan for tackling the encroachment under Bhuyanpara Range.

The Governing Body of the the MTCF meets annually under the Presidentship of the Minister, Environment and Forests, Government of Assam. The 3rd Meeting of the Governing Body of MTCF was held on 25 August, 2014 in Guwahati, Assam.

Details of the financial position of the Park in the last four years have been provided in **Table 1**.

Table 1. Disbursement of funds received from Central and State Government to Manas National Park in the last four years

Sl. no.	Item	Year	Amount sanctioned (INR Lakhs or in Million USD*) and Date	Amount released from Assam state Government (lakhs) and date received by Park authority	Remarks
1	National Tiger Conservation Authority, Government of India	2011-12	INR 553.04 (USD 0.886633728) on 30/09/2011	(a) INR 479.62 (USD 0.768926784 on 14/3/2013 (b) INR 73.42 0.117706944 on 21/03/2012	
		2012-13	INR 273.176 (USD 0.437955763 On 17/08/2012	(a) INR 273.176 (USD 0.437955763 Dt. 15/03/2013 (b) INR 8.65 (USD 0.01386768) on 26/03/2013	(a) received from DC, Chirang (b) received from State
		2013-14	INR 496.85 (USD 0.79654992 on 19/09/2013	(a) INR 372.9185 (USD 0.597862939 Dt.13/11/2013 (b) INR 24.85500 (USD 0.039847536 Dt. 21/12/2013 (c) INR 99.07650 (USD 0.158839445) Dt. 04/03/14	(a) received from DC, Chirang
		2014-15	INR 396.46 (USD 0.635604672) On 16/06/2014	-	
2	Project Elephant, Government of India	2011-12	INR 3.43 (USD 0.005498976)	(a) INR 3.43 (USD 0.005498976) on 31/03/2012	(a) Received from DFO, Kaziranga
		2012-13	INR 11.17 (USD 0.017907744) on 30/03/2013	(b) INR 11.17 (USD 0.017907744)on 31/08/2013	(b) Received from DFO, Zoo Guwahati
		2013-14	Nil		
		2014-15	Nil		
3	Biosphere Reserve, Government of India	2011-12	Nil		
		2012-13	INR 60.46 (USD 0.096929472) on 8/10/2012	INR 60.46 (USD 0.096929472) on 02/11/2012	2 nd instalment of 2008-09
		2013-14	Nil		
		2014-15	Nil		

Sl. no.	Item	Year	Amount sanctioned (INR Lakhs or in Million USD*) and Date	Amount released from Assam state Government (lakhs) and date received by Park authority	Remarks
4	Government of BTC	2011-12	INR 547.812 (USD 0.878252198)	NA	Amount directly transferred to Park Authority.
		2012-13	INR 1214.28864 (USD 1.946747548)	NA	
		2013-14	INR 508.25819 (USD 0.81483953)	NA	
		2014-15	INR 90.99461 ((USD 0.145882559)	NA	
5	Manas Tiger Conservation Foundation	2011-12	INR 17.21086 (USD 0.027592451)	Available with Park Authority	Funds being utilized as a sanction/loan amount for management of the Property
		2012-13	INR 28.34533 (USD 0.045443233)		
		2013-14	INR 66.33024 (USD 0.106340641)		
		2014-15	INR 15.15341 (USD 0.024293947) As on 31.12.2014		

**Rate of Conversion as on 9/1/2015 is 1 USD = 62.3097 INR*

3. PARA 4: NOTES WITH APPRECIATION THE POSITIVE RESULTS ACHIEVED UP TO 2013 WITH THE REINTRODUCTION OF GREATER ONE-HORNED RHINOCEROS, AS WELL AS THE DEVELOPMENT OF A COMPREHENSIVE EASTERN SWAMP DEER TRANSLOCATION PROTOCOL, THE IMPLEMENTATION OF WHICH IS ANTICIPATED TO COMMENCE IN 2014.

a) Rhino reintroduction

Rhino reintroduction is one of the flagship programs of the Assam State Government under the multi-stakeholder India Rhino Vision 2020 (IRV2020), and has been initiated since 2006 at the property. Currently there are 30 rhinos in the park. This year, a detailed Rhino Conservation Plan (2014-2024) has also been prepared and submitted to the State Govt to support the ongoing management activities

(**Annexure II**). The main objectives of the Rhino Conservation Plan (RCP) are as follows:

- To conserve Great one horned Rhino as the flagship species in Manas by managing habitat and other ecological attributes for the propagation of prey species in a balanced ecosystem.
- To strengthen anti-poaching strategies and capacity building for forest frontline staff and developing an intelligence network.
- To assess and summarise the conservation activities including research and monitoring aspects, community engagement etc since rhino reintroduction in Manas in 2008, and provide a road map for the next ten years.

The plan and the provisions therein must find legal support and, therefore, key recommendations from the RCP have also been incorporated into the Manas Tiger Conservation Plan (2014-24) as mandated under the Wildlife Protection (Amendment) Act, 2006 for all Tiger Reserves.

Table 2: Population Status of translocated Rhinos in Manas National Park (as on 31.12.2014)

Wild-to-Wild Translocation		Rescue-and-Rehabilitation	
Year	No. of Rhinos	Year	No. of Rhinos
2008	2	2006	3
2010	2		
2011	4		
2012	10	2012	3
2013	-	2013	1
2014	-	2014	3
Total	18	Total	10

An update on monitoring of translocated rhinos in Manas National Park is enclosed with details (**Annexure III**).

b) Swamp Deer Translocation:

Subsequent to IUCN-UNESCO recommendation for a recovery plan for the Eastern swamp deer in Manas, the State Party India has taken active initiative to undertake the process. The only viable population of Eastern Swamp Deer (*Rucervus duvaucelii ranjitsinhi*), is currently found only in Kaziranga National Park and World Heritage Site. Confirmed sightings of about 15-20 swamp deer in three locations in Manas National Park have also been reported in the last two years.

To augment the existing small population at Manas and as per the scientific guidelines of swamp deer translocation protocol, a capture process was initiated at Kaziranga on December 9, 2014, in presence of lead NGO (Wildlife Trust of India), veterinarians, translocation experts, and the Assam Forest Department.

A survey report on the status of Swamp deer and habitat suitability analysis and the translocation Protocol was also carried out and submitted to the WHS Committee last year. The protocol addresses three main components – the capture and translocation, the ecological monitoring and the risks involved and enumerate in detail various parameters for field implementation of the translocation process.

As per the protocol, the major highlight of the current financial year has been the successful translocation of 19 numbers of swamp deer from Kaziranga to Manas on 28th December 2014. These animals were subsequently captured and released in a specially prepared *Boma* (exclosure) that has been secured by a two-line power fence installed over a tree-pole (*Bombax ceiba*) barrier to deter leopards from entering the enclosure. The *Boma* has also been artificially flooded and short grass brought in from nearby areas for transplantation to ensure the well-being of the herd. The animals were doing well inside the *Boma* at the time of writing this report. It is expected that these deer shall be kept for the first few months inside the *Boma* and then subsequently released inside the park in batches. (**Annexure IV**).

4. PARA 5: NOTES WITH SERIOUS CONCERN THE REPORTED RECENT POACHING OF NEARLY ONE THIRD OF THE RECOVERING RHINO POPULATION, WHICH IS A SHARP REMINDER OF THE FRAGILITY OF THE PROPERTY'S RECOVERING OUTSTANDING UNIVERSAL VALUE (OUV), AND URGES THE STATE PARTY TO ENSURE THAT FOREST GUARDS ARE ADEQUATELY EQUIPPED AND TRAINED TO PROTECT THE PROPERTY AGAINST POACHERS AND MAINTAIN EFFECTIVE PATROLLING, IN ORDER TO SECURE THE RECOVERING POPULATIONS OF RHINO AND OTHER WILDLIFE, AND TO ENSURE THAT THE ANTICIPATED TRANSLOCATION OF EASTERN SWAMP DEER CAN BE CARRIED OUT EFFECTIVELY.

Manas currently has a population of 30 Rhinos. The existing population is an increase from the initially reintroduced population of 18 (wild to wild) and 9 (captive reared) rhinos (**Table 2**).

With the growing demand for rhino trade worldwide (Year 2013 witnessing the highest number of poaching in the world and in Assam), Manas also lost one adult male rhino to poachers in November 2014. The poachers took advantage of the overgrown and dense post-monsoon vegetation and a firecracker bursting festival (that is likely to mimic the sound of gun shots) to carry out this poaching in a remote corner of Bhuyanpara Range.

Table 3: Mortality and Birth of Translocated Rhinos in Manas National Park

Year	No. of Rhino Deaths	No. of Rhino Births
2011	1	-
2012	1	1
2013	5	9
2014	1	1
Total	8	11

While intelligence inputs have been strengthened, a GPS and digital camera based assisted SMART (Spatial monitoring and Reporting Tool) elephant patrolling has also been initiated in the Park especially during the Monsoon

season in the rhino ranging areas. The SMART patrol has been carried out at an interval of 8-10 days and has yielded highly beneficial results including the sighting of individual rhinos in the dense monsoon vegetation. Further details on SMART patrolling and some of its results are published under the Rhino Conservation Plan (2014-2024), Chapter Three, section 3.6 and placed as (Annexure II).

Presently, the Manas National Park also has a sanctioned strength of 380 staff out of which frontline forest staff is 343. In addition, there are 135 service providers, 75 homeguards, 35 personnel from Assam Forest Protection Force, 36 fixed pay workers and 68 casual workers. Augmentation in the existing staff strength has also been proposed under the Tiger Conservation Plan, submitted to the Govt. The forest staffs are equipped with wireless equipment, GPS sets, arms and ammunition. The park infrastructure has a current strength of 69 anti-poaching camps.

5. PARA 6: REQUESTS THE STATE PARTY TO TAKE URGENT MEASURES TO ADDRESS THE REPORTED NEW ENCROACHMENT AT BHUYANPARA RANGE WITHIN THE PROPERTY, AND REHABILITATE DEGRADED AREAS

In case of Bhuyanpara, it is stated that while there have been new clearings in the grassland area of the (Agrang-Betbari-Khoirbari) area of Bhuyanpara Range this year; these are not of permanent nature and there is no human settlement inside the clearing areas. This illegal cultivation/encroachment is not a new issue and has been a feature for over a decade due to complex socio-political reasons. The easternmost boundary of this illegal cultivation is next to Betbari camp and adjacent to the Kokilabari Agricultural Farm (approx 9 sq km) with only a small rivulet separating the two. The seed farm was until recently on a 30 years lease from the forest department. At the end of 2005-06, the seed farm was formally handed over to the Agriculture department, Govt of BTC. This farm supports people from at least 57 villages who take a small portion of the land on lease from the department every year. At the

same time, certain miscreants take advantage of the heterogeneity of the community and also indulge in illegal cultivation on the disputed side. The park authorities remain vigilant and use both conservation volunteers and armed guards to monitor and control this menace.

Under Rhino Conservation Plan Chapter 4, section 4.2 and 4.3 (Annexure II), the following Action Plan has been submitted to Govt of Assam/BTAD for approval and is stated as below:

a) Combating encroachment in Bhuyanpara (Short-term Plan)

The encroachment issue at Bhuyanpara is being addressed and the following timeline of action are therfeore proposed:

- Jan 2015: Serving of eviction notice and eviction operation with support and coordinated action with Forest department, Baksa District administration, Police and Army.
- Jan-Feb 2015: Area domination will be required with support of additional manpower (with arms) support for atleast 50 staff to camp in the area. The camps at Khoirbari, Agrang, Panda, Betbari, Maozi and Tangunmara would accordingly be strengthened with the additional forces for the winter season.
- Feb-Mar 2015: A trench along with a solar fence and boundary pillars will be erected at the disputed site so as to permanently repossess the area. The support of three local NGOs (Manas Bhuyanpara eco-tourism Society, Manas Agrang Society and Manas Maozegendri Ecotourism Society) along with the concerned village headmen will be crucial for the success of the eviction operation.

b) Combating encroachment in Bhuyanpara (Long-term Plan)

It has been observed that the encroachment at Bhuyanpara is a recurring problem that has been impacting the park since the declaration of the National Park in 1990. The disputed territories in Agrang Forest village and adjoining areas have been a bone of

contention, especially since it is an area for prime grasslands /agricultural area. the socio-political situation including the presence of militant outfits in the vicinity of the Park, unauthorized and illegal possession of weapons by civilians and the prevalence of country-made fire arms have also been some of the factors that have led to 'land mafia-backed' encroachment inside the Park. As already stated, the current encroachment is not of a permanent nature and the people from atleast 30 villages from nearby areas participate in clearing and cultivating small portions of grassland. Such encroachment is often backed and controlled by armed miscreants who have been identified and the information shared with intelligence authorities. A reconciliatory attempt to talk to the encroachers and come up with an amicable solution was also attempted by the Park authorities in 2011 with support of the local NGOs. Boundary pillars had been erected and the area of actual demarcation was also agreed upon. Similarly, in April 2014, eviction notices were served and conservation volunteers from Panbari. Bansbari and Kahitema area were deployed in greater numbers to prevent any further encroachment.

All the actions as mentioned above indicate that a multi-pronged comprehensive long-term strategy (atleast five years) is required for targeting the encroachers. The tentative timeline is proposed below:

- **Feb-Mar 2015:** eviction of encroachers, after the paddy cultivation season is over and to ensure that no further clearing in the grassland/forest is made. All access to forest, including grazing of livestock, collection of firewood and minor forest produce, fishing and hunting to be strictly banned and the law enforced through strictest of measures. Bringing in new forest staff and rotation of existing staff to other areas is being planned. Additional incentives such as provisioning for rations, vehicle and elephants for patrolling, wireless sets for communication and provisioning of winter gear are also being addressed for boosting the morale of the existing staff.

- **Feb 2015:** Deployment of Eco-Task Force (Two Companies) of Territorial Army under Ministry of Defence, Govt. of India currently based out of Kokrajhar, BTC for systematic area domination and undertaking plantation in the adjoining Daodhara and Batabari RF areas. Daodhara RF is part of the Critical Tiger Habitat and also an important elephant corridor for migratory elephant. Currently, Daodhara and Batabari RF are also facing an onslaught of clearing and illegal removal of trees. There is a tremendous potential to create large-scale plantations through the Eco-Task Force in both these RF areas. The advantage of bringing in the ETF is that they are trained army personnel and that their large numbers (two companies) will ensure area domination against the armed miscreants that support encroachers. Grassland improvement cum restoration including maintenance of forest roads and creation of artificial waterholes etc are some of the additional tasks that can be handed over the Eco-task Force in the National Park. The Task force can be based out of Kokilabari and Agrang Camps so that no further encroachment occurs in the area. The modalities for providing housing to the Eco-Task Force, the salaries, nurseries for plantation etc would be worked out in coordination with the Park authority and the adjoining Territorial Divisions.
- **March 2015 – Aug- 2020:** a systematic plan for creating nursery and plantations in the RF areas and complete closure of the National park to any anthropogenic pressures will ensure complete revival of the habitat and therefore the return of the Rhinos and mega herbivores.

6. PARA 7: ALSO NOTES WITH UTMOST CONCERN THE REPORTED DETERIORATION OF THE SECURITY SITUATION IN THE PROPERTY, AND CONSIDERS THAT A FURTHER DETERIORATION OF THE SECURITY SITUATION, ASSOCIATED WITH THE REPORTED SURGE IN POACHING AND CONCERNS REGARDING ENCROACHMENT COULD CREATE THE CONDITIONS TO RE-INSCRIBE THE PROPERTY ON THE LIST OF WORLD HERITAGE IN DANGER

While there have been unfortunate incidents of ethnic clashes and terrorist attacks primarily instigated by known militant outfits in certain areas of Assam in 2014, Manas being a geographical entity in this landscape has also borne the brunt of this civil strife time and again (Table 4). It may be pertinent to mention that 2014 saw a single rhino being poached despite the protection efforts. However, this is a marked improvement in the situation as compared to the previous years and indicates much better control over the poaching situation in the park. It has been a result of intensive protection efforts by the park authorities and active action in the field by frontline forest staff. The forest staffs have been carrying out joint operation with the police and armed forces of the government to secure the World Heritage property. Intensive combing operations by the armed forces have recently been undertaken in the region in the recent period targeting poachers and other armed miscreants. Joint patrolling has also been undertaken between Indian and Bhutan Manas Park Authorities along the border of the Manas property.

Forest staffs are also engaged in mobile camping in select areas of the forest to patrol vulnerable locations inside the park. A specialized rhino monitoring team is using radio-telemetry system to track and monitor the rhino population either on foot, elephant back, motorcycles and 4WD vehicles depending on the area where the rhinos were present. The Range Officers of the Park have conducted several consultations with the local stakeholders of the fringe villages for protection orientation and rapport-building towards cooperation between the local population and the forest department.

A high-level security committee for protection of Manas National Park has been formed by the Government of Assam which is headed by the Deputy

Chief and Incharge Forests of the Bodoland Territorial Council. Members of the committee include senior police, civil and forest officials.

Table 4: SWOT analysis for Rhino Conservation in Manas National Park (source: RCP (2014-2024))

<p>STRENGTHS</p> <ul style="list-style-type: none"> • Sense of pride for rhino in the people of BTC. • Largest and viable rhino habitat (past and current year data). • Staff dedication. • NGO and civil society willingness for partnership in rhino conservation. • Rhino based tourism • Multiple conservation value and tags in rhino bearing area • WHS values. • Funding support from NTCA. • State amendment of WPA for better investigation and conviction with legal support. 	<p>WEAKNESS</p> <ul style="list-style-type: none"> • Inadequate and untimely funding from State Govt. • Inadequate man power (number and quality). • Inadequate infrastructure. • Porous southern boundary. • Insufficient intelligence gathering. • Appropriate and insufficient number of modern fire arms. • Inadequate community development. • Low rate of conviction in wildlife offences.
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Preparation of a comprehensive Rhino conservation Plan, • Public and political goodwill. • Scope for research. • National and international support. • Use of modern technology for monitoring and protection. 	<p>THREATS</p> <ul style="list-style-type: none"> • Rise in global demand of illegally traded rhino horns. • Law and order situation. • Habitat degradation (invasive, woodland encroachment in grasslands). • Easy availability of fire arms including country-weapons. • Encroachment.

Monitoring and Management Evaluation Effectiveness of Manas Tiger Reserve

The National Tiger Conservation Authority (NTCA) with technical backstopping from the Wildlife Institute of India has been conducting the Management Effectiveness Evaluation (MEE) of the tiger reserve network in India using the IUCN-WCPA Framework, adapted to Indian situation. In the 2010-11 MEE assessment Manas Tiger Reserve got an overall rating of "Good" by a team of

independent experts. In the 2014-15 MEE assessment Manas Tiger Reserve has again been rated as "Good". This demonstrates that despite all odds the Site Management has remained in the same i.e "Good" condition. Details of the MEE report have been placed as (**Annexure V**).

7. PARA 8: REITERATES ITS REQUEST TO THE STATE PARTY OF BHUTAN TO SUBMIT A COPY OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE MANGDECHHU HYDRO-ELECTRIC PROJECT AS PER DECISION 36 COM 7B.10, INCLUDING AN ASSESSMENT OF POTENTIAL IMPACTS ON THE PROPERTY'S OUV AND CUMULATIVE IMPACTS IN RELATION TO THE EXISTING KURICHU DAM, IN CONFORMITY WITH IUCN'S WORLD HERITAGE ADVICE NOTE ON ENVIRONMENTAL ASSESSMENT

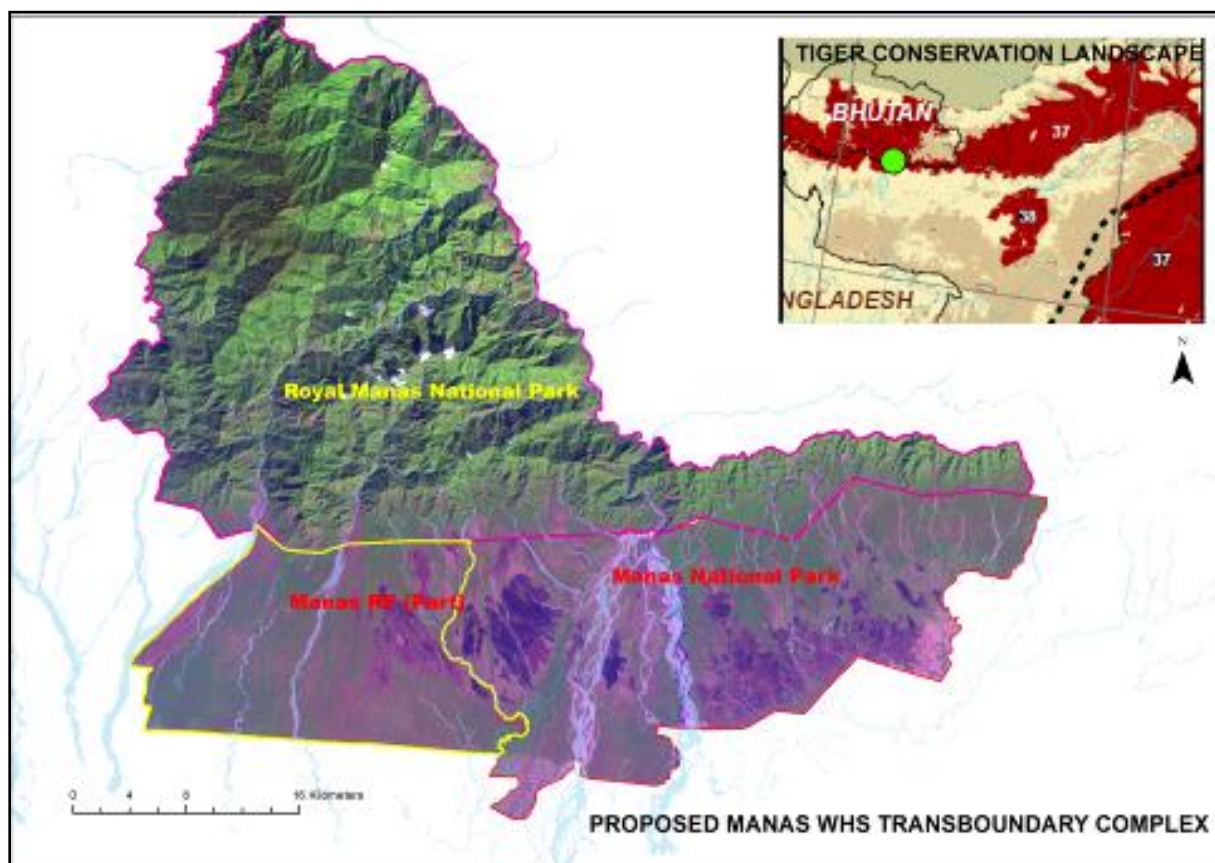
This response is to be submitted by the state party of Bhutan.

8. ADDITIONAL INFORMATION RELEVANT TO PREVIOUS DECISIONS AND RECOMMENDATIONS

(1) Extension of property in three stages: The State Party in its response of February 2014 had requested, that currently the property is maintained as a single entity which is a National Park that comprises a total area of 500 sq km. There is no reduction/ alteration in the boundary physically, but only an 'UPGRADATION' of protection and conservation status which is continuing since 1990. Hence ratification the '**first stage**' extension of the property by the WHS committee is again requested.

Regarding the '**second stage**' extension of the property, a detailed proposal for declaration of 350 sq km under Manas RF as a National Park has already been approved by the Assam State Board of Wildlife (a statutory body chaired by the Honblé Chief Minister of Assam) at its 7th Meeting held in Guwahati, Assam on 21st October, 2014. The gazette notification of the National Park is expected to be published within the next few months.

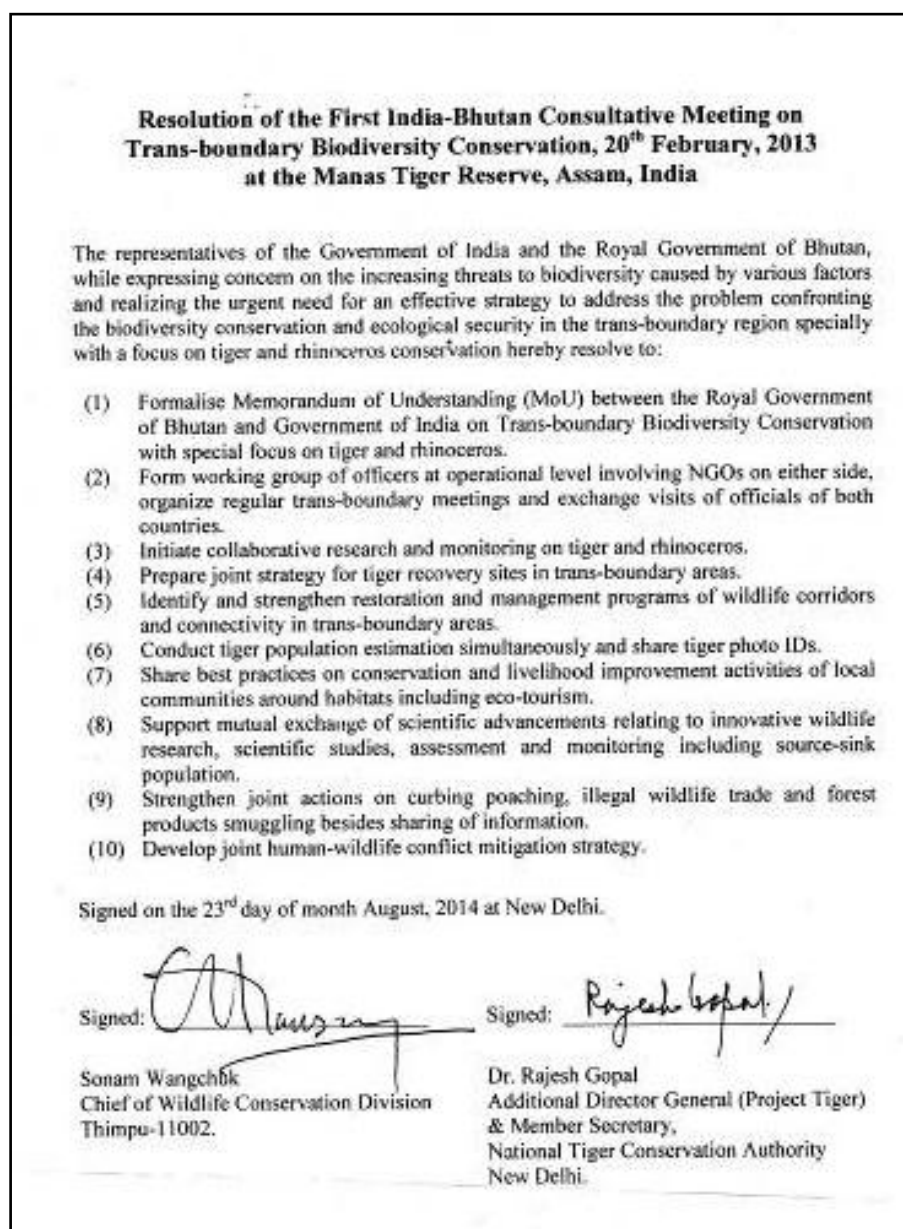
Fig 1: Proposed Manas WHS transboundary complex (Source: Ghosh, 2014)



(2) Trans-boundary cooperation and extension

Transboundary coordination meetings are being regularly held between the Park authorities and NGOs working in Manas National Park, India and Royal Manas National Park, Bhutan under the banner of TRAMCA (Transboundary Manas Conservation Area). The resolution for areas of common interest was also formally signed and ratified in the last year by both the governments in August, 2014 (**Fig 2**).

Fig 2: Copy of the Transboundary biodiversity conservation meeting and resolution between Government of India and Bhutan



As a result of these meetings, a joint herpetofauna survey has been conducted for the first time in August 2014 in which a total of 20 amphibians and 29 reptiles' species were recorded during the survey. Several new records such as *Uperodon globulosus*, *Ingerana borealis*, *Calotes maria*, *Cnemaspis assamensis*, *Ptyctolaemus gularis* and *Varanus salvator* are new addition to the herpetofauna of Rroyal Manas National Park in Bhutan (Annexure VI).

Similarly, the last meeting of TRAMCA was held on 2-3 September, 2014 in Guwahati, Assam. The meeting was held with the objective of analyzing transboundary tiger monitoring results as well as review of earlier meetings and new action points. It was decided that for subsequent years, the TRAMCA meeting will be held twice a year between representatives of Manas Park Authorities from Bhutan and India, conservation NGOs, and other stakeholders. (**Annexure VII**).

(3) Camera trap survey for tigers in transboundary Manas

Under the aegis of TRAMCA, the second joint monitoring and population of tigers using camera traps in transboundary manas was conducted in 2014. The results have been very encouraging and are summarized below:

- The first transboundary tiger monitoring and analysis in 2011 identified 14 individuals in the Transboundary landscape. (5 in Royal Manas National Park + 4 in Transboundary Manas + 5 in Manas National Park.
- From January to May 2014, second Joint Tiger Monitoring was carried out in the core of Transboundary Manas Conservation Area (TRAMCA). The sampling covered an area of 896 sq km in the RMNP and 300 sq km in the MNP. Some areas on either side could not be covered due to field logistic issues.
- A total of 12 individuals were identified in Royal Manas National Park and 11 individuals were identified in India Manas. Out of these two tigers were photo-captured on either side of the international boundary.
- The camera trapping exercise in Manas also brought in some good news that the first female tiger captured in 2006 at Manas National Park was again captured in 2014 with two grown up cubs. This makes her average survival age in Manas at least 12 years.

(2) Eco-development initiatives under Manas Forest Development Agency

As per Joint Forest Management and Eco-development guidelines of Govt of India, Manas Forest Development Agency (FDA) was registered under the Societies Registration Act on 28.05.2014 (Table 5). In the initial stages it has been decided to take up rapport building and microplanning in 64 fringe villages of the Manas National Park. It is pertinent to point out that, JFMCs under Territorial FDA s are already being operationalised in the buffer areas. The main purpose of Manas FDA would be to foster eco-development activities. As per guidelines of the Manas Tiger Conservation Fund, thirty percent of the Manas tiger Conservation Foundation funds are also earmarked for EDC activities in the fringe areas.

Table 5: Proposed Eco-development villages under Manas FDA (First Phase)

Panbari Range (District Chirang)	Bansbari and Kahitema Range (District Baksa)	Bhuyapara Range (District Baksa)
1. Lakhijhora No. 1. 2. Dailong No. 1. 3. Barpathar No. 1. 4. Saurang No. 1 5. Saurang No. 2. 6. Saurang No. 4. 7. Kachubeel No. 1. 8. Kachubeel No. 2 9. Thaisobari No. 1. 10. Thaisobari No. 2. 11. Burisuta No. 1. 12. Garabdara No. 1. 13. GarabdaraNo. 2. 14. Bogidora. 15. Bhatarmari.	1. Kahitama N.C. 2. Kahitama. 3. Kahitama Pathar. 4. Chamthaibari. 5. Oxyguri. 6. Labdanguri. 7. Labdanguri Pathar. 8. Bhalaguri Pathar. 9. Bhalaguri. 10. Bispani. 11. Elengamari. 12. Kuthrijhar. 13. Khagrabari N.C. 14. Narayanguri. 15. Giati Gaon. 16. Raghabeel. 17. Barengabari. 18. Mayangpara. 19. Madrijhora. 20. Kahibari. 21. Palsiguri. 22. Kamalabari. 23. Gohair Bhitha. 24. Rajabeel. 25. Katajhar.	1. Bamunkhal (Kumguri). 2. Bhuyanpara. 3. Koroibari. 4. Khusratari (Dongpar). 5. Borgaon. 6. Kalibari.N.C. 7. Sale Gaon. 8. Sarukhagra N.C. 9. Kurobaha N.C. 10. Kali Gaon N.C. 11. Borghagra. 12. Karankata N.C 13. Karankata. 14. Naba Dihira. 15. Bar Gaon N.C. 16. Bar Gaon. 17. Garumara. 18. Kamardaisa. 19. Kokilabari.N.C. 20. Kokilabari No. 5. 21. Daodhara.

In the initial pilot phase during the period from April to December 2014, a pilot feasibility study for microplanning was undertaken by inviting social scientists and student researchers from Tata Institute of social Sciences-Guwahati Campus. Based on their recommendations and others information available, Eight Eco-Development Committees have been taken up for establishment from Bansbari Range of Manas National Park in Baksa District of Assam.

Subsequent to the initial orientation meetings in the villages, a total of 6 EDCs were established in the fringe villages around Manas national Park during the latter six months of 2014. 2 more EDCs in this pilot phase are expected to be established in the first quarter of 2015. The EDCs formed in the villages include Barengabari, Palsiguri, Rajabil, Gohair Bhitha, Kahibari and Katajhar. Additional two villages are Madrihora and Kamalabari where EDCs are due to be established. Each of the EDCs has an Executive Committee with elected and nominated members from the local community and the forest department (**Annexure VIII**).

(3) Monitoring of flagship species including integrated ecological monitoring

As part of integrated ecosystem-based monitoring and population monitoring of flagship species such as Rhino, Tiger, Pygmy Hog, Hispid Hare, Bengal florican among others, several survey and research works have been undertaken under the auspices of the Forest Department / Manas Tiger Project with the support of technical and human resources of government and non-government scientific institutions and conservation organizations. These include both wildlife and habitat monitoring activities across the World Heritage Site. A study on monitoring and control of invasive species in the grassland ecosystem of Manas National Park is currently underway. Detailed reports on each of the flagship species and invasive species study is placed as (**Annexure IX, X, XI**)

As per the revised protocol prescribed by the Wildlife Institute of India (WII) and National Tiger Conservation Authority (NTCA) in 2014, the

‘Phase I’, ‘Phase-III’ and ‘Phase IV’ monitoring for tiger estimation was conducted in the Manas National Park. The Phase IV study was done using Capture Mark Recapture (CMR) framework using camera-traps. The study was led by Aaranyak NGO in collaboration with ATREE and WII and in partnership and ground support from the Assam Forest Department and BTC. The study was conducted in the Bhuyanpara and Bansbari ranges covering approximately 301Km². The double sided camera traps were installed in 89 grids in the first block and in 44 grids in the second block. The single sided camera traps were installed in 178 locations in the first block and 87 locations in the second block of the sampling area. Total 305 photographs of tigers were captured during the session starting from 01 February to 29 April 2014. The results are currently under detailed analysis to be finalised and released by the National Tiger Conservation Authority of India in 2015 as part of All India Tiger Estimation exercise.

(4) Eco-tourism and drafting of a comprehensive tourism plan

Subsequent to the comprehensive tourism management plan submitted for the Manas World Heritage Site, the tourism strategy has been further developed and included as a separate Chapter in the Manas Tiger Conservation Plan (2014-2024). Through this chapter, guidelines are proposed for the park management, tour operators, visitors and the host community. The tourism zone is demarcated and limited to the extent of not more than 20% of the core area of the National Park.

Guidelines have also been provided for determination of “carrying capacity” for regulating the flow of visitors in order to prevent disturbance to wildlife and habitat. Special brochure, logo, maps and signages have been developed to provide enhanced information to the visitors. Manas has been showing a steady increase in number of tourists (**Table 6**). Efforts are being made to provide quality tourism and decrease the number of day visitors to the Park. The revenue generated from tourism is also directly ‘ploughed back’ into the Manas

Tiger Conservation Foundation and is therefore readily available for sustainable and better management of the property.

Under the Comprehensive Tourism Management Plan, a Nature Guide Training Programme was held in Manas National Park during 10 – 13th October, 2014. A total of 60 participants from the fringe villages were trained during this programme. The programme included sessions on bird watching, animal signs/tracking, tree identification, wildlife legal provisions, tourism entrepreneurship, first-aid basics, etc. It is also included practical field orientation and experience sharing by other tour operators from Sunderbans, West Bengal. (**Annexure XII**).

Table 6: Inflow of tourist visitor Records in Manas National Park (2010-2015)

Year	Nos. (Indian)	Nos. (Foreigner)	Day Visitor	Total	Revenue (INR)	Revenue (USD)
2010-11	4793	129	12074	16996	56,146.00	902.739
2011-12	13167	177	10863	24207	23,74,655.00	38,185.71
2012-13	15890	218	13114	29222	24,88,065.00	40,009.40
2013-2014	23120	329	14562	38011	6633024.00	106,656.17
2014-2015 (up to Dec'14)	6610	255	5432	11855	16,80,343.00	27,019.19

Fig 3: Map depicting Tourism zone of Manas National Park
(Source: Tiger Conservation Plan of Manas (2014-2024))

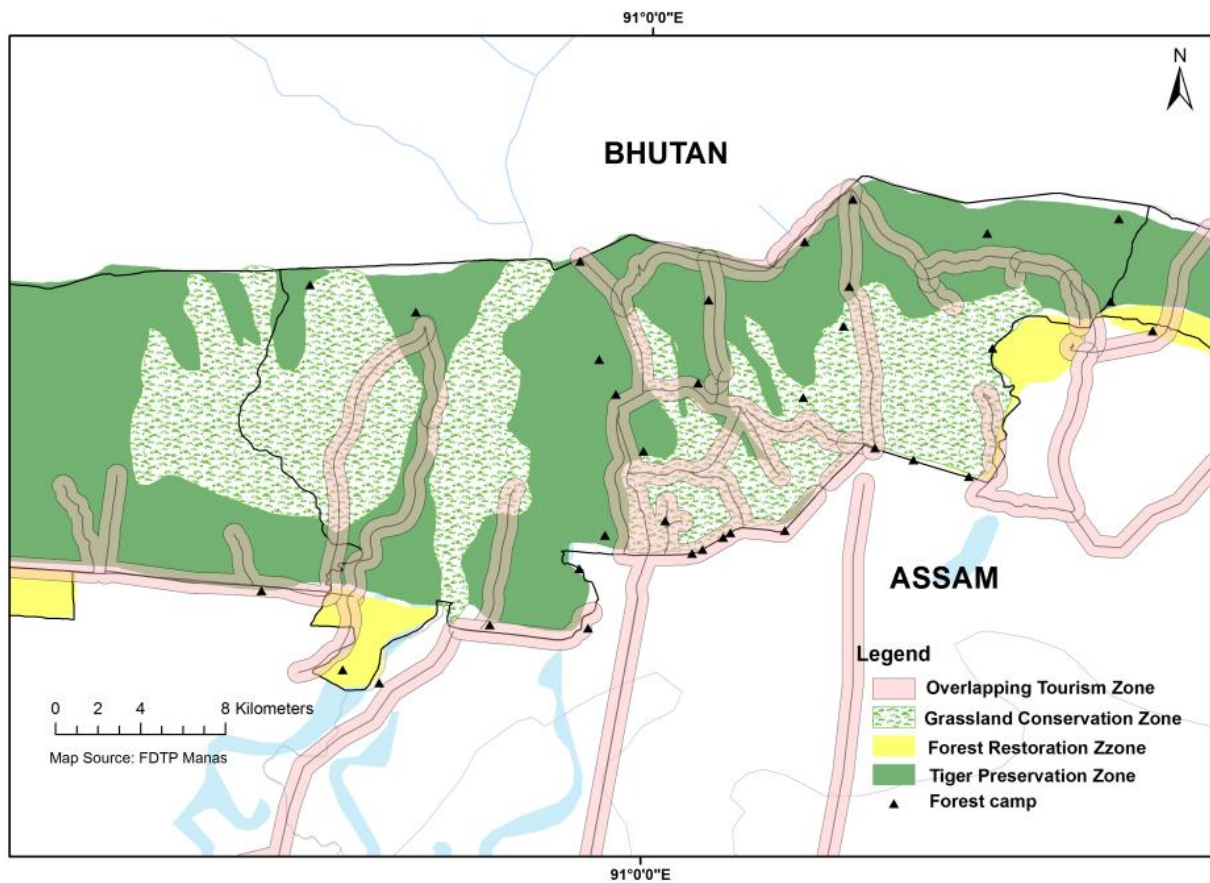
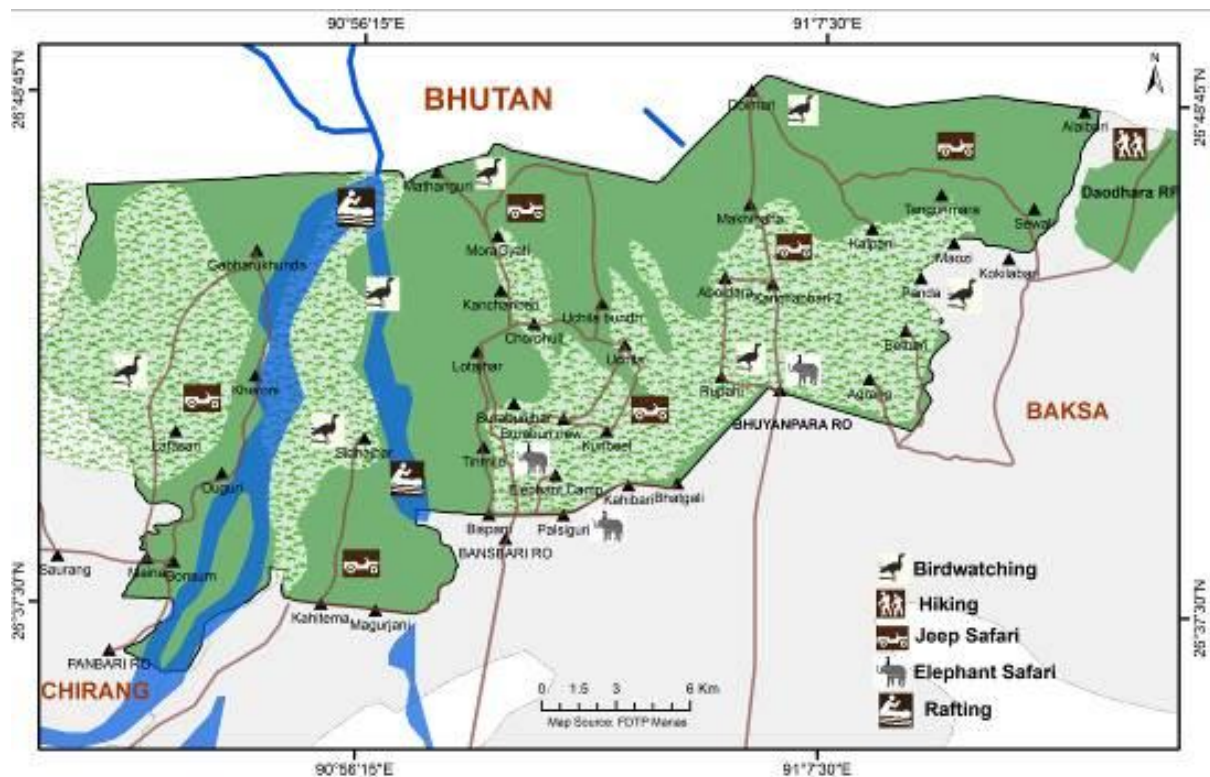


Fig 4 : Tourism map and logo designed for Manas National Park



Committee Decisions

38 COM 7B.65 Manas Wildlife Sanctuary (India) (N 338)

The World Heritage Committee,

1. Having examined Document WHC-14/38.COM/7B,
2. Recalling Decision **36 COM 7B.10** taken at its 36th session (Saint-Petersburg, 2012),
3. Welcomes the information provided by the State Party that the delay in fund release has been addressed, and recommends that the State Party provide updates of the financial situation of the property in future reports to the Committee;
4. Notes with appreciation the positive results achieved up to 2013 with the reintroduction of Greater One-horned Rhinoceros, as well as the development of a comprehensive Eastern Swamp Deer T
5. ranslocation Protocol, the implementation of which is anticipated to commence in 2014;
6. Notes with serious concern the reported recent poaching of nearly one third of the recovering rhino population, which is a sharp reminder of the fragility of the property's recovering Outstanding Universal Value (OUV), and urges the State Party to ensure that forest guards are adequately equipped and trained to protect the property against poachers and maintain effective patrolling, in order to secure the recovering populations of rhino and other wildlife, and to ensure that the anticipated translocation of Eastern Swamp Deer can be carried out effectively;
7. Requests the State Party to take urgent measures to address the reported new encroachment at Bhuyanpara Range within the property, and rehabilitate degraded areas;
8. Also notes with utmost concern the reported deterioration of the security situation in the property, and considers that a further deterioration of the security situation, associated with the reported surge in poaching and concerns regarding encroachment could create the conditions to re-inscribe the property on the List of World Heritage in Danger;
9. Reiterates its request to the State Party of Bhutan to submit a copy of the Environmental Impact Assessment (EIA) of the Mangdechhu hydro-electric project as per Decision **36 COM 7B.10**, including an assessment of potential impacts on the property's OUV and cumulative impacts in relation to the existing Kurichu dam, in conformity with IUCN's World Heritage advice note on Environmental Assessment;

Further requests the State Party to submit to the World Heritage Centre, by **1 February 2015**, a detailed report, including a 1-page executive summary, on the state of conservation of the property, on the implementation of the above and updates of the financial situation of the property, for examination by theWorld Heritage Committee at its 39th session in 2015.



RHINO CONSERVATION PLAN FOR MANAS NATIONAL PARK (2014-2019)

**A WORLD HERITAGE SITE (N 338)
UNDER CRITERIA (vii), (ix), (x)**

**Submitted by
Field Directorate, Manas Tiger Project
GOVERNMENT OF ASSAM**

Contents

Page No.

Acknowledgements

Chapter One: Overview of Rhino Conservation in Manas National Park

1.1 Background	1
1.2 Past history of Rhinos in Mans (Pre-2005)	3
1.3 Present Rhino Conservation status (Post-2005)	4
1.4 Plan objectives	6

Chapter Two: Species and Habitat Management Strategies

2.1 Vegetation and Forest Type	7
2.2. History of Rhino Presence in different habitats	7
2.3 Habitat quality	8
2.4 Rhino Ranging Pattern-an analysis	11
2.5 Radio collar status	19
2.6 Birth of new Rhino Calves	20
2.7 Master ID preparation	20
2.8 Stray and Man-animal conflict Management	21
2.9 Disease monitoring	23
2.10 Conclusion and specific recommendations	24

Chapter Three: Security assessment and staff capacity building

3.1 Challenges in managing Manas National Park	26
3.2 SWOT analysis	26
3.3 Poaching	27
3.4 Inadequate manpower and infrastructure	28
3.5 Rhino protection strategies	33
3.6 Strategic planning and LEMs (SMART patrolling)	34
3.7 Combating encroachment in Rhino-Bearing areas	41
3.8 Conclusion and specific recommendations	43

Chapter Four: Rhino Conservation-The Road Map Ahead

4.1 Aiming for zero poaching	44
4.2 Combating encroachment in Bhuyanpara (Short-term Plan)	44
4.3 Combating encroachment in Bhuyanpara (Long-term Plan)	44
4.4 Community engagement and public awareness	46
4.5 Enhanced intelligence network and LEMs	47
4.6 Habitat management	48
4.7 Transboundary habitat	48
4.8 Conclusion and specific recommendations	51

REFERNCES AND FURTHER READING

Appendix 1- Govt Notification for constitution of a Committee for protection of wildlife and control of wildlife crime in and around Manas Tiger Reserve.	54
Appendix 2- Govt Notification for constitution of a high level task force for overall improvement of Manas World Heritage site and checking all illegal activities in Manas National Park	55
Appendix 3- Govt Notification for constitution of a Committee to suggest and to improve the existing security arrangement to be carried out by Forest Department BTC in Manas National Park.	56
Appendix 4- Govt Notification for constitution of a Security assessment team under IRV2020	57
Appendix 5 - Govt Notification for constitution of a coordination team for SMART (LEM) under IRV2020 in Manas National Park	58
Appendix 6 – A master-ID key to Rhino Identification in Manas NP	59-116

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(DRAFTING TEAM)
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Suggested Citation: Ghosh, S and Dutta, D.K. (2014) Rhino Conservation Plan for Manas National Park-(November 2014) Published by: Field Directorate, Manas Tiger Project.

CHAPTER ONE

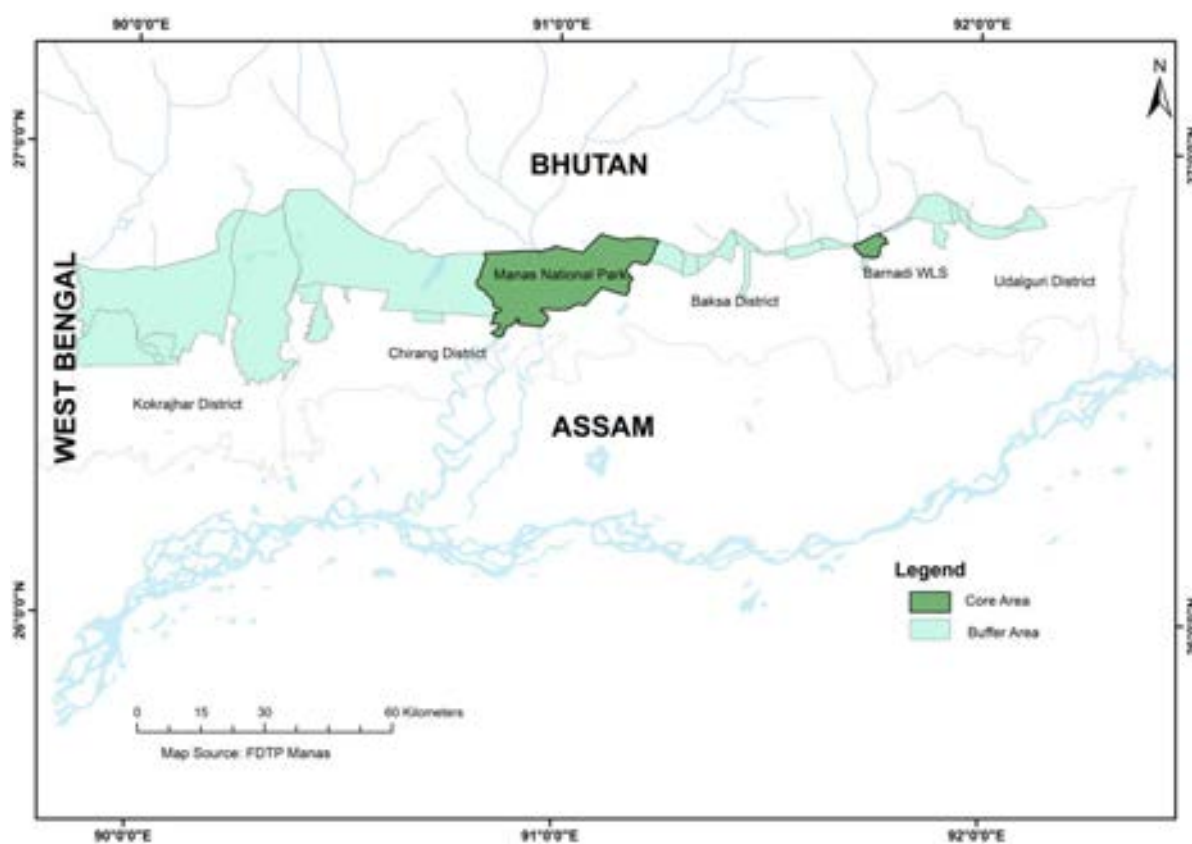
OVERVIEW OF RHINO CONSERVATION IN MANAS NATIONAL PARK

1.1 Background:

Manas National Park with an area of 500 sq km forms the core of Manas Tiger Reserve. Manas Tiger Reserve (MTR) Reserve spans across the districts of Kokrajhar, Chirang, Buxa and Udalguri in north-west Assam. To the North, it is separated from the Royal Manas National Park of Bhutan by the River Manas and its tributaries- Beki and Hakua; while to the west, it is separated from the Buxa Tiger Reserve of West Bengal by the River Sankosh (Fig 1 and 2).

Manas, with its spectacular landscape is one among most stunning pristine wildlife habitats in the world. The area has a unique distinction of being a Natural World Heritage Site, a Tiger Reserve, an Elephant Reserve, Biosphere Reserve and Important Bird Area. Evolutionarily, it is the entry point of tigers into India and combined with Buxa-Nameri-Pakke-Namdapha TRs and Protected areas in Bhutan and Myanmar; forms the single largest tiger conservation landscape for Bengal tigers (*Panthera tigris tigris*) in the world.

Fig.1.1 Location map of Manas Tiger Reserve (core and buffer area) in Assam, India

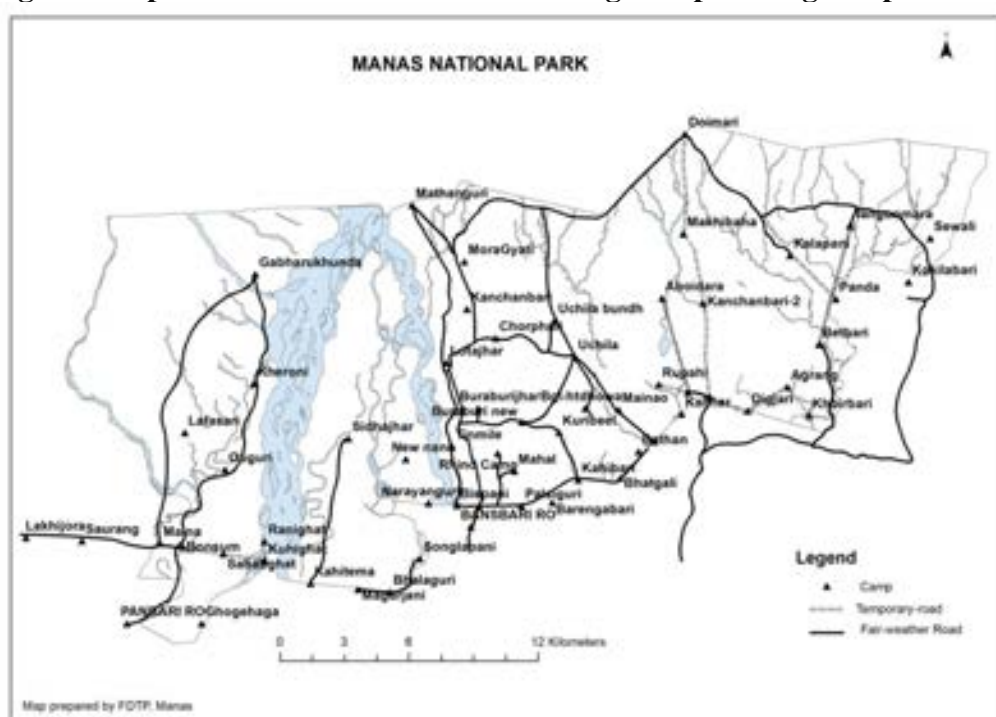


Although it has a long history of wildlife preservation dating back to 1905; key animal species such as one-horned rhinoceros and other large herbivores were extirpated during the insurgency period that lasted from 1989 to 2003. The formation of a democratically elected local government (BTAD; Bodoland Territorial Areas District) in 2005; restoration of law and park infrastructure resulted in revival of key species and their habitat. The Park regained its UNESCO Heritage Site status in 2011 in recognition to all its efforts in scientific management of the Park.

Manas National Park harbours 61 species of mammals, 450 species of birds, 42 species of reptiles, 9 species of amphibians, 79 species of fishes and more than 200 species of butterfly and 100 species of invertebrates. Manas NP supports (IUCN listed) one critically endangered, seven endangered, ten vulnerable mammals; five critically endangered, two endangered, eighteen vulnerable birds and four endangered and nine vulnerable reptiles. The avifaunal diversity of Manas is very rich as there is a confluence of wide range of habitats. Over 450 bird species has been recorded so far in this (IBA) Important Bird Site (Fig 2).

The rich assemblage is due to its unique bio-geographical location which is at the confluence of Indo-Malayan, Indo-Chinese and Australasian pathways making it an important refuge for several endemic and charismatic wildlife species. It also provides an ideal habitat ranging from high altitude Himalayan dense canopied forests to the sub-tropical woodlands and alluvial floodplain grassland and riverine ecosystems in the lower elevations.

Fig 1.2: Map of Manas National Park showing anti-poaching camps and road network



1.2. Past History of Rhinos in Manas (Pre-2005)

The Great One horned Rhinoceros (*Rhinoceros unicornis*) had been historically found in the flood plain grasslands on the north-Bank of Brahmaputra, including areas within Manas National Park. Prior to 1989, about 100 rhinos had been estimated in the Park. Published information was rather scarce while sourcing for past history of rhino occurrence in Manas National Park. It is well known that Manas was declared reserved forests where ‘Game’ could be hunted for a price way back in 1905. A compilation of published literature is therefore limited to a report by Menon (1996) for WWF-TRAFFIC-India.

According to this report, the IUCN /SSC Asian Rhino Specialist Group (AsRSG) proclaimed that in 1989, there only remained three of the seven refuges for Rhino in India (Kaziranga, Manas and Orang) that were known to have a viable population of the species. Unfortunately, by 2001 it was confirmed that most of the 100 rhinos in Manas had been poached (Menon, 1996).

Table 1.1: Population and poaching of native Rhinos in Manas National Park (upto 2001; source Vigne and Martin, 1994; Menon, 1996 and FDTP, Manas)

Year	Population	Poaching	Remarks
1962		1	
1963		1	
1965		1	
1966	15	0	Population estimation by E.P.Gee (Spillet, 1966)
1971		1	
1976	40	4	Population estimation by Laurie, 1978
1977	75	0	Population estimation by Deb Roy.
1978		1	
1981		2	
1982		1	
1983		3	
1984		4	
1985		1	
1986	75-80	1	Population estimation by Forest department
1987		7	
1988		1	
1989	85	6	Population estimation by Forest department

1990	85-100	2	Population estimation by Forest department
1991		3	
1992	80	11	Population estimation by Forest department
1993	60/30	22	Population estimation by Forest department
1995	30/120		Population estimation by Forest department
2001	?	1	Poaching as reported by Forest Department

1.3. Present Rhino Conservation status (Post-2005)

At the Centenary celebration of Kaziranga and Manas National Park in 2005, it was decided to reintroduce Rhinos to areas where it had been exterminated as per a multi-stakeholder plan which is popularly known as IRV 2020 (India Rhino Vision-2020). The process of reintroduction began on 20th January 2014 with the translocation of a rehabilitated rhinos named “Mainao” in *Gahori pam* area Basbari range of Manas.

The Indian Rhino Vision 2020 as conceived is a joint conservation initiative of the Assam Forest Department, WWF India and International Rhino Foundation, supported by the Bodoland Territorial Council, United States Fish and Wildlife Service, Wildlife Areas Welfare and Development Trust and other partner organizations. Under this programme, wild-to-wild translocation of rhinos to Manas from two other rhino bearing protected areas in Assam was initiated in 2008 with 2 rhinos. As of 2012, this had increased to a cumulative total of 18 rhinos. In parallel, 9 rescued rhinos hand raised at Center For Wildlife rehabilitation and Conservation (CWRC) from Kaziranga National park were also rehabilitated in Manas (Table 2).

Table 1.2: Population Status of Rhino Translocation in Manas National Park

Wild-to-Wild Translocation		Rescue-and-Rehabilitation	
Year	No. of Rhinos	Year	No. of Rhinos
2008	2	2006	3
2010	2	2012	2
2011	4	2013	1
2012	10	2014	3
Total	18	Total	9

Unfortunately, a number of rhino poaching incidents occurred during the last two years in the region as a whole. Both the World Heritage Sites namely, Kaziranga National Park and Manas National Park were affected by the sudden spurt in poaching. In Manas, a

total of 8 rhinos have succumbed to poaching till date (as on 30.11.2014). On the other hand, the translocated rhinos also gave birth to 11 rhino calves in the new habitat (Table 3). Currently there are 31 Rhinos in the Park (Table 4).

Table 1.3: Mortality and Birth of Translocated Rhinos in Manas National Park

Year	No. of Rhino Deaths	No. of Rhino Births
2011	1	
2012	1	1
2013	5	10
Till 30 th Nov 2014	1	
Total	8	11

Table 1.4: Current distribution of Rhino population in Manas National Park

Rhino distribution status as on 23.10.2014						
sno	Name	Sex	age	reintroduction type	collar	Ranging area
1	Rhino-3	Female	Adult	wild		Bansbari
2	Rhino-6	Female	Adult	wild		Bansbari
3	Rhino-9	Female	Adult	wild		Bansbari
4	Rhino-11	Female	Adult	wild	Working	Bansbari
5	Rhino-13	Female	Adult	wild	Working	Bansbari
6	Rhino-15	Female	Adult	wild	Working	Bhuyanpara
7	Ganga	Female	Adult	Rehabilitated		Bansbari
8	Jamuna	Female	Adult	Rehabilitated		Bansbari
9	Mainao	Female	Adult	Rehabilitated		Bansbari/Bhuyanpara
10	Rhino-4	Female	Adult	wild		Bansbari
11	Rhino 7	Male	Adult	wild		Bansbari
12	Rhino-18	Male	Adult	wild		Bansbari
13	Rhino-19 (Raja)	Male	Adult	Rehabilitated	working	Bansbari
14	Rhino-20 (Maju)	Male	Adult	Rehabilitated		Bansbari
15	Rhino-6- calf	unsexed	SA	wild		Bansbari

16	Rhino-21	Male	SA	Rehabilitated	Boma	Bansbari
17	Rhino-22	Male	SA	Rehabilitated	Boma	Bansbari
18	Rhino-23	Male	SA	Rehabilitated	Boma	Bansbari
19	Rhino3-calf	unsexed	calf	wild		Bansbari
20	Rhino8-calf	unsexed	calf	wild		Bansbari
21	Rhino9-calf	unsexed	calf	wild		Bansbari
22	Rhino10-calf	male	calf	wild		Bhuyanpara
23	rhino13calf	unsexed	calf	wild		Bansbari
24	rhino15calf	unsexed	calf	wild		Bansbari
25	Ganga-calf	Female	calf	wild		Bansbari
26	Jamuna calf	Female	calf	wild		Bansbari
27	Mainao-calf	Female	calf	wild		Bansbari
28	Rhino-14	Male	calf	wild		Bansbari
29	Dwimalu	Male	calf	Under rehabilitation	Boma	Bansbari
30	Purabi	Female	calf	Under rehabilitation	Boma	Bansbari

1.4 Plan Objectives

The main objective of this plan is to maintain a viable population of Rhinos in Manas landscape by maintaining a harmonious relation with indigenous people without causing any damage to the PA resources. They can be broadly described as follows:

- **To conserve Great one horned Rhino as the flagship species in Manas by managing habitat and other ecological attributes for the propagation of prey species in a balanced ecosystem.**
- **To strengthen anti-poaching strategies and capacity building for forest frontline staff and developing an intelligence network.**
- **To assess and summarise the conservation activities including research and monitoring aspects, community engagement etc since rhino reintroduction in Manas in 2008, and provide a road map for the next ten years.**

CHAPTER TWO

SPECIES AND HABITAT MANAGEMENT STRATEGIES

2.1. Vegetation and Forest type:

The vegetation and forest types of Manas National Park can broadly be classified as follows:

1. **Tropical semi-evergreen forests:** *Aphanomixix polystachya*, *Anthocephalus chinensis*, *Syzygium cumini*, *S. formosus*, *S. oblatum*, *Bauhinia purpurea*, *Mallotus philippensis*, *M. roxburghianus*, *Cinamomum spp.*, *Actinodaphne obovata*, etc. The under growth in these forests comprises mainly of *Leea aequata*, *Coffea benghalensis*, *Phlogocanthus thyrsiflorus*, *Clerodendrum viscosum*, *Holmskioldia sanguinea*, *Piper diffusum*, *Desmodium spp.*, *Derris spp.*, grasses and members of Zingiberaceae.

2. **Tropical moist and dry deciduous forests:** This is commonest vegetation type in the park and it is invading to the grassland. The common trees of this type are *Bombax ceiba*, *Sterculia villosa*, *Dillenia indica*, *Dillenia pentagyna*, *Careya arborea*, *Lagerstroemia parviflora*, *L. speciosa*, *Terminelia bellerica*, *T. chebula*, *Trewia nodiflora*, *Gmelina arborea*, *Albizia procera*, *Vitex glabrata*, *Bridelia spp.* Common undergrowth of this forest type are *Desmodium spp.*, *Leea spp.*, and grasses.

3. **Alluvial grassland:** Extensive patches of grasslands are found towards Southern boundary of the park. The common grass species are *Apluda mutica*, *Brachiaria distachya*, *Capilipedium assimile*, *Cynodon dactylon*, *Cyrtococcum accrescens*, *Digitaria ciliaris*, *D. longiflora*, *Echinochloa colonum*, *Eleusine indica*, *Erianthus longisetosus*, *Imperata cylindrica*, *I. cylindrica var. major*, *Neyraudia reynaudiana*, *Pogonotherum rufobarbatum*, *Polytoca digitata*, *Rottboellia exaltata*, *Saccharum procerum*, *S. spontaneum*, *Phragmites karka*, *Themeda villosa*, *Eragrostris tenella*, *Panicum spp.* *Paspalum spp.*, etc. Several trees and shrubs have invaded the grasslands, these are *Dillenia pentagyna*, *Embllica officinalis*, *Bombax ceiba*, *Lagerstroemia parviflora*, *Careya arborea*, *Glochidion assamicum* and species of *Clerodendrum*, *Leea*, *Grewia*, *Premna*, *Mussaenda*, etc.

In terrai region wetland hydrophytes are – *Alpinia nigra*, *Cyperus brevifolius*, *Lasia spinosa* and some grasses are common. Other hydrophytes found are- *Ceratophyllum demersum*, *Limnophylla sessiliflora*, *L. heterophylla*, *Ottelia alismoides*, *Vallisneria spiralis*, etc.

2.2 History of rhino presence: According to locally available information, rhinos were known to graze in the grassland areas that included the current encroached areas of Betbari and also the leased out Kokilabari Seed Farm. The last rhino was allegedly poached at Krishipukhuri area under Bhuyanpara Range in the year 2001.

2.3: Habitat quality

a) Food: Rhino are graziers and therefore eat a variety of grasses and forbs. Past observation (under IRV2020 annual monitoring) indicate that Bansbari and Bhuyanpara ranges of Manas NP bear sufficient fodder plant species generally eaten by the rhinos in all the habitats. The common fodder species available and generally grazed and browsed by the rhinos are *Paspalum orbiculare*, *Paspalum conjugatum*, *Pogonotherum crinitum*, *Echinochola colonum*, *Panicum spp.*, *Leersia hexendra*, *Dol*, *Cynodon dactylon*, *Limnophylla sessileflora*, *Hydrophylla zeylanica*, *Vallisneria spiralis*, *Azolla pinnata*, *Monochoria hastata*, *Eichornia crassipes*, *Cyperus spp.*, *Themeda villosa*, *Arundinacia sp.*, *Saccharum spontaneum*, *Phragmites karka*, *Alpinia nigra*, *Lasia spinosa* and several species of undergrowths etc. Rhino also generally grazed new shoots sprouted of tall grasses after burning. However, the grazing pressure by livestock is medium to very high, especially along the Southern boundary of the Park. Rhinos were also found to feed on algae species, *Bihalangani* (*Amphineuronopulentum*), *Dhekia* (*Diplaziumesculentum*) and other varieties of ferns, herbs, shrubs and creepers specially during the late or retreating monsoon (August –September). The Rhinos were also seen to eat the seeds of Oxy (*Dillenia pentagyna*) during July – August and also on the young and new leaves during March – April.

Table 2.1: list of fodder plants for reintroduced Rhinos in Manas National Park (Ref: IRV2020 Rhino monitoring Report 11-12)

SI No	Scientific name	Family	Season of feeding
1	<i>Casia tora</i>	Caesalpinaceae	Summer
2	<i>Amaranthus spinosus</i>	Amaranthaceae	Spring, Summer, & Autum
3	<i>Amaranthus viridis</i>	Amaranthaceae	All round the year
4	<i>Cida equata</i>	Malvaceae	Winter
5	<i>Centrella asiatica</i>	Apiaceae	Winter and Spring
6	<i>Hydrocotyle sibthorpioides</i>	Apiaceae	Winter and Spring
7	<i>Solanum torvum</i>	Solanaceae	Winter
8	<i>Oxalis corniculata</i>	Oxalidaceae	All round the year
9	<i>Spilanthes paniculata</i>	Asteraceae	Summer
10	<i>Dactyloctenium aegyptium</i>	Poaceae	Summer
11	<i>Cyperus compressus</i>	Poaceae	All round the year
12	<i>Cyperus digitatus</i>	Poaceae	All round the year
13	<i>Astraceae sps</i>	Astraceae	All round the year
14	<i>Eurana lobata</i>	Malvaceae	All round the year
15	<i>Astraceae sps</i>	Astraceae	All round the year
16	<i>Digilaria sps</i>	Poaceae	All round the year
17	<i>Eragrostis sps</i>	Poaceae	All round the year
18	<i>Eleusine indica</i>	Poaceae	All round the year
19	<i>Axonopus compressus</i>	Poaceae	All round the year
20	<i>Commelina sps</i>	Commelinaceae	Winter

21	<i>Malastoma malabaricum</i>	Malastomaceae	Summer
22	<i>Malastoma sps</i>	Malastomaceae	Summer
23	<i>Rubiaceae sps</i>	Rubiaceae	Summer
24	<i>Comelina longifolia</i>	Comelinaceae	Summer
25	<i>Papilionaceae sps</i>	Papilionaceae	All round the year
26	<i>Paederia foetida</i>	Rubiaceae	All round the year
27	<i>Paederia husota</i>	Rubiaceae	All round the year
28	<i>Scrophulariaceae sps</i>	Scrophulariaceae	All round the year
29	<i>Pouzolzia sps.</i>	Urticaceae	All round the year
30	<i>Vallisneria</i>	Hydrocharitaceae	All round the year
31	<i>Premna herbaceae</i>	Verbenaceae	Spring and early part of
32	<i>Morus sps</i>	Moraceae	Winter and Spring
33	<i>Macaramga denticulata</i>	Euphoraiaceae	All round the year
34	<i>Carex sps</i>	Cyparaceae	Spring and early part of
35	<i>Sateria palmifolia</i>	Poaceae	Summer
36	<i>Fimbristylis aestivalis</i>	Cyparaceae	All round the year
37	<i>Sterculia villosa</i>	Sterculaceae	All round the year
38	<i>Mariscus compactus</i>	Poaceae	All round the year
39	<i>Cyperu rotundus</i>	Poaceae	All round the year
40	<i>Cynodon dactylon</i>	Poaceae	All round the year
41	<i>Bombax cieba</i>	Bombacaceae	Spring and early part of
42	<i>Dillenia pentagyna</i>	Dilaneaceae	Spring and early part of

b) Extent of Invasive species

The prime grassland habitat in Manas is currently facing the onslaught of alien invasive species (weeds) that have increased in extent due to several anthropogenic factors such as increase in livestock grazing, human movement and dispersal, uncontrolled fires etc (Fig 3). Invasive species have been observed where ever disturbances like grazing and creation of opening in grassland for roads, camps, boma etc (Lahkar et.al, 2011). It has been observed that *Chromolaena odorata* invasion is greater in a stretch of 2–4 km along the southern boundary of the Park. Invasive weeds have spread to the southern boundary, replacing in situ vegetation that has been destroyed due to biotic pressures including livestock grazing. *Chromolaena odorata* is spreading very fast in the grasslands of Manas, where the authorities face enormous challenges to eradicate it. In addition to *Chromolaena*, the spread of *Mikania* in Manas NP grasslands is alarming. The *Mikania* invasion is observed more in riverine grassland patches and on the edge of forest patches. Invasive species have been changing the structure and function of grasslands in Manas NP. This may reduce the amount of habitat suitable for the reintroduction of rhinos, as outlined in IRV 2020.

Some of the species have been described as below

- 1) *Chromolaena odorata* is a perennial shrub species native to neotropical America stretching from southern Florida to the upper drainage basin of the Amazon in Southern Bolivia.

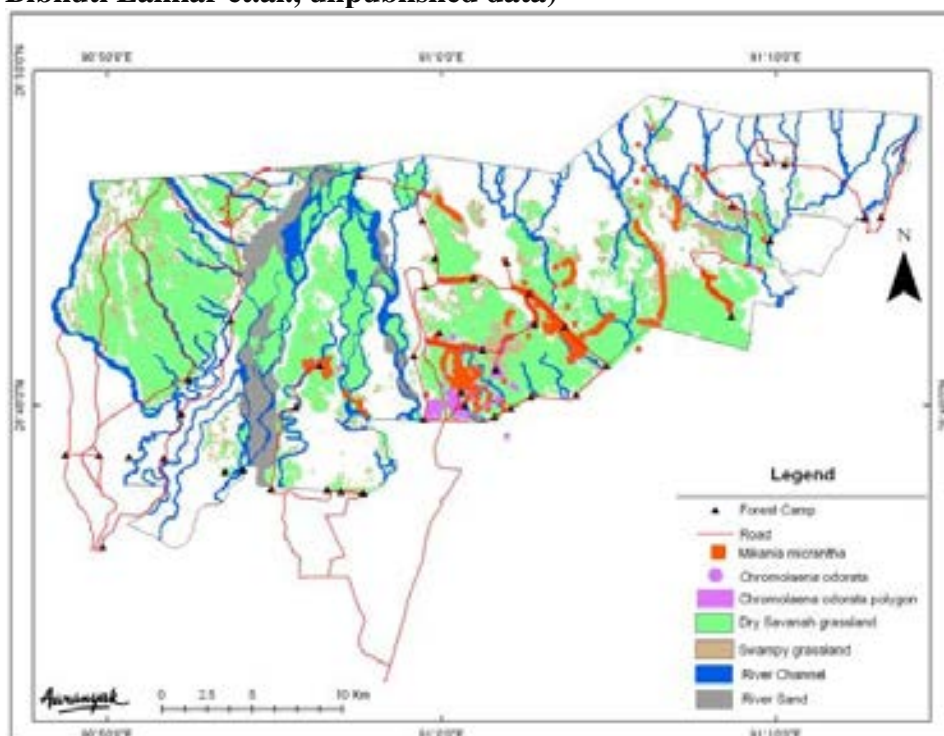
IUCN's Invasive Species Specialist Group has identified *Chromolaena* as one of the hundred worst invaders. Until recently, it was taxonomically classified as Eupatorium. The genus *Chromolaena* belongs to the family Asteraceae, one of the largest and most evolved of plant families.

2) *Mikania micrantha* is a perennial creeping climber known for its vigorous and rampant growth. It grows best where fertility, organic matter, soil moisture and humidity are high. It damages or kills other plants by cutting out the light and smothering them and competing for water and nutrients. A native of Central and South America, *Mikania micrantha* was introduced to India after World War II to camouflage airfields. Once established, *Mikania micrantha* spreads at an alarming rate, readily climbing and twining on any vertical support, including crops, bushes, trees, walls and fences. Significantly, it is believed that the plant releases substances that inhibit the growth of other plants (IUCN/ISSG database).

3) *Ipomoea carnea*, the Pink Morning Glory, is of American origin. This flowering plant has heart shaped leaves that are a rich green and 6–9 inches long. It can be easily grown from seeds which are toxic and it can be hazardous to herbivores (USDA database).

4) *Lantana camara* is a low erect or subscandent, vigorous shrub with stout recurved prickles and a strong odour of black currents. It grows to 1.2–2.4 metres or more. The diverse and broad geographic distribution of lantana is a reflection of its wide ecological tolerances. It occurs in diverse habitats.

Fig 2.1: Distribution of key invasive species in Manas National Park in 2014 (Ref: Dr Bibhuti Lahkar et.al., unpublished data)

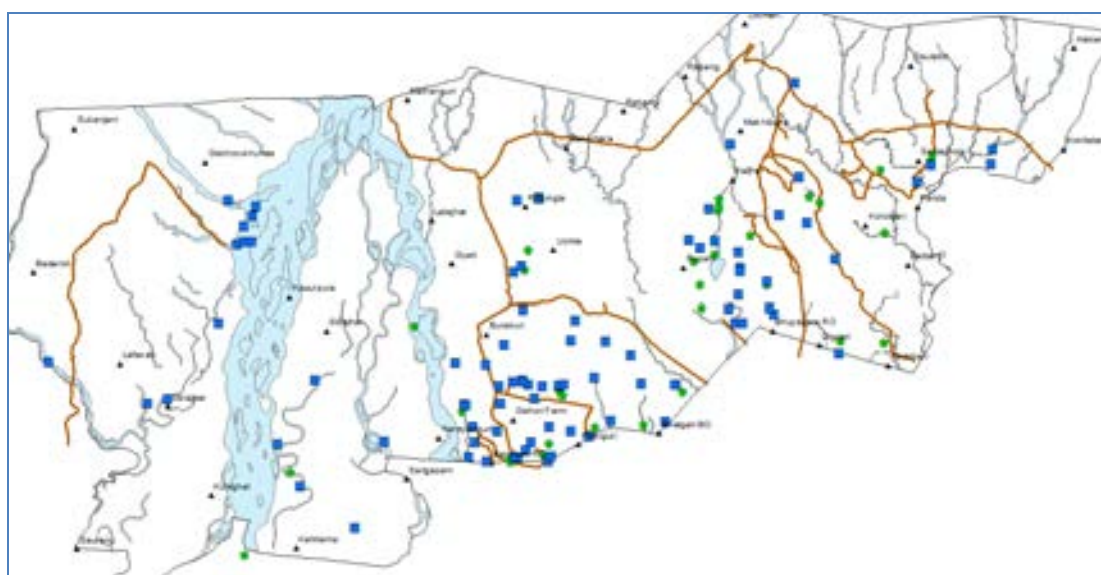


The main strategy to eradicate invasive should be to set up a surveillance system to monitor new invasive species in the park and also to monitor spread of existing species. Priority wise, invaded area should be restored by removing invasive species. Few experiments plots should be established to find out best practices. Livestock grazing should also be completely stopped, as it is a major driver of spreading invasives.

b) Water bodies: Rhino needs water bodies both for drinking and wallowing. They preferred muddy water body for wallowing to protect themselves from ecto-parasites and for rapid healing of their body injuries.

Large stagnant water bodies are absent in Manas but there are some small perennial water bodies here and there towards northern sides locally called as pukhuri and beel where according to field forest staff rhinos wallowed earlier. In the Terai region towards southern boundary there are muddy areas and perennial streams where rhinos wallow. According to the field staff during flood period rhinos moved to the northern highland and during winter and summer they stayed at southern Terai region (Fig 3). During flood period at the high land of Northern side short grasses and forbs eaten by the rhino covers the forest floor and they preferred to stay there due to availability food and water bodies. A good numbers of river system works throughout the Park. All the rivers, streams, nallas forming the drainage of the valley confluence with the river Brahmaputra flowing at the south. Rivers and streams flow from north to south. In the bhabar areas most of the rivers, streams, nalla excepting perennial ones, Manas, Hakuwa, Beki, Paglladia dried up during winter and dry seasons. But, these same rivers filled up with water in the north and regular flow in the terrain region.

Fig 2.2 Location of Rhino Dung(blue) and waterholes sed (green) locations in Manas National Park (Data source: Deba Dutta pers observ.)



2.4 Rhino Ranging Pattern- An analysis

a) Release of rhinos at Manas NP

The wild to wild rhino translocation began in 2008 and during this period (2008-14), a total of 18 wild rhinos have been translocated to Manas National from Pobitora WLS and Kaziranga National Park. The first phase of rhino translocation has been well documented and a video documentary has been prepared including entire process of translocation (footage available on websites <http://www.wfindia.org/>; <http://www.rhinos.org>). The still photographs were also distributed to all relevant persons in the form of a presentation and is also available at the Assam Forest Department official website under the section Indian Rhino Vision:2020 (www.assamforest.in) along with a report on both the rounds.

b) Post release monitoring at Manas National Park using radio telemetry

It had been strongly recommended that intensive post-release monitoring be undertaken immediately after release and during the settling in phase. The basis for any rhino monitoring approach should be that it provides the quality of information needed to meet the objectives of the monitoring programme. A successful monitoring approach must form a match between required data quality and available resources.

Rhinos were deployed with VHF radio collars and were tracked on a 24x7 basis. Monitoring was carried out by using radio-telemetry system directional antennae either on foot, elephant back, motorcycles and 4WD vehicles depending on the area where the rhinos were present. Homing using the VHF signal was done to locate the individual visually from a safe distance and a handheld GPS (Garmin Inc.) was used to record spatial information. The radio collars have an average life span of one year and most of them have therefore dropped off/removed and also dysfunctional at present. Currently six rhinos have active radio collars (as on 30.11.2014). The monitoring of other rhinos is therefore carried out based on rhino ID (specific identification Mark) on body and ear notch,.

c) Habitat Preferences and Ranging Pattern of Rhinos

Habitat preferences and ranging was studied by comparing frequencies of animal distribution on particular habitat type on the basis of direct focal observation. Initially, Rhinos were ranging throughout the grassland areas under Bansbari and Bhuyanpara Ranges (Fig 4, 5, Table 6) of the Park. Infact the rhinos were moving very large distances (Table 6) initially perhaps to establish their individual territory in the best possible habitat. Gradually, some of the rhinos dispersed and stayed at certain specific locations.

Table 2.2 Ranging pattern of the reintroduced rhinos in Manas National Park (ref: IRV Rhino Monitoring Report 11-12)

Sl.No.	Details	Area (Sq. kms.)	Remarks (Apr11-Mar12)
1	Rhino1	188	MCP irrespective of park boundary
2	Rhino2	74	MCP irrespective of park boundary
3	Rhino3	133	MCP irrespective of park boundary
4	Rhino4	13	MCP irrespective of park boundary
5	Rhino5	174	MCP irrespective of park boundary
6	Rhino6	72	MCP irrespective of park boundary
7	Rhino7	81	MCP irrespective of park boundary
8	Rhino8	116	MCP irrespective of park boundary
9	Rhino9	53	MCP irrespective of park boundary
10	Rhino10	214	MCP irrespective of park boundary
11	Rhino11	42	MCP irrespective of park boundary
12	Rhino12	146	MCP irrespective of park boundary
13	Rhino13	138	MCP irrespective of park boundary
14	Rhino14	94	MCP irrespective of park boundary
15	Rhino15	45	MCP irrespective of park boundary
16	Rhino16	17	MCP irrespective of park boundary
17	Rhino17	150	MCP irrespective of park boundary
18	Rhino18	53	MCP irrespective of park boundary

Some general observations based on ranging pattern on reintroduced rhinos have been described in the following pages.

- Rhino-1 (R1) used both the Bansbari and Bhuyanpara ranges and also used some part of eastern buffer of Manas National Park. But R1 never crossed the Beki River.
- Rhino2 (R2) was found to use River Beki as a western and Digihari river as the eastern boundary of its ranging area. Usually Rhino2 liked to utilize areas near to southern boundary in the summer and central and northern part of Bansbari and Bhuyanpara during the winter season.
- Rhino 3, 8, 13 and 14 specifically used central part of Bansbari Range.
- Rhino 4, 9, 11, 17 and 18 ranged into Kahitama beat areas as well as the central part of Bansbari range. Rhino 4 and Rhino 17 were also known to range upto Kheroni grassland area under Panbari range on few occasions.
- Rhino 6, 7, 8 frequently crossed between Bansbari and Bhuyanpara range. While adult rhino 5, 10, 12, 15 and 16 preferred to use eastern and western part of Bhuyanpara range.

Fig 2.3 Habitat use by reintroduced rhinos in Manas National Park (as recorded between April 2008-March 2010)

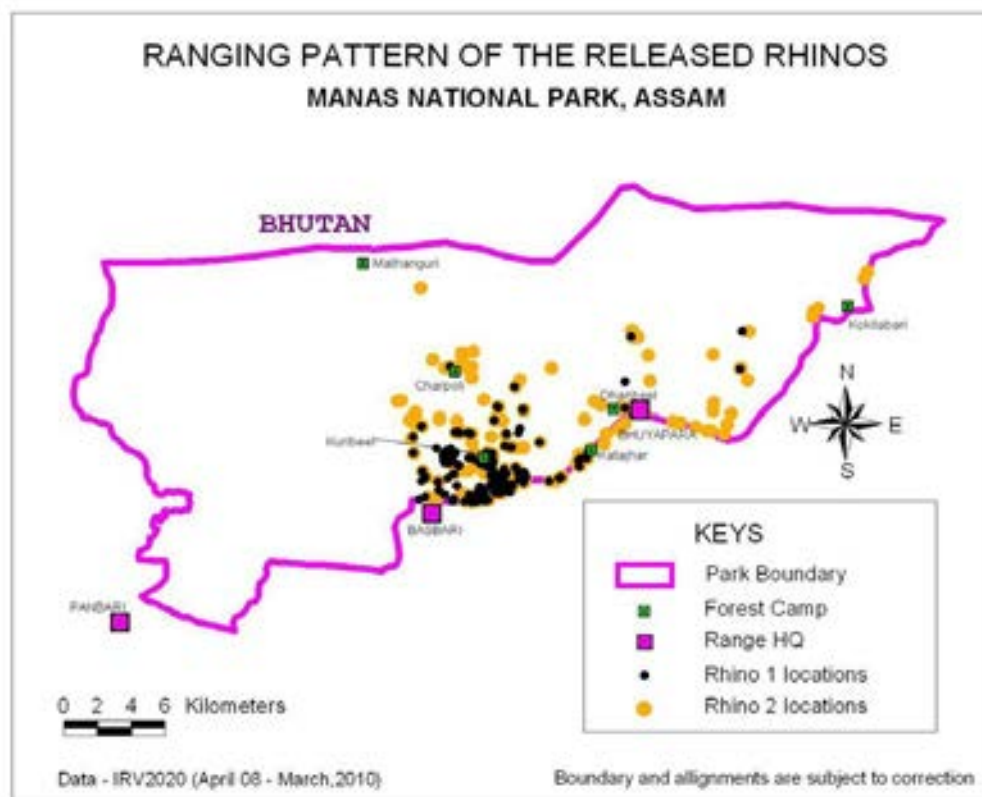
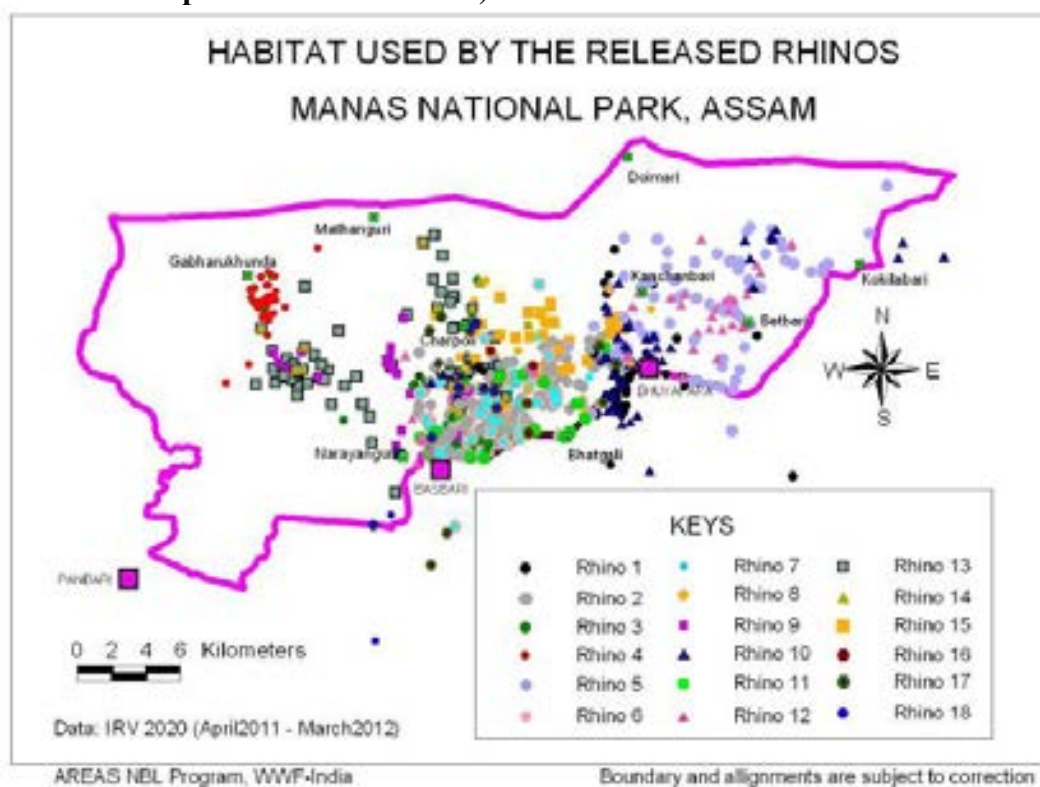


Fig2.4 Habitat use by reintroduced rhinos in Manas National Park (as recorded between April 2011-March 2012)



d) Rhino Behavior

Rhino's behavior as per focal observations (Deba Dutta pers. obs) indicated a seasonal variation in diurnal and nocturnal activities. In summer, diurnal activity was very less as compared to winter season. Since the beginning of their reintroduction in 2008, Rhinos in Manas were showing a medium level response in social interactions. Cow-calf pairs were very common. Rhino 6 & 7, 13 & 14 usually moved together in the Bansbari Range, although Rhino 7 (calf of Rhino 6) was beginning to stay away from his mother. Sub adult female Rhino-4 and male R 18 were also observed to form a group. In contrast, Rhino-9 and Rhino-4 were behaving in a solitary manner and using large tracts of habitat under Panbari and Bansbari by crossing the river Beki. This indicates that small rhino calves are good swimmers and also able to fast flowing river like Beki. Adult rhinos association was also found between Rhino-3 and Rhino-8 for a few months. However adult male Rhino 5 was usually found with Rhino-10 and its new born calf. Subsequent to poaching of Rhino-10 in October 2013, the orphaned calf was found to move with male Rhino-5.

A note on male Rhino Behaviour inside Boma after release

In 2006, four rescued rhinos were rehabilitated in the Manas National Park within a 0.136 sq km solar electric fence enclosure (Boma). Orphaned rhinos were rescued in Kaziranga National Park (KNP) when they were about one to five months old during the flood season. The calves were hand reared and nursed at the Centre for Wild Life Rehabilitation and Conservation (CWRC) with the aim of releasing them to natural habitat. At the age of about three years the calves were translocated to Manas National Park and rehabilitated (Barman et al 2014). The first rhino, a three and a half-year old female christened Mainao by Honbl'e Deputy Chief of BTC, Shri Kampa Borgayary was moved to the Boma on 21 February 2006. Mainao thus got the distinction of being the first rhino to reach Manas post-2005. On 28 January 2007; two more female rhinos Ganga and Jamuna were relocated to Manas from CWRC Kaziranga. On 23 February 2008 a female rhino calf was also relocated to Manas National Park.

In a peculiar incident, On 10th June 2008, the adult male rhino 1 (code rhino 7000) broke open the fence and managed to enter the rehabilitation *boma*. Three adult females (within the age group of 4-6 years of age) were also present during the period. Social interactions in the form of facial touches with short snorts were observed during the period. Pre-mating or mating behavior with characteristic vocalization was not recorded during the observation period. The adult male continued to stay with the *boma premises* until 3rd May 2009 for a total of 323 days.

Interestingly, another adult male rhino (rhino no 2) who strayed out of the PA premises was captured and relocated on 15th Sept 2008 and was released inside the boma. Agonistic behavior with loud snorting was observed when the two males and the three females were together inside the *Boma*. The male rhino 2 broke fence and came out of the *boma* on 25th Nov 2009 after spending a period of almost 400 days inside the boma. Water was provided by pumping inside from the nearest streams during November till March. Adult male were always found agonistic to each other and sometime violent fighting occurred in between Rhino-1 and 2 & Rhino-2 and 5. Aggression was very common when any one of them entered their occupied areas. At present no adult male rhino is present in Manas NP so no infighting has been observed.

Several different types of vocalization have been noted (Deba Dutta pers. obs.) for communication between rhinos. A loud snort was very common and mainly used by the rhinos as initial contact with each other. Sudden confrontation, including aggression displays between male rhinos and other wild animals like elephant and buffalos resulted in snorts. Snort was also observed during courtship behavior (locally, the call made by female rhinos to attract adult males is termed *suhuri*).

Mother with new born calf is always agonistic to other adult male and patrolling staffs. They are furious and chase away animals by making fuzzy sound. Young calves are also known to softly 'whistle' to their mother to remain in their vicinity as they have poor eyesight.

Rhinos usually defecate at one place (latrine sites) in areas that are used regularly by them. Defecation is along their travelling paths (Dundies) as a way of marking their territory. Rhinos are not found to defecate near waterholes or wallowing sites (locally called as Leti) . Frequently used areas have more dung pile than less used areas.

It was observed that Kuribeel, Rhino camp. Charpuli, Tin-mile, Palsiguri areas had more dung piles than other places of Bansbari. In Bhuyanpara Rupahi, Sikagonda , Kanchanbari and Chengmarijhar had more dung piles and in Kahitama, Sidhajhar area was the major dung pile site. In Panbari, Kheroni area had vast tract of grassland but the number of dung piles were fewer, as only one rhino was using the area. Rhinos are mainly found to prefer short grasses and herbs close to the ground. But occasionally they found to feed tall grasses, shrubs, bushes and trees. According to analyzed data 40% of observations are found on feeding. Plants are often uprooted, the foliage bitten off and usually roots dropped. But some occasions they eat everything. In monsoon and retreat monsoon seasons they are more found to feed aquatic plants by duckling the head beneath the water. In the winter season

they are found to devote maximum time on foraging activity including browsing and walking. They are found to lick or eat soils near to Bhuyanpara. Sometime some rhinos visit regularly some anti-poaching camps to lick kitchen discharge contain with salts and other food material.

Detailed studies based on focal animal sampling in the initial years of release led to valuable insights into rhino behaviour in their new habitat (Dutta et.al., 2012). Overall, among the major land cover classes categorized in the study area, the authors observed that the marshy/swampy and grassland areas were more preferred than the woodlands. Among the grasslands the rhinos preferred to occupy the areas dominated by *Cynodon dactylon*, *Andropogon sps.*, *Leersia hexandra*, *Cyperus rotendus*, *Cyperusiria*, *Phragmites karka*, *Saccharum ravennae*, *Saccharum narenga*, *Imperata cylindrica*, etc. It is known that the tall grass land and riverine forests are the critical habitats for the greater one horned rhinoceros as in case of translocated Rhinos in Nepal (Dinerstein, 1991). In case of Manas, it was also observed that short and open grass land was more preferred compared to the tall grasslands.

Tall grass land was found highly preferred by both male and female during the monsoon. It was also observed that the rhinos were using grass land near to southern part of the National Park close to the boundary which is adjoined to the agricultural fields. Rhinos were found to raid crops during summer season when fringe villagers started paddy cultivation.

Even though water bodies are much used areas by rhinos for wallowing, in Manas, rhinos spent only 20 -30% of their time wallowing. The main purpose of wallowing was to maintain heat regulation and also keep the flies and ecto-parasites at bay. Wallowing time was even less during month of January to March (Dry period) but very high in summer season. In case of Manas, it has been observed that permanent flood-plain grasslands (swampy areas) are much lesser as compared to in Kaziranga and Pabitora. Therefore even smaller waterholes with water during the wet season were being used. During the dry season, the grassland areas gets very dry and almost all the shallow water pools dry up. During this time, perennial water sources, small rivulets and springs (Bhumuk) become critical and get highly frequented by the wandering rhinos.

Besides wallowing, rhinos usually rested for the day during the hot summer season. During winter, rhinos were also known to move towards the woodland areas for warmer temperatures. The resting period is therefore accounted for about 7-8% of the total activity budget. (Some time rhinos were approached from very close distances but due to hindrance

of tall and dense grass land, it was not possible to record the rhino behavior. Therefore, we included another category as unknown behavior(~25%) in the total activity pattern

Rhinos were also observed to exhibit natural 'commensalism' with common mynas and cattle egrets, the birds fed on the ecto-parasites and possibly alerted the animal in case of any approaching predators. Rhinos were also observed to be feeding along with hog deer, wild pig, elephants, gaur and domestic livestock.

e) Ranging patterns of hand-reared Rhinos

In case of hand-reared rhinos, initially they tend to remain in the vicinity of the Rhino Camp where they had been soft-released (inside Boma). For example, GPS fixes of Raja (Rhino 19), indicate that the animal tends to use the area round the Rhino boma, rhino camp and Madlijora swamp area of Basbari range of the park. The effective area of its foraging, resting and wallow remained same since January till July 2014. The animal has visited the rhino camp area on 30 occasions of the month, typically ranging from 2:30 pm till 10 pm. It spends overnight in the vicinity of the camp, primarily foraging and resting in between. The area of its foraging also overlaps with the younger rehabilitated sub-adult male Maju (Rhino 20) and the two adult rehabilitated female Rhino Ganga and Jamuna.

The only exception to this has been Mainao with her calf. She has shown instances of straying outside the Park and in Bhuyanpara. Similarly, Rhino has also been observed to stray outside in the fringe tea gardens. The three sub-adult male rhinos (Rhino 21, 22, 23) released from their Boma on 3rd Nov 2014 have since then showed a characteristic behaviour of residing together, in the vicinity of the camp .

f) Rhino calves under rehabilitation inside Boma

Both *Dwimalu* (calf of Rhino 17; 1.3 years) and *Purabi* (orphaned calf from Kaziranga; 2 years) are currently being hand-reared inside Boma. Both the rhinos have gained weight and improved body condition after several bouts of diarrhea and pectode infestation. Concentrate food is introduced to their diet without reducing their milk formula (DM). Supportive therapy is being continued in the form of herbal liver stimulant and macro and micro minerals. The rhinos will be weaned off milk at the age of 24-30 months with gradual withdrawal of artificial formula. The rhinos can be shifted to a larger enclosure with some provisional food and can be held till the age of 36-42 months; after which they can be released in the wild and to be monitored for survival and ranging pattern.

2.5. Radio collar status

As part of the IRV2020 protocol, most of the reintroduced rhinos have been fitted with radio collars. It is mandatory to observe radio-collar belt of rhino at a regular interval. The collars are designed to adjust according to the animal's neck size and also 'drop-off' after a certain period. However, in case of 20 collars used on rhinos reintroduced in Manas, most of the collars have remained even after the validity period. In case it is observed that the collar is in any way a hindrance or has 'tightened' then it becomes essential to physically remove the collar so that it doesn't become a life risk to for the animal.

As per decision taken by 2nd May, 2014 Translocation Core Committee Meeting, PCCF(WL) at present has given permission to remove of six (Rhino-3,7.9.11,13 &15) rhinos radio collars that shall be undertaken in the coming winter season. It is important to note that, at present all the radio collars on reintroduced Rhinos are dysfunctional (as on 29.11.2014) .

Table 2.3 : Status of radio collars of Rhinos at Manas National Park (as on 31.11.2014)

	Rhino code/Name	Radio Collar Frequency	Sex	Date of Collaring	Duration of radio collar functioning	Remark
1	Rhino-1*	149.7000	A-M	11/4/2008	12 month	Radio collar was removed 21 st June,2011
2	Rhino-2*	149.3202	A-M	25/4/2011	12 month	Dropped 8 th November and recovered 11 th November 12
3	Rhino-3	148.7800	A-F	27/12/2010	11 month	Stopped (dtd.30/11/2011) collar belt tightened
4	Rhino-5*	148.3200	SA-M	18/01/2011	9 months	Stopped (dtd 3/11/2011), removed 22/1/2013 by capturing the rhino
5	Rhino-6	148.7200	A-F	18/01/2011	6 months	Dropped (dtd.8/8/2011) due to courtship with Male rhino
6	Rhino-7	148.3200	SA-M	18/01/2011	22 months	Stopped (dtd.13/10/2012) Collar belt around the neck it is tightened
7	Rhino-8*	149.3830	SA-F	18/01/2011	36 months	Working till rhino killed by poacher on 31/12/2013
8	Rhino-9	148.8510	A-F	8/1/2012	11months	Stopped(Recent Status Unknown)
9	Rhino-10*	149.2720	A-F	8/1/2012	21months	Working till rhino killed by poacher on 29/10/2013
10	Rhino-11	148.2590	SA-F	19/2/2012	23 month	Working (collar tightened)
11	Rhino-12*	150.51	A-F	19/2/2012	4months	Rhino was killed with active radio collar on 23/5/2013
12	Rhino-13	150.250	A-F	19/2/2012	22 months	Working
13	Rhino-14	148.3900	A-M	19/2/2012	13 months	Dropped(dtd.21/03/2012)

						pull out by adult male Rhino-2
14	Rhino-15	150-070	A-F	11/3/2012	20 months	Working(Not getting signal 27 th June,2014
15	Rhino-16*	149.2410	SA-M	11/3/2012	4 months	Dropped(dtd.2/6/2012) pull out by adult male Rhino-2
16	Rhino-17*	150.110	A-F	11/3/2012	13 months	Working till poached on 2/4/2013.
17	Rhino-18	150.290	SA-M	23/11/2012	13 months	Dropped
18	Rhino-19 (Ram)	151.700	SA-M	27.12.2013	11 months	Working
19	Rhino-21	151.880	SA-M	3.11.2014	1 month	Working
20	Rhino-22	151.051	SA-M	3.11.2014	1 month	working

A-M= Adult Male, , A-F= Adult Female, SA-M- sub-adult Male, SA-F= sub-adult female, *= poached
Average radio collar age -14.7 months

2.6 Birth of New Rhino Calves

Since 2006, 8 trans-located (wild to wild) females and 3 rehabilitated (hand reared) females have given birth to 11 calves. These births indicate that the trans-located rhinos are breeding successfully and have adapted well to the new environment. It is now important to ensure the safety of these newborn calves and their mothers as well as the other rhinos in Manas so that the vision of establishing a viable rhino population is achieved over the long term. The new mother rhinos are very protective and always remain in the vicinity of the young one. While running, the young calf tends to run in front of their mother so it is very difficult to observe rhino calves for the first 2-3 months. Sometimes mother 'hid' her calf for 1-2 hours in grassland area and moved in the vicinity of 100-200m radius. In case of any approaching danger, the calf would make a low pitched snorting sound that alerted its mother. It was also observed that rhino calf footprint circumference were on an average around 12.2cm in a muddy place. The footprints grew (increased) in size up to 1 cm per month, thereby indicating the rapid growth in body size in the first six months (Deba Dutta pers observ).

2.7 Master ID preparation

Rhino ID based monitoring is one of the most essential system of monitoring rhinos for a newly established rhino population of Manas NP. Master ID of all translocated rhinos has also recently been completed on the basis of Greater One horned Rhinoceros Monitoring Training Manual based on IUCN SSC AsRSG Rhino Monitoring Course (**ANNEXURE 6**).

The Rhino ID Master file contains details of potential identification features such as horn shape, ear notch. Ear tears, skin folds deformities, body scars or tail shape. So each

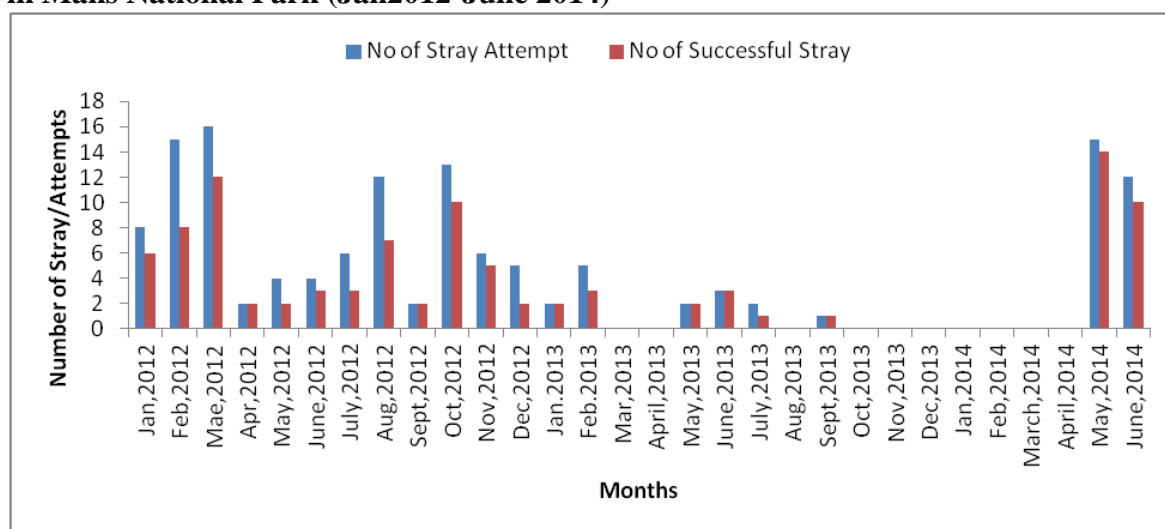
member of ground field staff should understand better way to collect unbiased data of rhinos. Regular monitoring and correct identification function will help to deter other illegal activity. It will also help to develop all round development of park. Poachers killed 7 translocated rhinos of Manas. So presence of monitoring team on patrol on a daily basis plus knowledge of rhino behaviour, IDs may help to deter all illegal activity. These processes also helps to keep all rhino using areas under close demographic surveillance, so that any illegal threat may be detected.

2.8 Stray and Man-animal conflict management:

In case of wild-to-wild reintroduced Rhinos, there were several instances of straying outside the Park in the initial years. This was possibly due to the fact that adult rhinos were trying to establish their territory in the new area. Few individuals strayed outside into adjacent paddy fields as well as cultivable lands and depredated crops. During January-April, 2012 there were 3 major stray incidents wherein one person was killed when he got himself very close to rhino in spite of forest personal warning him against it. Rhino stray incidences gradually came down by the year 2013, although as a precautionary measure, one crate with accessories and limited quantity of tranquilizing drugs are kept under the supervision of the Forest Veterinary Officer (FVO) for any emergency use.

Usually rhino stray attempts are just near to boundary 10-20m. If rhino overcomes this distance from the patrolling and monitoring staff then they can moved upto 1-2 km and more for raiding crops or exploring new areas. This has been termed as a ‘sucessful stray’ and the number of such instances recorded (Fig 1.6). As evident the straying usually coincides with the paddy growing season in May-June and also during the drier months.

Fig-2.5. Monthly Rhino Stray Attempt and Successful Straying (crop raiding) by rhinos in Mans National Park (Jan2012-June 2014)



During this period two distinct pattern of rhino straying was observed, one by the rhinos released in the park earlier straying out for crop raiding and the other by the newly released rhinos post-release as a part of their exploration and adaptation to the new habitat. The stray took place only along the stretches which was not protected by electric fencing. Of the earlier released group, Rhino1 was most prone to stray and Rhino5 also demonstrated a very limited trend. Among the new batch, Rhino10, 17 & 18 strayed out of the park soon after getting release probably as they were trying to explore the new area. Rhino10 strayed over to small distances of about 1 to 2 km close to Kaljhar and Kokilabari and returned back. Rhino17 and 18 strayed out along the Beki River through the Kahitema area and strayed over a larger distance as they had to experience a large human pressure leading to a lot of problems and chaos. This was the first experience of a post release stray in Manas.

2.8.1. Human-animal Conflict

Certain Rhinos along with elephants also reported to stray and raid crops in the fringe areas. As evident from Fig7 and Fig 8, the Rhino-Human conflict is highest along the southern boundary in Bansbari and Bhuyanpara Ranges. Erection of solar fencing, community watchtowers and driving rhinos inside are some of the mitigation measures that may be tested.

Fig 2.6 Human-animal conflict in Manas National Park (2011)

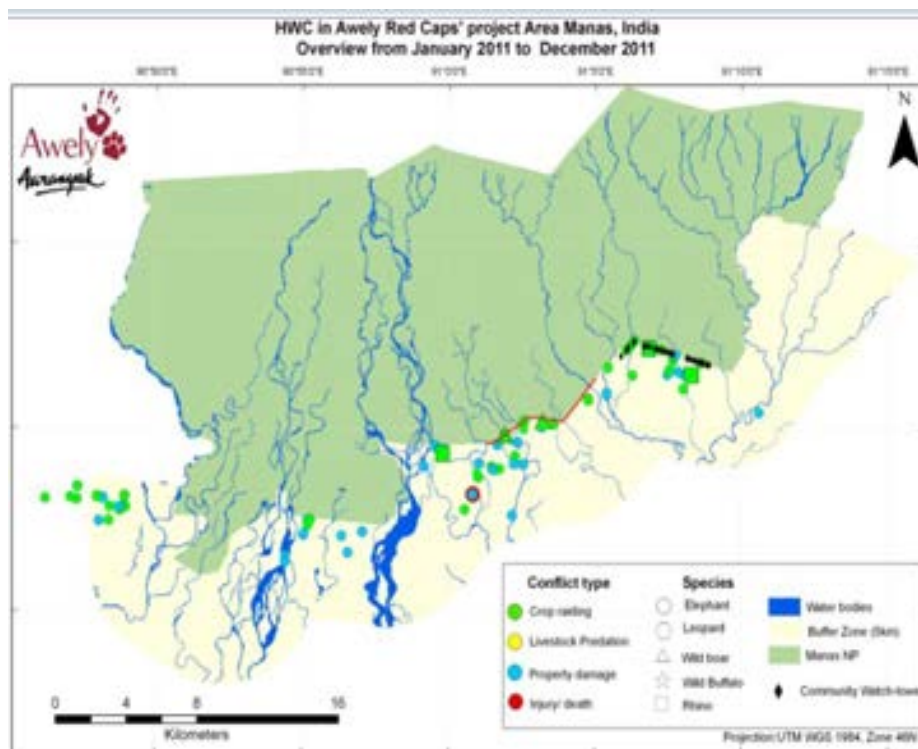
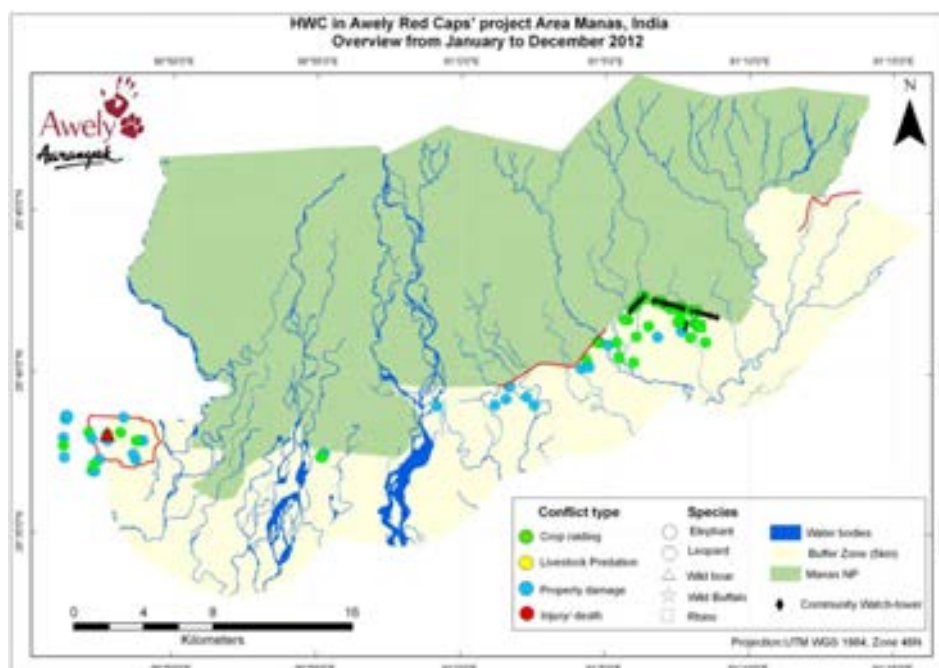


Fig 2.7 Human-animal conflict in Manas National Park (2012)



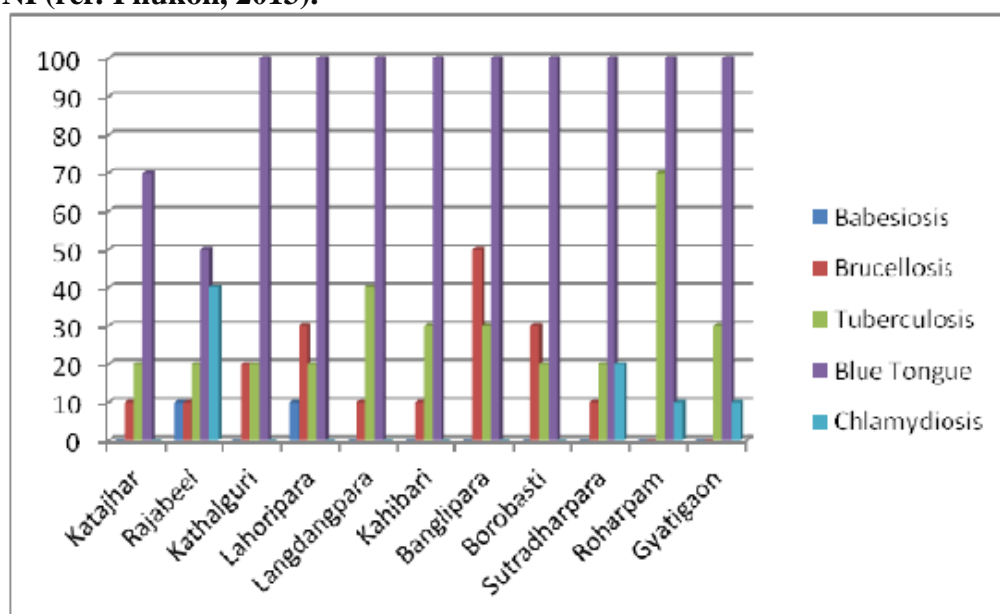
2.9 Disease monitoring:

Disease ecology is a fast emerging discipline in wildlife conservation. There is particular interest for mega herbivore-livestock interface issues. Diseases also play a role in structuring the demography and viability of the wild population, and this could be addressed by quantitative knowledge on the emergence, spread, persistence and evolution of infectious diseases. Re-introduced wild populations mimic the small population which are vulnerable to stochastic events and disease impacts.

A masters dissertation study in 2013 (Phukon, 2013) focused on re-introduced population of Greater One-horned Rhinoceros (*Rhinoceros unicornis*) and their sharing of habitat with livestock in Bansbari Range of Manas National Park. It was hypothesised that the interaction of rhinos with livestock has potential to contract diseases from the livestock population, and therefore the diversity and magnitude of disease prevalence in livestock is likely to pose serious threat to the rhinos. The study quantified disease distribution pattern and commonality between livestock and rhino population and map disease gradient in MNP during the period (Jan-April, 2013).

The study established wide prevalence of disease in the livestock (Fig 2.7). Given that the Zone of Influence of livestock in MNP includes home range of rhinos, it indicated that the rhino population is likely to be under disease risk and conservation efforts needs to incorporate disease perspective for recovery efforts and long-term viability of rhinos in MNP.

Fig 2.8: Percentage of infectious diseases in fringe villages of Bansbari Range,Manas NP(ref: Phukon, 2013).



The major intervention required includes a well planned disease surveillance and management programme, ensuring proper scientific management of livestock and restricting movement of livestock inside the park through proper checks at entry points. Efforts should be focused on villages showing high Index of threat, viz. Katajhar and Rajabeel, while executing any management interventions including veterinary care.

2.10 Conclusion and specific recommendations

1. There are 30 Rhinos at present in Manas (28.11.2014) and majority has established a set pattern in their ranging and behaviour. The ranging is comparatively much larger as compared to Rhinos in other areas (such as Kaziranga, Pabitora and Orang) and straying behaviors has also been associated with a few individuals.
2. Habitat management interventions especially for systematic removal of invasive species and control of livestock grazing is most urgently required in key rhino habitat areas.
3. Provisioning of artificial water holes for wallowing is also critical during the dry winter season. Existing natural water bodies (especially small rivulets) need to be protected and devoid of any biotic interference.
4. Straying, including crop-raiding by certain individual rhinos can be controlled by adopting a proactive 'driving in' strategy by patrolling staff along the southern boundary.

5. Provisioning of (solar fencing and its regular maintenance and upkeep) has been beneficial towards controlling straying of wild (and domestic) animals.
6. The existing monitoring of rhinos using radio telemetry should be gradually phased out and identification of individual Rhinos based on external physical features and behaviour as prepared under the Master-ID file (Annexure 6) by field staff must be encouraged. The monitoring based on identification key has already shown signs of success with frontline staff and must serve as a key protocol for small Reintroduced rhino populations in other areas under IRV2020.

CHAPTER THREE

SECURITY ASSESSMENT AND STAFF CAPACITY BUILDING

3.1 Challenges in managing Manas National Park

Within Manas National Park, new challenges such as grassland habitat management, expanding peri-urban infrastructure along the southern boundary, trans-boundary vehicular traffic, poaching, instances of insurgency and illegal wildlife trade remain to be completely addressed. Holistically, MTR landscape needs to be managed as a trans-boundary entity with international cooperation with the Government of Bhutan.

Some of the good practices that have been initiated and need mainstreaming and institutional continuity in managing Manas National Park have been the involvement of local communities, especially unemployed youth for joint protection of forests and eco-tourism initiatives. Similarly, rebuilding park infrastructure, multi-stakeholder partnership towards scientific management of tiger populations and rhino reintroduction since 2008, has contributed significantly towards rapid revival of the Park.

The need to have a unified command for the core and buffer combined with proposed up-gradation of certain good quality (> 40% canopy cover) forest areas such as Ripu-Chirang and Manas RF (part) into wildlife sanctuaries will be necessary for the increasing wildlife population from the core (in Manas National Park and Barnadi wildlife sanctuary) in the long run. Rapid expansion of agriculture and settlement areas along the southern boundary, increasing human-animal conflict and expansion of border towns have also contributed to forest fragmentation and disruption of animal corridors have been some of the challenges in the buffer areas of MTR.

3.2 SWOT analysis of Manas National Park for Rhino conservation

STRENGTHS	WEAKNESS
<ul style="list-style-type: none"> • Sense of pride for rhino in the people of BTC • Largest and viable rhino habitat (past and current year data) • Staff dedication • Ngo and civil society willingness for partnership in rhino conservation. • Rhino based tourism • Multiple conservation value and tags 	<ul style="list-style-type: none"> • Inadequate and untimely funding from state govt. • Inadequate man power (number and quality). • Inadequate infrastructure. • Porous southern boundary. • Insufficient intelligence gathering. • Appropriate and insufficient number of modern fire arms.

in rhino bearing area <ul style="list-style-type: none"> • WHS values. • Funding support from NTCA. • State amendment of WPA for better investigation and conviction with legal support. 	<ul style="list-style-type: none"> • Inadequate community development. • Low rate of conviction in wildlife offences.
OPPORTUNITIES <ul style="list-style-type: none"> • Preparation of a comprehensive Rhino conservation Plan, • Public and political goodwill. • Scope for research. • National and international support. • Use of modern technology for monitoring and protection. 	THREATS <ul style="list-style-type: none"> • Rise in global demand of illegally traded rhino horns. • Law and order situation. • Habitat degradation (invasive, woodland encroachment in grasslands). • Easy availability of fire arms including country-weapons. • Encroachment.

3.3 Poaching

Rhino conservation initiatives at Manas NP under IRV-2020 gave major setback when 7 adult rhinos and 1 sub adult male rhino were poached within the period of the three year (2011 to 2014). Adult male (Rhino 1) was poached in the October, 2011. Adult female (Rhino12) was poached 23 May 2012, adult male (Rhino2) was poached in the month of January, 2013 and Adult Female (Rhino-17) was poached on 3rd April, 2013. Sub adult male Rhino-16 was poached on 16 August, 2013. Adult female Rhino-10 was poached at Chengmarijhar area of Bhuyanpara range on 29th October, 2013. On 31st December, 2013 another adult female Rhino-8 was poached at Charfuli areas of Bansbari range. In the year 2013 altogether 7 rhinos were killed by poachers. During this year one adult male Rhino-5 was poached in the month of November. Among the 7 poached rhinos 3 adult females have gave birth calves at Manas.

Table 3.1 : Summary of poaching of Reintroduced rhinos in Manas National Park

	Name	likely cause/arm used/remarks	Sex	App rox Age	Date of Poaching/Det ection	Location	Range
1	Rhino-1	Probably bullet injury, carcass badly decayed,	M	10	1.10.2011	Sikagonda	Bhuyanpara
2	Rhino-12	Gun shots wounds about 0.5cm diameter over right eye, right forearm, right shoulder, left shoulder and lower mandible, horn, nail and meat removed.	F	10	22.05.2012	Chengmarijhar	Bhuyanpara
3	Rhino-2	Gun shots wounds about 0.5cm diameter over neck left arm, left shoulder and forehead noticed, horn meat and nail removed	M	7	13.01.2013	Daokabaha (Bhatghali)	Bansbari
4	Rhino-17	Gun shots wounds about 0.5cm diameter size over right chest region just behind the shoulder joints, horn, nail, tail removed	F	12	02.04. 2013	Sidhajhar	Kahitema
5	Rhino-16	Single bullet above chest, 0.315 bullet suspected; meat etc recovered from suspected poacher	M	8	06.08.2013	Kuchiabeel (Bhatgali)	Bansbari
6	Rhino-10	Three bullets 0.303, Gajimara. Bullet and weapon recovered. One suspected poacher killed.	F	12	29.10.2013	Kochubari (Betbari)	Bhuyanpara
7	Rhino-8	Bullets from AK47 suspected	F	9	31.12.2013	Chorpuli	Bansbari
8	Rhino-5	Bullets from AK47 suspected	M	12	01.11.2014	Dawjeng (Kanchanbari)	Bhuyanpara

3.4. Inadequate Manpower and Infrastructure

With the increase in the number of camps and the complexity of protection it is felt that the current number of manpower is highly inadequate, especially at the frontline level. (Table 9). An analysis of age and the length of service put into Manas are also very revealing (Fig 8) and there are several instances when the person has served for more than twenty years at the same location and at the same post. The average age of frontline staff in all categories is above 40 years. This is a severe impeding factor towards conducting physically challenging duties such as foot patrolling and night vigil.

Additional support has been provided in terms of support from local NGO conservation volunteers, armed Home Guards and Assam Forest Battalion (Table 10). however due to their low wages (as in case of casual workers and conservation volunteers) and diminished levels of motivation (due to prolonged stay at the same place and temporary position for a number of years) , nature of leave etc, it is suggested that a serious review and strategy be undertaken for bringing in ‘change’ in the existing man power.

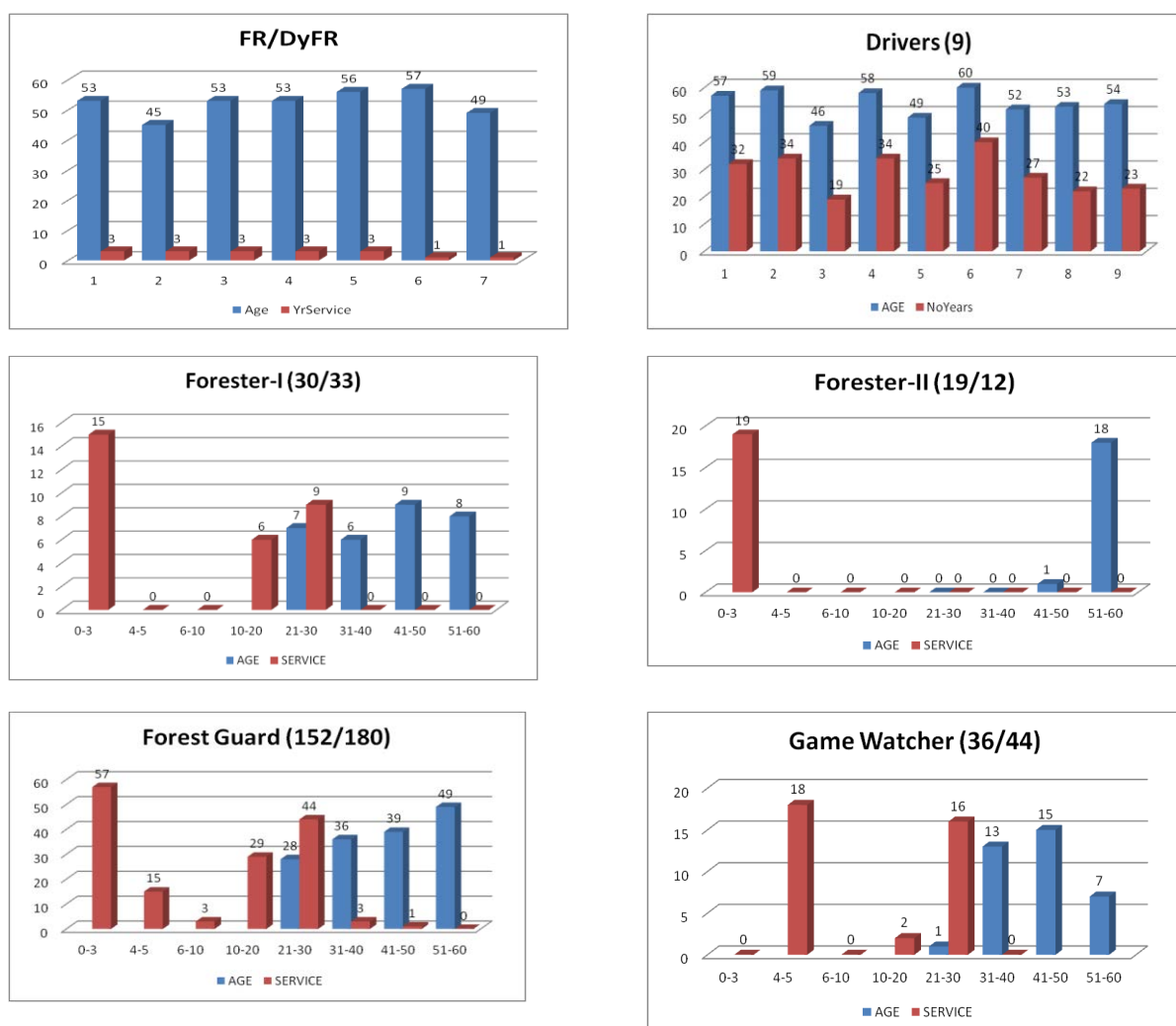
Table 3.2: Existing Sanctioned and proposed Field Staff increase in Manas National Park (as on 30.11.2014)

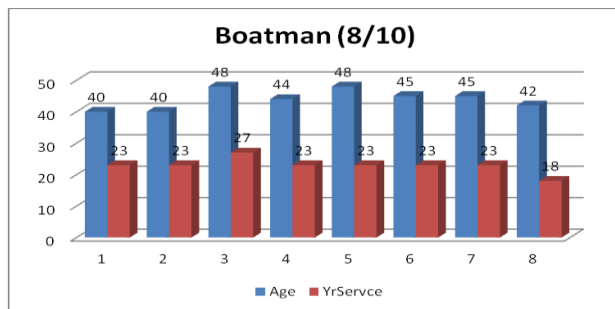
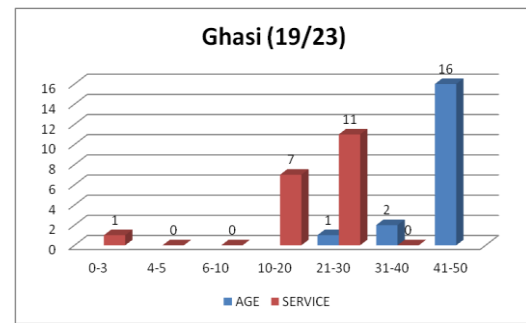
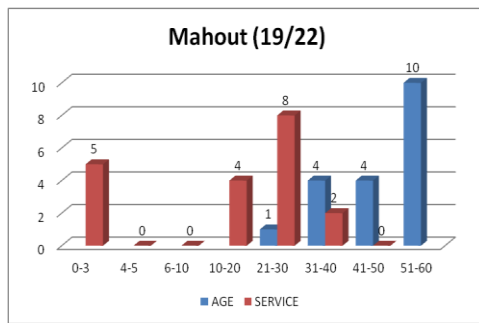
Sl.No.	Name of Post	Total Strength	Man in position	Vacancy	With Proposed Increase (Total)
1	Field Director	1	1		1
2	Dy. Director	1	1		2
3	ACF	1	0		4
4	Forest Ranger	4	4		6
5	Deputy Ranger	5	4	1	8
6	Forester-I	33	24	9	50
7	Forester-II	18	23	(+5)	18
8	Forest Guard	180	157	23	250
9	Driver	8	8		10
10	Handiman	3	2	1	8
11	Mahut	22	19	3	40
12	Grass Cutter	23	19	4	30
13	Boatmen	10	8	2	20
14	Game Watcher	44	37	6	50
	Total	353	307	49	497

Table 3.3: Categories of Manpower available in Manas NP

Sl. No.	Category of Manpower	Availability
1	Casual Frontline Staff	70
2	Conservation Workers (BTC supported)	100
3	Conservation Workers (IRV supported)	35
4	Armed Home Guards (IRV supported)	20
	Armed Home Guards (NTCA supported)	50
5	Assam Forest Protection Force (AFPF)	11
	TOTAL =	275

Fig 3.1 Age (Blue) and years in service (Red) as rendered by various staff of Manas National Park. The number in parentheses is the actual number present/total staff strength(as on 30.11.2014).





3.4.1. Camps and Infrastructure

Currently, there are about 60 numbers of anti-poaching camps distributed all over the Park. However the camps are not uniformly distributed and there are several gaps in patrolling especially along the northern and northwestern part of the Park (Fig 9) .More camps are required as the terrain is difficult and inaccessible because of which monitoring and protection have not been possible uniformly (Fig 10).

Similarly, the number of vehicles, patrolling infrastructure such as boats, wireless sets, patrolling paths and infrastructure remain inadequate and depend on fund position to compensate for the gaps. Detailed analysis of the same has already been made in Swargowary et.al., 2012.

Fig 3.2: A geospatial analysis of gap areas for camp network in Manas National Park (ref: Swargowary et.al., 2012)

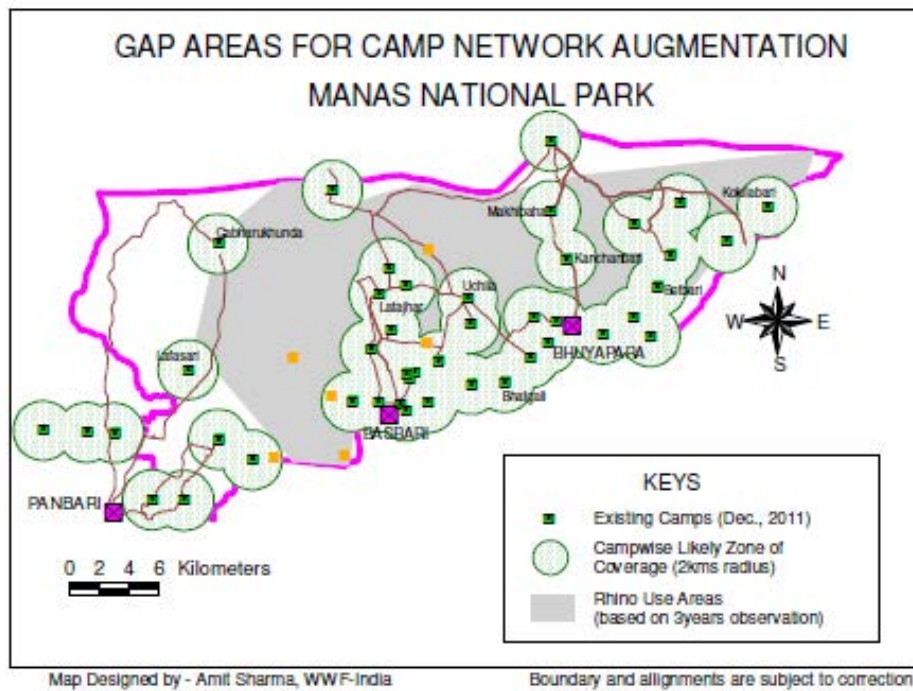
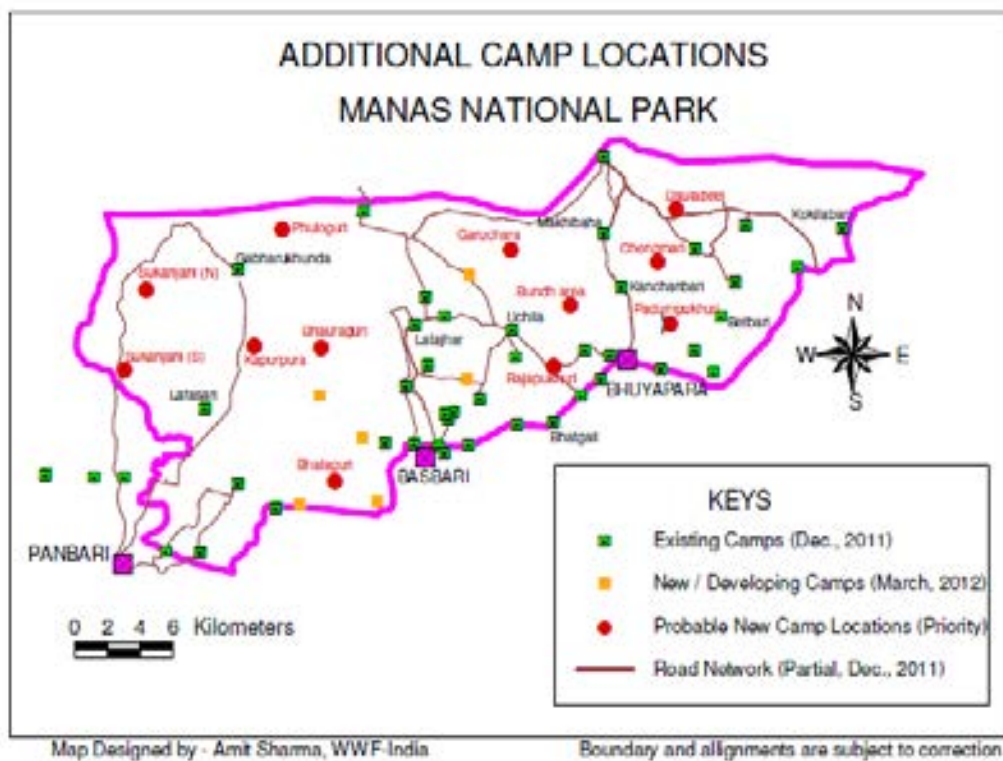
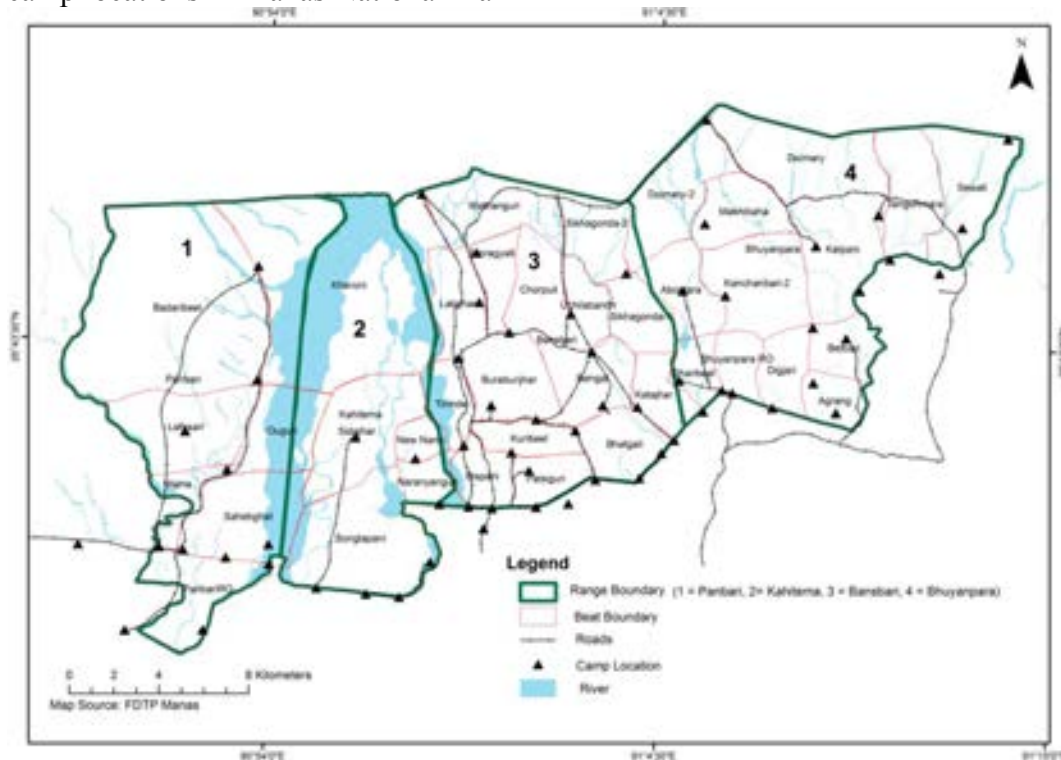


Fig 3.3: A geospatial analysis of probable areas for camp construction in Manas National Park (ref: Swargowary et.al., 2012)



3.4.2 Establishment of Ranges and Beat boundaries

Fig 3.4 Map depicting proposed new Range(Kahitema) and beat boundaries along existing camp locations in Manas National Park



As it is evident from the Fig 3.4. above, new range and beat boundaries (based on natural features, roads and past maps) have been proposed under the Tiger Conservation Plan for Manas (2014-2024). The beat boundaries must be demarcated on the ground and the staff encouraged to carry out regular field patrolling based on their area of jurisdiction.

3.5 Rhino protection Strategies

The last security assessment had been undertaken for the Park by the IRV2020 Security assessment team in June 2012 (Swargowary et.al., 2012) and there is a need to conduct this again in the light of new poaching and encroachment threats to prime Rhino Habitat. Several High-level security committees have also been formed by the State government (Annexure) and it is important that a consolidated anti-poaching strategy be adopted for the Park. Details of the integrative strategy and the road map for the next ten years have also been discussed in Chapter Four.

While, several emergency measures have been rolled out by the authorities to deal with the serious poaching issue and a series of high-level security meetings were held to ensure greater coordination between the Forest Department, the Civil Administration and the Police Establishment. Seven suspected people have also been arrested for alleged

involvement in the criminal offence and one intruder in the National Park was also killed in an encounter with forest guards.

Significant steps by the Manas National Park authorities with the goal of improving the protection mechanism include establishment and improvement of infrastructure (anti-poaching camps, road bridges, communication equipment), intensified patrolling using SMART techniques, engagement of additional personnel for enforcement, filling-up of vacant positions, capacity building of frontline forest staff and local community engagement through eco-development and eco-tourism activities. The details of the same have been described in the following pages.

3.6 Strategic planning and enforcement of Law Enforcement Mechanism (LEMs)-SMART

3.6.1 Introduction and background:

The Spatial Monitoring and Reporting Tool (SMART) is designed to improve anti-poaching efforts and overall law enforcement effectiveness in established conservation areas. SMART makes it possible to collect, store and evaluate data on patrol efforts (e.g. time spent on patrols, areas visited and distances covered), patrol results (e.g. snares removed, arrests made) and threat-levels. When effectively used to create and sustain information flows between frontline staff, analysts and conservation managers, the SMART approach can help to substantially improve protection of wildlife and their habitats. The SMART approach can be introduced to any conservation area that relies on patrol teams to protect wildlife and the natural ecosystems they depend upon. This approach has already demonstrated its effectiveness in improving law enforcement effort, improving morale of enforcement teams, and reducing poaching levels in multiple sites across the world. Already SMART has been implemented in 120 conservation areas in 27 countries worldwide and fast becoming a global standard for law enforcement monitoring and management.

Manas National Park was the first choice under the program Indian Rhino Vision 2020 program for the range expansion of the rhinos in Assam and to build a new population through wild to wild translocations. As a part of the program 18 rhinos were successfully translocated to the park during 2008 to 2012 and all the rhinos seemed to have adapted well to their new habitat. Before the release of the rhinos in the park necessary rebuilding was done for the security of the rhinos to be released and poaching was not an issue in the park till October 2011. In the year 2013, five translocated rhinos total 7 rhinos (last 3 years) killed by

poachers. This was not a healthy sign at all for a newly established population through a lot of efforts and financial inputs. As per discussions in the Rhino Task Force meeting held on 30th January 2013 a decision was taken that to improve the patrolling, SMART systems are to be adopted and tried on a trial basis in Manas.

Following that decision a training program on SMART was organized for the park staff during the month of March, 2013. After some gap period, Forest Department of Assam, Manas National Park authority planned to implement SMART with support of WWDT and WWF from the month of March, 2014. SMART has been implementing as pilot basis some selected vulnerable locations of Manas to improve the security scenario through improved patrolling and monitoring. 12 GPS and 12 digital cameras have been used for SMART patrolling in some vulnerable locations.

The patrolling was done by using elephants for combing the patrolling area and attempt was made to locate rhino and other wild life as far as possible. Later, all the spatial information was analyzed with SMART software for better output.

3.6.2 Orientation on SMART software

A special SMART software orientation program was arranged in the month of June, 2014. Principal objective of this program was to orient SMART software to core computer cell groups of Field Director Office of Manas Tiger Reserve. To do a preliminary analysis of duty GPS data on SMART tool for basic idea about outcome of SMART effort.

3.6.3. A Brief Progress of LEM implementation at Manas

Field implementation and experiment was carried out in the month of March , April and May in a very limited areas. In the month of July there were no such effort undertaken due to change of park administration.

A proper patrolling plan has been prepared on 8th August, 2014 at Bansbari range with frontline staff of Manas National Park. Later on all patrolling elephants were deployed at different anti-poaching camps. There are 12 patrolling teams containing 3-4 elephants and 5-8 frontline staffs for patrolling all vulnerable locations of Central Part of Bansbari and Bhuyanpara Range . Patrolling effort led to a positive atmosphere among frontline staff. They have improved their data collection capacity. All team members of Bansbari are now able to handle GPS, binoculars and cameras. They are also developing their patience to identify rhinos at wild stage on the basis of rhino unique ID.

As a result, patrolling team located Rhino-4 at Bansbari range after 400 days of uncertainty. Regular outcome of SMART report and discussion with patrolling staffs helped them to improve their work quality. Deployment of elephant in some strategic location

helped them to patrol regularly in some difficult areas. As a result of patrol on 16th August, 2014 one patrolling team recovered huge amount of ammunition and hunting accessories and fortunately saving rhino from poaching. So there is a big challenge in front of Manas Park Authority to cover entire Manas NP under LEM patrol on coming days.

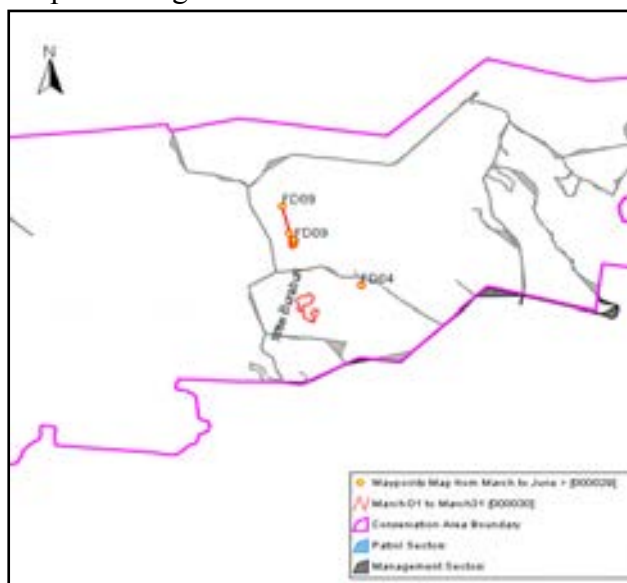
3.6.4. Summary of field data and Maps

a) Month of March Data Analysis- During the month of March, only New Buraburi, FD09, FD04 GPSs used on patrolling duty.

Table-1- Summary of duty GPS used in for the month of March, 2014

Code name of Duty GPS	Distance Covered (km)
New Buraburi	6.68
Buraburi	0
FD09	4.5
FD04	0.4
Rupahi	0
DD2	0

Map Showing GPS use areas of Manas National Park in March, 2014

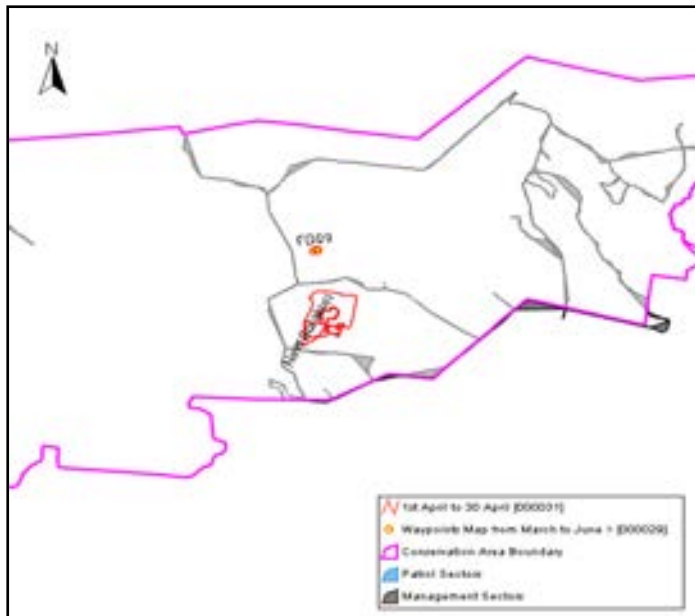


b) Month of April, 2014 Data Analysis- In the month of April, New Buraburi GPS was in use on patrolling duty while FD09 GPS had limited use. Other four GPS has not recorded any data.

Table- Summary of duty GPS used in the month of April, 2014.

Code name of Duty GPS	Distance Covered (km)
New Buraburi	31.36
Buraburi	0
FD09	0.25
FD04	0
Rupahi	0
DD2	0

Map Showing GPS use areas of Manas National Park in April, 2014

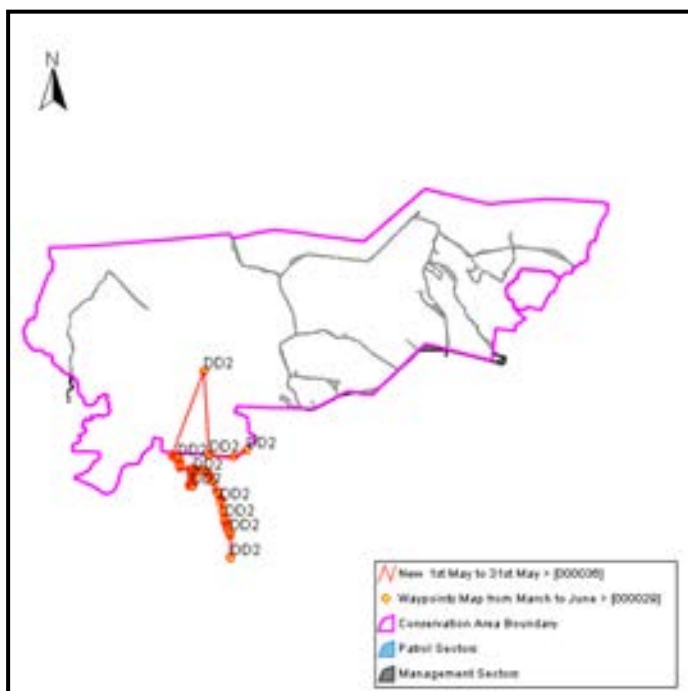


c) Month of May,2014 Data Analysis- In the month of May, only DD2 GPS was found to be used for patrolling duty. Major part of the patrolling was done outside the park boundary.

Table- Summary of duty GPS used in the month of May,2014.

Code name of Duty GPS	Distance Covered (km)
New Buraburi	0
Buraburi	0
FD09	0
FD04	0
Rupahi	0
DD2	30.91

Map--GPS use areas of Manas National Park on the month of May,2014

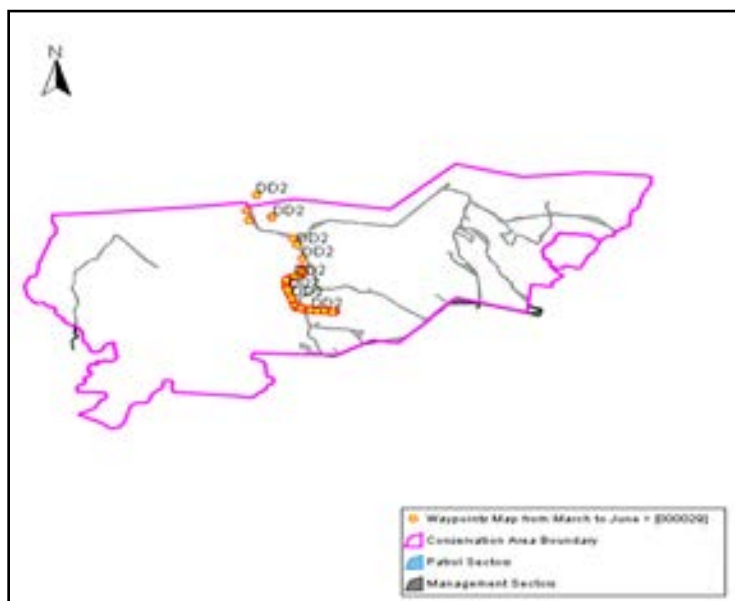


d) Month of June ,2014 Data Analysis- In the month of June, only DD2 GPS was found to use for patrolling duty. Other GPS were not in any use.

Table-3- Summary of duty used GPS in the month of June.

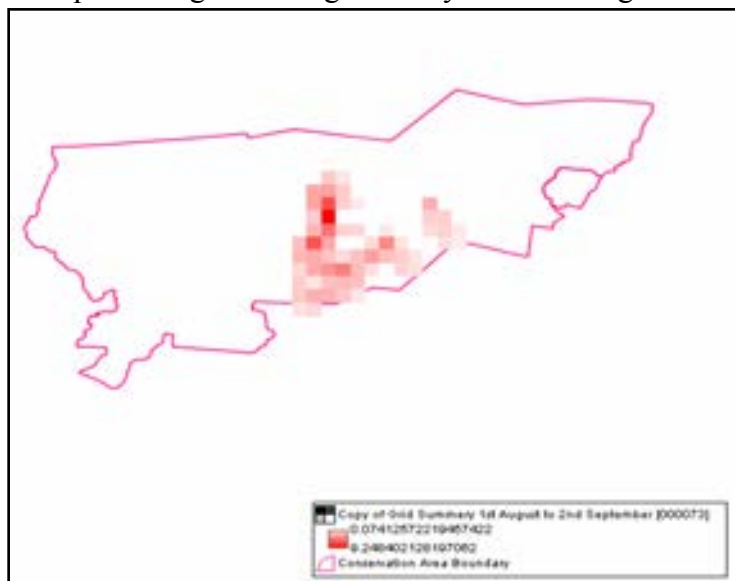
Code name of Duty GPS	Distance Covered (km)
New Buraburi	0
Buraburi	0
FD09	0
FD04	0
Rupahi	0
DD2	29.14

Map-4-GPS use areas of Manas National Park on the month of June.



e) Field data analysis for the month of August and September,2014

Map showing Patrolling intensity areas 1st August-2nd September,2014



3.6.5. Patrolling Effort

Patrolling effort is improving. Each team is giving hard effort to patrol as much as possible. Following are brief analysis of each team effort.

a) Patrolling effort from 1st - 15th August,14

Serial No	Name of Team	Distance (km)	Total Hours of Duty
1	FD04	7.4	4.2
2	DD2	5.27	3
3	FD06	12.64	5.6
4	FD07	12.53	4.8
5	FD08	10.31	4.4
6	FD09	0	0
8	FD10	16.73	9.1
9	GPS1	0	0
10	Bhuyanpara RO	0	0
11	Charfuli	0	0
12	FD11	0	0

b) Patrolling effort from 16th August - 2nd September, 2014

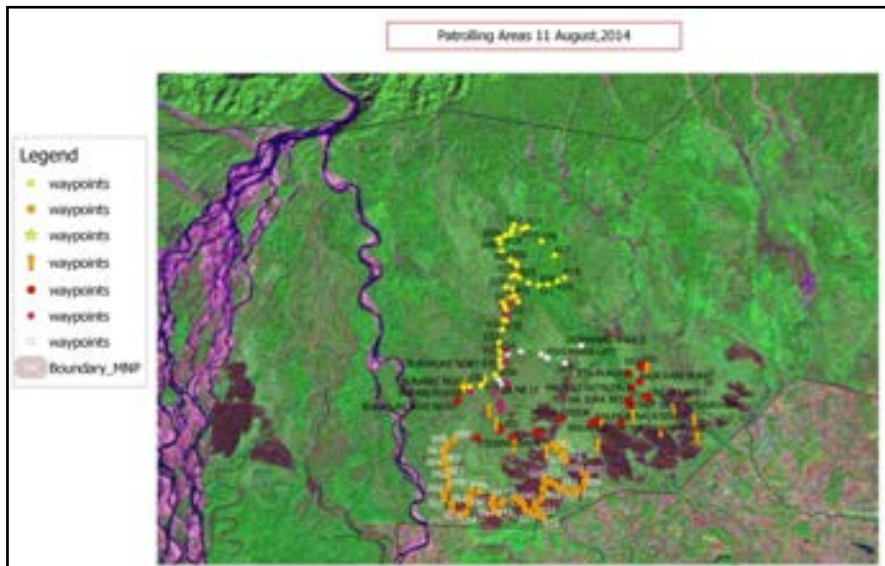
Serial No	Name of Team	Distance (km)	Total Hours of Duty
1	FD04	0	0
2	DD2	13.03	4.7
3	FD06	10.36	6.2
4	FD07	10.43	4.6
5	FD08	0	0
6	FD09	0	0
8	FD10	12.13	5.43
9	GPS1	0	0
10	Bhuyanpara RO	7.5	5.9
11	Charfuli	0.37	10
12	FD11	15.33	6.39

c) Patrolling effort from 1st August to 2nd September, 2014

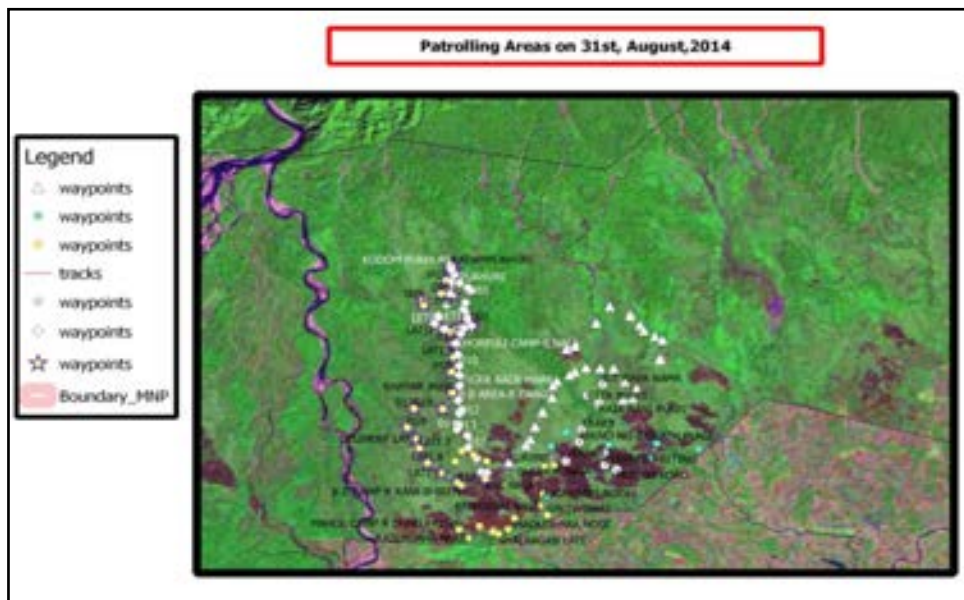
Serial No	Name of Team	Distance (km)	Total Hours of Duty
1	FD04	7.5	4.56
2	DD2	18.3	7.72
3	FD06	23.0	11.86
4	FD07	22.96	9.57
5	FD08	10.4	4.48
6	FD09	10.4	4.56
7	FD10	28.8	14.62
8	GPS1	0	0
9	Bhuyanpara RO	7.5	5.9
10	Charfuli	0.37	10
11	FD11	15.33	6.39

3.6. 6. Special Rhino Search Operation

There were two special rhino search operation undertaken at Bansbari and Bhuyanpara on 11th and 31st August. In this operation, mainly rhino ranging areas were covered. As a result of search operation 18 rhinos were located on different part of Bansbari and Bhuyanpara Range.



Map depicting Special Rhino Search Operation 11th August, 2014



Map depicting Special Rhino Search Operation 31st August, 2014

3.6.7. Other Wild Life Observation

On most of the occasions each team members dedicatedly devoted their patrolling effort to locate rhino with support of specific Rhino-ID. Moreover, other wild life as well as wild life signs were also recorded during their patrolling.

3.6.8. Future Plan

A detail security assessment was made on entire Park by IRV2020 security assessment team in the year 2013, considering all kind of threat for management of park. As per the security analysis it was recommended to increase SMART patrol to entire areas of Manas NP. Therefore park authority has immediately planned to implement SMART patrolling system entire areas of Park. Significantly, park authority has been trying to improve infrastructure (anti-poaching camps, road bridges, communication equipment), engagement of additional manpower, filling-up of vacant positions, capacity building of frontline forest staff etc. In this context park authority need additional resources (including 100 IRV2020 local volunteers and 100 arm home guard salaries apx . \$10 million) in place to operate patrol on regular basis at least for coming 3 years. Besides park authority need financial resources regular training, procurement of necessary equipments and improving infrastructure.

3.6.9 Evaluating the SMART Approach

When SMART patrol monitoring and the adaptive patrol management cycle are operating entire park areas, regular patrol reports (usually monthly or quarterly) will be produced to evaluate patrol performance and provide feedback to frontline staff. Less frequent (e.g. annually) more in-depth data analyses, with an evaluation of various trends in patrol performance and threat-levels, as well as an evaluation of the entire patrol management system will be reflected in that report

3.7 Combating encroachment in Rhino-bearing areas (Bhuyanpara)

The Manas NP has two identified encroachments viz. – Panbari (south) and Betbari under Bhuyanpara Ranges. These encroachments have not happened overnight and trace their origin to the insurgency period in 1990s.

In case of Bhuyanpara, it is stated that while there have been new clearings in the grassland area of the (Agrang-Betbari) area of Bhuyanpara Range, but these are not of permanent nature and there is no human settlement inside the clearing areas. This illegal cultivation encroachment is not a new issue and has been a feature for over a decade. The

easternmost boundary next to Betbari camp is adjacent to the Kokilabari Agricultural Farm (approx 9 sq km) with only a small rivulet separating the two. The seed farm was until recently on a 30 years lease from the forest department. At the end of 2005-06, the seed farm was formally handed over to the Agriculture department, Govt of BTC. This farm supports people from at least 57 villages who take a small portion of the land on lease from the department every year. At the same time, certain miscreants take advantage of the heterogeneity of the community and also indulge in illegal cultivation on the disputed side. The park authorities remain vigilant and use vigilant and use both conservation volunteers and armed guards to monitor and control this menace.

To keep the sanctity of the National Park and a world heritage site, the entire park area should be cleared from the existing encroachers and enforcement should be in place to prevent any further encroachment. The total encroachment area estimated within the above mentioned locations of the national park is about 15 km². Sporadic illegal activities are also at times reported from different parts of the park and the area with the highest problem is the Kahitema area in between the rivers Beki and Manas. This is mainly because of inaccessibility of the area. It is essential to stop all forms of illegalities affecting the park.

The Government of Assam and Bodoland Territorial Council should come ahead to solve this key issue to maintain the sanctum of the World Heritage Site (Annexure 1 & 2).

3.8. Conclusion and specific recommendations

1. Poaching of Rhino has emerged as the biggest threat that must be controlled at any cost. A detailed security assessment is therefore recommended every six months.
2. The manpower, especially in forest frontline staff is currently highly inadequate and skewed towards an older age-group of above 45 years. The length of service rendered by forest frontline staff at the same location is also more than 3 years in most cases. A detailed evaluation of motivation levels, health and fitness etc needs to be undertaken for the permanent staff.
3. Gap areas in construction of camps at strategic locations must be urgently addressed in the coming one year. Temporary camping at critical locations needs to be reinitiated with patrolling being carried out by using departmental elephants in these areas. Regular patrolling based on 'Beat Area' system needs to be augmented.

4. In case of non-permanent staff including conservation volunteers, there is an urgent need to mainstream their involvement into Park protection (by enhanced wages and a job security).
5. SMART-based patrolling has been initiated but must be carried out at the Beat level on a regular interval. The main objective of such a patrol should be to monitor Rhinos, detect and combat any perceived threats that may result in poaching. The frontline staff have shown tremendous improvement towards handling of GPS and camera, however the current logistical constraints at the Range-level require that the data is collected and analyzed at a central location. A SMART-Cell at Field Directorate office has been established and a stand-alone monitoring schedule can be worked out in coordination under the leadership of the Deputy Director. For greater transparency and coordination, analysis of field data can be coordinated with support from researchers who are familiar with rhino ranging behaviour at Manas.
6. A consolidated approach towards planning and assessment needs to be envisaged. Currently there are several committees that have been nominated by the Assam State and BTAD governments (Annexure 1-6). A joint effort by involving policy makers from both the governments must be urgently carried out to re-interpret/smooth out the differences that may be a hindrance towards active governance in the field. The committee meetings review and recommendations must be time-bound. Recommendations from each of the committees must be implemented on the ground with a feedback mechanism to feed into the assessments.

CHAPTER FOUR

RHINO CONSERVATION - THE ROAD MAP AHEAD

4.1 Aiming for Zero Poaching

The current demographic profile of Rhino population at Manas suggests that there may exist a breeding gap for the next 2-3 years as all the adult breeding males have been removed from the population. The last adult male Rhino 5 was poached on Nov 1, 2014. There is some speculation whether Ganga, who was observed with characteristic ‘courtship injuries’ in the first week of October 2014 had already mated with Rhino 5 then she may have the next calf in another one and half years. The need to supplement the existing population with adult breeding male Rhinos for population stabilization and aiming for zero poaching is therefore the immediate action point suggested for the next two years.

4.2 Combating encroachment in Bhuyanpara (Short-term Plan)

The encroachment in Bhuyanpara is currently on a standstill and since there are no permanent settlements a massive eviction drive with support from the District Administration in most urgently needed. The following timeline of action are therfeore proposed:

- Dec 2014: serving of eviction notice and eviction operation with support and coordinated action with Forest department, Baksa District administration, Police and Army.
- Dec 2014-Jan2015 : area domination will be required with support of additional manpower (with arms) support for atleast 50 staff to camp in the area. the camps at Khoirbari, Agrang, Panda, Betbari, Maozi and Tangunmara can accordingly be strengthened with the additional forces for the winter season.
- Jan-Feb 2015 : A trench along with a solar fence and boundary pillars can be erected at the disputed site so as to permanently repossess the area. The support of three local NGOs (Manas Bhuyanpara eco-tourism Society, Manas Agrang Society and Manas Maozegendri Ecotourism Society) along with the concerned village headmen will be crucial for the success of the eviction operation.

4.3 Combating encroachment in Bhuyanpara (Long-term Plan)

It has been observed that the encroachment at Bhuyanpara is a recurring problem that has been impacting the park since the declaration of the National Park in 1990. The disputed territories in Agrang Forest village and adjoining areas have been a bone of contention, especially since it is an area for prime grasslands /agricultural area. the socio-political

situation including the presence of militant outfits in the vicinity of the Park, unauthorized and illegal possession of weapons by civilians and the prevalence of country-made fire arms have also been some of the factors that have led to ‘land mafia-backed’ encroachment inside the Park. As already stated, the current encroachment is not of a permanent nature and the people from atleast 30 villages from nearby areas participate in clearing and cultivating small portions of forest land. Such encroachment is often backed and controlled by armed miscreants who have been indentified and the information shared with intelligence authorities. A reconciliatory attempt to talk to the encroachers and come up with an amicable solution was also attempted by the Park authorities in 2011 with support of the local NGOs. Boundary pillars had been erected and the area of actual demarcation was also agreed upon. Similarly, in April 2014, eviction notices were served and conservation volunteers from Panbari, Bansbari and Kahitema area were deployed in greater numbers to prevent any further encroachment.

All the actions as mentioned above indicate that a multi-pronged comprehensive long-term strategy (atleast five years) is required for targeting the encroachers. The tentative timeline is proposed below:

- Jan-Feb2015: eviction of encroachers, after the paddy cultivation season is over and to ensure that no further clearing in the grassland/forest is made. All access to forest, including grazing of livestock, collection of firewood and minor forest produce, fishing and hunting to be strictly banned and the law enforced through strictest of measures. Bringing in new forest staff and rotation of existing staff to other areas will be helpful. Any added incentive such as provisioning for rations, vehicle and elephants for patrolling, wireless sets for communication and provisioning of winter gear will most certainly boost the morale of the existing staff.
- Feb 2015: Deployment of Eco-Task Force (Two Companies) currently based out of Kokrajhar, BTC for systematic area domination and undertaking plantation in the adjoining Daodhara and Batabari RF areas. Daodhara RF is part of the Critical Tiger Habitat and also an important elephant corridor for migratory elephant. Currently, Daodhara and Batabari RF are also facing an onslaught of clearing and illegal removal of trees. There is a tremendous potential to create large-scale plantations through the Eco-Task Force in both these RF areas. The advantage of bringing in the ETF is that they are trained army personnel and that their large numbers (two companies) will ensure area domination against the armed miscreants that support

encroachers. Grassland improvement including maintenance of forest roads and creation of artificial waterholes etc are some of the additional tasks that can be handed over the Eco-task Force in the National Park. The Task force can be based out of Kokilabari and Agrang Camps so that no further encroachment occurs in the area. The modalities for providing housing to the Eco-Task Force, the salaries, nurseries for plantation etc must be worked out in coordination with the District and Territorial Division.

- March 2015 – Aug- 2020 : a systematic plan for creating nursery and plantations in the RF areas and complete closure of the National park to any anthropogenic pressures will ensure complete revival of the habitat and therefore the return of the Rhinos and mega herbivores.

4.4 Community engagement and public awareness

A total of 64 forest fringe villages have been identified that are in the immediate vicinity of the Park. Manas Forest Development agency has been registered and Eco-development activities need to be initiated that instill a sense of pride and ownership among the local communities. The local NGOs, fringe communities and the youth bodies around the national park are supportive towards conservation and this has helped the park to revive. For a better understanding of the community linkage discussion was held with members from the local NGOs like Manas Maozigendri Ecotourism Society, Agrang Society, Bhuyapara Society, Manas Ever Welfare Society and Panbari Society. It has been observed that almost every local NGO have a large number of members and a lot of them are engaged in supporting the park staff, this is healthy if used with care, however it has been learnt that the NGOs cannot sustain their large membership and often some of the guys leave the organization for other works and are not monitored. This leads to a risk of exposure of vital park information leading to complications in the anti-poaching measures. A large number of youths from the fringe villages of Manas are engaged as conservation volunteers and this is aiding building relationship and ensuring community goodwill to some extent. Some of these youths also understand that IRV-2020 is offering them a livelihood and this is helping to spread a good message.

It is also learnt that a regular community reach-out program has been organized since 2008 under the IRV-2020 program by the WWF team and almost all the villages and schools in the fringe of Basbari has been covered. It is also learnt that limited livelihood support program for the fringe community has also been extended under IRV-2020, the Government

biodiversity program as well as through some other programs run by NGOs like ATREE, Aaranyak and WTI. It is very important that the community out-reach programs are continued and areas under Bhuyapara and Panbari are also extensively covered to spread the message of conservation. Further it is necessary that livelihood support programs are initiated and systematically implemented to sustain the goodwill and support of the fringe community for long term conservation success in the park.

4.5 Enhanced Intelligence Network and LEMs

The support from the local community and help from the ex-poachers has built up the possibility of setting up an intelligence network in and around Manas National Park. A functional and effective intelligence network is very essential to minimize wildlife crime in any protected area which has wildlife like rhinos, tigers and elephants. At present it is not clear if any proper intelligent network exist in the park but efforts should be made to immediately form a working network that support the park authorities that can help in enhancing the protection for the rhinos and other wildlife.

The GPS-based SMART patrol that has been initiated in Manas NP this year needs to be continued and expanded in the coming years. The main objective of this patrol had been to undertake monsoon-patrol using elephants and also bring innovation in Rhino-monitoring. The current method (of combined patrol at an interval of 10-15 days) has yielded results, although several lacunae exists. For the coming dry season, it is necessary that the individual camps/beats are provided GPS and Camera and trained and motivated to undertake SMART patrol in their designated area. The following immediate actions points are suggested for SMART patrol for the winter season

- Distribution of GPS/Camera sets to target camps and locations (currently 20 each and targeted in rhino-bearing areas), including clearing of beat boundaries in the field shall be coordinated by Deputy Director and respective Range officers by 10th December, 2014.
- SMART-cell already established in FFDTP office comprising of Girin Barman, Kiran Basumatary, Mamoni Boro, Lalita Das and Farida Begum shall be solely responsible for managing and record keeping of the data generated.
- SMART re-orientation and training for the camps shall be organized by Deputy Director with support from WWF and Aaranyak by 15.12.2014.

- A dedicated SMART patrol shall be executed at least once in a week, over and above the patrolling duties assigned to the camp staff. Aaranyak has agreed to strengthen this with dedicated team member for managing the logistics and data on the ground.
- The daily/ weekly patrol shall be coordinated by Deputy Director in consultation with concerned Range officers and executed as per schedule. Data compilation and analysis shall be undertaken by SMART cell with support from Deba Dutta and Deputy Director.
- A lumpsum for conducting the field exercise and contingencies shall be requested from WADWT and made available to Deputy Director for execution of the SMART exercise.
- Gap areas, including locations especially in southern boundary, DaodharaRF, Manas RF shall be filled up by coordinators as appointed by Aaranyak.

4. 6. Habitat management

It is now widely accepted that the control of alien invasive species is not a short-term or isolated effort. It requires the long-term application of efforts aided by constant monitoring and investigation. Concerted effort is needed to control invasive species and a better understanding of the causes of their spread can help to implement pre-emptive measures. Recognizing the seriousness of the problem, the 31st session of the World Heritage Committee held in Christchurch in 2007 suggested that the Forest Department of Assam develop an independent management plan to control invasive species.

The potential of these invasive alien plants to destroy prime rhino habitat is enormous and should be investigated properly and immediately. The cost and difficulty of eradication increase exponentially with each season of delay. It cannot be over-emphasized; experience elsewhere has shown that if left too long the problem will become so immense that infestations cannot be practically or economically dealt with. Thus important habitats for the rhino would be destroyed. Government agencies, institutions and individuals in rhino bearing areas lack adequate knowledge of the ecological and environmental consequences caused by invasive alien species and how to address it. Hence emphasis should be given to apprise policy makers, managers, conservationists, media and the academic community about this genuine threat to Asian rhinos. Alien species in rhino habitats *Mimosa diplotricha* is a fast growing, abundantly thorny, biennial or perennial shrub with angular branching stems that become woody with age. Its leaves are alternate, bipinnate and compound. Once established, *Mimosa* spp. is difficult to control. Mimosa seeds are typically dispersed in two ways: carried

downstream during floods or transported by animals or machinery. Moreover, it is reported to be poisonous to herbivores and considered to be one of the most serious alien invasive species (IUCN/ISSG database).

4.7 Transboundary habitat

The proposed first addition to Manas NP extends from the Indo-Bhutan boundary on the north to the Manas road on the south. The eastern side is bounded by the river Sukanjan which is the western boundary of Manas NP and extends to the Sukanteklai river on the west. Beyond the western boundary there lies the remaining part of the Manas (Pt.) RF which stretches to the Chirang RF, Ripu RF and then to Buxa Tiger Reserve of West Bengal. Excluding the southern side of the proposed NP, the other three sides have contiguous forest areas both in Bhutan and India. The total area of the Proposed NP is 350 sq km.

Fig 4.1: Map of Manas RF(addition) proposed National Park



Current status: The National Park proposal has already been endorsed by the BTAD and also the State Board of Wildlife in their meeting held on 20.10.2014.

Justification for declaration as a National Park and as a potential Rhino habitat

- Manas RF is a protected forest for more than 80 years (declared as RF in 1927). It also has a unique location of ‘forests’ on all three sides of its boundary.

- Manas RF is already part of the critical tiger habitat that has already been declared by the Assam Govt in 2007 for Manas Tiger Reserve. This, along with Daodhara RF and Barnadi wildlife sanctuary roughly covers an area of 840 sq km which is as per the needs of supporting 25 breeding tigers in the future. Expansion of the landscape is the next logical step towards attaining this.
- UNESCO as per its periodic reporting format has been enquiring time and again about the three-stage extension of the world heritage site (Manas wildlife sanctuary) property (*WHC-11/35.COM/20, p. 22*). As per this three stage extension, Manas needs to be expanded to cover the entire Manas National Park, addition to Manas National park (Manas RF part) and the Royal Manas in Bhutan. The next reporting is due in Feb 2015.
- The human settlement remains only on the south of Manas road of the proposed NP. There is no Forest Villages inside the proposed NP area. There is no encroachment on the land
- The areas is home to the critically endangered White Bellied Heron (*Ardea insignis*) which is now being protected through local community based (United Forest Conservation Network of BTAD) conservation measures.
- Due to its Reserved Forest status, the area has witnessed an onslaught of forest degradation during the insurgency period, collection of forest produce and extraction of sand and boulders in the past. The current staff strength (about 38 persons for 350 sq km) is highly inadequate for forest protection. The staff strength needs to be increased and a wildlife conservation orientation is required. The ‘upgradation’ of status from Reserved Forest to National Park will help in garnering state and central support (and funds) to do that.

4.8 Conclusion and Key Recommendations

1. The key recommendation of this plan is to aim for zero poaching for the next three years using all possible means of strengthening the current anti-poaching strategies. Special efforts, manpower and funds may be required to achieve this and all agencies currently involved in implementing the Rhino conservation programme at Manas must come forward and join hands with the Park authorities.
2. A systematic time-bound short term and long-term plan as stated in the Chapter must be implemented to tackle the encroachment problem at Bhuyanpara. Since the encroachment and the intrusion of unauthorised persons into the park is linked to the poaching of rhinos, the same must be give TOP priority by the Government.
3. Community engagement and public support has been initiated through formation of Eco-development committees in the key rhino-bearing area under Bansbari in the first phase. The model needs to be expanded to other ranges and awareness and alternative livelihood support activities be initiated through proper micro-planning.
4. Expansion and securing potential Rhino habitat in Manas RF area shall be beneficial to all mega herbivores in the long run. Transboundary linkages to Bhutan may also be explored for further extending safety net and territory.
5. The Rhino Conservation Plan (RCP) and the provisions therein must find legal support and therefore key recommendations from the RCP have been also incorporated into the Manas Tiger Conservation Plan (2014-2024) as envisaged under the Wildlife (Protection) Act, 1972 (2006 amendment) for all Tiger Reserves. The overlapping / stand-alone action points therein including budgetary provisions etc must therefore emanate from a single Plan which in case of Manas has been accepted as the Tiger Conservation Plan. The Plan recommendations must be evaluated in a time-bound manner with a feedback mechanism to improve the document on a yearly basis.

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 GOVERNMENT OF ASSAM
 ENVIRONMENT AND FORESTS DEPARTMENT
 DISPUR, GUWAHATI-6

**ORDERS BY THE GOVERNOR
NOTIFICATION**

Dated Dispur, the 9th July, 2013

No.FRW.25/2008/pe/69: The Governor of Assam is pleased to constitute a coordination committee for the protection of Wildlife and control of Wildlife Crime in and around the Manas Tiger Reserve consisting of the following Officers.

1. Additional PCCF & Council Head of Forest Department, BTC, Kokrajhar.	Chairman
2. CCF & Field Director, Manas Tiger Reserve, Barpeta Road	Member-Secretary
3. Inspector General of Police, Kokrajhar	Member
4. Superintendent of Police, Kokrajhar	Member
5. Superintendent of Police, Baksa	Member
6. Deputy Director Manas Tiger Reserve, Barpeta Road	Member
7. DFO, Chirang Division	Member
8. DFO, Baksa Division	Member
9. DFO, North Kamrup Division, Rangia	Member
10. Commandant, SSB, Howly	Member
11. Commandant, SSB, Bongriganj	Member
12. All Range Officers under Field Director, Manas Tiger Reserve	Member
13. Officer-in-Charge, Salbari, P.S.	Member
14. Officer-in-Charge, Gohardham, P.S.	Member
15. Officer-in-Charge, Bijni, P.S.	Member

The Committee will have following functions :-

- 1) Hold meeting every 3 months to share intelligence and other vital information for safety of the Manas Tiger Reserve. The minutes of the meeting will be sent to Principal Secretary, Department of Environment and Forests and Principal Chief Conservator of Forests, Assam and Principal Chief Conservator of Forests (WL) Assam within 7 days of the meeting by Member Secretary of the Committee.
- 2) Draw up action plan for protection of Manas Tiger Reserve during the next 3 months which will also be communicated.

Sd/- Kumar Sanjay Krishna, IAS,
 Principal Secretary to the Government of Assam,
 Environment and Forests Department
 Dated Dispur, the 9th July, 2013

Memo. No.FRW.25/2008/pe/69-A.

Copy to:-

1. The Principal Chief Conservator of Forests, Assam, Rehbari, Guwahati-8
- ✓ 2. The Principal Chief Conservator of Forests (WL) Assam, Basistha, Guwahat-29
3. The Director General of Police, Ulubari, Guwahati-7
4. The Principal Secretary, BTC, Kokrajhar
5. The Chief Conservator of Forests & Field Director, Manas Tiger Reserve, Barpeta Road
6. All Members of the Committee.


 Joint Secretary to the Government of Assam,
 Environment and Forests Department

GOVERNMENT OF ASSAM
ENVIRONMENT AND FORESTS DEPARTMENT
DISPUR, GUWAHATI-5

**ORDERS BY THE GOVERNOR
NOTIFICATION**

Dated Dispur, the 17th May, 2014

No.FRW.48/2010/127: In pursuance of D.O. letter No.CMO.4/2014/121, dated 22/01/2014 received from the Office of the Hon'ble Chief Minister, Assam and as proposed in the meeting held on 4/2/2014 vide Principal Chief Conservator of Forests, Wildlife, Assam's letter No.WL/FG/Rhino Poaching/MNP/2014, dated 13/2/2014, a high level task force with the following composition is hereby constituted with immediate effect to ensure overall improvement of Manas World Heritage Site & checking all illegal activities in Manas National Park.

- | | |
|--|-------------------|
| 1. Executive Member, incharge Forests, Bodoland Territorial Council, Kokrajhar | -Chairman |
| 2. Council Head of Department, Bodoland Territorial Council, Kokrajhar | -Member |
| 3. Inspector General of Police, Bodoland Territorial Council, Kokrajhar | -Member |
| 4. Deputy Inspector General of Police, Western Range, Bongaigaon | -Member |
| 5. Secretary General & CEO, WWF- India | -Member |
| 6. Representative of International Rhino Foundation | -Member |
| 7. Conservator of Forests, Wildlife, Office of the Principal Chief Conservator of Forests (WL) Assam | -Member |
| 8. Field Director, Manas | -Member Secretary |

Sd/- Davinder Kumar, IAS
Principal Secretary to the Government of Assam,
Environment and Forests Department
Dispur, Guwahati-6


Memo No.FRW.48/2010/127-A,

Dated Dispur, the 17th May, 2014

Copy for information to:-

1. The Principal Chief Conservator of Forests, Assam, Rehabari, Guwahati-8
2. The Principal Chief Conservator of Forests, (WL) Assam, Basistha, Guwahati-29
3. The Executive Member, in-charge Forest, Bodoland Territorial Council, Kokrajhar
4. The Council Head of Department, Bodoland Territorial Council, Kokrajhar
5. The Inspector General of Police, Bodoland Territorial Council, Kokrajhar
6. The Deputy Inspector General of Police, Western Range, Bongaigaon
7. The Secretary General & CEO, WWF-India, 172-B, Lodhi Estate, New Delhi-11
8. Representative of International Rhino Foundation, C/o- Dr. Bibhab Talukdar, Evergreen, 50 Samannay Path, Aaranyak, Survey, Guwahati-28
9. The Conservator of Forests, Office of the Principal Chief Conservator of Forests, (WL) Assam, Basistha, Guwahati-29
10. The Field Director, Manas National Park, Barpeta Road, Assam.

By order etc.,


Under Secretary to the Government of Assam,
Environment and Forests Department,

BODOLAND TERRITORIAL COUNCIL SECRETARIAT::BODOFA NWGWR, KOKRAJHAR
Department of Forest & Wildlife

Dated Kokrajhar, the 21st June,2012

N O T I F I C A T I O N

No.BTC/Forest-1/2003/122: In pursuance to the minutes of the review meeting on Manas National Park held on 29th May,2012 at Bansbari Range and in the interest of public service, the Bodoland Territorial Council is pleased to constitute a committee to suggest and to improve the existing security arrangement to be carried out by the Forest Department of BTC in Manas National Park consisting of following members:

- | | | | |
|-----|---|---|------------------|
| 01. | Chief Conservator of Forest & CHD Forest, BTC | - | Chairman |
| 02. | Superintendent of Police, Baksa | - | Member |
| 03. | Dr. Bibhuti Lahkar, Programme Secy. Aranyak | - | Member |
| 04. | Sri Amit Sharma, WWF-Coordinator | - | Member |
| 05. | Sri Phwjwngshar Narzary, MMES | - | Member |
| 06. | The Field Director, Manas National Park | - | Member Secretary |

The Field Director, Manas National Park & Member Secretary will take necessary steps to convene meeting and recommend the suggestions put forward by the Committee to the BTC.

This will come into force with immediate effect.


Sd/-
Secretary,
Bodoland Territorial Council,
Kokrajhar.

Memo No.BTC/Forest-1/2004/122 (A),

Dated Kokrajhar, the 21st June,2012

Copy to:-

- 1) PS to Chief of BTC, Kokrajhar
- 2) PS to Deputy Chief of BTC, Kokrajhar
- 3) PS to Principal Secretary, BTC, Kokrajhar
- 4) The Chief Conservator of Forest, BTC, Kokrajhar
- 5) The Field Director, Manas Tiger Project, Barpeta Road.
- 6) The Superintendent of Police, Baksa.
- 7) Dr. Bibhuti Lahkar, Programme Secy. Aranyak
- 8) Sri Amit Sharma, WWF-Coordinator
- 9) Sri Phwjwngshar Narzary, MMES


Secretary,
Bodoland Territorial Council,
Kokrajhar

By - Email



GOVERNMENT OF ASSAM
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS, WILDLIFE, ASSAM,
BASISTHA, GUWAHATI-29

No. WL/PG.41/ Rhino Translocation/ 2005

Dated Guwahati, the 25th November, 2014

A Security Assessment Team under IRV2020 is constituted as follows for preparing a report after assessing the current security status in Manas NP and suggest corrective measures accordingly –

- | | |
|--|----------|
| 1. CF Wildlife, o/o PCCF(WL), Assam | - Leader |
| 2. Deputy Director Manas TP | - Member |
| 3. Sri. A. Baig, DFO o/o PCCF(WL), Assam | - Member |
| 4. Sri. Anupam Sarmah, WWF-India | - Member |

Terms of Reference :

1. The team will be responsible for carrying out Security Assessments in the field and as required for suggesting measures for ensuring the security of the rhinos in Manas NP.
2. The team will analyze the gaps in the implementation of the suggestions in the previous security assessment and meetings conducted in relation to the security in Manas NP and suggest there-off.
3. The team will work in co-ordination with the Field Director, Manas TP and he is requested to provide all necessary information and extend support to carry out the assessments.
4. The team may also take the help of individuals to accomplish necessary activities.
5. The team will be supported from the IRV2020 program for their operation.
6. The team will submit detailed reports to the undersigned within a stipulated timeframe of 30 days and will also have to present the findings as and when requested.

[Rajendra P. Agarwala, IFS]

Principal Chief Conservator of Forests (Wildlife)
and Chief Wildlife Warden, Assam

and Chairman, Task Force for Translocation of Rhinos within Assam

Copy to,

1. The PCCF & HOFF, Assam, Rehbari, Guwahati for his kind information.
2. The Field Director Manas TP, Barpeta Road for his information and action.
3. The CHD Forest, BTC, Kokrajhar for his kind information.
4. Sri Amit Sharma, WWF-India for information and facilitation.
5. All members.

[Rajendra P. Agarwala, IFS]

Principal Chief Conservator of Forests (Wildlife)
and Chief Wildlife Warden, Assam

and Chairman, Task Force for Translocation of Rhinos within Assam
Basistha, Guwahati - 29



GOVERNMENT OF ASSAM
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS, WILDLIFE, ASSAM,
BASISTHA, GUWAHATI-29

No. WL/FQ.41/ Rhino Translocation/ 2005

Dated Guwahati, the 25th November, 2014

A Co-ordination Team for SMART (LEM) under IRV2020 is constituted as follows for effective implementation in Manas NP and Kaziranga NP -

- | | |
|--|----------|
| 1. CF Wildlife, o/o PCCF(WL), Assam | - Leader |
| 2. Deputy Director Manas TP | - Member |
| 3. DFO EAWL Division | - Member |
| 4. Sri. A. Baig, DFO o/o PCCF(WL), Assam | - Member |
| 5. Sri. Deba Dutta, WWF-India | - Member |

Terms of Reference :

1. The team will be responsible for ensuring effective implementation of SMART (Spatial Monitoring and Record Tool) which was decided to be implemented in Manas NP and Kaziranga NP by the Rhino Task Force in its meeting dated 30th January 2013 for ensuring better patrolling and security.
2. SMART has been in implementation in both Manas NP and Kaziranga NP and the team will analyze the gaps in the implementation and come up with suggestions to address the gaps.
3. The team will work in co-ordination with the FDTP Manas TP, Director Kaziranga NP, Chairman WADWT and Co-ordinator Rhino Conservation, WWF-India.
4. The Deputy Director, Manas NP and DFO EAWL will be the Nodal persons for their respective parks for implementation of SMART and WWF is requested to provide all necessary technical support. They will also generate regular reports on SMART implementation and submit to the office of the undersigned every quarter.
5. Chairman WADWT will facilitate the operation of this team and WADWT will be the Nodal Agency for providing support for the effective implementation of SMART in Manas NP and Kaziranga NP.
6. The team will co-ordinate to ensure effective implementation of SMART and regular reporting for an initial period of two year.

[Rajendra P. Aggarwal, IFS]
 Principal Chief Conservator of Forests (Wildlife)
 and Chief Wildlife Warden, Assam
 and Chairman, Task Force for Translocation of Rhinos within Assam

Copy to,

1. The PCCF & HOFF, Assam, Rehbari, Guwahati for his kind information.
2. The Field Director Manas TP and Director Kaziranga NP for their information and support.
3. The Chairman, WADWT for his kind information and request for facilitation.
4. Sri Amit Sharma, Co-ordinator Rhino Conservation WWF-India for information.
5. All members.

[Rajendra P. Aggarwal, IFS]
 Principal Chief Conservator of Forests (Wildlife)
 and Chief Wildlife Warden, Assam
 and Chairman, Task Force for Translocation of Rhinos within Assam
 Basistha, Guwahati - 29

**A MASTER-ID KEY TO RHINO IDENTIFICATION IN
MANAS NATIONAL PARK**

Prepared by : Shri Deba Kr. Dutta

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Iragdwa**

Sex: Adult Male

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino 2

Age: 12 years

Father: Unknown

Mother: Unknown

Date of Birth: Unknown

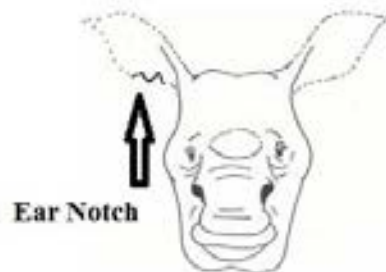
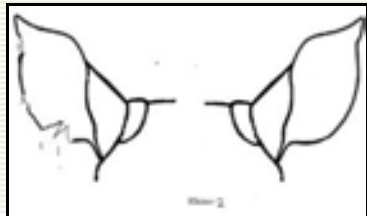
Ear Notch ID: 2

Radio Collaring Date-12/04/2008

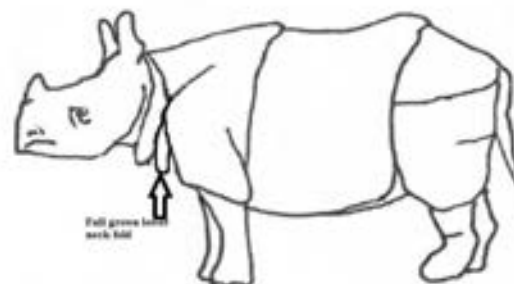
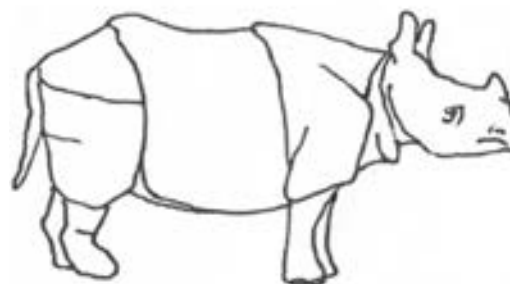
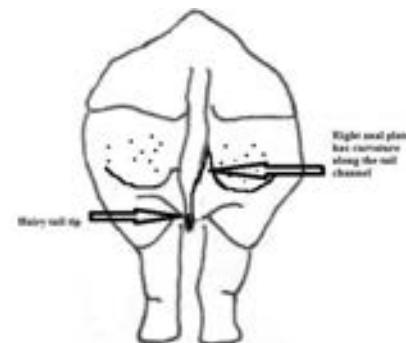
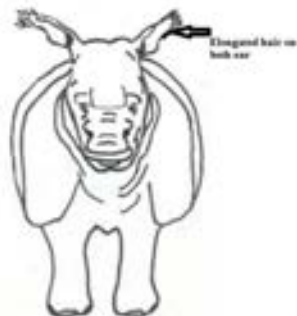
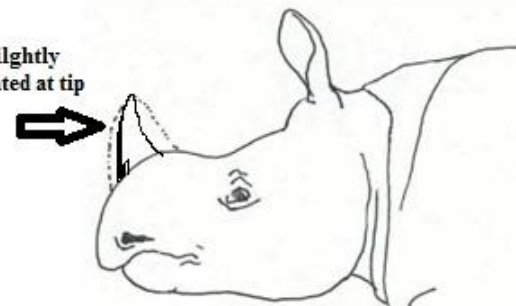
Radio Collar Stopped Functioning

Radio-collaring Date-25/4/2011

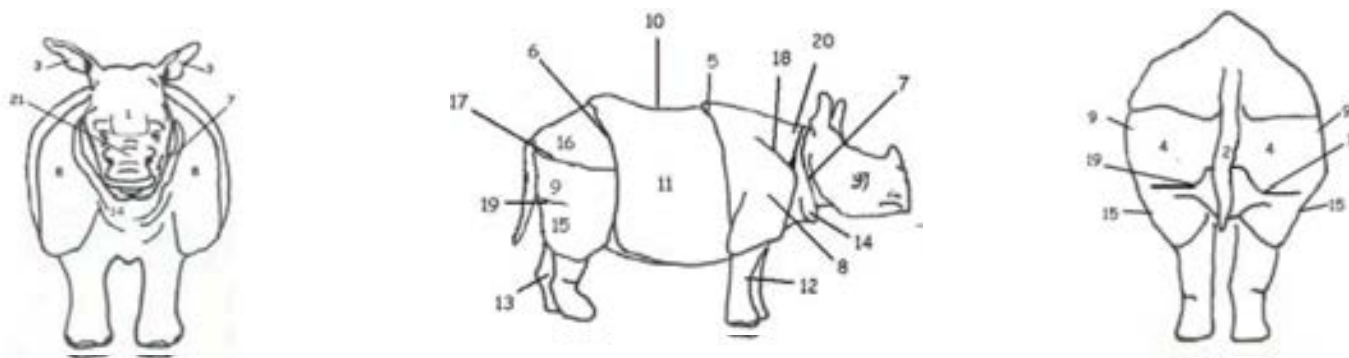
Radio Collar Dropped Date-11/11/2012



Broad base, slightly bend and pointed at tip



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics :

- | |
|--|
| 1. Horn: Broad base, Slightly curved and pointed |
| 3. Ear: Elongated hair on both outer line of ears |
| 4. Anal plate: Right anal plate has curvature at the tail length |
| 7. Neck fold: Stout and full grown and V-Shaped |
| 14. Lower neck fold: Full grown lower neck fold |
| |
| |
| |

Rhino History, Ranging, Association

Rhino History: Rhino-2 was captured and translocated from Pobitora Wild Life Sanctuary to Manas National Park on 11th April, 2008 and released at wee hours in Buraburijhar under Bansbari range. This is only dominant male among female rhinos at Manas. It was rescued back again to Manas NP from the 100km park boundary after 15 days continuous hard effort. This killed by poachers in 13th January,2013.

Range: East bank of river Beki to Betbari camp of Bhuyanpara range of Manas.

Group Composition: Rhino-2 like to associate with Rhino-6 and 7, Mainao, Ganga ,Jamuna, R9, R 10,13 and 15.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Laisiri**

Sex: Adult Female

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino 3

Age: 13 years

Father: Unknown

Mother: Unknown

Date of Birth: Unknown

Ear Notch ID: 3

Radio-collar status-

Radio collaring date-

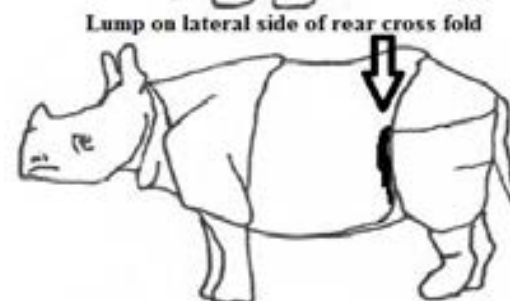
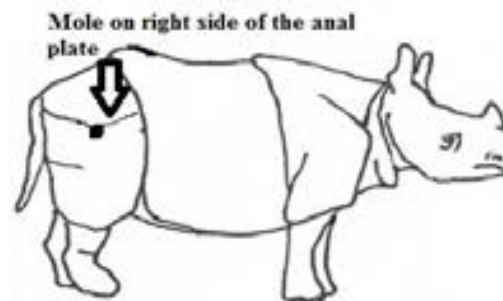
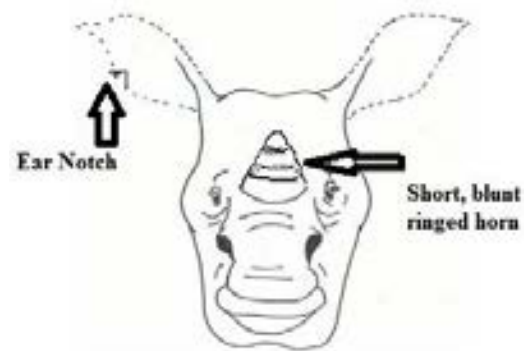
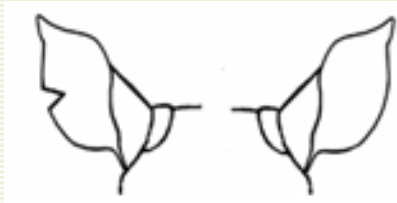
27/12/2010

Radio Collar Stopped Function-

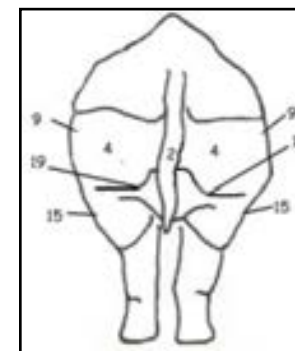
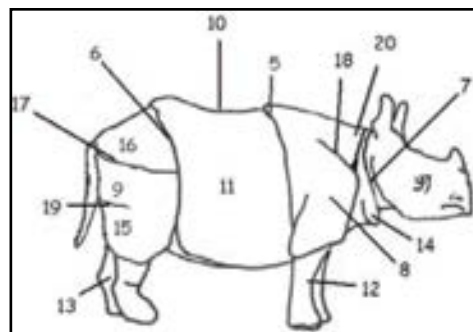
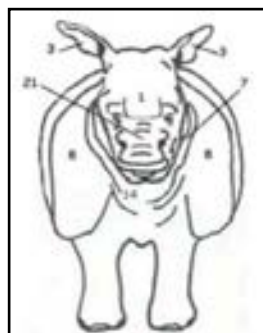
30/11/2012

Radio Collar Dropped

22/11/2014

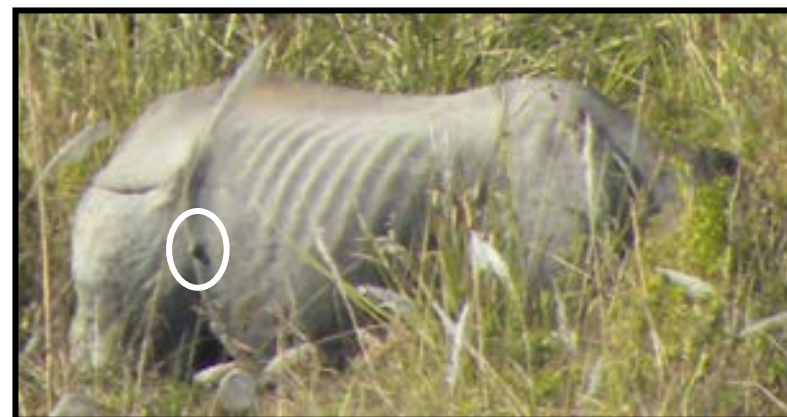


GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics	Rhino History, Ranging , Association
1. Horn: Broad base, small and ringed	History: This is adult female captured and translocated from Pobitora wild Life Sanctuary on 27/12/2010. Mother and calf were dissociated just after two month of release at Manas. Usually she moved alone in short and swamp areas of Bansbari range .
3. Ear: With elongated hair	Claves: She has one female calf translocated and released at Manas as Rhino-4 and on 27/9/2013 Rhino-3 gave birth another calf at Charphuli areas of Manas National Park.
4. Anal plate: Mole on right side of the anal plate	Range: She is using Charpuli, Kuribeel, Palsiguri , Secondgate and Langpati areas of Bansbari range
17. Upper back corner: Lump along the right lateral side	Group composition: Sometime she is located in association with adult female Rhino 8.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-3

All photographs Taken in the year 2010
(March) and 2012 (May)

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Anida**

Sex: Sub adult female

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino 4

Age: 5 years

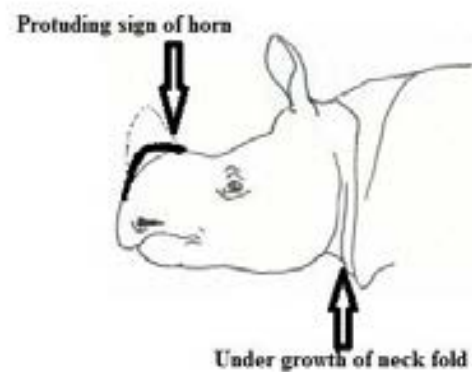
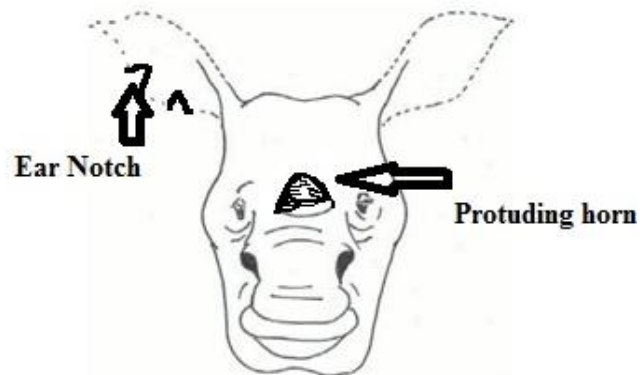
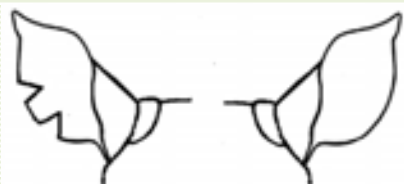
Father: Unknown

Mother: Rhino-3

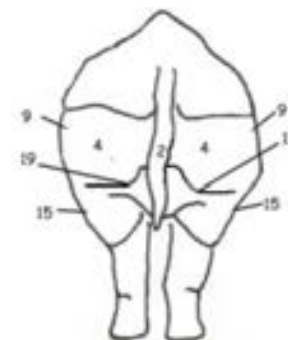
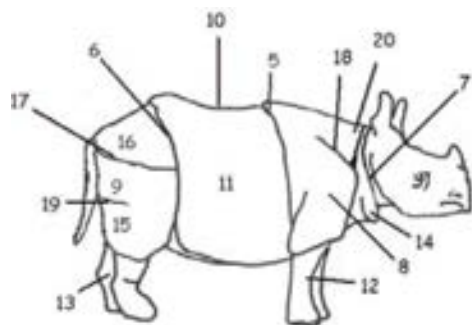
Date of Birth: Unknown

Ear Notch ID: 4

Radio Collar- Nil



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics

1. Horn: Sign of protruding horn

3. Ear: Ear ID-Mark on the right ear.

14. Lower neck fold: Under growth.

Rhino History, Ranging and Association

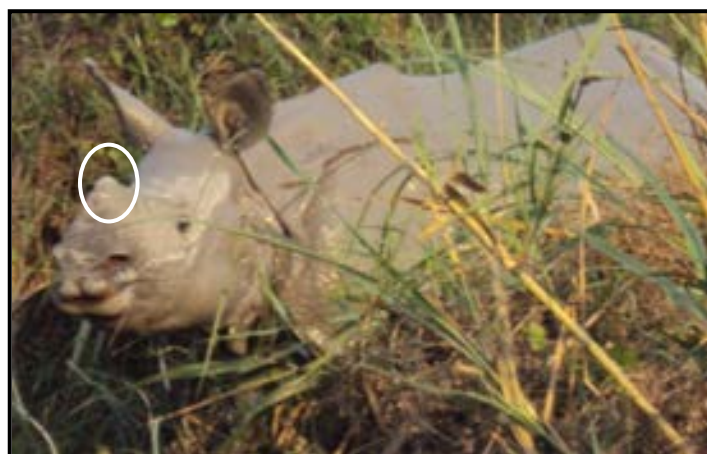
History: This is sub adult female captured and translocated from Pobitora wild Life Sanctuary on 27/12/2010 along with her mother (Rhino 3) Mother and calf were dissociated just after two month of release at Manas. Sub adult female crossed river Beki and reached Panbari range. She was first translocated rhino to reach Panbari range . She has been using vast Gabharukhunda areas along with other herbivores such as Buffalo , gaur and elephants .

Claves:

Range: She is using vast Bhabar tract of Gabharukhunda area of Panbari range and since April,2013 she was using Bansbari.

Group composition: Male Sub adult Rhino-18 and Rhino-4 commonly observed along the Panbari and Bansbari area.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-4

All photographs Taken in the year 2010 and 2011

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Manas**

Sex: Adult Male

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino 5

Age: 12 years

Father: Unknown

Mother: Unknown

Date of Birth: Unknown

Ear Notch ID: 5

Radio Collaring Date-

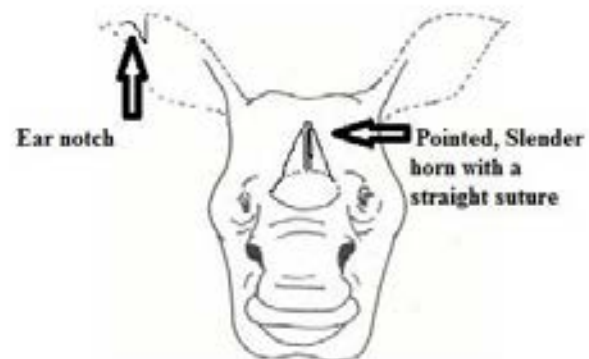
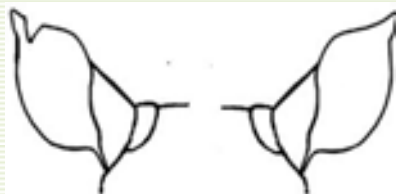
18/01/2011

Radio Collar Stopped Functioning-

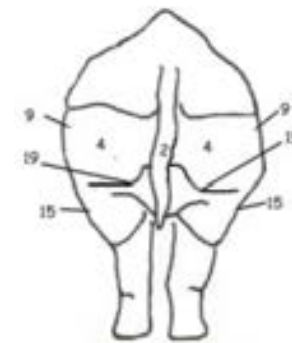
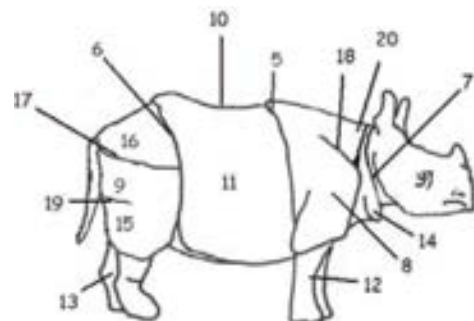
3/11/2011

Radio Collar Removing Date-

22/1/2013



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics

- 1.Horn: Slender, slightly pointed at the tip and suture through the front side of the horn
- 3. Ear: Unique ID cut mark upper right side of the ear
- 7. Neck fold: Full grown neck fold

Rhino History, Ranging and Association

History: This is second potential male of Manas National Park. It was captured at Pobitora Wild Life Sanctuary on 17/1/2011 and released at Buraburijhar about 9-30pm on 18/1/2011.

Range: Rhino 5 used eastern part of the Bhuyanpara range since released at Manas National Park.

Group composition: Rhino 5 was associated with R3, R10,R10A R13, Ganga Jamuna Mainao .

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Xavira**

Sex: Adult Female

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino-6

Age: 15

Father: Unknown

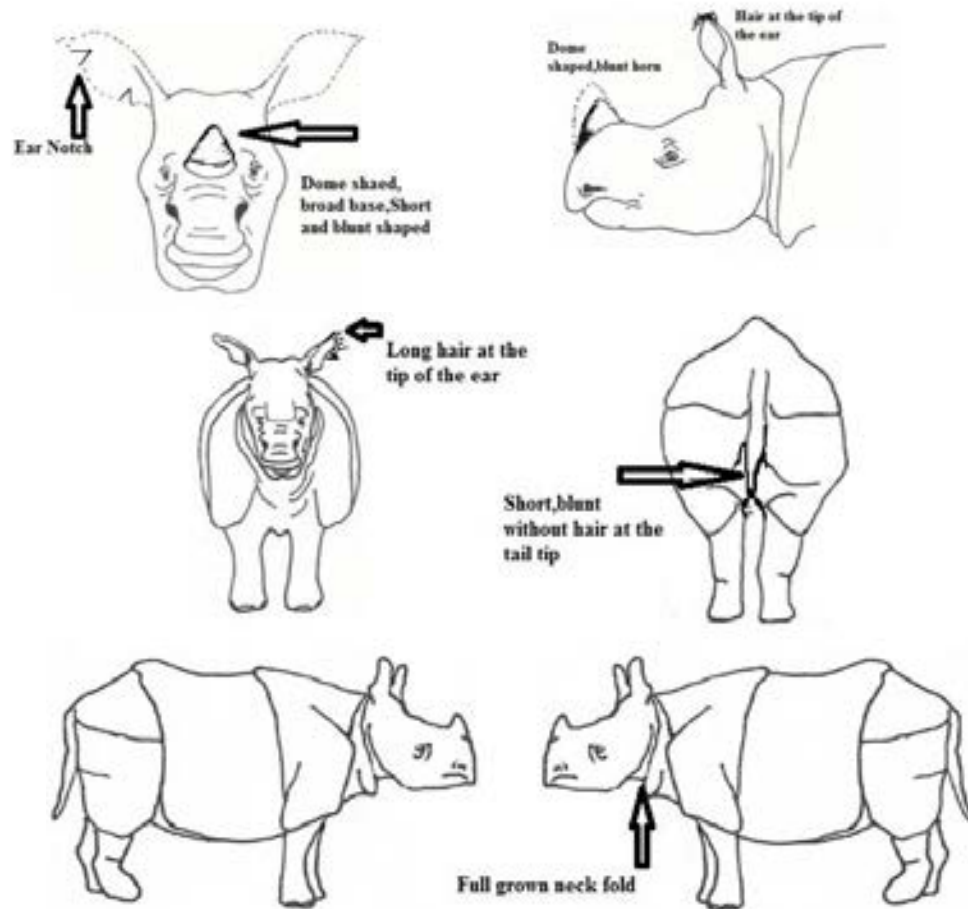
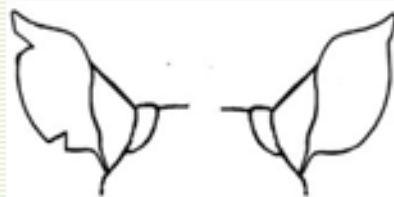
Mother: Unknown

Date of Birth: Unknown

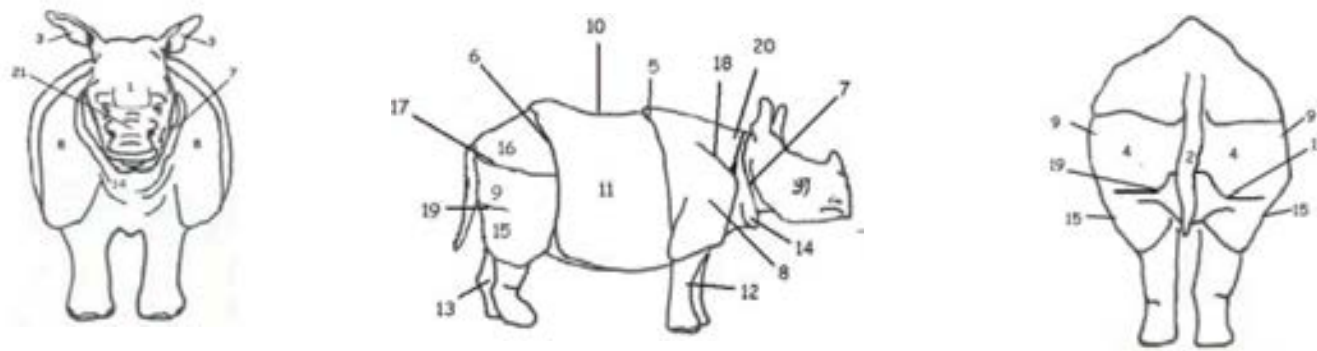
Ear Notch ID: 6

Radio Collaring Date-18/01/2011

Radio Collar Dropped Date-8/8/2011



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: Dome shaped, broad base, short and blunt
2. Tail: Short tail without hair at the tip of the point
3. Ear: Unique ID cut mark upper right side of the ear and long hair on the both ear
7. Neck fold: Full grown neck fold

Rhino History, Ranging , Association

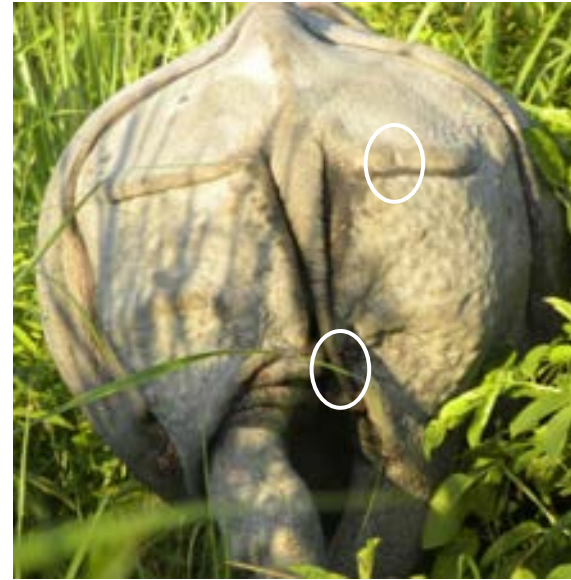
History: This is adult female captured and translocated from Pobitora wild Life Sanctuary on 18/01/2011. Mother and calf were dissociated just after two month of release at Manas. Usually she moved alone in short and swamp areas of Bansbari range as well as Rupahi area of Bhuyanpara

Claves: She has one male calf translocated and released at Manas as Rhino-7 and on same day. Rhino-6 gave birth another calf at Kuribel areas of Manas National Park on 14/5/2013.

Range: She is using Charpuli, Kuribeel, Palsiguri , Secondgate and Langpati areas of Bansbari range and Rupahi area of Bhuyanpara range.

Group composition: Sometime she is located in association with adult female Rhino 2, Rhino 13 and 14 .

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-6

All photographs taken July, 2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Syria**

Sex: Sub Adult Male

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino-7

Age: 6 years

Father: Unknown

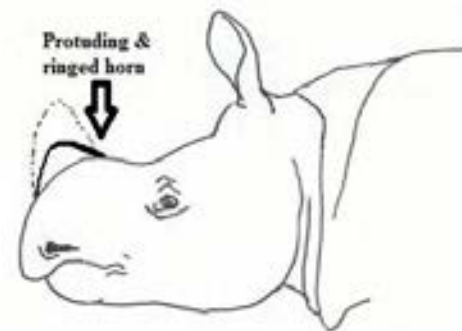
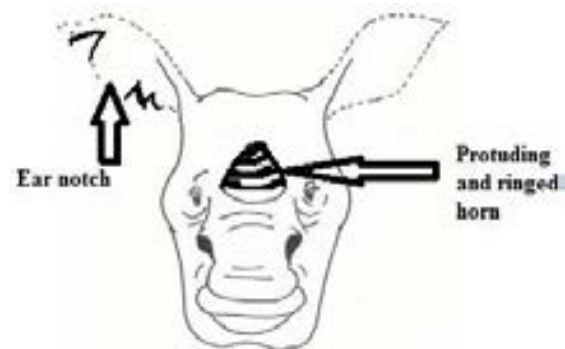
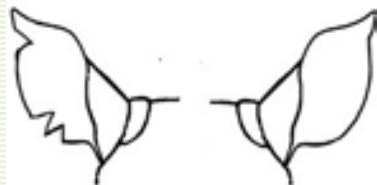
Mother: Rhino-6

Date of Birth: Unknown

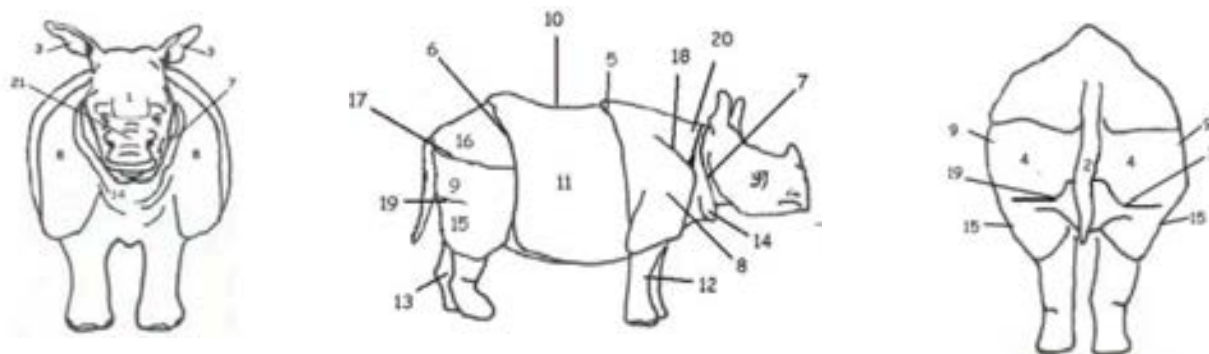
Ear Notch ID: 6

Radio Collar Date-18/01/2011

Radio collar stopped- 13/10/2012



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Characteristics:

1.Horn: Bulging and ringed slightly pointed

3. Ear: Unique ID cut mark upper right side of the ear and long hair on the both ear

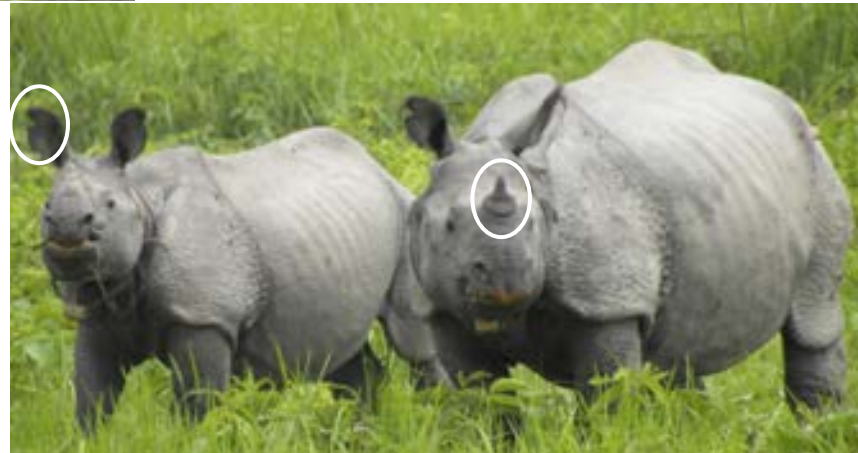
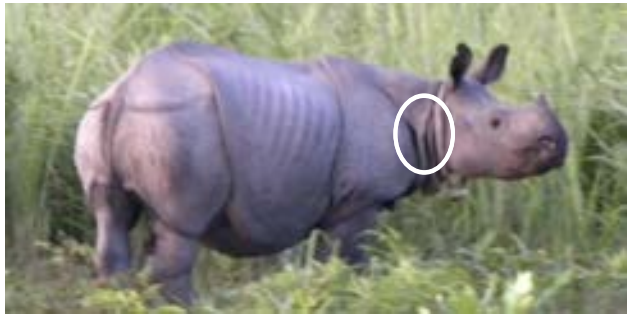
5. Neck fold: Under growth

History: This is a sub adult male calf rhino captured and translocated on 17/1/2011 and released at Manas National Park Buraburijhar at 8-45am on 18/1/2012 simultaneously with his mother (Rhino-6).

Range: Charphuli, Timile, Kahibari, Kuribeel and Rupahi areas.

Group composition: Rhino-7 associated with another sub adult male Rhino-14

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-7 and Mother and calf

First two photographs August, 2012 Mother and calf May, 2011.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Giribala**

Sex: Adult Female

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino-8

Age: 10 years

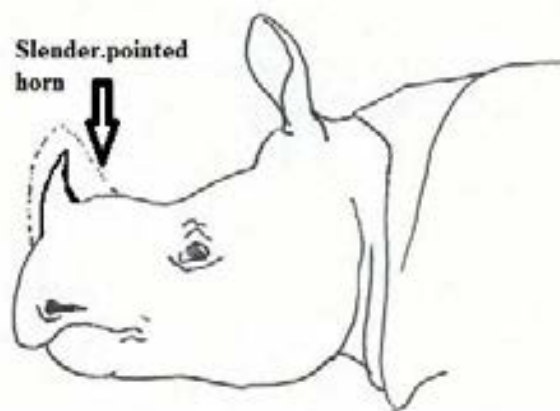
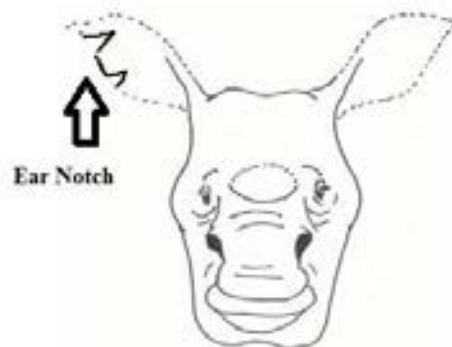
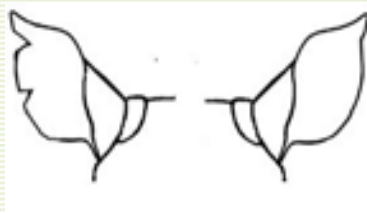
Father: Unknown

Mother: Unknown

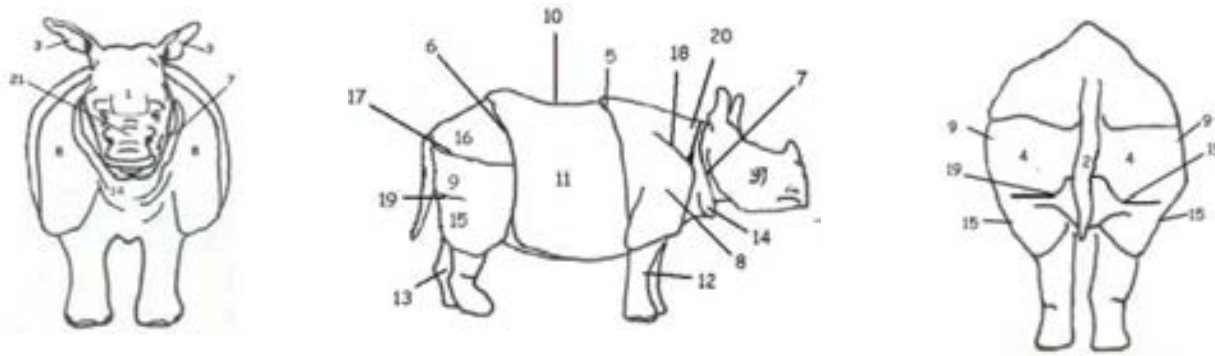
Date of Birth: Unknown

Ear Notch ID: 8

Radio-Collaring Date: 8/01/2011



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics

1. Horn: **Slender, slightly inward curve at the tip and medium height.**
3. Ear: **Unique ID cut mark upper right side of the ear and long hair on the both ear**

Rhino History, Ranging Pattern , Association

History: This is an adult female. She was captured at Pobitora Wild Life Sanctuary and Translocated to Manas National Park on 17/1/2011 and released at rhino enclosure (*Rhino boma*) around 10.00am on 18/1/2011. Usually she likes to use central part of Bansbari and western part of Bhuyanpara range. She was killed on 31/12/2013 at Charphuli area of Basnabri.

Claves: Rhino-8 gave birth calf on 23/3/2013 at Charphuli area

Range: Usually uses central part of the Bansbari, eastern bank of river Beki and Rupahi areas of Bhuyanpara range.

Group composition: Rhino-8 like to associate with another adult female Rhino-3.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-8

First two photograph May-2012 , Third on
February,2011

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Pabitra**

Sex: Sub adult Female

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino-9

Age: 8 years

Father: Unknown

Mother: Unknown

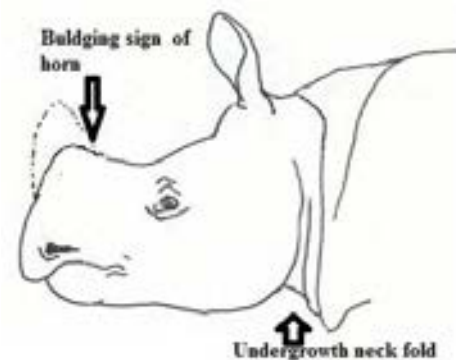
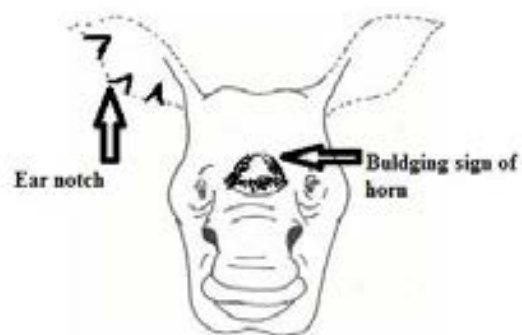
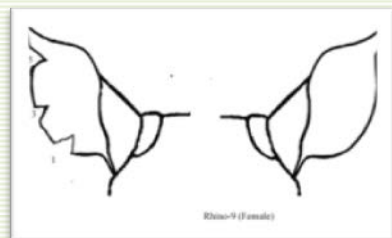
Date of Birth: Unknown

Ear Notch ID: 9

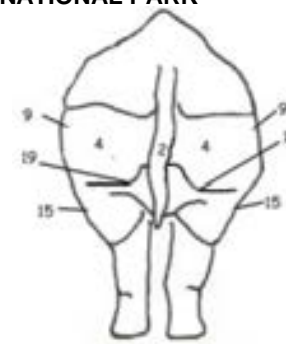
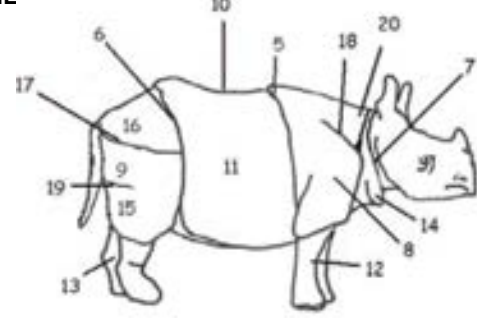
Radio-Collaring date-8/1/2012

Radio Collar Stopped Functioning

November, 2012



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics

1. Horn: **Bulging horn.**
3. Ear: **Unique ID cut mark right side of the ear**
7. Neck fold: **Under growth neck fold**

History: This sub adult female rhino was captured at Pobitora Wild Life Sanctuary and Translocated on 8/1/2012 and released at Buraburjhar Manas NP release site around 9-00am.

Claves: Gave birth calf 4/3/2014

Range: Kahitama, Tinmile Charphuli, Uchila, Rupahi and Katajhar area

Group composition: Usually stay alone with her calf.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-9

First photo taken-9/1/2012 , Second
21/3/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Odangshi**

Sex: Adult Female

Origin: Pobitora Wild Life Sanctuary

Rhino ID: Rhino-10

Age: 10 years

Father: Unknown

Mother: Unknown

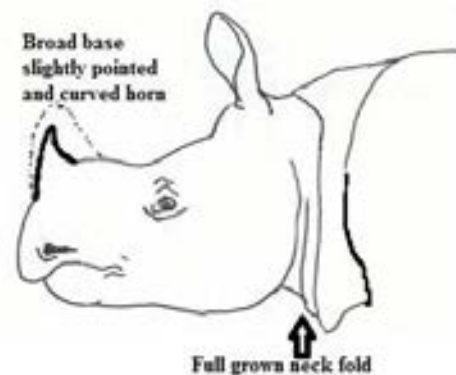
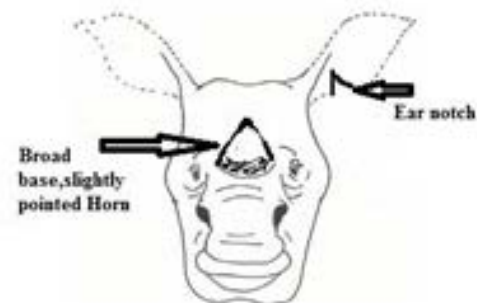
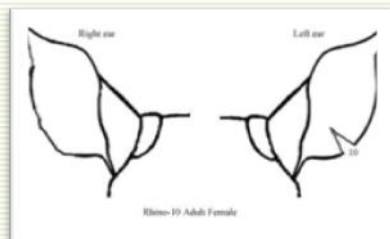
Date of Birth: Unknown

Ear Notch ID: 10

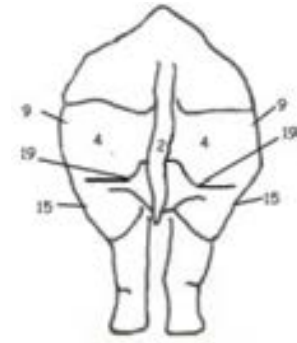
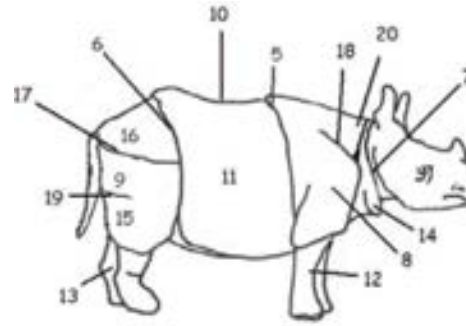
Radio Collar Date-8/1/2012

Radio Collar Stopped

29/10/2013



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Characteristics:

1. Horn: **Broad base, rough outer side, slightly pointed .**
2. Tail: **Elongated and Hair on the tip**
3. Ear: **Prominent ID mark at the left side of the ear**
6. Neck fold: **Full grown neck fold**

History: This adult female rhino was captured at Pobitora Wild Life Sanctuary and translocated to Manas National Park on 8/1/2012. She was released at 8-30am Buaraburijhar ,rhino release site Manas National Park on 9/1/2012.

Claves: She gave birth at male calf on 26/9/2012 at Chengmarijhar, Bhuyanpara range.

Range: She is mainly using Central part of Bhuyanpara range of Manas national park

Group composition: Usually Rhino-5 and Rhino-10 found together.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-10

First photo taken-9/1/2012 , Second
3/3/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Maidangsri**

Sex: Sub adult female

Origin: Kaziranga National Park

Rhino ID: Rhino-11

Age:

Father: Unknown

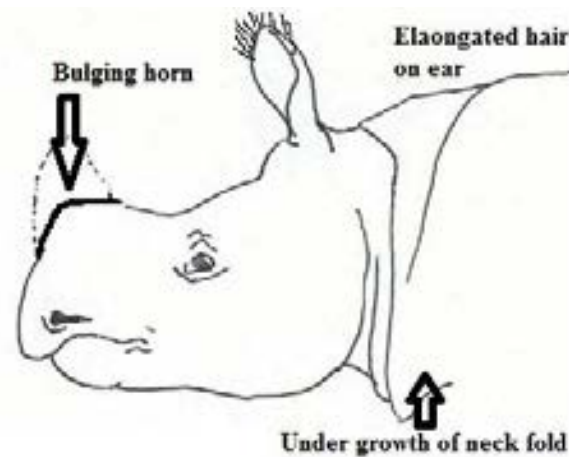
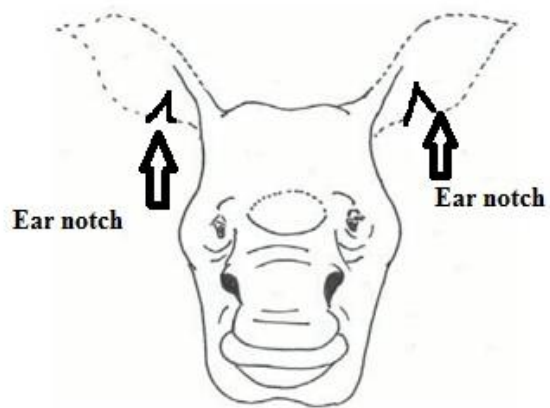
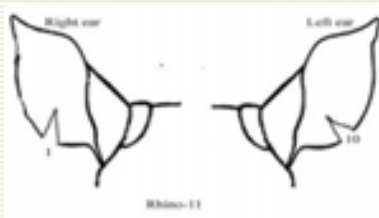
Mother: Rhino-12

Date of Birth: Unknown

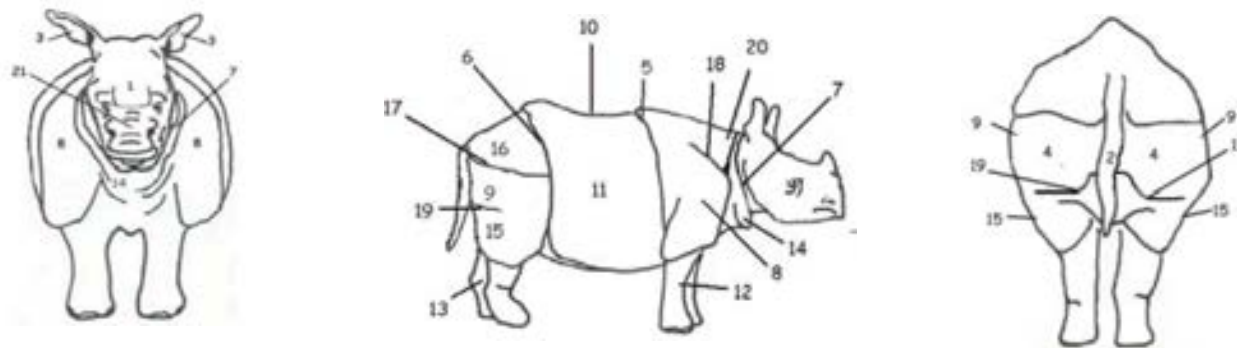
Ear Notch ID: 11

Radio Collaring date-19/2/2012

Radio collar Functioning till (Nov,2014)



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: **Bulging sign of horn.**
2. Tail: **Elongated and Hair on the tip**
3. Ear: **Prominent ID mark at the left and right side of the ears, ears have elongated hair.**
6. Neck fold: **Under growth**

Rhino History, Ranging, Association

History: This is a sub adult female calf captured at Bagori Range of Kaziranga National Park and Translocated to Manas National park on 19/2/2012 along with her mother Rhino-12. They were released simultaneously at Buraburijhar release site around 8-15am on 20/2/2012.

Claves:

Range: she had used Bhatghali areas of Banbari range till 19th August, 2012 and thereafter she crossed river Beki and like to stay at Chaonglapani area of Bansbari range of Manas National Park since April 2013 R11 spent central part of Bansbari

Group composition: R11 associated with R6, 9, 13. At Bansbari range

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-11

Photograph Date- 13/8/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Swamli**

Sex: Adult Female

Origin: Kaziranga National Park

Rhino ID: Rhino-13

Age: 12 years

Father: Unknown

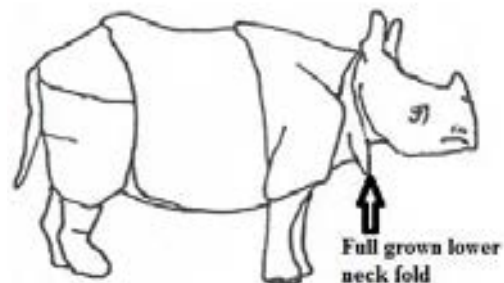
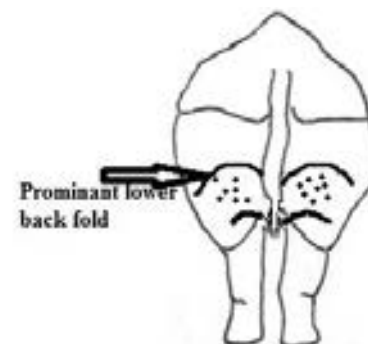
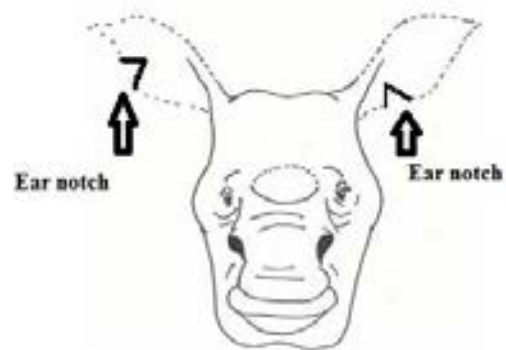
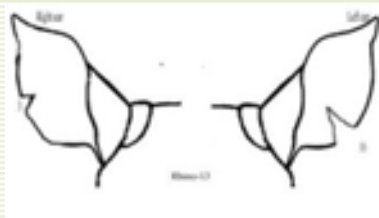
Mother: Unknown

Date of Birth: Unknown

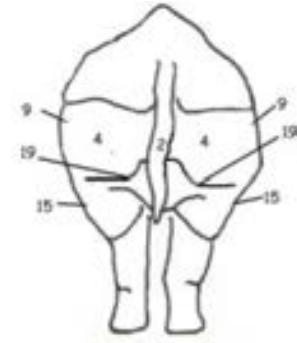
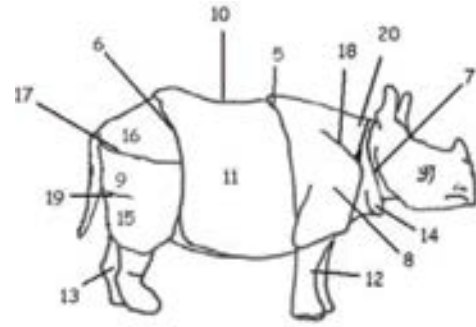
Ear Notch ID: 13

Radio Collaring date-19/02/2012

Radio collar removed-19/11/2014



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: **Broad base, curved & pointed**
3. Ear: **ID cut mark on both left and right side of the ears**
14. Lower neck fold: **Full growth of lower neck fold**
19. Lower back corner: **Bow shaped and prominent**

Rhino History, Ranging and Association

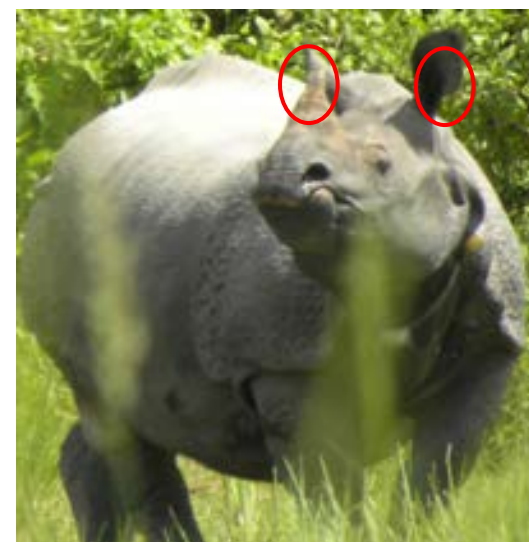
History: This is adult female rhino captured at Bagori Range of Kaziranga National Park and Translocated to Manas National park on 19/2/2012 along with her male calf Rhino-14. They were released simultaneously at Buraburijhar release site around 9-30am on 20/2/2012.

Claves: She gave birth calf 27/9/2013 at Second gate

Range: Both mother and calf moved together Bansbari and Bhuyanpara range of Manas NP. After release certain period of time they were used Kahitama area of Bansbari.

Group composition: She share space with R3 ,R6,R9,R11

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-13

Photographs date- 14/8/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Daodai**

Sex: Male calf

Origin: Kaziranga National Park

Rhino ID: Rhino-14

Age:

Father: Unknown

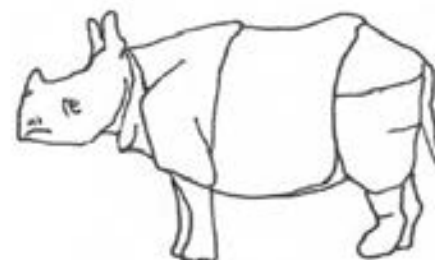
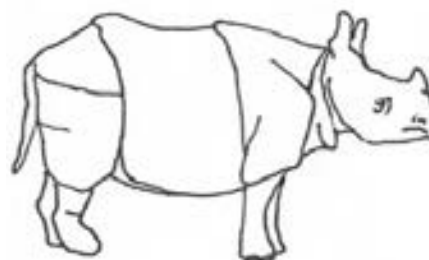
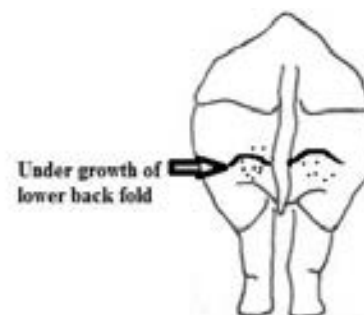
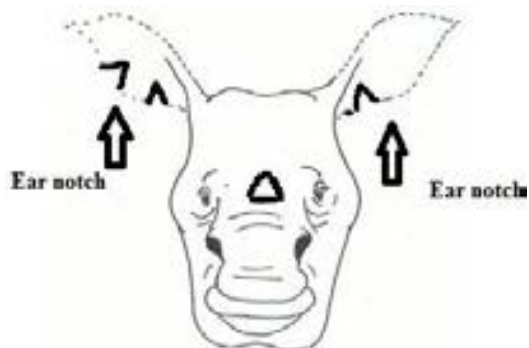
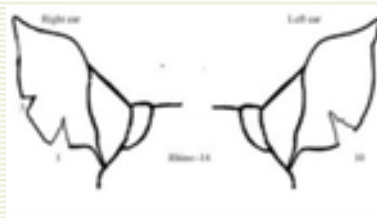
Mother: Rhino-13

Date of Birth: Unknown

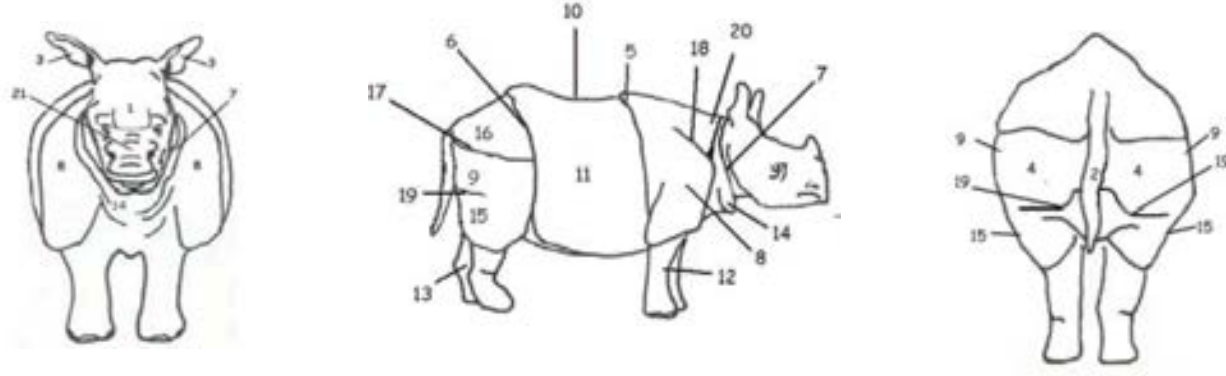
Ear Notch ID:

Radio collaring Date-19/02/2012

Radio Collar Dropped Date-21/03/2012



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: **Bulging and pointed at the horn site**
3. Ear: **ID cut mark on both left and right side of the ears**
6. Neck fold: **Neck folds are not well growth**
14. Lower neck fold: **Under growth of lower neck fold**
- 19 Lower back corner: **Back corner undergrowth and visible**

Rhino History, Ranging and Association

History: This is sub adult male rhino captured at Bagori Range of Kaziranga National Park and Translocated to Manas National park on 19/2/2012 along with his mother c Rhino-13. They were released simultaneously at Buraburijhar release site around 9-30am on 20/2/2012.

Range: Both mother and calf moved together Bansbari and Bhuyanpara range of Manas NP. After release certain period of time they were used Kahitama area of Bansbari.

Group composition: R7 and R8A

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-14

Photographs date- First two Photo-
13/8/2012, Third one-20/6/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Malati**

Sex: Adult female

Origin: Kaziranga National Park

Rhino ID: Rhino-15

Age: 15 Year

Father: Unknown

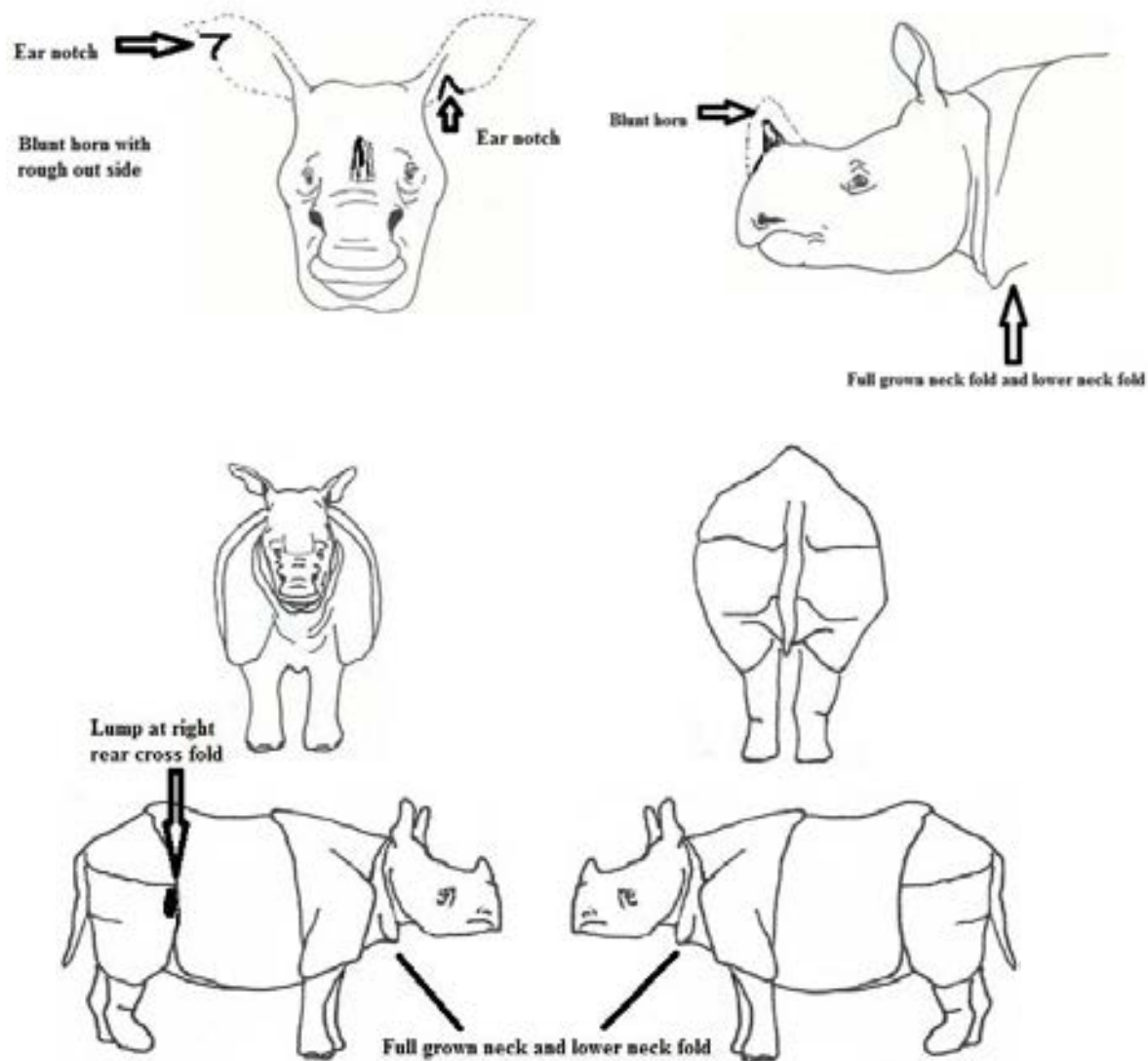
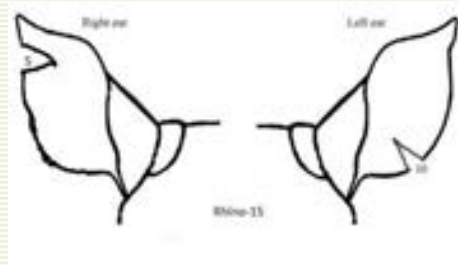
Mother: Unknown

Date of Birth: Unknown

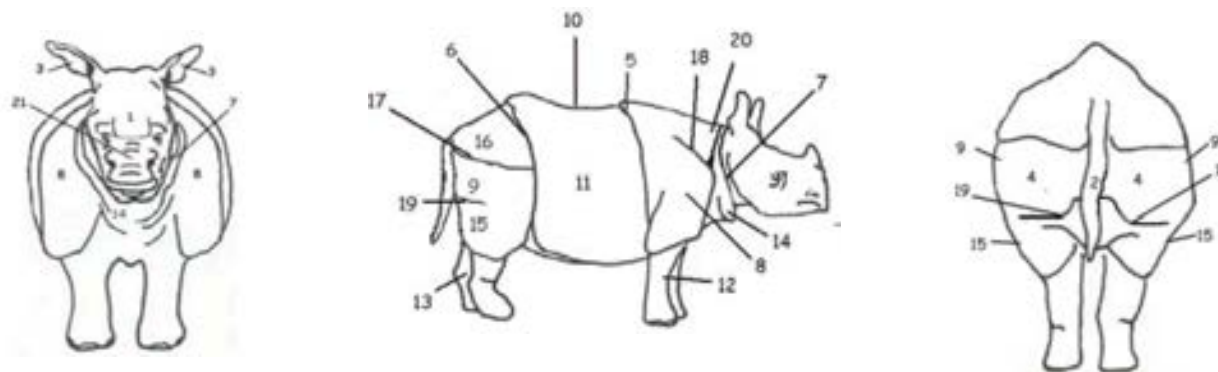
Ear Notch ID: 15

Rhino Radio Collaring Date-11/03/2014

Radio Collar working (Nov,2014)



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: **Rough, blunt medium , broad base size horn**
3. Ear: **ID cut mark on both left and right side of the ears**
- 6.. Rear Cross Fold: **Right rear cross fold has visible lump**
7. Neck fold: **Full grown neck fold**
14. Lower neck fold: **Full grown lower neck fold**
19. Lower back corner: **Back corner undergrowth and visible**

History, Ranging, Association

History: This adult female rhino was captured at Bagori range of Kaziranga National Park and translocated to Manas national park on 11/3/2012 and released at Buraburijhar release site at Bansbari range of Manas NP on 12/3/2012 at the 9-00am with her male calf (R 16)

Claves: She gave birth one male calf 2/11/2013

Range: Both mother and calf moved together at Bhuyanpara range of Manas NP. They mainly prefer to use central part of the Bhuyanpara range.

Group composition: R5, R6, Mainao.

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-15

Photographs date- 26/7/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Mann**

Sex: Male calf

Origin: Kaziranga National Park

Rhino ID: Rhino-16

Age: 4 years

Father: Unknown

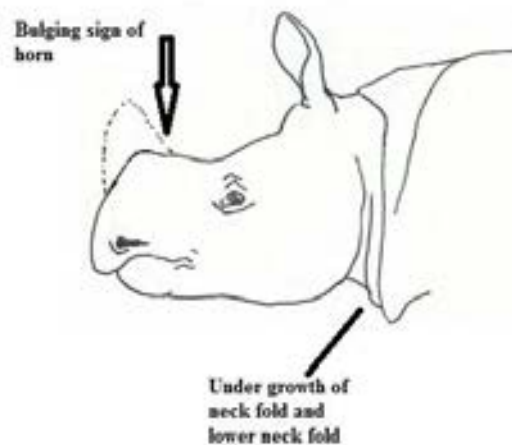
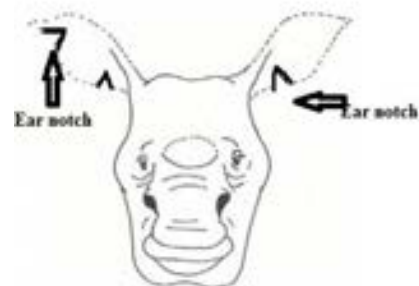
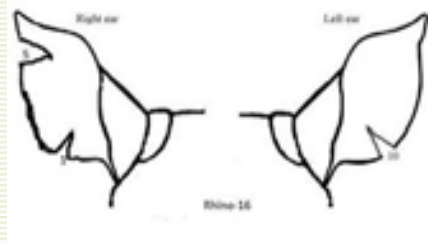
Mother: Rhino-15

Date of Birth: Unknown

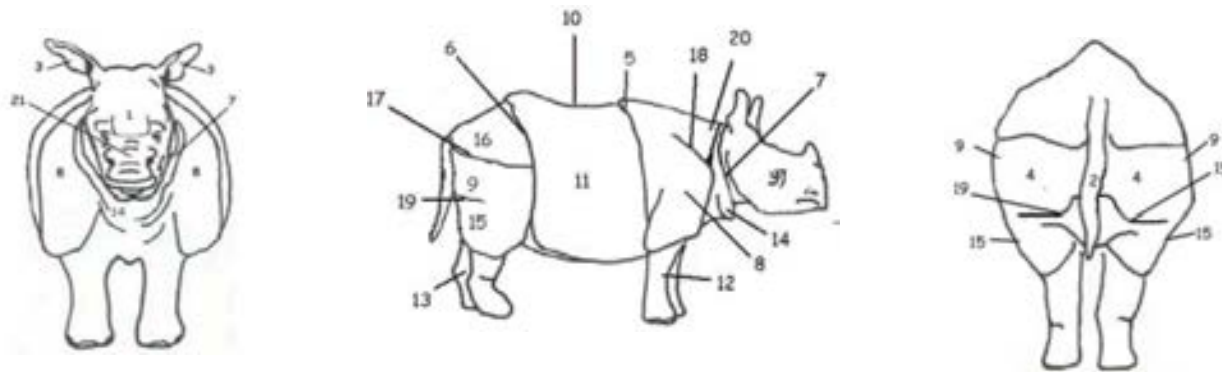
Ear Notch ID: 16

Radio Collaring Date-11/03/2012

Radio-Collar Dropped-2/6/2012



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics

1. Horn: **Only bulging sign of horn site**
3. Ear: **ID cut mark on both left and right side of the ears**
7. Neck fold: **Under growth of neck fold**
14. 14. Lower neck fold: **Under growth of lower neck fold**
19. Lower back corner: **undergrowth and visible**
20. Rear Cross Fold:

History: This is male rhino calf was captured at Bagori range of Kaziranga National Park and translocated to Manas national park on 11/3/2012 and released at Buraburijhar release site at Bansbari range of Manas NP on 12/3/2012 at the 9-00am with his mother (Rhino-15).

Rhino was killed 6/8/2013

Range: Both mother and calf moved together at Bhuyanpara range of Manas NP. They mainly prefer to use central part of the Bhuyanpara range.

Group composition:

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-16

Photographs date- 11/3/2012

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Hainari**

Sex: Adult female

Origin: Kaziranga National Park

Rhino ID: Rhino-17

Age:

Father: Unknown

Mother: Unknown

Date of Birth: Unknown

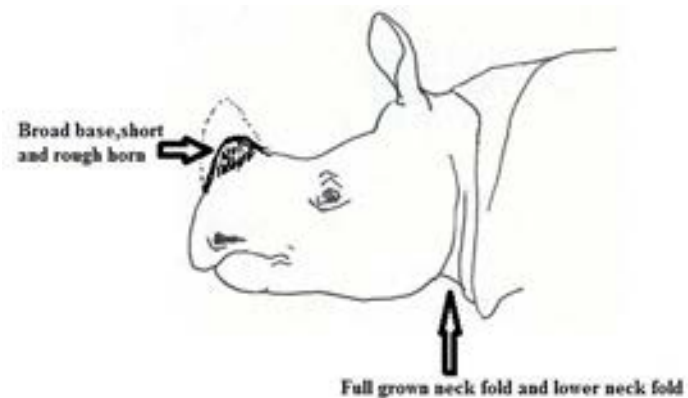
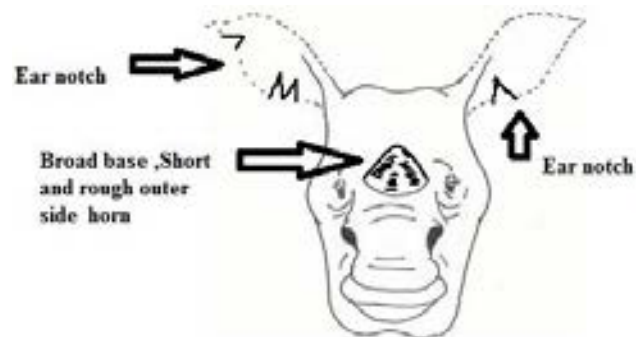
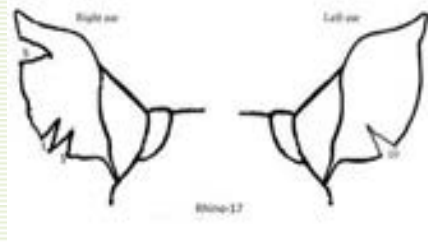
Ear Notch ID: 17

Radio collaring date-

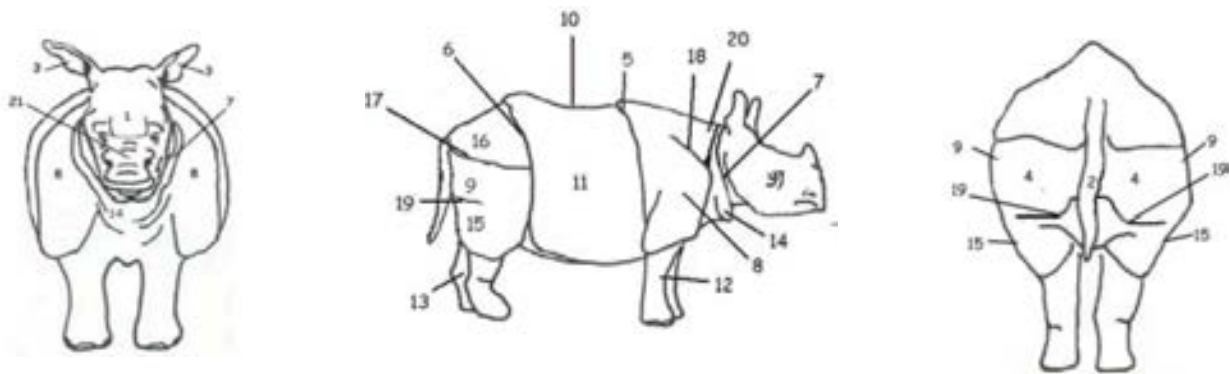
11/03/2014

Radio Collar Stopped functioning

2/4/2013



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: Board base, short, rough outside horn
3. Ear: ID cut mark on both left and right side of the ears
7. Neck fold: Full grown neck fold
14. Lower neck fold: Full grown lower neck fold

Rhino History, Ranging, Association

History: This is adult female rhino. She was captured at Bagori range of Kaziranga National Park and translocated to Manas National Park on 11/3/2012 and released at Buraburijhar rhino release site on 12/3/2012 at 10-00am. Rhino was killed on 2/4/2014

Claves: She gave birth one male calf on 20/3/2013

Range: Rhino-17 and 18 like to use western part of Bansbari (Kahitama area) and eastern part of Panbari range (Kunhighat area)

Group composition:

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Photographs of Rhino-17

Photographs date- 27/3/2012 & 18/4/2012



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: **Khwamajinai**

Sex: Sub adult male

Origin: Kaziranga National Park

Rhino ID: Rhino-18

Age: 5 years

Father: Unknown

Mother: Rhino-18

Date of Birth: Unknown

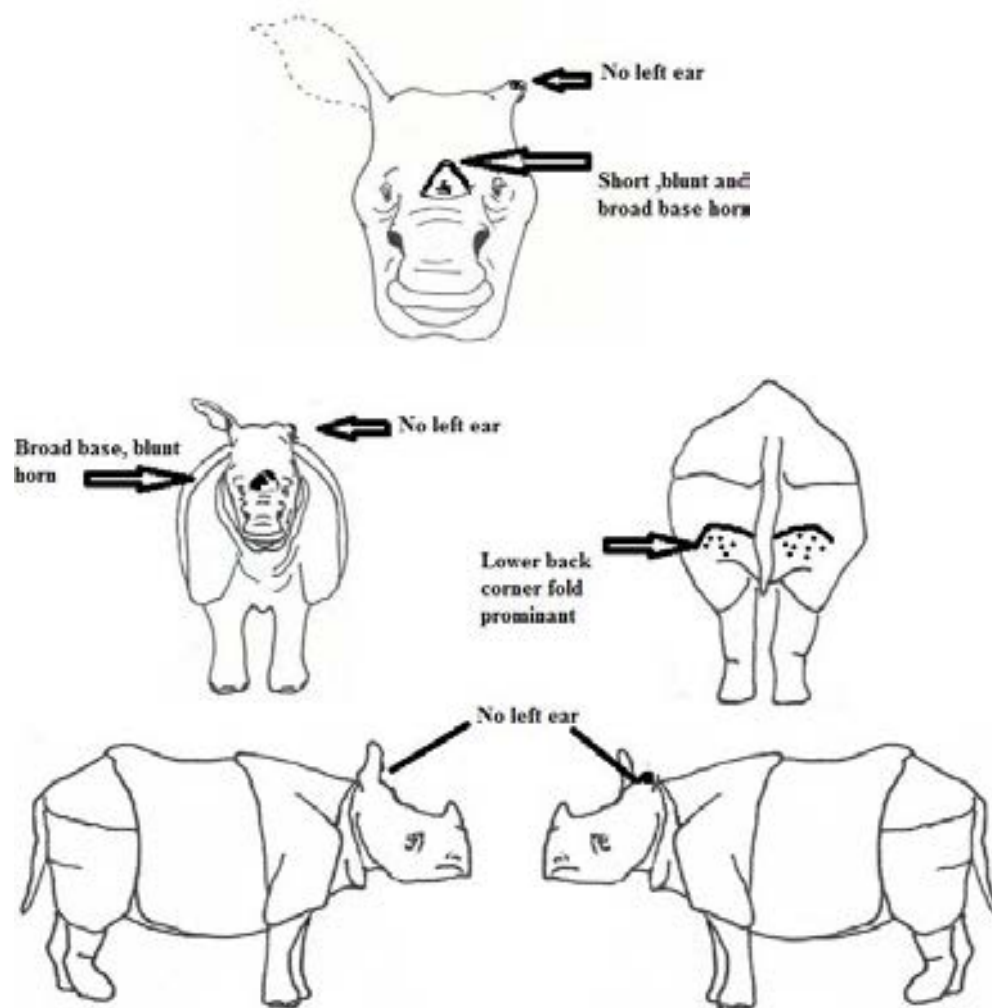
Ear Notch ID: No ear notch

Radio Collaring Date

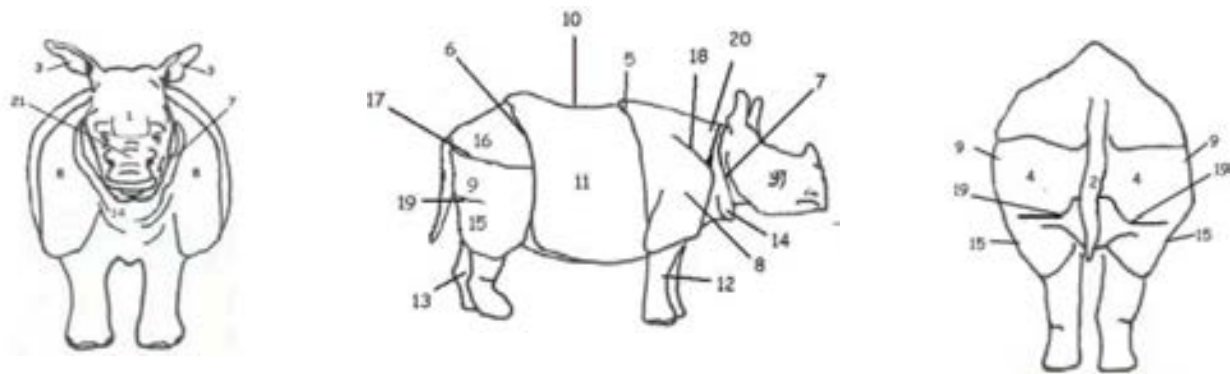
11/03/2012

Radio Collar Stopped functioning

March, 2013



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Characteristics:

1. Horn: Board base, short, rough outside
3. Ear: No left ear
7. Neck fold: Full grown neck fold
14. Lower neck fold: Full grown lower neck fold

History: This is a sub adult male rhino. Rhino was captured at Bagori range of Kaziranga National Park and translocated to Manas National Park on 11/3/2012 and released at Buraburijhar rhino release site on 12/3/2012 at 10-00am.

Range: Rhino- 18 like to use western part of Bansbari (Kahitama area) eastern part of Panbari range (Kunhighat area), Charphuli and Tinmile area of Bansbari.

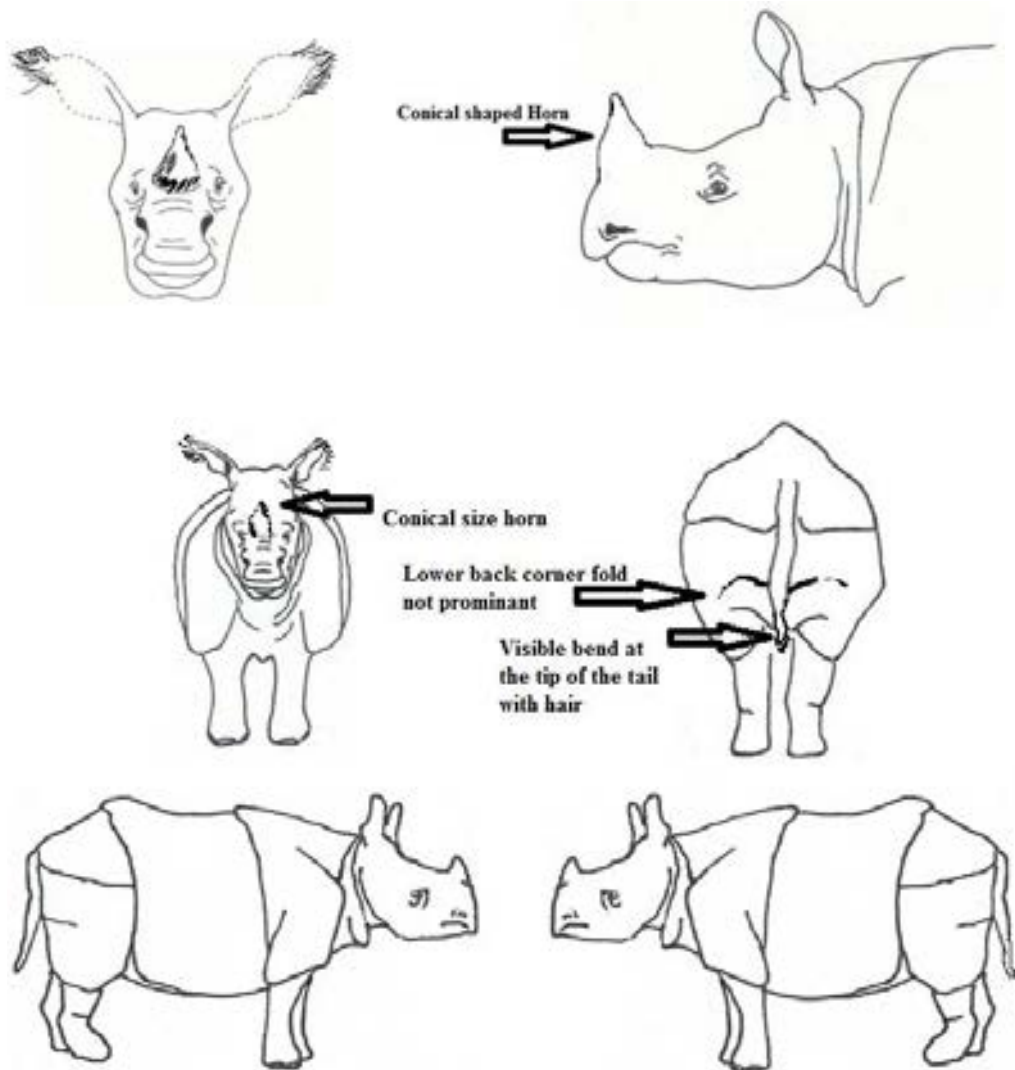
Group composition: Rhino 4 and Rhino 7 and 14

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

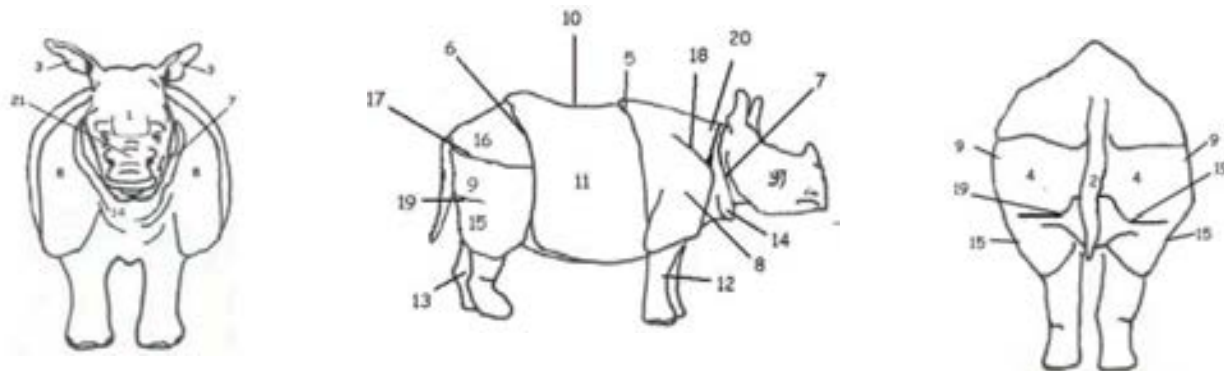


GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: Mainao
Sex: Adult Female
Origin: CWRC, Kaziranga NP
Age: 11 Years
Father: Unknown
Mother: Unknown
Date of Birth: Unknown
Ear Notch ID:



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: **Broad base, Slightly curved and pointed**
2. Tail:
3. Ear: **Visible bend at the tip of the tail and hair only at the tip of the tail.**
4. Anal plate:
5. Front cross fold:
6. Rear Cross Fold:
7. Neck fold: **Stout and full grown**

History, Ranging and Association

History: Mainao was translocated to Manas National Park on 21st February, 2006. Mainao thus got the distinction of being the first rhino to reach Manas after the resident population of rhinos had been wiped out during the decade of political instability in the region.

Calves: Mainao gave birth a calf on 2/6/2013

Ranging : Bansbari and Bhuynapara range

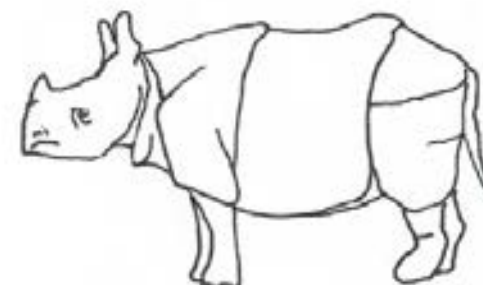
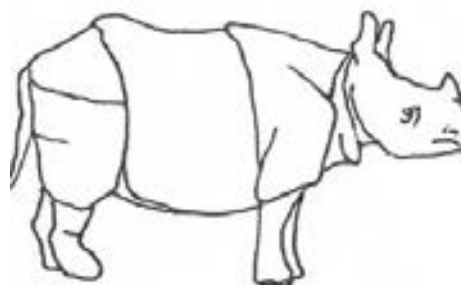
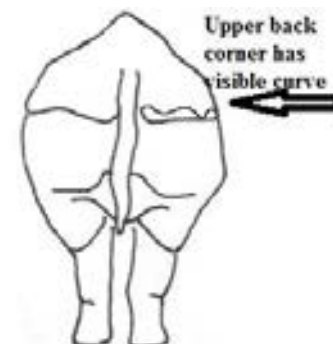
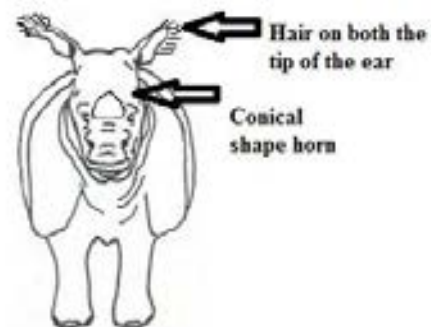
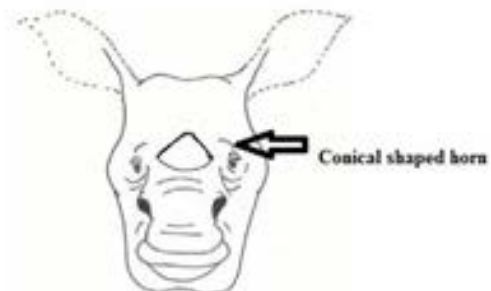
Grouping: R3, R6, R15, R13, R15, Ganga, Jamuan

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

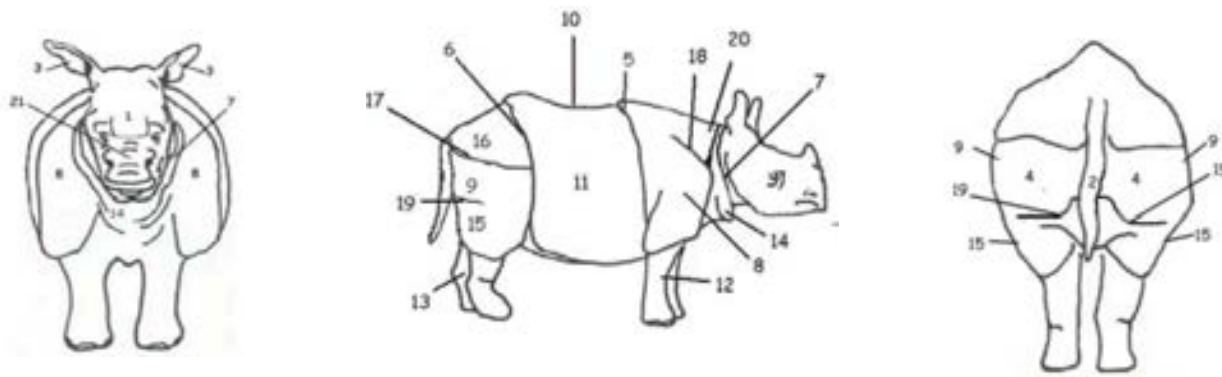


GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: Ganga
Sex: Adult Female
Origin: Wild Life Rescue Centre, Kaziranga NP
Rhino ID:
Age: 10 (apx)
Father:
Mother: Unknown
Date of Birth:



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: *Conical shaped horn*
2. Tail: *Elongated tail*
14. Lower neck fold: *Full grown lower neck fold*
17. Anal plate: Upper back corner: *Right upper back corner has visible fold*

History, Ranging and Association

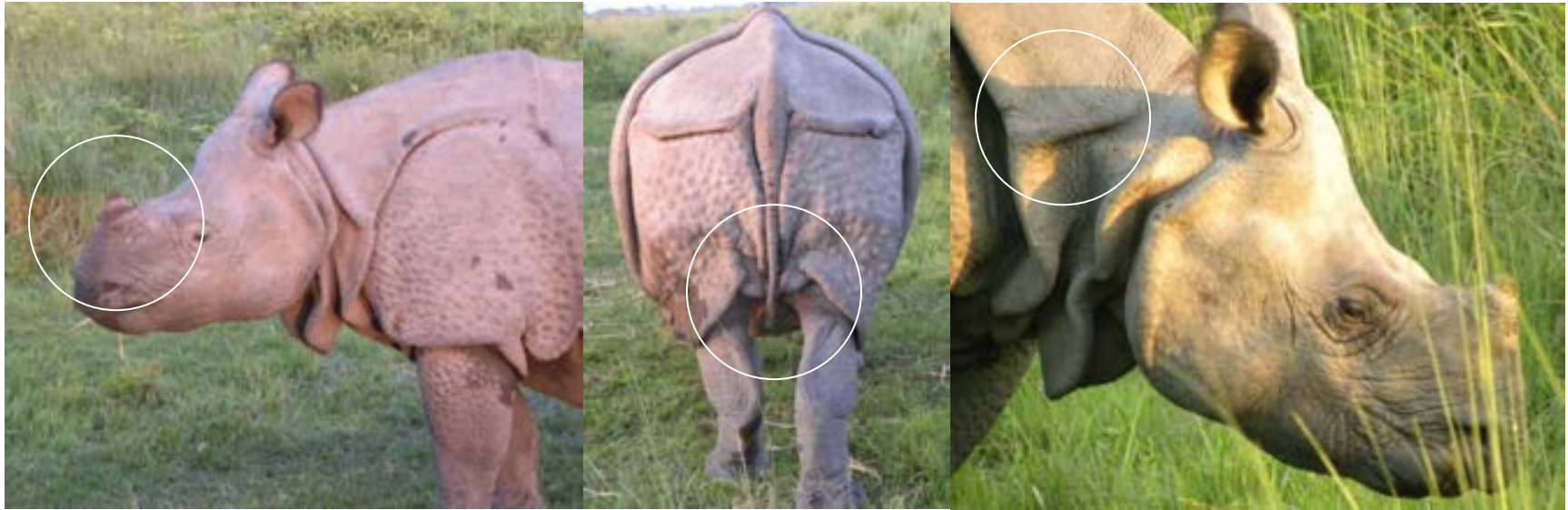
History: Ganga was translocated to Manas National Park on 28th January, 2007 .

Calves: Ganag gave birth a calf on 5/4/2013 at Rhino camp area

Ranging : Bansbari range only

Grouping: R3, R6, R15, R13, R15, Mainao, Jamuan

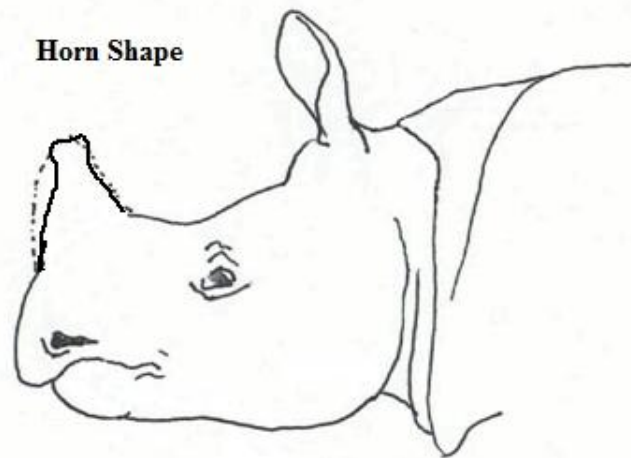
GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK

Name: Jamuna
Sex: Sub Adult Female
Origin: CWRC, Kaziranga NP
Rhino ID:
Age: 10 years(Apx)
Father:
Mother:
Date of Birth:
Ear Notch ID:

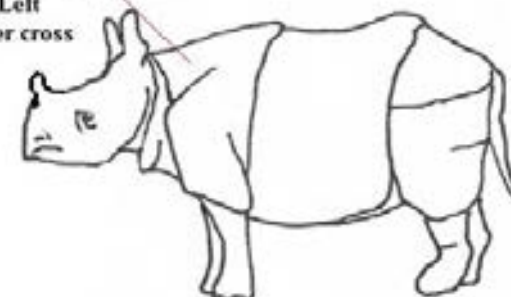
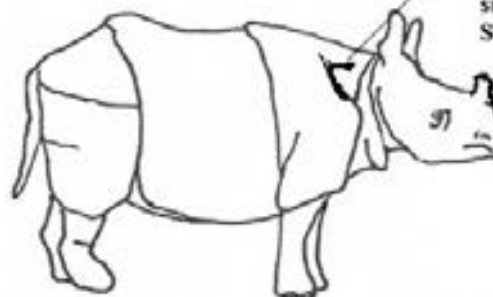
Horn Shape



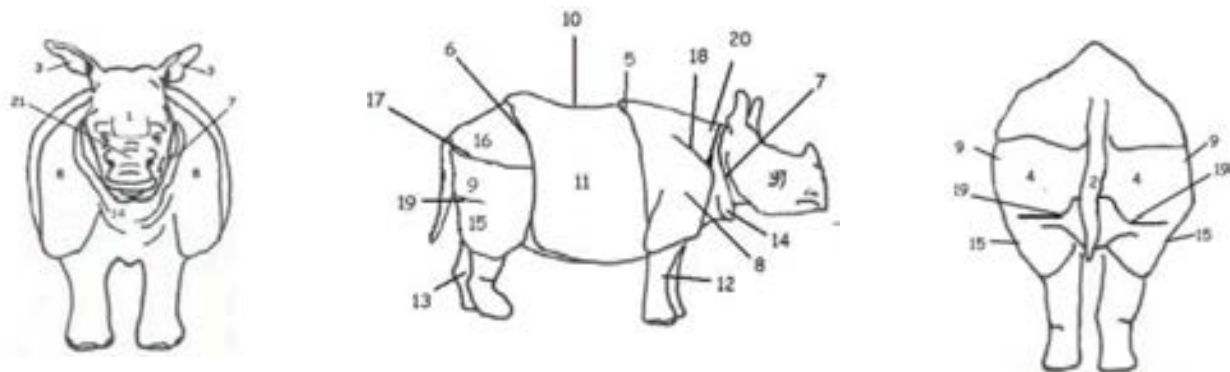
Knob like structure at the tip of the horn



Right Shoulder Cross fold prominent, No sign of Left Shoulder cross



GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK



Specific Body Characteristics:

1. Horn: **Knob like structure at the tip of the horn**
2. Tail: **Medium length tail**
3. Ear: **Hair on both ears.**
14. Lower neck fold: **Full grown lower neck fold**
17. Shoulder cross fold: **Right shoulder cross folder is visible but left side has no any sign of growth.**

History, Ranging and Association

History: Jamuna was translocated to Manas National Park on 28th January, 2007 .

Calves: Jamuna gave birth a calf on 4/7/2013 at Rhino camp area

Ranging : Bansbari range only

Grouping: R3, R6, R15, R13, R15, Mainao, Ganga

GREATER ONE HORNED RHINO MASTER RECORD FOR MANAS NATIONAL PARK





An update on Reintroduced Rhinos At Manas National Park



Period 2013-14

Field Directorate, Manas Tiger Reserve
Barpeta Road
Assam

Background

As part of IRV-2020 rhino population range expansion strategy, eighteen (18) rhinos were translocated from Pobitora Wild Life Sanctuary and Kaziranga National Park to Manas National Park since the year of 2008 to 2012 (Singh et al 2012). In parallel, 9 rescued rhinos from other areas were also rehabilitated in Manas (Table 1).

Table-1 Rhino reintroduction status at Manas National Park

Wild-to-Wild Translocation		Rescue-and-Rehabilitation	
Year	No. of Rhinos	Year	No. of Rhinos
2008	2	2006	3
2010	2	2012	2
2011	4	2013	1
2012	10	2014	3
Total	18	Total	9

Rhino Monitoring Methods,

It is strongly recommended that intensive post-release monitoring be undertaken immediately after release and during the settling in phase (Richard H Emsile et al 2009). The basis for any rhino monitoring approach should be that it provides the quality of information needed to meet the objectives of the monitoring programme. A successful monitoring approach must form a match between required data quality and available resources.

Intensive monitoring records are kept on day to day basis in MS-Excel database for final integrations to GIS analysis. The Translocation Core Committee supervises the operations. Current period of 2013-2014 .

Rhinos were deployed with VHF radio collars (African Wildlife Tracking) and were tracked and located 24X7 basis. Monitoring is carried out by using radio-telemetry system directional antennae either on foot, elephant back, motorcycles and 4WD vehicles depending on the area where the rhinos were present. Homing using the VHF signal was done to locate the individual visually from a safe distance and a handheld GPS (Garmin Inc.) was used to record spatial information. Radio collars of maximum rhinos dysfunctional and dropped so monitoring is carried out on the basis of rhino's ID (specific identification Mark) on body and ear notch. At present only three rhinos have active radio collars and rest other monitored on the basis of ID's method.

Ranging and Habitat preferences of rhinos

Habitat preferences and ranging is studied by comparing frequencies of animal distribution on particular habitat type on the basis of direct focal observation. Rhinos are distributed in almost 80% of Manas National Park. Some of rhinos dispersed and stay till the end of the year at certain specific locations.

During this period Rhino 3, 4, 8A, 7, 9, 9A, 11, 13, 13A , 14 and 18 were more specifically used central part Bansbari Range. Rhino 6, 6A were Trans user of Bansbari and Bhuyanpara range. While adult rhino 5, 10A, 15 and 15A were like to use eastern and western part of Bhuyanpara range. Ganga, Jamuna with calves used in the central and southern part of Bansbari and Mainao with calf like to use western part of Bhuyanpara and Katajhar areas of Bansbari range. Ramu and Raja mainly used Kuribeel and Rhino camp areas of Bansbari range. Following Ramu and Raja other 3 hand reared rhinos also using same areas of Bansbari range of Manas National Park. At present no rhinos used western part of Bansbari and entire Panbari range.

Behavior

Rhino's behaviors accounted as per focal observation (Altman,1974). There is a seasonal variation seen on diurnal and nocturnal activities. In summer diurnal activity is very less as compare to winter season. However focal observation is considering all occurrences of activity of rhinos.

According to analyzed data 40% of observations are found on feeding. Plants are often uprooted, the foliage bitten off and usually roots dropped. But some occasions they eat everything. In monsoon and retreat monsoon seasons they are more found to feed aquatic plants by duckling the head beneath the water. They are found to lick or eat soils near to Bhuyanpara. Sometime some rhinos visit regularly some anti-poaching camps to lick kitchen discharge contain with salts and other food material.

According to observation records 30% of rhino's observation found on wallowing and 20% observation on walking and resting. During this period 10% of time monitoring team unable to observe rhinos because of dense vegetation so this part included as unknown behavior. Rhinos are mainly found to prefer short grasses and herbs close to the ground. But occasionally they found to feed tall grasses, shrubs, bushes and trees.

Table-2 Listing common food plant and seasonal preference of rhinos

SI No	Scientific name	Family	Seasonal observation of feeding
1	<i>Casia tora</i>	Caesalpiaceae	Summer
2	<i>Amaranthus spinosus</i>	Amaranthaceae	Spring, Summer ,Autum
3	<i>Amaranthus viridis</i>	Amaranthaceae	All round the year
4	<i>Cida equata</i>	Malvaceae	Winter
5	<i>Centrella asiatica</i>	Apiaceae	Winter and Spring
6	<i>Hydrocotyle sibthropioides</i>	Apiaceae	Winter and Spring
7	<i>Solanum torvam</i>	Solanaceae	Winter
8	<i>Oxalis corniculata</i>	Oxalidaceae	All round the year
9	<i>Spilanthus paniculata</i>	Asteraceae	Summer
10	<i>Dectyloctenium aegyptium</i>	Poaceae	Summer
11	<i>Cyperus compressus</i>	Poaceae	All round the year
12	<i>Cyperus digitas</i>	Poaceae	All round the year
13	<i>Astraceae sps</i>	Astraceae	All round the year
14	<i>Eurana lobata</i>	Malvaceae	All round the year
15	<i>Astraceae sps</i>	Astraceae	All round the year
16	<i>Digilaria sps</i>	Poaceae	All round the year
17	<i>Eragrostis sps</i>	Poaceae	All round the year
18	<i>Eleusine indica</i>	Poaceae	All round the year
19	<i>Axonopus compressus</i>	Poaceae	All round the year
20	<i>Commelina sps</i>	Commelinaceae	Winter
21	<i>Malastoma malabaricum</i>	Malastomaceae	Summer
22	<i>Malastoma sps</i>	Malastomaceae	Summer
23	<i>Rubiaceae sps</i>	Rubiaceae	Summer
24	<i>Comelina longifolia</i>	Comelinaceae	Summer
25	<i>Papilionaceae sps</i>	Papilionaceae	All round the year
26	<i>Paederia foetida</i>	Rubiaceae	All round the year
27	<i>Paederia husota</i>	Rubiaceae	All round the year
28	<i>Scrophulariaceae sps</i>	Scrophulariaceae	All round the year
29	<i>Pouzolzia sps.</i>	Urticaceae	All round the year
30	<i>Vallisneria</i>	Hydrocharitaceae	All round the year
31	<i>Premna herbaceae</i>	Verbenaceae	Spring and early part of summer
32	<i>Morus sps</i>	Moraceae	Winter and Spring
33	<i>Macaramga denticulata</i>	Euphoraiaceae sps	All round the year
34	<i>Carex sps</i>	Cyparaceae	Spring and early part of summer
35	<i>Sateria palmifolia</i>	Poaceae	Summer
36	<i>Fimbristylis aestivalis</i>	Cyparaceae	All round the year

SI No	Scientific name	Family	Seasonal observation of feeding
37	<i>Sterculia villosa</i>	Sterculaceae	All round the year
38	<i>Mariscus compactus</i>	Poaceae	All round the year
39	<i>Cyperu rotundus</i>	Poaceae	All round the year
40	<i>Cynodon dactylon</i>	Poaceae	All round the year
41	<i>Bombax cieba</i>	Bombacaceae	Spring and early part of summer
42	<i>Dillenia pentagyna</i>	Dilaneaceae	Spring and early part of summer

Wallowing activity is very less during month of January to March (Dry period) but very high in summer season. Besides maintaining heat regulation at summer rhinos are also attack by some of ecto-parasites (flies). So they keep wallowing maximum time. Sometime they used very small waterholes contain with mud for longer period. But sometime they spent complete day in aquatic pond by feeding aquatic plants. During dry season all shallow waterholes are dried up so they depend upon some specific perennial water sources, springs (*Bhumuk*). Almost all those water sources are present in the central part of national park so rhinos prefer to use those areas for drinking and wallowing.

Association

Rhinos in Manas are showing very medium level response on social interaction. Cow-calf pairs are very common. All calves are now well grown and associated with their mothers'. As per official decision all calves are coded as 6A, 9A etc. Presently, adult cow (R6 and calf R6A) commonly found in Sikagonda areas with hand reared rhino Mainao with her calf Mainao A and R10 A. Rhino 15 and R15A also found to associate all the time in Aboidora areas of Bhuynapara range. While sub adult female R4 found to associate with R7 and 14 and another calf Rhino8 A. Adult Rhino3 with her calf R3A and adult Rhino 13 with her calf R13A commonly associated in the Charfuli areas of Bansbari range. Rhino 10A orphaned male calf was found to associate with male adult Rhino-5. Unfortunately, adult male rhino was killed by poacher during the month of November, 2014.

Mother with new born calf is always agonistic to other adult male and patrolling staffs. They are furious and chasing any animals by making fuzzy sound.

Rhinos usually defecate same particular places. Normally rhinos defecate areas where they used for certain period. Rhinos are not found to defecate near waterholes. Frequently used areas have more dung pile than less used areas. In Kuribeel, Rhino camp, Charfuli, Tinmile Pulsiguri have more dung pile than other places of Bansbari. In Bhuyanpara Rupahi, Sikagonda, Kanchanbari and Chengmarijhar more dung piles.

Rhinos are often found with natural commensalism mynah and egrets. Birds also alerted rhinos when any danger approaches. Besides theses rhino's are also associated with cattle, wild pig, wild and domesticated elephants and wild gaur. Some rhinos even like to use some areas near to certain anti-poaching camps.

Rhino Stray

Rhinos often stray outside from the park and created much problem. Few individuals stray outside adjacent paddy fields as well as cultivable lands and depredated crops. Rhino stray incidences gradually come down in the year 2013. There were no any major stray last part of the year 2013-14. During this period two hand reared rhino Mainao and Ramo only stray outside from the fringe of Bansbari and Bhuyanpara area.

As a precautionary measures one crate with all other accessories and limited quantity of tranquilizing drugs kept at Field Directorate Officer, Barpeta Road for any emergency use.

Radio collar removal operation

It is mandatory to observe radio-collar belt of rhino at a regular interval. Usually some collars are dropped due to physical incidences. While some dysfunctional radio collar belt

never dropped so it must take necessary precautions to remove. Otherwise it may create life risk for the animal. As per decision taken by 2nd May, 2014 Translocation Core Committee Meeting, PCCF (WL) has given permission to remove of six (Rhino-3,7,9,11,13 &15) rhinos radio collars. Park authority has removed Rhino13 radio collar was removed on 19th November at Charphuli area of Bansbari range and Rhino3 collar was dropped 22nd November. Park authority has been preparing all necessary arrangement for removing four rhinos (R7, R9, R11, R15) radio collars very shortly.

Birth of New Rhino Calf

During the period 2012 to 2014, 8 translocated female rhinos and 3 rehabilitated female gave birth 11 calves. These births indicate that the translocated rhinos are breeding successfully and have adapted well to the new environment. It is now important to ensure the safety of these newborn calves and their mothers as well as the other rhinos in Manas so that the vision of establishing a viable rhino population is achieved over the long term. Unfortunately, 3 calves become orphaned. Among the 3 orphaned calves Rhino17 calf was orphaned just after 24 days rest two (Rhino10 and Rhino8) calves orphaned after 14 months and 9 months respectively.

Table-3 Details of rhino new born calves records

SI No	Name of the mother	Date of Birth
1	Rhino-10	26/9/2012
2	Rhino-17	20/3/2013
3	Rhino-8	23/3/2013
4	Ganga	5/4/2013
5	Rhino-6	14/5/2013
6	Mainao	2/6/2013
7	Jamuna	4/7/2013
8	Rhino-13	27/9/2013
9	Rhino-15	2/11/13
10	Rhino-3	12/11/2013
11	Rhino-9	March,2014

Rehabilitation of rhino calf

Rhino 17 orphaned calf was rescued and upkeep at Elephant training centre for about 22 days. Dr.Prabhat Basumatary veterinary surgeon of Manas Tiger Reserve and Dr. Bhaskar Choudhury WTI closely observed health condition of calf after rescue. Calf has minor injury on lower jaw and it has been healed within a week of proper treatment.

On 26 September calf was transferred to newly construct temporary enclosure nearby Rhino camp. Utmost care has been taken during construction of enclosure for protection of rhino calf. At present rhino calf is feeding 3ltrs of milk in every 3 hours interval. Since month of June 2013rhino calf has another associates female calf which was rescued year 2012 and rehabilitated at CWRC (Central Wild Life Rescue Centre Kazirnaga NP and then brought to MNP. Rhino calf is now fine with good health.

Extension of enclosure

Two orphan calves rehabilitated in 40 foot square enclosure since September, 2013. Two calves required space for movement so enclosure size was extended to 120 square feet by encircling perennial water source during this year.

Poaching of translocated Rhinos at Manas National Park

Rhino conservation initiatives at Manas NP under IRV-2020 gave major setback when 7 adult rhinos and 1 sub adult male rhino were poached within the period of the three year

(2011 to 2014). Adult male (Rhino 1) was poached in the October, 2011. Adult female (Rhino12) was poached 23 May 2012 , adult male (Rhino2) was poached in the month of January, 2013 and Adult Female (Rhino-17) was poached on 3rd April, 2013. Sub adult male Rhino-16 was poached on 16 August, 2013. Adult female Rhino-10 was poached at Chengmarijhar area of Bhuyanpara range on 29th October, 2013. On 31st December, 2013 another adult female Rhino-8 was poached at Charfuli areas of Bansbari range. In the year 2013 altogether 7 rhinos were killed by poachers. During this year Rhino5 was poached at Daojeng areas of Bhuynapara on 1st November 2014. Among the 8 poached rhinos 3 adult females have gave birth calves in this period . As a result of poaching we have lost all adult male rhinos from the park.

Electric fence

During this period elephants were damaged more than 614 times entire stretches of electric fence. From the last week of December, 2013 some necessary initiative has been undertaken to change rusted G.C wires for better propulsion of electric current. During this year three solar enersizers were placed at three equal distances and e-fence strength has been improving accordingly. As per decision another 3.8km electric fence under commissioned since the month of November, 2014 from the Pahumara river east bank to Bhuyanpara range.

Acknowledgement

We duly acknowledge the all the members of Rhino Translocation Core Committee (TCC) and Chief Wildlife Warden of Assam. Thanks also to Mr. R.P Agrawalla (PCCF, WL), Mr. Suresh Chand (Rtd PCCF, WL), Mr. S. S. Rao (CCF, WL) Mr. H. Choudhury and Mr. Jayanta Das from WADWT; and Mr. A Swargowari (CHD Forest, BTC and former FTDP

Rhino code./Name	Sex	Age(apx)	Poaching Date/ Date of Detection	Place of Poaching
Rhino-1 Sat Hazar	M	10	14/10/2011	Sikagonda Area Bhuyanpara
Rhino-2 Iragdao	M	7	13/01/2013	Daokabaha area under Bhatghali beat
Rhino-12	F	10	23/05/2012	Chengmarijhar area Bhuyanpara range
Rhino-17 Hainari	F	12	02/04/2013	Sidhajhar Bansbari areas
Rhino-16 Mann	M	7	06/08/2013	Kuchiabeel
Rhino-10 Udanshi	F	13	29/10/2013	Chengmarijhar
Rhino-8 Gribala	F	12	31/12/2013	Charfuli
Rhino-5 Manas	M	12	01/11/2014	Daojeng area, Bhuyanpara

Manas) and Mr. Khampa Borgoyari (Deputy Chief BTC) for their continued support, encouragement and advice. Thanks to the media, Police Department, District Administration for their much needed support. Last but not the least we acknowledge the dedicated efforts of the officers and frontline staff of Manas, the Conservation Volunteers, the Home Guards and members from the WWF team in Assam who were always ready with a helping hand.

MEDIA REPORTS ON SWAMP DEER TRANSLOCATION

1. 19 eastern swamp deer shifted from Kaziranga to Manas



The deer being released in a special enclosure, „boma’, at Manas National Park Saturday. (Source: WTI)

Written by Samudra Gupta Kashyap | Guwahati | Posted: December 29, 2014 2:37 am | Updated: December 29, 2014 2:38 am

INDIAN EXPRESS

For the first time in India, eastern swamp deer were shifted from Kaziranga National Park to Manas National Park, both in Assam but about 400 kilometres apart, with the authorities saying translocation was the one way the sub-species, found only in Kaziranga, could be saved from a point of no return.

In the last count held in May this year, it was found that Kaziranga had 854 Eastern swamp deer, including 176 adult males, 504 adult females and 174 calves.

On Saturday, 19 eastern swamp deer (*Rucervus duvaucelii ranjitsinhi*) — 3 male, 26 female — were brought to Manas National Park by road and **released in a specially prepared ‘boma’ secured by a two-line power fence installed over a bamboo barrier, to deter leopards from entering the enclosure. Short grass was earlier transplanted in the ‘boma’ to ensure steady fodder supply to the animals.**

Wildlife Trust of India (WTI) officials said the deer will be kept in the special enclosure for the first few months and would be later released in

the National Park in batches. Some of them would be kept in the boma for breeding purposes. **"Since this would be the source population for Manas National Park, stringent arrangements have been made to ensure their welfare," a WTI official said.**

While the translocation was conducted jointly by the state forest department and WTI in collaboration with ONGC, experts from College of Veterinary Science (AAU) monitored the entire translocation process. Markus Hofmyr, a renowned conservation and animal welfare biologist, was flown in specially from South Africa to help with the capturing of the deer.

A team of experts from WTI and the state forest department will also monitor the deer population to see if the translocation has any adverse impact on them.

Launched in 2010, the three-year long ecological research programme **called 'Eastern Swamp Deer Conservation Project' intends to understand** the ecology of the sub-species and develop management strategies for conservation of their last surviving population in India. Findings on diet, genetic constitution and behaviour have already provided useful insight for scientific management of the deer in Kaziranga, as well as to propel the project into its current second phase of creating a second home for them in Manas National Park, the WTI official said.

- See more at: <http://indianexpress.com/article/india/india-others/19-eastern-swamp-deer-shifted-from-kaziranga-to-manas/#sthash.Dn7IX46j.dpuf>

2. 19 swamp deer translocated from Kaziranga to Manas SIVASISH THAKUR



A herd of eastern swamp deer which was translocated to Manas from the Kaziranga National Park. - UB Photos

GUWAHATI, Dec 28 – The eastern swamp deer (*Rucervus duvaucelii ranjitsinhi*) that has been endemic to Kaziranga National Park has got a second home in Manas National Park with the successful release of 19 deer captured from Kaziranga.

In what is a first-of-its-kind feat in India, the process of mass capture of the deer started in December 9, and it culminated with the release of the deer in Manas last evening.

On their way to Manas, the deer, which were captured in Kaziranga on December 26, reached Manas after travelling over 400 km on NH-31.

The eastern swamp deer is a sub-species of the swamp deer popularly called barasingha, and its entire population is currently sheltered in Kaziranga. A team of experts from the Forest Department, Wildlife Trust of India (WTI) and the College of Veterinary Science, Khanapara, Guwahati, monitored the entire process that is part of the ongoing project supported by the ONGC.

The capture process was initiated on December 9 in the presence of Dr Markus Hofmyr of SANParks, South Africa and other experts. The animals were released in a specially prepared boma (enclosure) in Manas which is secured by a two-line power fence installed over a bombax barrier to deter leopards from entering the enclosure.

The boma was also flooded and short grass was brought from nearby areas for transplantation to ensure the well-being of the herd. Terming it as a great conservation achievement, RP Agarwalla, Principal Chief Conservator of Forest, Assam, said that the teamwork by the Forest Department, WTI and the College of Veterinary Science, Khanapara, ensured that the entire exercise was conducted smoothly.

“It is a moment of great pride for the Forest Department and conservationists, and we are happy to be a part of this historic experiment,” he added. In 2010, the Forest Department and WTI collaborated with ONGC to launch a three-year ecological research programme – the ‘Eastern Swamp Deer Conservation Project’ in Kaziranga. The aim of the project was to understand the ecology of the eastern swamp deer and develop management strategies for conservation of their last surviving population in India.

“Findings on diet, genetic constitution and behaviour provided useful insight for the scientific management of the sub-species in Kaziranga, as well as propel the project into its current second phase of creating a second home for the eastern swamp deer in Manas,” a WTO official said.

Post-capture, the deer will be kept in the boma for the first few months and later released in the park in batches. Some of them would be kept in the boma for breeding purposes. As this would be the source population for Manas, stringent arrangements have been made to ensure their welfare.

Renowned conservation and animal welfare biologist, Dr Markus Hofmyr was flown in specially from South Africa to support the capture exercise. Experts from WTI and the Forest Department will also monitor the eastern swamp deer population in Kaziranga to see if translocation has any impact on the population there.

ANNEXURE-V

MANAGEMENT EFFECTIVENESS EVALUATION REPORT (2013-14)

MANAS TIGER RESERVE

The Manas Tiger Reserve spreads across Baksa and Chirang districts of BTAD, Assam, where the Bhutan hills rolls down to form an extensive bhabar and terai area on the north bank of the river Brahmaputra. The river Manas flows through, dividing the TR into two halves, further drained by large number of rivulets and streams. Contiguous with the Royal Manas National Park of Bhutan, the TR offers excellent ecosystems for the wild denizens of the area. The MTR is one of the first and important tiger conservation areas in India linking North Bengal to Arunachal Pradesh in the landscape and comprising of grasslands, forests, rivers, wetlands and low hills habitats to different kinds of mammals, birds, reptiles, amphibians, butterflies and insects. It is the only Protected Area with five different conservation statuses and contains more than 22 species listed in Schedule 1 of WPA 1972.

The forest types of the TR comprises of Moist Mixed Deciduous Forest, Semi Evergreen Forest, Eastern Bhabar Sal Forest, Low Alluvial Savannah Woodlands and Eastern Wet Alluvial Grasslands. More than 550 species of plants have been identified so far. The faunal diversity of the TR is extraordinarily rich with 60 species of mammals, 312 species of birds, 42 species of reptiles, 7 amphibians and 54 species of fish recorded so far. The important fauna includes Pygmy Hog, Golden Langur, Bengal Florican, Tiger and Asian Elephant.

MANAGEMENT EFFECTIVENESS EVALUATION (MEE)

1. Context

1.1 Are the values of the TR well documented, assessed and monitored?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Values not systematically documented, assessed and monitored.	Poor		TCP page # 32	Notification of NP and TR does not describe. However UNESCO report mentioned about its value
Values generally identified but not systematically assessed and monitored.	Fair			
Most values systematically identified, assessed and monitored.	Good	✓		
All values systematically identified, assessed and monitored.	Very good			

****Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10***

1.2 Are the threats to TR values well documented and assessed*?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Threats not systematically documented or assessed.	Poor		TCP page # 95	
Threats generally identified but not systematically assessed.	Fair	✓		
Most threats systematically identified and assessed.	Good			
All threats systematically identified and assessed.	Very good			

⁺*This assessment should be based on number, nature and extent of threats*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

1.3 Is the 'Core Area' of TR free from human and biotic interference?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
The 'Core Area' has extensive human and biotic interference.	Poor			1. Core and buffer are not under unified control of FD.
The 'Core Area' has some human and biotic interference.	Fair	✓		
The 'Core Area' has little human and biotic interference.	Good			
The 'Core Area' has no human and biotic interference.	Very good			

⁺*This assessment should be based on existence and the efforts made by TR management to address issues related to human settlements/ villages inside the core area; livestock grazing, cultivation, encroachments etc, resource extraction/ livelihood dependence of local communities and should reflect the overall interference due to all the above factors. The issue of 'Unified Control' of the 'Core' and 'Buffer' zones under the Field Director would also be taken into account.*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

1.4 Has the TR complied with the four Statutory⁺ Requirements (SR) along with Tripartite MoU and three Standard Operation Procedures (SOP)?

Assessment criteria				
Condition	Category[*]	(Tick ✓)	Reference document(s)	Remarks
None of the four SR, no compliance of Tripartite MoU and three SOPs met	Poor		TCP page # 232	TR is notified but in area demarcation is not given for core
Two of the four SR, 50% conditions of the Tripartite MoU and SOPs complied	Fair			
Three of the four SR, 75% conditions of the Tripartite MoU and SOPs complied	Good			
All four SR, 100% conditions of the Tripartite MoU and SOPs complied	Very good	✓		

⁺*Statutory requirements are (1) Legal delineation and notification of Core and Buffer Areas; (2) Establishment of Tiger Conservation Foundation; (3) Development of a Tiger Conservation Plan; and (4) Constitution of a State-level Steering Committee under the Chairmanship of the Chief Minister. TA refers agreement between Field Director, State Government and NTCA. The 3 SOPs are on (i) Straying of Tiger in human dominated landscape, (ii) Tiger Mortality and (iii) Disposal of Carcasses*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

2. Planning

2.1 Status of Tiger Conservation Plan (TCP) ⁺?

Assessment criteria				
Condition	Category[*]	(Tick ✓)	Reference document(s)	Remarks
No TCP in place.	Poor		NTCA letter # 1-14/2011-NTCA dated 2 May 2014	No records are available to justify about participatory process
TCP is under preparation	Fair			
TR has a relevant TCP	Good	✓		
TR has a comprehensive and relevant TCP, duly approved by the NTCA	Very good			

**Score: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

⁺*The scientific content and the participatory processes used in preparation of the TCP will be taken into account in assessing the quality of TCP.*

2.2 Does the TR safeguards the threatened biodiversity values?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
TR does not safeguard the threatened biodiversity values.	Poor			MNP has safeguards but threats to other areas of TR are not under control of FD
TR safeguards a few threatened biodiversity values.	Fair	✓		
TR safeguards a large number of threatened biodiversity values.	Good			
TR safeguards all threatened biodiversity values.	Very good			

⁺Remarks need to elaborate on the kind of safeguards and how they work or are intended to work

Score : 2.5; Fair: 5; Good: 7.5; Very Good: 10

2.3 Are stakeholders given an opportunity to participate in planning process?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
Little, if any opportunity for stakeholder participation in planning.	Poor		Minutes of meeting	Biosphere protection committee and EDC are having participatory process
Stakeholders participate in some planning.	Fair	✓		
Stakeholders participate in most planning processes.	Good			
Stakeholders routinely and systematically participate in all planning processes.	Very good			

⁺The result of participation must show in the field and not merely reported as a routine exercise.

Score : 2.5; Fair: 5; Good: 7.5; Very Good: 10

2.4 Are habitat management programmes systematically planned, relevant and monitored, and contribute effectively to Tiger and other endangered species conservation?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
Habitat management programmes are entirely adhoc.	Poor			Special emphasis has started for grassland management.
Limited planning and monitoring programmes are in place for habitat management.	Fair			
Habitat management programmes are generally planned and monitored.	Good	✓		
Habitat management programmes are thoroughly planned and monitored.	Very good			

⁺*This assessment should be primarily based on habitat management programmes in relation to habitats for species that are threatened (IUCN categories), are habitat specialists, subjected to seasonal movements, wide ranging with emphasis on the breeding and rearing habitat and may include factors such as food, water, shelter (all connotations). Habitat structure, composition, unique patches of vegetation and sensitive sites, sources of water and their distribution are integral. Corridors within buffer zone are critically important. For example, all riparian habitats. Have these been addressed? Is there a planning process in place? The management practices dealing with invasive species such as Lantana, Michania etc. would be examined. *Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

2.5 Does the TR has an effective Protection Strategy (PS)* and Security Plan and Security Audit (SA) in place?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
TR has little or no PS and SA.	Poor			Only MNP part of TR is having well defined PS as other areas of TR is not under control of FD
TR has an adhoc PS and SA.	Fair	✓		
TR has a generally relevant PS and SA but is not very effective.	Good			
TR has a comprehensive and very effective PS and SA.	Very good			

⁺*This assessment takes inter-alia into account the nature of threats, the number and location of patrolling camps and foot and mobile patrolling, needs that relate to available manpower, terrain difficulties, practicability of area coverage, readiness to contain specific threats with necessary support and facilities. The constitution and functioning of Special Tiger Protection Force (STPF), Number of offences reported, arrests made, prosecution initiated and conviction achieved will be taken into account.*

**Score: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

2.6 *Has the TR been effective in the mitigation of human-wildlife conflicts?*

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
Human-wildlife conflicts are significant but poorly addressed.	Poor	✓		11 km long solar fence on southern boundary but budget is a major constraint to undertake effective mitigation measures
TR has been able to mitigate few human-wildlife conflicts.	Fair			
TR has been able to mitigate many human-wildlife conflicts.	Good			
TR has been effective in mitigating all human-wildlife conflicts.	Very good			

⁺*The assessment will take into account the number of incidences reported and payment of compensation made and its timeliness.*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

2.7 *Is the TR integrated into a wider ecological network/ landscape following the principles of the ecosystem approach?*

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
TR not integrated into a wider network/ landscape.	Poor		TCP and UNESCO report	
Some limited attempts to integrate the TR into a network/ landscape.	Fair			
TR is generally quite well integrated into a network/ landscape.	Good	✓		
TR is fully integrated into a wider network/ landscape.	Very good			

⁺*Assessment needs to consider the scope of opportunities on the landscape scale that exist. Consider whether any attempts have been made and what are these? Have all the important corridors been identified? What actions are planned/implemented for their security? Have the Forest Working Plans and Forest Development Corporation Plans within the identified landscapes taken cognizance of such new requirement? These should have been reflected in TCPs. Is there is any effort to rationalize landuse around TR? Is any effort being made to plan and use 'Smart Green Infrastructure'?*

** Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

3. Inputs

3.1 Are personnel adequate, well organized and deployed with access to adequate resources in the Tiger Reserve (TR)*?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
Few, personnel explicitly allocated but poorly supported for TR management.	Poor		Existing staff strength list	More man power are needed
Some personnel explicitly allocated for TR management but not adequately supported and systematically linked to management objectives.	Fair			
Some personnel with fair support explicitly allocated towards achievement of specific TR management objectives.	Good	✓		
Adequate personnel appropriately supported and explicitly allocated towards achievement of specific TR management objectives.	Very good			

⁺*This assessment should inter-alia be based on number of personnel allocated for attainment of TR objectives at the Range , Round, Beat and Patrolling camps levels or as relevant to the needs (sanctioned posts vis- a- vis existing personnel and needs beyond the sanctioned strengths. It is possible that posts have last been sanctioned several years back that do not now account for the current needs)*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

3.2 Are resources (vehicle, equipment, building etc.) adequate, well organized and managed with desired access?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
Few, if any, resources explicitly allocated for TR management.	Poor		Office record	
Some resources explicitly allocated for TR management but not systematically linked to management objectives.	Fair			
Some resources explicitly allocated towards achievement of specific TR management objectives.	Good	✓		
Adequate resources explicitly allocated towards achievement of specific TR management objectives.	Very good			

⁺*These form a variety of resources. These may be segregated into immovable (structures) and movable categories and each further may be considered under the essential and desirable categories. It is best to start with what are the minimum needs to attain each objective, what is available and manner of use/deployment. The proportions of the 'essentials' and 'desirables' along the importance gradient of objectives would serve as pointers for score categories. Specific remarks would be vitally important.*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

3.3 Are financial resources other than those of the State linked to priority actions and are funds adequate, released timely and utilized?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Resource allocation is adhoc, funds are inadequate and seldom released in time and not utilized.	Poor	✓	Office record	
Some specific allocation for management of priority action. Funds are inadequate and there is some delay in release, partially utilized.	Fair			
Comprehensive planning and allocation that meets the most important objectives. Generally funds released with not much delay and mostly utilized.	Good			
Comprehensive planning and allocation of resources for attainment of most objectives. Funds generally released on-time and are fully utilized.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

⁺Obtain details of funds released by NTCA and their utilization by TR in the last 3 years and indicate them under 'Remarks'. Also comment on the problems associated with fund allocations and their utilization.

3.4 Are financial resources from the State linked to priority action and funds adequate, timely released and utilized for the management of Tiger Reserve?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Resource allocation is adhoc, funds are inadequate and seldom released in time and not utilized.	Poor	✓	Office record	
Some specific allocation for management of priority action. Funds are inadequate and there is some delay in release, partially utilized.	Fair			
Comprehensive planning and allocation that meets the most important objectives. Generally funds released with not much delay and mostly utilized.	Good			
Comprehensive planning and allocation of resources for attainment of most objectives. Funds generally released on-time and are fully utilized.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

⁺Obtain details of funds released by State and their utilization by TR in the last 3 years and indicate them under 'Remarks'. Also comment on the problems associated with fund allocation and their utilization.

3.5 What level of resources are provided by NGOs?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
NGOs contribute nothing for the management of the TR.	Poor		Office record	
NGOs make some contribution to management of the TR but opportunities for collaboration are not systematically explored.	Fair			
NGOs contributions are systematically sought and negotiated for the management of some TR level activities.	Good			
NGOs contributions are systematically sought and negotiated for the management of many TR level activities.	Very good	✓		

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

4. Process

4.1 Does the TR have manpower resources trained in wildlife conservation for effective TR management?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
No trained officers and frontline staff in the TR.	Poor		Office record	
Some trained officers and few trained frontline staff, posted in the TR.	Fair	✓		
All trained officers and fair number of trained frontline staff posted in the TR.	Good			
All trained officers and most of the trained frontline staff is posted in the TR.	Very good			

⁺Indicate % of trained staff in various categories. The number and thematic areas of the 'Internal Training' programmes organized in the TR in the last 3 years may be taken into account. Has the TR prepared a 'Staff Development Plan'? Is it being implemented?

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

4.2 Is TR staff management performance linked to achievement of management objectives?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
No linkage between staff management performance and management objectives.	Poor		Office record	
Some linkage between staff management performance and management objectives, but not consistently or systematically assessed.	Fair	✓		
Management performance for most staff is directly linked to achievement of relevant management objectives.	Good			
Management performance of all staff is directly linked to achievement of relevant management objectives.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

4.3 Is there effective public participation in TR management⁺ and does it show in making a difference?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Little or no public participation in TR management.	Poor		Minutes of meeting with stakeholders	
Opportunistic public participation in some of the relevant aspects of TR management.	Fair			
Systematic public participation in most of the relevant aspects of TR management.	Good	✓		
Comprehensive and systematic public participation in all important and relevant aspects of TR management.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10⁺The involvement of NGOs/NGIs in population estimation may be taken into account)**

4.4 Is there a responsive system for handling complaints and comments⁺ about TR management?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Ad-hoc approach to handling complaints.	Poor			No formal system are in place
Complaints handling system operational but not responsive to individual issues and with limited follow up.	Fair	✓		
Coordinated system logs and responds effectively to most complaints.	Good			
All complaints systematically logged in coordinated system and timely response provided with minimal repeat complaints.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

⁺Does the TR maintains 'Suggestions Register'? What actions are taken to deal with suggestions?

4.5 Does TR management addresses the livelihood issues⁺ of resource dependent communities, especially of women?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
No livelihood issues are addressed by TR management.	Poor		Biosphere reserve document	
Few livelihood issues are addressed by TR management.	Fair			
Substantial livelihood issues are addressed by TR management.	Good	✓		
Livelihood issues of resource dependent communities especially of women are addressed effectively by TR managers.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

⁺The number of mandays generated in the last 3 years may be taken into account. Are funds received from District Agencies and other sources? Provide details of funds received in last 3 years.

4.6 Has the TR planned and implemented the voluntary ‘Village Relocation’ from the Core/ Critical Tiger Habitat (CTH)?

Assessment criteria⁺				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
No planning and no implementation	Poor			No human settlement in MNP
Plans have been made but no implementation	Fair			
Plans have been made and some implementation is in progress	Good			
Plans have been made and are being actively implemented/ no human habitation in the CTH	Very good	✓		

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

⁺Assessment will look into the village relocation planning process including availability of manpower, financial resources and NGO support, if any. Is there a mechanism to address the complaints received in respect of relocation process? Effort must be made to assess post-relocation success or otherwise.

5. Output

5.1 Is adequate information on TR management publicly available?

Assessment criteria				
Condition	Category*	(Tick ✓)	Reference document(s)	Remarks
Little or no information on TR management publicly available.	Poor			1. Current website describe only about MNP. 2. Proper signage at strategic location are missing
Publicly available information is general and has limited relevance to management accountability and the condition of public assets.	Fair	✓		
Publicly available information provides detailed insight into major management issues and condition of public assets.	Good			
Comprehensive reports are routinely available in public domain on management and condition of public assets.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

5.2 Are visitor services and facilities appropriate and adequate?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Visitor services and facilities do not exist.	Poor			Grading based on field observation
Visitor services and facilities are very basic.	Fair	✓		
Visitor services and facilities are monitored from time to time and are fairly effective.	Good			
Visitor services and facilities are conscientiously maintained, regularly upgraded and monitored for visitor satisfaction	Very good			

⁺Include the existence and quality of visitor and interpretation centers, including skills and capabilities of personnel manning these, TR related publications, films, videos; arrangements of stay (including places serving refreshments and food owned and managed by TR), watch towers and hides including safety factors, vehicles assigned for visitors including riding elephants, if any and their deployment, drinking water, rest rooms, garbage disposal, attended and self guided services in the field, visitor feed back on the quality of wilderness experience.

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

5.3 Are research/ monitoring related trends systematically evaluated and routinely reported and used to improve management?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Little or no systematic evaluation or routine reporting of trends.	Poor		TCP page # 292	
Some evaluation and reporting undertaken but neither systematic nor routine.	Fair			
Systematic evaluation and routine reporting of trends undertaken.	Good	✓		
Systematic evaluation and comprehensive reporting of trends undertaken and attempts made at course corrections as relevant.	Very good			

⁺Not all TRs attract projects and researchers and with exceptions, little research takes place on the TRs own steam because of systemic limitations. However, monitoring of some critical issues is expected e.g. population of tiger, co-predators and prey with insights into their demography and distribution (some opportunistic sampling by sightings, signs and spatial distribution during assessment would be extremely useful in terms of expert impression and as a pulse), monitoring incidence of livestock grazing, fires, weeds, sources of water, a variety of illegal activities typically associated with the reserve, wildlife health (e.g. epidemics, immunization of livestock) regeneration and change in vegetation, visitors and their activities, offence cases, ex-gratia payments etc. Efforts must be made to assess the planning and implementation of Phase-IV monitoring protocols and the success of implementation of M-Stripes (wherever applicable). Are the 'Sykes and Horill' monitoring plots maintained and data analyzed?

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

5.4 Is there a systematic maintenance schedule and funds in place for management of infrastructure/assets?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
No systematic inventory or maintenance schedule.	Poor			This is undertaken on need base
Inventory maintenance is adhoc and so is the maintenance schedule.	Fair	✓		
Systematic inventory provides the basis for maintenance schedule but funds are inadequate.	Good			
Systematic inventory provides the basis for maintenance schedule and adequate funds are made available.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10.** Outcomes

6.1 Are populations of threatened species declining, stable or increasing?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Populations of key threatened/ endangered species are declining.	Poor		TCP page # 336	
Some threatened/ endangered species populations declining, some are increasing, most others are stable.	Fair			
Several threatened/ endangered species populations increasing, most others are stable.	Good	✓		
All threatened/ endangered species populations either increasing or stable.	Very good			

⁺This needs to practically relate to the natural ecosystem potential rather than being driven merely by numbers and visibility. The assessment score may be elaborated under remarks.

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

6.2 Is the population of tigers showing a declining, stable or increasing trend?

<i>Assessment criteria</i> ⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Population of tiger is showing a declining trend	Poor		TCP page # 336	
Population of tiger is stable	Fair			
Population of tiger is showing an increasing trend	Good	✓		
Population of tiger has significantly increased	Very good			

**This assessment should be based in the context of available population estimate (2010-11) and the outcomes of the currently ongoing Phase-IV analyses.*

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

6.3 Have the threats⁺ to the TR being reduced/ minimized? Or is there an increase?

<i>Assessment criteria</i>				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Threats to the TR have not abated but have enhanced.	Poor		Offence record	
Some threats to the TR have abated, others continue their presence	Fair	✓		
Most threats to the TR have abated. The few remaining are vigorously being addressed	Good			
All threats to the TR have been effectively contained and an efficient system is in place to deal with any emerging situation	Very good			

**Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10*

⁺Does the TR has a Disaster Risk Management Plan to deal with existing as well as emerging threats?

6.4 Are the expectations of visitors⁺ generally met or exceeded?

Assessment criteria				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Expectations of visitors generally not met.	Poor			Grading based on field observation
Expectations of many visitors are met.	Fair			
Expectations of most visitors are met.	Good	✓		
Expectations of all most all visitors are met.	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

⁺What is the compliance status on Supreme Court/NTCA Guidelines on Ecotourism in TRs?

6.5 Are local communities supportive of TR management?

Assessment criteria⁺				
Condition	Category *	(Tick ✓)	Reference document(s)	Remarks
Local communities are hostile.	Poor			Grading based on field observation
Some are supportive.	Fair			
Most locals are supportive of TR management.	Good	✓		
All local communities supportive of TR management.	Very good			

⁺There could be many reasons for disenchantment. It could be real because of managerial neglect or the managerial efforts could be appropriate but there could be local elements/organizations who would like to keep the disaffection simmering for their own ulterior motives. Likewise success could be entirely because of the efforts of managers or they might be fortunate in striking partnerships with credible NGOs. Assessment may take the prevailing causes into account.

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

7. MEE Score Card⁺

Frame work Element Number	Frame work Element Name	Number of Criteria (a)	Maximum Mark per question (b)	Total (a x b)	Marks obtained for the Element	Overall MEE Score and % age
1.	Context	04	10	40	27.5	62.9
2.	Planning	07	10	70	40.0	
3.	Inputs	05	10	50	30.0	
4.	Process	06	10	60	40.0	
5.	Outputs	04	10	40	22.5	
6.	Outcomes	05	10	50	35.0	
Total		31		310	195.0	

⁺Efforts will be made by the NTCA-WII-MEE Team to address the issue of assigning 'differential' weightages to the 30 Assessment Criteria including 'normalization'.

Assessment Criteria for addressing issues relating to Climate Change & Carbon capture in the Tiger Reserves (TRs)

1. Additional Criteria on Climate Change: Is the TR being consciously managed to adapt to climate change?

Condition	Category *	(Tick ✓)	Comment/ Explanation	Next Steps
There have been no efforts to consider adaptation to climate change in management	Poor		PA managers are having basic understanding about issues but unable to translate into action	PA managers need training to make them aware about the issue
Some initial thought has taken place about likely impacts of climate change, but this has yet to be translated into management plans	Fair	✓		
Detailed plans have been drawn up about how to adapt management to predicted climate change, but these have yet to be translated into active management.	Good			
Detailed plans have been drawn up about how to adapt management to predicted climate change, and these are already being implemented	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

2. Additional Criteria on Climate Change: Is the TR being consciously managed to prevent carbon loss and to encourage further carbon capture?

Condition	Category *	(Tick ✓)	Comment/ Explanation	Next Steps
Carbon storage and carbon dioxide capture have not been considered in management of the TR	Poor	✓		PA managers need training to make them aware about the issue
Carbon storage and carbon dioxide capture have been considered in general terms, but has not yet been significantly reflected in management	Fair			
There are active measures in place to reduce carbon loss from the TR, but no conscious measures to increase carbon dioxide capture	Good			
There are active measures in place both to reduce carbon loss from the TR and to increase carbon dioxide capture	Very good			

***Score: Poor: 2.5; Fair: 5; Good: 7.5; Very Good: 10**

A Rapid Assessment of Herpetofaunal Diversity in Manas-Bhutan Trans-boundary Landscape



Report

Submitted to

**Field Directorate Manas Tiger Reserve, Assam, India and
Park Manager, Royal Manas National Park, Bhutan**

August 2014

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Survey Team

Abstract

This report provides a rapid assessment of the herpetofaunal diversity at the World Heritage site Manas which acts as a transboundary complex for a variety of species. The survey was conducted between 16 June 2014-23 June 2014. In Manas National park (MNP), India we surveyed Mathanguri, Doimari, Kuribeel, Uchila, Lotajhar and Bansbari areas and in Royal Manas National Park (RMNP), Bhutan, we surveyed Manas range and Panbang area.

We used visual encounter search; opportunistic search and pitfall method to document the diversity of herpetofaunal species. Habitats surveyed include semi-evergreen forest, moist mixed deciduous forest, grassland, wetland and marshy areas.

From MNP, we recorded 17 species of amphibians belonging to 13 genera and five families. Record of *Feihyla vittatus*, *Rhacophorus maximus*, *Rhabdophis himalayanus* and *Microhyla butleri* are significant. From RMNP, we recorded 12 species of amphibians belonging to 10 genera. 31% of all the recorded species from RMNP constitute new report for Bhutan. Among amphibians, *Uperodon globulosus* and *Ingerana borealis* are a new addition to Bhutan fauna. Records of *Calotes maria*, *Cnemaspis assamensis*, *Ptyctolaemus gularis*, *Varanus salvator* from RMNP also adds to new records for Bhutan.

Among the recorded species, *Python bivittatus* and *Varanus bengalensis* have been accorded the highest legal protection status, under Schedule I of the Indian Wildlife (Protection) Act, 1972. *Naja naja*, *Ophiophagus hannah* and *Xenochrophis piscator* are listed in Schedule II, while all the other snake species are under Schedule IV of the Act.

Of the recorded species *Varanua bengalensis*, *Melanochelys tricarinata* are under Appendix I of CITES, *Varanus salvator*, *Python bivittatus*, *Hardella thurjii*, *Melanochelys trijuga*, *Indotestudo elongata*, *Ophiophagus hannah*, are listed in Appendix II of CITES. The only amphibian species *Hoplobatrachus tigerinus* is under CITES II and *Xenochrophis piscator* is under Appendix III of CITES.

Contents

	Page No.
1. Introduction	
1.2 Manas National Park	1
1.2 Royal Manas National Park	1
1.3 Literature review	1
2. Study Area	2
3. Methodology	
3.1 Survey Period	3
3.2 Survey objective	3
3.3 Survey Methodology	3
3.4 Data collection	4
4. Species account	
4.1 Amphibians	6
4.2 Lizards	13
4.3 Snakes	19
5. Discussion	26
6. References	30
7. Appendix	37
Map 1: Manas and Royal Manas National Park	2
Map 2: Map of Manas National Park showing survey locations	2
Plate 1: A Glimpse from the field	5
Plate 2: Amphibians of MNP and RMNP	10
Plate 3: Amphibians of MNP and RMNP	11
Plate 4: Amphibians of MNP and RMNP	12
Plate 5: Lizards of MNP and RMNP	17
Plate 6: Lizards of MNP and RMNP	18
Plate 7: Snakes of MNP and RMNP	23
Table 1: Herpetofauna recorded from MNP, India	24
Table 2: Herpetofauna recorded from RMNP, Bhutan	25

1. INTRODUCTION

Manas Tiger Reserve (MTR), Assam: with a total area of 2837.31 km² spans across the districts of Kokrajhar, Chirang, Buxa and Udalguri in north-west Assam. It is located between latitudes 26°30'N to 26°45' N and longitudes 89°45' E to 92°30' E. Manas National Park (26°35'-26°50'N, 90°45'-91°15'E) with a total area of 500 km² is the core area of Manas Tiger Reserve. It forms part of the Eastern Himalayan biodiversity hotspot and is a key conservation area in the Jigme Dorji-Manas-Bumdaling conservation landscape in the eastern Himalayan ecoregion (Wikramanayake et al., 2001).

The Reserve is situated in the eastern duars and has extensive bhabar and some terai areas, typical of Himalayan foothills. These terai like tracts are more or less flat. The natural gradient of the land is gently sloping southward. The area along the southern boundary is flatter than the northern parts and get water-logged during the rains. The landscape experiences moist tropical to sub-tropical climate with up to 76% relative humidity.

The mean annual rainfall is 3330 mm. The mean maximum summer temperature is 37°C, and the mean minimum winter temperature is 5°C. To the north, it is separated from Bhutan by the river Manas and its tributaries- Beki and Hakua, while to the west, it is separated from the Buxa Tiger Reserve in West Bengal by the river Sankosh. The area has a unique distinction of being a Natural World Heritage Site, a Tiger Reserve, an Elephant Reserve, Biosphere Reserve and Important Bird Area.

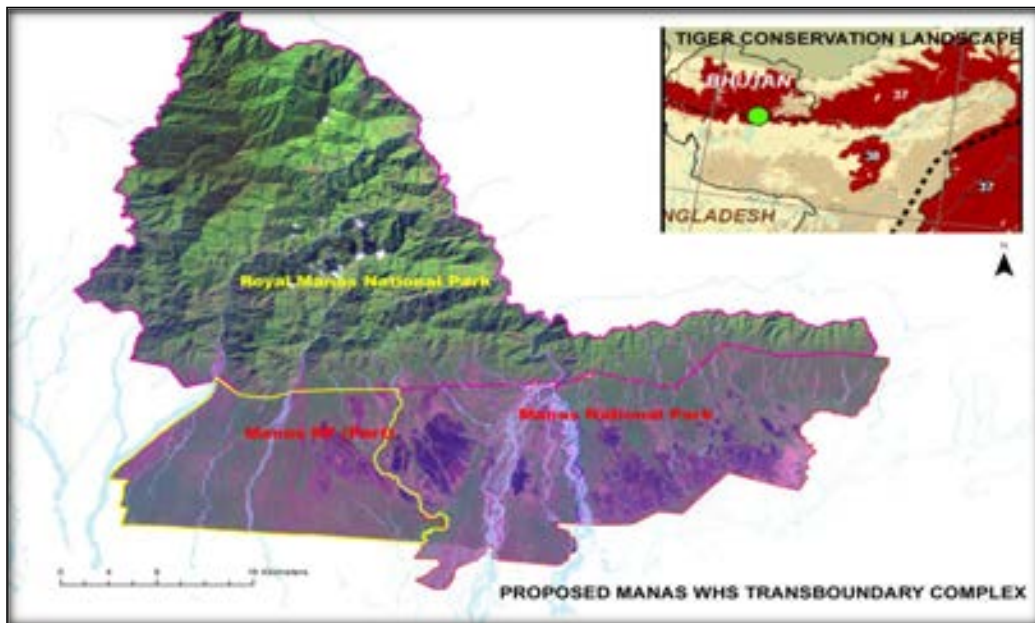
MNP known to harbour 61 species of mammals, 450 species of birds, 79 species of fishes and more than 200 species of butterflies and 100 species of invertebrates.

Royal Manas National Park (RMNP), Bhutan: The Royal Manas National Park (1023 sq Km) is the country oldest National Park located in southern Bhutan, that is contiguous to India's Manas Tiger Reserve in the south and Jigme Singye Wangchuck National Park in the North of Bhutan. The RMNP is the most important protected area in the country due to its outstanding unique biological reserves (900 species of plants, 60 species of mammals and 431 species of birds have been recorded) encompassing extremely diverse habitats ranging from grasslands and tropical deciduous forests to alpine meadows and perpetually snow-covered mountain tops in the north and with largest manifestation of sub-tropical forest in the Country.

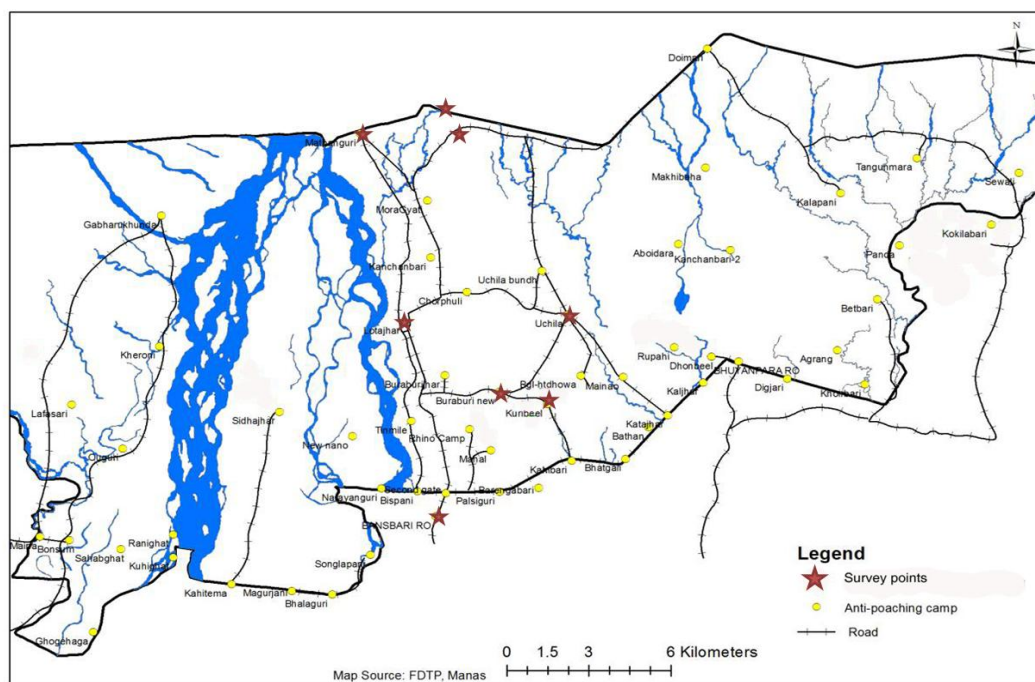
Literature review: Scanty information exists on the herpetofauna of Manas landscape. Hitherto no detailed herpetofaunal survey was conducted for this area. Alfred et al. (2006) listed 49 species of herpetofauna without mentioning any basis for these records. Das (1988), Narayan and Rosalind (1989), Das (1990), Bauer et al. (2007) and Ahmed and Das (2010) reported on the turtle fauna of Manas Tiger Reserve.

Herpetofauna of the Himalayan kingdom of Bhutan was dealt with by Biswas (1975), Bustard (1980), Bauer and Gunther (1992), Das and Palden (2000), Delorme and Dubois (2001), Palden (2003), Tillack (2006), Hobcroft and Schulz (2010), Wangyal and Tenzin (2009), Deuti (2010), Wangyal (2011), Wangyal and Gurung (2012a), Wangyal and Gurung (2012b), Wangyal (2012) and Wangyal (2013).

2. MAP SHOWING STUDY AREA:



Map 1: Manas and Royal Manas National Park



Map 2: Survey locations in Manas National Park

3. METHODOLOGY

3.1 Survey periods

Manas National Park: We conducted inventories from 16 June 2014 to 19 June 2014. At Mathanguri (16-17 June 2014), Lotajhar (18 June), Kuribeel (18 June), Doimari (19 June).

Royal Manas National Park: We inventoried the Manas Range on 17 June (1100h -1530 h) and 20-23 June 2014.

3.2 Survey objectives

The objective of the study was to document species diversity from the representative lowland habitats of Manas- Bhutan trans-boundary landscape within a period of seven field days. In addition to presence records, we collected natural history, microhabitat and reproductive information of recorded taxa. We recorded geo coordinates and latitudinal distributional pattern of the recorded herpetofauna which will enable in understanding the distribution pattern of the herpetofauna of the hill range.

Another objective of the study was to impart hands-on training to the front line forest staff's of the two forest ranges in India and Bhutan part *vis a vis* theoretical class. We showed techniques to conduct visual encounter surveys, acoustic searches, active search method, installing pitfall traps, recording morphometrics and provided training on live snake handling. The preliminary result in this report will add to our hitherto poor understanding of the herpetology of this seemingly hyper-diverse region.

Based on these initial results, we can plan for a long term herpetofaunal surveys and monitoring efforts for this world heritage site and generate operational plans for trans-boundary conservation initiatives.

3.3 Survey Methodology

We spent seven field days to document the herpetofaunal diversity. In that period we surveyed semi-evergreen forest, secondary forest, mixed deciduous, grassland, and forest habitation edges. We employed visual encounter surveys (Heyer *et al.* 1994; Rödel and Ernst 2004) where we walked within an identified survey site visually searching for amphibian and reptile species. Visual encounter surveys were employed in all terrestrial sites with the effort focused on sampling particular areas which appeared to provide suitable habitat for potentially present species. However, active search involving turning rocks and logs, peeling bark, digging through leaf litter, and excavating burrows and termite mounds also produced good results. For frogs, we conducted acoustic searching along forest trails, forest edges and forest streams, starting from late evening up to 2000-2200 hrs aided by flashlight. During day time we searched for heliothermic (basking) reptiles along forest trails, forest edges and stream sides besides active search method. The aquatic searches involved examining each aquatic habitat (forest streams, sweeps, ephemeral pools and permanent pools).

We employed four pitfall trap arrays, each 25 m long, with 3-4 buckets and drift fences of 0.5 m tall plastic material. Pitfall traps were placed in different local microhabitats (to the extent possible)

We made opportunistic observations any time a species was located in an area that was not actively being surveyed. GPS points were recorded at the location of the observation, and some general descriptions of the species and location were made as well.

3.4 Data collection

We collected data for locality, date, time, weather condition, habitat, microhabitat, gender of each (when possible) and reproductive condition of each (if it can be determined), co-existing species if any and behavioural notes were recorded in the field data sheet. We also collected meristic and morphometric data for all individuals captured, and made taxonomic notes. Photographs were taken of representatives of each species and habitats with DSLR using 90 mm macro lens. Geographic coordinates for each survey site were determined in the field with a Garmin GPS receiver. Coordinates were recorded as latitude and longitude in decimal degrees. Identification of species was done using the keys in Smith (1935 and 1943); Schleich & Kästle (2002) and Das (1995). Common English name of herpetofaunal species follows Das & Dutta (1998), Das (2002) and Whitaker & Captain (2004). Status evaluation for the conservation status of herpetofaunal species, we referred IUCN Red List (2014), The Wildlife (Protection) Act 1972, GAA (2000), and Appendices of CITES (CITES 2014). Nomenclature and taxonomic arrangement in the text follow Frost (2014) for amphibian and Das (2003) and Uetz (2014) for reptiles.

Abbreviations used: SVL - Snout Vent length, TL - Tail length, MNP - Manas National Park, RMNP - Royal Manas National Park, asl- above sea level, IUCN- International Union of Conservation of Nature,

Plate 1: A Glimpse from the Field

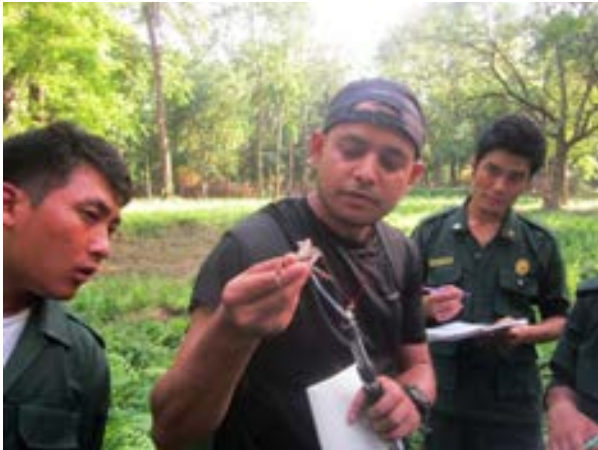


Figure 1: Demonstrating taxonomic keys for species identification



Figure 2: Releasing a Burmese Rock Python during night survey



Figure 3: Locating amphibian breeding pools at RMNP, Bhutan.



Figure 4: Demonstrating handling and scale count of snakes



Figure 5: Putting drift fence along the pitfall in Gharial Pokhari, Manas, India.



Figure 6: Putting up pitfall traps at Kuribeel grassland, Manas, India.

4. SPECIES ACCOUNT

4.1. AMPHIBIANS

Bufonidae

Duttaphrynus melanostictus (Schneider, 1799)

MNP, Mathanguri, 1 ex (SVL 72 mm), N 26.780312° E 90.956811°4, 16 June 2014, 1940 h, active near forest rest house, 1 ex (SVL 48 mm), 26.77316°, 90.98699° at 116 m elevation 18th June, 1910h.

RMNP, Manas Range, Zhemgang District, 4 ex, N 26.782815° E 90.958315°, 16 June 2014, between 2357h to 0015h, calling individual and amplexing pairs along road side waterlogged areas, 21 June 1 ex, juvenile (SVL 55 mm), 1925 h, active along the forest trail of a burnt patch towards Hatilora. Earlier record from Maukhola, RMNP, Sarphang District (Das and Palden, 2000).

Dicroglossidae

Euphlyctis cyanophlyctis (Schneider, 1799)

MNP, Mathanguri, India, 3ex (SVL 44-48 mm), N 26.77481° E 90.99261°, 18 June 2014, 1935 h, seen along a pond (Gharial pukhri) with thick algal growth.

RMNP, Manas Range, Zhemgang district, 1ex. 16 June 2014, 1320h, on a forest trail close to Beki River. Earlier records are from Sarphang, RMNP, Sarphang district, Tshangkha lake, Dagana district, Gelephu, Bhangtar, Samdrup Jongkhar, distributed from 225-1378 m in Bhutan. (Das and Palden, 2000; Wangyal 2013)

Zakerana pierrei (Dubois, 1975)

MNP, Kuribeel, India, 1 ex, ♂ (SVL 34 mm), 19 June, 2014, 0900h, N 26.68367° E 91.02661°, elevation 58 m, at wetland-grassland edge.

RMNP, Manas Range, Zhemgang District, Bhutan, 2 ex. (SVL: 32 and 34 mm), 16 June, 2014, 1240 am, along gravel Panbang road. From Bhutan, known from Tshangkha Lake, Dagana district at 1378m elevation (Wangyal, 2013).

Zakerana teraiensis (Dubois 1984)

MNP, Mathanguri, India, 1 ex (40 mm), N 26.780312° E 90.956811°, 16 June 2014, 2315h, outside Mathanguri rest house.

RMNP, Manas Range, Zhemgang District, Bhutan, 2 ♂, 2 unsexed (SVL 42mm-47mm), 26.784782°, 90.960007°, 16 June 2014, 0029h, along gravel Mathanguri- Panbang road. In Bhutan known from Gelephu, Sarpang district at 255 m elevation (Wangyal 2013).

Zakerana nepalensis (Dubois, 1975)

RMNP, Manas Range, Zhemgang District, 1 ex, ♂ (SVL 28 mm), N 26.784782°, E 90.960007°, 16 June 2014, 2340h, along Mathanguri- Panbang gravel road. In Bhutan known from Ngera Ama Ri in Samdrup Jongkhar district at 356 m elevation (Wangyal 2013).

Hoplobatrachus tigerinus (Daudin, 1803)

MNP, Mathanguri, 1 ex, ♂ (SVL 130 mm), N 26.77481° E 90.99246°, 1935h, near pond (Gharial Pukhri); 19 June, 1 ex Juvenile (SVL 33 mm), 1225h, Kuribeel pitfall, N 26.68367° E 91.02661°, elevation 58m.

RMNP, Manas Range, Zhemgang District 1 ex (SVL 147 mm), N 26.793419° E 90.959845°, 17 June 2014. Also recorded from RMNP, Maukhola, Sarphang District (Das and Palden, 2000).

Ingerana borealis (Annandale, 1912)

RMNP, Manas Range, Panbang Road, Zhemgang district, N 26.79801° E 90.96329°, 20 June 2014, 2 ex, ♂ (SVL 27 and 31 mm), calling from edges of a first order rocky stream in moist evergreen forest. One individual was found in a seepage area close to a forest stream.

Known from India: Northern West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, and Nagaland, China: Tibet, Nepal: Eastern part, Bangladesh: Cox's Bazaar District, and Myanmar: Chin and Rakhine states (Ao et al., 2003; Devi and Shamungou, 2006; Wogan et al., 2008; Sailo et al., 2009; Ahmed et al. 2009; Hasan et al., 2011, Fei et al., 2012). Frost (2014) included Bhutan in its distribution range without any reference. This study confirms his speculation.

Microhylidae

Microhyla ornata Duméril & Bibron, 1841.

MNP, Mathanguri, N 26.78004°, E 90.97318°, 1 ex (SVL 24 mm), 17th June, 0845h, under leaf litter close to stream; Lotajhar, 26.78159°, 90.95872°, calling aggregation, 19 June, 1940h, from thick leaf litter around waterlogged area in the forest interior.

RMNP, Manas range, Zhemgang District, N 26.79561° E 90.95633°, 1545 h, egg-mass and tadpoles observed in the water puddle, small ponds with thick algal growth, adults observed in the vicinity.

Microhyla cf. *butleri* Boulenger, 1900

MNP, Kuribeel grassland, India, 1 ex (SVL 28 mm), N 26.68367°, E 91.02661°, 18 June 2014, 1500h, Under log in open grassland area near forest antipoaching camp.

In India, known from Assam and Mizoram (Das et al., 2009; Lalremsanga et al., 2007). This species is also known from Southern China from Yunnan and eastern Sichuan to Zhejiang (including Hainan and Taiwan); north-eastern India; Myanmar; Vietnam; Thailand; Malay Peninsula and Singapore (Frost, 2014).

Micryletta cf. *inornata* (Boulenger, 1890)

MNP, Lotajhar, 1 ex (SVL 32 mm), 26.78159°N, 90.95872°E, 19 June 2014, on a rotten tree stump at ca. 10 cm above in the forest interior. The surrounding area was waterlogged and with thick leaf litter. We provisionally kept this taxon under „*innornata*“. Similar specimens were also observed in Orang National Park of Assam and may represent an undescribed taxon.

Uperodon globulosus (Günther, 1864)

MNP, Songrong road, N 26.77942° E 90.96675°, elevation 87 m, 19 June, 2014, 2030h, calling aggregation along waterlogged forest road. Observed along with *Humerana humeralis* in a heavily raining night.

RMNP, calling aggregation near waterlogged area around Geylongkhola pond, N 26.79433°, E 90.95501°, 1 ex, ♂ (SVL 57mm), in the pitfall trap inside semi-evergreen forest near a pond.

Known from Terai and Central Nepal, Northeastern India (Assam, Arunachal Pradesh), Bihar, West Bengal, Madhya Pradesh, Orissa, Gujarat, Andhra Pradesh, Karnataka and Kerala, Bangladesh. (Choudhury et al., 2002; Daniels, 2005; Schleich and Kastle, 2002, Srinivasulu et al., 2006; Sarker et al., 2012; Frost, 2014). First record for Bhutan.

Ranidae

Hylarana tytleri Theobald, 1868

MNP, Bansbari, 1 ex (SVL 38 mm), N 26°42.654'N, E 90°59.847'E, elevation 72 m, 1845 h, near tea garden- forest edge close to habitation. In Assam known from Cachar, Kamrup, Golaghat districts (Dey and Gupta 1999; Das et al. 2009). Also known from Arunachal Pradesh, West Bengal, Orissa, Uttar Pradesh, Northeastern India, Bangladesh and Nepal (Ohler and Mallick 2002). Frost (2014) suggested its possible occurrence in lower elevation of Bhutan.

Hylarana leptoglossa (Cope, 1868)

MNP, Lotajhar, 1 ♂ (SVL 48 cm), 1 ♀ gravid (SVL 60 mm), N 26.77859°, E 90.97215°, 17 June 2014, 1920 h, on rock and leaf litter along a slow flowing stream. Calling aggregation on (SVL 48-52 mm), 17 June 2014, 2040 h, Gharial Pukhri, N 26.78051° E 90.96489°.

RMNP, 20 June 2014, Geylongkhola pond, N 26.79435° E 90.955001°, 1920h, calling aggregation in waterlogged areas at forest edges. Also reported from Dungkarling, Phuntshothang, Samdrup Jongkhar, elevation 150 m (Wangyal, 2013). Distributed throughout lowland of Northeast India, Bangladesh, Myanmar and Thailand (Ahmed et al., 2009).

Humerana humeralis (Boulenger, 1887)

MNP, Mathanguri, 1 ex (SVL 83 mm), 17 June 2014, N 26.78051° E 90.96489°, elevation 118 m, 2037h, Near Gharial pokhri; 19 June, 1940 h. calling aggregation, 26.77942, 90.96675, elevation 87 m, waterlogged area along the forest road. Four individual measured ranged from 79-87 mm in SVL. In India reported from Nagaland, Assam and Arunachal Pradesh states (Ao et al. 2003; Hussain et al. 2007, Das et al. 2009). Also occurs in Myanmar and Nepal (see Schleich and Kastle, 2002).

Rhacophoridae

Polypedates teraiensis (Dubois, 1987)

MNP, Doimari road, 1 ex (SVL 56 mm), N 26.77481° E 90.99261°, 18 June 2014, 1930h, on a plant ca. 1.2 m above; Lotajhar, 1 ex (SVL 50 mm), 19 June 2014, N 26.78159° E 90.95872°, 1940h, calling from understory shrubs around waterlogged forest floor.

Rhacophorus maculatus himalayensis Annandale, 1912

MNP, Lotajhar, calling aggregation, N 26.78159°, E 90.95872°, 19 June 2014, 1945h, calling aggregation, individuals calling from underground vegetation or leaf litter at the edges of waterlogged area.

RMNP, Manas Range, Zhemgang District, N 26.79561° E 90.95633°, 17 June 2014, 1621h, 1 ex ♂ (SVL 53 mm), among grass near waterlogged area. Foam nests were found under rocks close to water logged area in Bhutan. Calling aggregation, 500 m away from the beginning of Geylongkhola walking trail, 22 June 2014, 2025 h.

This is a cryptic species that is still considered as a subspecies of the widespread *Polypedates maculatus*. However, its call characteristics and breeding microhabitats are distinct from *P. maculatus* and a detailed taxonomic assessment is under preparation (Saibal Sengupta, Pers. Comm.)

Rhacophorus maximus Günther, 1858

MNP, Lotajhar, 1 ex ♀ (SVL 120 mm), N 26.77873°, E 90.97203°, elevation 102 m, 17 June, 1930h. It was sitting on a tree (GBH 1.8 m) at 7 m above a slow flowing stream. In India, the species was reported from Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland (Chanda 1994; Pawar and Birand, 2001; Das et al., 2009) between elevations 30m-1895 m elevation.

Rhacophorus bipunctatus Ahl, 1927

RMNP, Manas Range, Zhemgang District, 2 ex, ♂ (SVL 47 and 51 mm), N 26.796061° E 90.948153°, 20 June, 2014, calling from understory lianas ca. 2.5 m above ground around water puddle in semi-evergreen forest interior.

Known from Northeast India (Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura, Nagaland and Mizoram), Bangladesh, China, Cambodia, Myanmar, Thailand, Malaysia (Ohler et al., 2002, Chan-ard, 2003; Nguyen et al., 2005; Grismer et al., 2006; Stuart, 2005; Devi and Shamungou, 2006; Reza and Mukul, 2009; Fei et al., 2012). This is a new record for Bhutan.

Feihyla vittata (Boulenger, 1887)

MNP, Lotajhar, calling aggregation, two ♂ measured (SVL 23 and 25 mm), N 26.78159° E 90.95872°, 19 June, 2014, 1940 h. Among overhanging leaf of understory plants, 2-3 m above submerged leaf litter, one clutch contained 104 eggs; eggs are light green in colour.

In Northeast India this species was reported from Assam, Mizoram, and Nagaland. Also Bangladesh, Myanmar and Thailand through Laos, southwestern Cambodia, and Vietnam, South eastern Xizang, southern China (Deuti and Dutta 2002; Ao et al., 2003; Frost 2014). Bain et al. (2007) observed eggs in foam nest in Vietnam. However, Manas population did not have foam nest.

Philautus cf garo (Boulenger, 1919)

MNP, Doimari road, 1 ex (SVL 20 mm), N 26.77325° E 90.98694°, elevation 113 m, 18 June, 2014, 2100h, calling from shrub 1 m above ground, in a semi-evergreen patch.

PLATE 2: Amphibians of MNP and RMNP



Figure 12: *Chrysobatrachus*



Figure 14: *Agalyptis*



Figure 15: *Agalyptis*



Figure 16: *Agalyptis* of *ganga*



Figure 17: *Agalyptis*



Figure 18: *Agalyptis*

Plate 3: Amphibians of MNP and RMNP



Figure 13: *Chrysobatrachus indicus*



Figure 14: *Chrysobatrachus indicus*



Figure 15: *Chrysobatrachus indicus*



Figure 16: *Chrysobatrachus indicus*



Figure 17: *Chrysobatrachus indicus*



Figure 18: *Chrysobatrachus indicus*

Plate 4: Amphibian of MNP and RMNP



Figure 12: *Hyla arborea*



Figure 10: *Hyla himalaica*



Figure 11: *Hyla himalaica*



Figure 22: *Hyla himalaica*



Figure 13: *Hyla himalaica*



Figure 14: *Hyla arborea*

4.2. LIZARDS

Gekkonidae

Cnemaspis assamensis Das and Sengupta 2000

RMNP, Manas Range, Zhemgang District, Bhutan, 1 ex ♀, gravid, with two eggs (SVL 35.38 mm, head length 5.1 mm, eye diameter 2.5 mm, eye to snout 3 mm, fore arm length 12 mm, femur 7.1 mm, tibia 6.2 mm, foot length 6.6 mm), N 26.81100° E 090.95676°, 21 June, 2014, 1245h, Elevation 229 m, found on bark of a large tree at 1.5 m above on the way to Panbang.

The species is known from Assam: Mayeng Reserved Forest, Garbhanga reserved forest, Amchang Wildlife Sanctuary, Nilachal hills, Kaziranga National Park, Ultapani reserved forest and Meghalaya: Nongkhel Wildlife Sanctuary (Das and Sengupta 2000; Sengupta et al., 2000; Das, 2002; Das and Ahmed, 2007; Purkayastha and Das, 2011, pers. Obs.). This is the only known species of day gecko in eastern India. Present record from Bhutan constitutes new country record for the species.

Hemidactylus platyurus (Schneider, 1792):

MNP, Bundh road, 1 ex, gravid, ♀ (SVL 61 mm), N 26.77789°, E 90.95881°, 18 June 0830h, under rotten log in mixed deciduous forest floor, with thick undergrowth.

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 55 mm), N 26.79610° E 090.95719°, elevation 147m, 21 June 2014, 1855h, found on tree bark/trunk.

Also known from Serzhong, Mongar dist. 1500-1540 m. Also recorded by Bauer and Gunther (1992) from Phuntsholing, Wangdi Phodrang.

Hemidactylus frenatus (Duméril & Bibron, 1836):

MNP, Mathanguri, 1 ex (SVL 48 mm), N 26.782205°, E 90.956929°, 19 June 2014, 1847h, other individuals seen feeding on insects around light sources of rest house wall.

Hemidactylus brookii (Gray, 1845)

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 42 mm), N 26.793641° E 90.960772°, 1530h, 21 June 2014, under a boulder at the base of a tree close to range forest office.

Also known from road between Sershong and Gelephu Town and Samchi (Das and Palden 2000; Bauer and Günther 1992).

Gekko gecko (Linnaeus, 1758)

MNP, Mathanguri, Barpeta district, 4 ex, N 26.780312° E 90.956811°, 16 June 2014, seen inside the wooden crevices at Manthaguri forest rest house.

RMNP, Manas range, photographic record on a tree by Wangyal (2012).

Gekko gecko is the second largest extant gecko species that growing upto 400 mm in length and over 300 g in weight (Manthey and Grossmann, 1997). Tokay geckos are distributed across Cambodia, Indonesia (excluding territory in Borneo and New Guinea), Lao PDR,

Peninsular Malaysia, the Philippines, Singapore, Thailand and Vietnam), Southern China, Hong Kong SAR and Northeastern India and Nepal (Das, 2010).

In Bangladesh populations are estimated to have recently declined by 50% as a result of collection for the Novel Medicinal Claims trade (M.H. Khan, in litt). In China, tokay geckos are listed as an endangered species in that country's Red Data Book and population declines have been recorded with over-harvesting for traditional medicine (Zhao, 1998; Chan et al., 2006). Similarly, population declines have also been reported in Java, Indonesia (Anon., 2011a) and north-eastern Thailand. Tokay geckos are considered to be rare in Nepal (Shrestha, 2000) and are listed as a threatened species in Viet Nam's Red Data Book.

Recently sporadic cases of *Gekko gecko* trade was recorded from eastern and northeast India and looking at the seriousness and volume of the trade the species was proposed to be included in the Wildlife (protection) act, 1972.

Cyrtodactylus khasiensis (Jerdon, 1870):

MNP, Doimari, Assam, India, 1 ex (SVL 62 mm), N 26.77481° E 90.99261°, 18 June 2014, 1940h, elevation 99 m, on shrub ca. 1.5 m above ground; Doimari, 1 ex (SVL 29 mm), N 26.78442° E 90.99874°, elevation 131 m, 19 June, 2014, 0930h, found under rocks 3 m away from stream.

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 38 mm), N 26.79546° E 90.95764°, found under abandoned tin shed lying on the ground near range office; 1 ex (SVL 65.3 mm), 1055 h, 21 June 2014, found under rock near Panbang road side slope; 1 ex (SVL 62 mm), N 26.80963°, E 90.95667°, elevation 202 m, 1320 h, under rotten log of a burnt patch; 1 ex (SVL 64 mm), 22 June, 2014, 2155 h, found on tree bark at 1.5 m above ground. 3 ex, among low vegetation 1-2.5 m above ground along Hatilora trail.

Earlier record from RMNP, Serzhong, Sarphang District, inside rotting tree trunk (Das and Palden, 2000).

Agamidae

Ptyctolaemus gularis (Peters, 1864)

RMNP, Manas Range, Zhemgang District, 1 ex ♀, (SVL 78 mm TL 179 mm), N 26.79355°, E 90.94133°, 22 June, 2014, 2015h, found sleeping on a dry branch of understory plant, approximately 1.5 m above ground, semi-evergreen forest, burnt understory.

Distributed in Myanmar, Northeast India, Bangladesh and Tibet (Das, 2010). First record for Bhutan.

Calotes versicolor (Daudin, 1802):

MNP, Mathanguri, 1 ex ♂ (SVL 72 mm) N 26.77789° E 90.95881°, 17 June 2014 0830h, on bush at 1 m above ground near forest trail; 1 ex, ♀ (SVL 90 mm), 18 June 2014, 1350h, on roadside vegetation near Songrang river; Pagli doha, 1 ex, (SVL 103 mm), 19 June 2014, N 26.77558° E 90.96212°, 1350 h, basking among vegetation at 1.5 m height along forest road; 17 June 2014, 0921h, 1 ex, ♂ near forest rest house; 18 June 2014, 0830h, 1 ex, ♀ (SVL 76 mm), 26.77789°, 90.95881°, roadside vegetation; 18 June, 1 ex, ♀ (SVL 90 mm), 1350 h.

RMNP, Manas Range, Zhemgang District, 1 ex, gravid ♀ (SVL 81 mm), 16 June 2014 at 1145 h, sleeping on a dry branch at 1 m above along roadside slope, 1 ex ♂ (SVL 78 mm), 1320h, among forest roadside vegetation. RMNP, Manas Range, Zhemgang district, Hatilora trail, 4 ex (SVL 32-44 mm), 22 June 2014, all juveniles found sleeping on the branch of dry shrubs along forest trail, 22 June, 2010 h, 1 ♀ (SVL 87 mm), sleeping on branch at 1.5 m above.

Earlier records are from Sheripam, Mongar district, Wangdiphodrang, Samdrup Jongkhar, Gelephu town, Sarpang district, Phuntsholing, Bale Jhura, Wangdi Phodrang (Biswas, 1975; Bauer & Gunther 1992, Das & Palden, 1999).

Calotes maria Gray, 1845

RMNP, Manas Range, Zhemgang district, 1 ex, ♀ (SVL 88 mm, TL 275 mm), N 26.78355° E 90.93120°, 22 June 2014, 2100 h, Approximately 2 m above ground, sleeping on a branch, about 10 m away from a evergreen forest stream.

Known from Khasi Hill, Meghalaya and Garbhanga Reserved Forest, Assam (Smith, 1935, Sengupta et al., 2000)

Japalura variegata Gray, 1853

RMNP, Manas Range, Zhemgang District, Bhutan, 1 ex (SVL 62 mm), N 26.79546° E 090.95764°, 20 June, 2014, 1250h, on forest floor close to a rocky area, elevation 138 m; 21 June 2014, Hatilora trail, 2005 h, 1 ex ♂ (SVL 73 mm); 22 June, 2014, 2010 h, 1 ex ♀ (SVL 65 mm) sleeping on the branch.

Earlier records from Phuntsholing, Batase, Bumdeling wildlife sanctuary head office, Serzhong Range office, Monger district (Biswas, 1975; Bauer and Gunther, 1992; Wangyal, 2011).

Hora 1926 & Smith (1935) reported this species from 330-2970 m. The recorded specimens showed similarity with *Japalura bengalensis* that was described from Buksa Duars by Annandale (1906) and currently considered as a synonym of *Japalura variegata*.

Scincidae

Sphenomorphus maculatus (Blyth, 1853)

MNP, Mathanguri, Pagli Doha, 1 ex, ♂ (SVL 55 mm, TL 89 mm), N 26.77558° E 90.96212°, elevation 95m, found in pitfall trap at mixed deciduous forest edge.

RMNP, Manas Range, Zhemgang District, 1 ex, ♂ (SVL 55 mm, TL 60 mm), N 26.79801° E 090.96329°, 21 June, 2014, 0955 h, found under the rocks in a flowing stream on way to Panbang at 170 m. Also reported by Wangyal (2012) from Manas forest range.

Lygosoma albopunctata (Gray, 1846)

MNP, Mathanguri, Barpeta district, India, 18 June, 2014, collected from an old building near Mathanguri IB; 1 ex, 18 June, 2014, 0920h, N 26.77590° E 90.96111°, juvenile individual, juvenile, under a rock at forest grassland edge. India, MNP.

Eutropis dissimilis (Hallowell, 1857)

MNP, Mathanguri, 1 ex (SVL 64 mm TL 48 mm), N 26.77558° E 90.96212°, 19 June, 2014, 1350h, basking on leaf at 50 cm above among roadside vegetation on road side at Pagli Doha;

One of the most widely distributed species of Skink in South Asia from Eastern Afghanistan, Pakistan, Kashmir, Punjab, Bihar, Madhya Pradesh, West Bengal Bihar and Rajasthan, Nepal, India, Bangladesh, Myanmar.

Bauer et al. (2008) reported it from Manas National Park and also opined that the species may also occur in Bhutan part at least in the immediately adjacent Royal Manas National Park.

Varanidae

Varanus bengalensis (Daudin, 1802):

MNP, Mathanguri, India, 17 June, 2014, 0921h, N 26.73020° E 90.99769°, crossing forest road near a mixed deciduous patch; 18 June, 2014, 1313 h, N 26.69748° E 90.99828°, crossing road at Kuribeel grassland, 19 June, 2014, 1300 h seen on forest road near Bura-buri area. It climbed a roadside *Ficus* tree for refuge.

RMNP, Not recorded in this survey. Bauer and Gunther (1992) recorded it from Phuntsholing.

Varanus salvator (Laurenti, 1768)

RMNP, Manas Range, Zhemgang District, 1 ex, N 26.796061° E 90.948153°, 20 June 2014, found in a small waterlogged puddle in the semi-evergreen forest interior.

Known from Sri Lanka, India, southern China, Myanmar, Thailand, Laos, Cambodia, Vietnam, Peninsular Malaysia, Singapore, Sumatra, Indonesia, Java, Lesser Sundas and Bali. This widely distributed species is represented by four subspecies (Das 2010) and Indian and South China population is referred to *Varanus salvator macromaculatus*.

This is a new addition to the herpetofauna of Bhutan.

Plate 5: Lizards of MNP and RMNP



Figure 15: *Calotes versicolor*



Figure 16: *Gekko gecko*



Figure 17: *Comptosia sublineata*



Figure 18: *Hemidactylus granatensis*



Figure 19: *Hemidactylus variegatus* (female)



Figure 20: *Hemidactylus variegatus* (male)

Plate 6: Lizards of MNP and RMNP



Figure 11: *Cnemidophorus tigris*



Figure 12: *Eumeces orientalis*



Figure 13: *Lacerta dipodops*



Figure 14: *Eumeces orientalis*



Figure 15: *Lacerta dipodops*



Figure 16: *Lacerta dipodops*

4.3 SNAKES

Typhlopidae

Indotyphlops braminus (Daudin, 1803)

MNP, Mathanguri, Barpeta District, Assam, India, 1 ex (SVL 150mm), 26.77590°N, 90.96111°E, 18 June 2014, 0930 h, Under rock of a forest open grassland edge.

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 144 mm.), 26.79546° N, 90.95764° E, 20 June 2014, 1330 h., under abandoned tin sheet near range office, Earlier records from Bhutan includes College campus, Punakha district and Samchi, Phuntsholing (Wangyal 2012; Bauer and Gunther 1992). In Bhutan recorded up to 1406 m asl. A parthenogenetic species that established itself to subtropical and tropical parts of Asia (Das 2002; Whitaker & Captain 2004)

Pythonidae

Python bivittatus Kuhl, 1820

MNP, rescued from fringe area and released near Songrong stream, Mathanguri, 1 ex ♂ (~1.5 m). Earlier records (27 December, 2006 and 8 March 2007) are from Bhuyapara range, Buraburi camp.

RMNP, Manas Range, Zhemgang District, Not recorded during this survey. Harris et al., (1964) reports Python as common inhabitants of duar plains of Bhutan. This species was reported from Gortey and Kanamakura at 245 m in Sarpang district by Wangyal (2012).

Colubridae

Boiga gokool (Gray, 1835)

RMNP, Manas Range, Zhemgang District, Bhutan, 1 ex (SVL 610 mm, TL 163 mm, V 221, SC 108), preserved specimen in the collection in Manas Range office, fed on *Calotes* cf. *versicolor*.

Little is known about the natural food of *B. gokool*. Greene (1989) summarized the sparse information given by Shaw et al., (1941, 1999) and Wall (1910) who reported a mouse as stomach content. A specimen examined from Sylhet (MCZ R58261) contained a juvenile *Calotes* sp. In captivity *Boiga gokool* fed on *Hemidactylus frenatus*, *Hemidactylus platyurus* and juvenile *Calotes versicolor* (personal observation).

Boiga gokool is a South Asian endemic species and known with certainty only from India and Bangladesh. In India, *Boiga gokool* is reported with certainty from Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland and West Bengal. In Bangladesh *Boiga gokool* is known from Divisions of Khulna, Sylhet, and Chittagong. No explicit record of the species exists from Myanmar (Das et al., 2010). An addition to the herpetofauna of Bhutan.

Boiga siamensis Nutaphand, 1971

RMNP, Manas Range, Zhemgang District, 1 ex, ♀ (SVL 1260 mm, TL 390 mm), preserved specimens in the collection in Manas Range office, Chick ingestro, was killed inside human

habitation; 1 ex ♂ (SVL 1400 mm TL 405 mm, V 251, MSR 23, A 1, SC 121), preserved specimen, it was killed near human reported to be killed from near Manas Range office.

Known from Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim Northern West Bengal (Sclater, 1891; Wall, 1909; Wall, 1910; Wall, 1924; Smith, 1943; Kroon, 1973; Sclater, 1891; Mathew, 1992; Mathew, 1995; Captain and Patel, 1997; Swan and Leviton, 1962; Jha and Thapa, 2002; Chettry and Bhupathy, 2007; Inglis et al., 1920; Shaw et al., 1941; Ahmed and Dasgupta, 1992; Whitaker and Captain, 2004; David and Mathew, 2005; Borang et al., 2005; Sanyal and Gayen 2006; Dasgupta and Raha, 2006; Bhupathy, 2007).

Boiga ochracea (Günther, 1868)

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 580 mm, TL 166 mm), 1815h, near a rocky stream among stream-side vegetation, about 2.5 m above ground; 1 ex, 1845h, crossing a gravel road close to a landslide area ~ 1 km away from Indian Manas part. Both individual were active while it was raining.

Known from Assam, Arunachal Pradesh, Meghalaya, Sikkim, Darjeeling (Schleich and Kästle, 2002; Whitaker and Captain, 2004; Günther, 1868; Sclater, 1891; Wall, 1924; Smith, 1943; Captain and Patel, 1997; Borang et al., 2005; Athreya, 2006; Sanyal and Gayen 2006; Pawar and Birand 2001; Swan and Leviton, 1962; Tillack, 1999; Jha and Thapa, 2002; Chettry and Bhupathy, 2007; Wall, 1909; Inglis et al., 1920; Shaw et al., 1941; Smith, 1943; Swan and Leviton, 1962; Ahmed and Dasgupta, 1992).

Earlier records from Phuntsholing, Serzhong, Mongar dist, elevation 1766 m, recorded from maize field (See Tillack, 2006; Wangyal, 2011).

Boiga ochracea is currently regarded as a species complex. Orlov and Ryabov (2002) recognized three subspecies [*Boiga ochracea ochracea* (Günther 1868), *Boiga ochracea stoliczkae* (Wall, 1909) and *Boiga ochracea walli* Smith 1943]. A re-examination of specimens throughout the range of the species revealed that south of Brahmaputra forms have 19 DSR at midbody and northern population has 21 DSR. So, Smith's subspecies „walli” is a subjective junior synonym of *Boiga ochracea*. So we have two form: a northern *Boiga ochracea stoliczkae* and a southern *Boiga ochracea ochracea*. Both forms are distinguished by its DSR count 19 in *B. o. ochracea* and 21 in *B. o. stoliczkae*. Nepal, Bhutan and Western Arunachal Pradesh population comes under the later form.

Boiga cyanea (Duméril, Bibron & Duméril, 1854)

MNP, not recorded during this survey. Our earlier survey recorded it from Ultapani Reserved Forest at the fringe of Manas Tiger Reserve. In India, known from Assam, Arunachal Pradesh, Meghalaya, Sikkim, Darjeeling (Whitaker and Captain, 2004; Borang et al., 2005; Sclater, 1891; Wall, 1924; Smith, 1943; Das, 2009; Wall, 1908; Mathew, 1992, 1995; Jha and Thapa, 2002; Schleich and Kästle, 2002; Stoliczka, 1871; Wall 1909; Shaw et al., 1941; Chettri and Bhupathy, 2007).

RMNP: Not recorded during this survey. Tillack (2006) showed that specimens collected from Phuntsholing, elevation 200-400 m and mentioned as *Boiga ochracea ochracea* by Bauer and Gunther (1992) in fact represented *Boiga cyanea*. Wangyal (2011) reported highest elevational distribution (1929 m) for the species from Bumdeling Wildlife Sanctuary, Shingdogor, Sherimung, Mongar district.

Ptyas korros (Schlegel, 1837)

RMNP, Manas Range, Zhemgang District, 1 ex, ♂ (SVL 980 mm, TL 400 mm), N 26.796043° E 90.948113°, 20 June 2014, roosting at a height of 1.5 m among thick bush, about 50 m away from a forest trail.

Other record of the species is from Bumdeling Wildlife Sanctuary, Rollong, Trashigang district, elevation 694 m. Juvenile recorded in the month of November (Wangyal, 2011).

Rhabdophis himalayanus (Günther 1864)

MNP, Lotajhar, India, 1 ex, ♂ (SVL 504 mm, TL 190 mm), N 26.78169° E 90.95872°, 19 June 2014, 2030h, found roosting on a shrub at 2 m height near an amphibian breeding spot. It regurgitated one *Polypedates* cf. *himalayensis* after capture.

RMNP, Bhutan, 1 ex, ♀ (SVL 704 mm, tail incomplete.) preserved specimen, 23 June, 2014, reported to be collected from near range office. Also known from Bumdeling Wildlife Sanctuary, Tingtibi, Zhemgang district at 1945 m elevation (Wangyal, 2011).

Xenochrophis piscator (Schneider, 1799):

MNP, Uchila Grassland area, 1 ex (SVL 550, TL 230 mm), N 26.77300° E 90.96071°, 17 June 2014, 0750h, among moist grass near a slow flowing first order stream.

RMNP: Not recorded in this survey. Bauer and Gunther (1992) recorded it from Phuntsholing.

Lycodon jara (Shaw, 1802)

MNP, Mathanguri, Barpeta district, India, 1 ex (SVL 420 mm, TL 80 mm), 18 June, 2014, 2314h, found inside an old abandoned house near Mathanguri Forest rest house.

RMNP: Not recorded in this survey. Known from Gelephu town, Sarpang district at elevation 255m (Wangyal, 2012).

Chrysopelea ornata (Shaw, 1802)

RMNP, Manas Range, Zhemgang District, 1 ex ♀ (SVL 740 mm, TL 275 mm, V 214, A 1, SC 116), 17 June 2014, 1040 h, N26.79561° E90.95633°; gravid female (SVL 1050 mm, TL 330 mm), preserved specimen, range office of Royal Manas National Park.

Also known from RMNP, Range office, at elevation 124 m (Wangyal 2012).

Psammodynastes pulverulentus (Boie, 1827)

RMNP, Manas Range, Zhemgang District, 1 ex (SVL 435 mm, TL 92 mm), N 26.79801° E 90.96329°, 21 June 2014, 1005 h, on stream-side boulder covered in herbaceous vegetation, wet evergreen forest.

Das and Palden (2000) recorded a gravid female (383 mm, TL 80 mm) containing three neonates in the month of July from Sershong, Sarpang district from the edge of a secondary forest at 15 m from a hill stream.

The species is distributed in Assam, Arunachal Pradesh, Mizoram, Meghalaya, Uttar Pradesh, Northern West Bengal, Northern Orissa, Northern Andhra Pradesh (Ahmed et al., 2009; Das et al., 2010; Mohapatra et al., 2010). Also known from Nepal, South China, Southeast Asia (Smith, 1943; Swan and Leviton, 1962; Zhao and Adler, 1993).

Elapidae

Ophiophagus hannah (Cantor, 1836)

MNP, Not recorded during this survey. Previous reports of the species are from Bansbari, Kasimdaha and the Kuribeeel grassland of Manas National Park (Narayan and Rosalind, 1989).

RMNP, Manas Range, Zhemgang District, present record of the species is based on a skin shed obtained from near Range office. The area is open with scattered tree with thick ground cover.

Other records from Bhutan include Gomkora, Trashiyangtse district and Khoma, Lhuentse district. Juvenile obtained in September. Also reported by Biswas (1975) from Manas Valley.

Viperidae

Trimeresurus popeiorum Smith, 1937

RMNP, Manas Range, Zhemgang District, 1 ex ♂ (SVL 357 mm, TL 85 mm, V 167, Subcaudals 71, 1 scales between supra oculars; inter-nasals separated by one scale, 10/10 supralabials, 1st supralabial separated from nasal completely, 3rd touches eye; 4 and 5 separated by 1 row of scales 13/13 infralabials, post-ocular stripe red above and white below), N 26.79356°, E 90.94173°, Elevation: 156 m, 22 June, 2130 h, on a tree among leaf at 3 m above near a seasonal stream.

In India this species is reported from Sikkim, Darjeeling, Meghalaya (Smith, 1943; Regenass and Kramer 1981; Ahmed and Dasgupta 1992), Arunachal Pradesh, Mizoram, Assam (A. Captain, S. Sengupta and A. Das unpublished). Also known Myanmar, Northern Laos, northern and western Thailand (Vogel et al. 2004; Das, 2010; Whitaker and Captain, 2004). First record of the species from Bhutan.

Plate 7: Snakes of MNP and RMNP



Figure 37: *Liasis fuscus*



Figure 38: *Spheerophis naja*



Figure 39: *Liasis fuscus*



Figure 40: *Liasis fuscus*



Figure 41: *Liasis fuscus*



Figure 42: *Liasis fuscus*

Table 1: Herpetofauna recorded from Manas National Park, Assam, India

Species	Common Name	Microhabitat	IUCN	WLPA
Amphibians				
<i>Duttaphrynus melanostictus</i>	Common Asian Toad	near forest rest house, along trail	LC	NL
<i>Euphlyctis cyanophlyctis</i>	Indian skipping frog	Ponds, waterlogged area	LC	Sc IV
<i>Zakerana teraiensis</i>	Terai Cricket frog	ground vegetation along forest road	LC	NL
<i>Zakerana pierrei</i>	Pierre's Cricket Frog	moist grasses near human habitation	LC	NL
<i>Hylarana leptoglossa</i>	Assam forest frog	near water puddle, pond	LC	Sc IV
<i>Hylarana tytleri</i>	Leaf Frog	aquatic plants at forest edge	LC	Sc IV
<i>Humerana humeralis</i>	Bhamo frog	along waterlogged forest road	LC	Sc IV
<i>Hoplobatrachus tigerinus</i>	Indian Bull frog	grassland-wetland edge (Pitfall)	LC	Sc IV
<i>Microhyla ornata</i>	Ornate narrow Mouth Frog	leaf litter near waterlogged forest interior	LC	NL
<i>Microhyla butleri</i>	Butler's Pigmy Frog	Under log of open grassland	LC	NL
<i>Micryletta cf. inornata</i>	False Narrow-mouthed Frog	rotten tree stump, forest understory	LC	NL
<i>Uperodon globulosus</i>	Balloon frog	along waterlogged forest road	LC	NL
<i>Feihyla vittatus</i>	Two Striped Pigmy Tree Frog	on leaf around waterlogged forest interior	LC	NL
<i>Polypedates teraiensis</i>	Terai Tree frog	on shrub; ca. 1 m above the ground	NA	NL
<i>Polypedates cf. himalayensis</i>	Himalayan Tree Frog	along waterlogged forest interior	NA	NL
<i>Rhacophorus maximus</i>	Large tree frog	tree at 5.6 m height	LC	NL
<i>Philautus cf. garo.</i>	Garo Hill Bush Frog	on fern, at 3 feet above ground		
Lizards				
<i>Calotes versicolor</i>	Common garden lizard	branch, leaf above ground	NA	NL
<i>Cyrtodactylus khasiensis</i>	Bent Toed Gecko	tree bark, dry branch, under rock	NA	NL
<i>Eutropis dissimilis</i>	Striped grass skink	Leaf litter along forest road	NA	NL
<i>Eutropis macularia</i>	Bronze Grass Skink	Leaf litter along forest road	NA	NL
<i>Sphenomorphus maculatus</i>	Spotted litter Skink	Pitfall at Moist deciduous forest edge	NA	NL
<i>Hemidactylus platyurus</i>	Flat tailed gecko	under rotten log; mixed deciduous forest	NA	NL
<i>Hemidactylus frenatus</i>	Asian House Gecko	Rest House Wall	NA	NL
<i>Gekko gekko</i>	Tokay Gecko	Rest House crevices	NA	NL
<i>Varanus bengalensis</i>	Bengal Monitor	forest road near grassland; <i>Ficus</i> tree bark	LC	Sc I
<i>Lygosoma albopunctata</i>	White spotted Supple Skink	under hay inside abandoned house	NA	NL
Snakes				
<i>Indotyphlops brahminis</i>	Brahminy Blind Snake	under rocks, tin shed, loose soil	NA	Sc IV
<i>Python bivittatus</i>	Burmese Rock Python	grassland, near river	VU	Sc I
<i>Rhabdophis himalayanus</i>	Himalayan Keelback	understory shrub ca. 2 m above	NA	Sc IV
<i>Lycodon jara</i>	Twin Spotted Wolf Snake	Inside abandoned house	LC	Sc IV
<i>Xenochrophis piscator</i>	Checkered Keelback	Near small stream	NA	Sc II
<i>Ophiophagus hannah</i>	King Cobra	Grassland, Wetland	VU	Sc II
<i>Naja naja</i>	Spectacled Cobra	Grassland near forest road	NA	Sc II

Table 2: Herpetofauna recorded from Royal Manas National Park, Bhutan

Species	Common Name	Microhabitat	IUCN
Amphibians			
<i>Duttaphrynus melanostictus</i>	Common Asian Toad	Slow flowing water along road, forest trail	LC
<i>Zakerana nepalensis</i>	Nepal Cricket Frog	slopes along gravel road	LC
<i>Zakerana teraiensis</i>	Terai Cricket Frog	Seasonal pool, forest trail	LC
<i>Zakerana pierrei</i>	Cricket frog	Roadside habitat	LC
<i>Microhyla ornata</i>	Ornate Narrow Mouth Frog	Among moist grass	LC
<i>Uperodon globulosus</i> +	Indian Balloon Frog	Waterlogged areas	LC
<i>Hoplobatrachus tigerinus</i>	Indian Bull frog	aquatic edge of seasonal pool	LC
<i>Hylarana leptoglossa</i>	Assam Forest Frog	Waterlogged areas along forest edges	LC
<i>Ingerana borealis</i> +	Trickle Frog	Forest stream edges and seepage areas	VU
<i>Polypedates teraiensis</i>	Terai Tree Frog	on bushes and shrubs around waterlogged area	NA
<i>Polypedates himalayensis</i>	Himalayan Tree Frog	Under rock, leaf litter along seasonal water pool	NA
<i>Rhacophorus bipunctatus</i> +	Twin spotted Tree frog	On lianas in forest interior	LC
<i>Philautus</i> sp	Bush Frog	On leaf forest interior	
Lizards			
<i>Calotes versicolor</i>	Common garden lizard	branch at ~1.5 m above	NA
<i>Calotes maria</i> +	Gray's forest lizard	branch 2 m above ground, near stream	NA
<i>Japalura variegata</i>	Variegated Mountain Lizard	leaf litter near rocky patch, dry branch	LC
<i>Ptyctolaemus gularis</i> +	Blue fan-throat lizard	dry branch, approximately 1.5 m above ground	NA
<i>Sphenomorphus maculatus</i>	Spotted litter skink	under moss covered rocks of streambed	NA
<i>Cnemaspis assamensis</i> +	Assamese Day gecko	tree bark, ca. at 1.6 m height	NA
<i>Hemidactylus platyurus</i>	Flat tailed gecko	tree bark at 1 m height	NA
<i>Hemidactylus brookii</i>	Brook's House Gecko	Under rock near range office	NA
<i>Cyrtodactylus khasiensis</i>	Khasi Hill Bent-toad Gecko	under rock, rotten log, on shrubs	NA
<i>Varanus salvator</i> +	Water Monitor	Water puddle inside forest	LC
Snakes			
<i>Indotyphlops braminus</i>	Brahminy blind snake	Under tin sheet on the ground	NA
<i>Psammodynastes pulverulentus</i>	Mock viper	Bush along the stream	NA
<i>Ptyas korros</i>	Indo Chinese Rat Snake	Among thick bushes at 2 m above	NA
<i>Boiga siamensis</i> +	Siamese cat snake	Human habitation near forest edge	NA
<i>Boiga gokool</i> +	Eastern cat snake	No data	NA
<i>Rhabdophis himalayanus</i>	Himalayan keelback	Open grassy area near habitation	NA
<i>Crysopelea ornata</i>	Ornate flying snake	Thatched house forest edge	NA
<i>Ophiophagus hannah</i>	King Cobra	edge of semi-evergreen forest	VU
<i>Trimeresurus popeiorum</i> +	Pope's Pit Viper	branch at ~3 m above near a seasonal stream	LC

Annotation: “+” indicates new addition to the Herpetofauna of Bhutan.

LC - Least Concern, NA - Not Assessed, VU - Vulnerable, in IUCN assessment

Sc I, Sc II, Sc IV, NL: Schedule I, Schedule II, Schedule IV and Not Listed respectively in of Indian Wildlife (Protection) act

5. DISCUSSION

From MNP we recorded 17 species of amphibians belonging to 13 genera and five families, viz., Bufonidae (1 species), Dicroglossidae (4 species), Ranidae (3 species), Microhylidae (4 species) and Rhacophoridae (5 species). 10 species of lizards recorded belonging to 8 genera and four families, viz., Agamidae (1 species), Gekkonidae (4 species), Scincidae (4 species) and Varanidae (1 species). Snakes were represented by 7 species belonging to 7 genera viz., Typhlopidae (1 species), Pythonidae (1 species), Colubridae (3 species) and Elapidae (2 species).

The families Bufonidae, Typhlopidae, Viperidae and Pythonidae are represented by one species each viz., *Duttaphrynus melanostictus*, *Indotyphlops brahminus*, *Trimeresurus popeiorum* and *Python bivittatus* respectively. Records of poorly known forest species such as *Feihyla vittatus*, *Rhacophorus maximus*, *Microhyla butleri*, *Lycodon jara*, *Rhabdophis himalayanus* etc., from MNP is of significance. *Micryletta cf inornata* is probably an undescribed taxon found in this survey. Bush frogs of the genus *Philautus* were conferred to its closely related species, and one skink species could not be identified. The positive identification of these species will need additional studies. *Polypedates maculatus himalayensis* and *Cyrtodactylus khasiensis* encountered during the survey are regarded as members of cryptic species complexes. Among the recorded species, *Python bivittatus* and *Varanus bengalensis* have been accorded the highest legal protection status, under Schedule I of the Indian Wildlife (Protection) Act, 1972. *Naja naja*, *Ophiophagus hannah* and *Xenochrophis piscator* are listed in Schedule II while all the other snake species are included under Schedule IV of the Act.

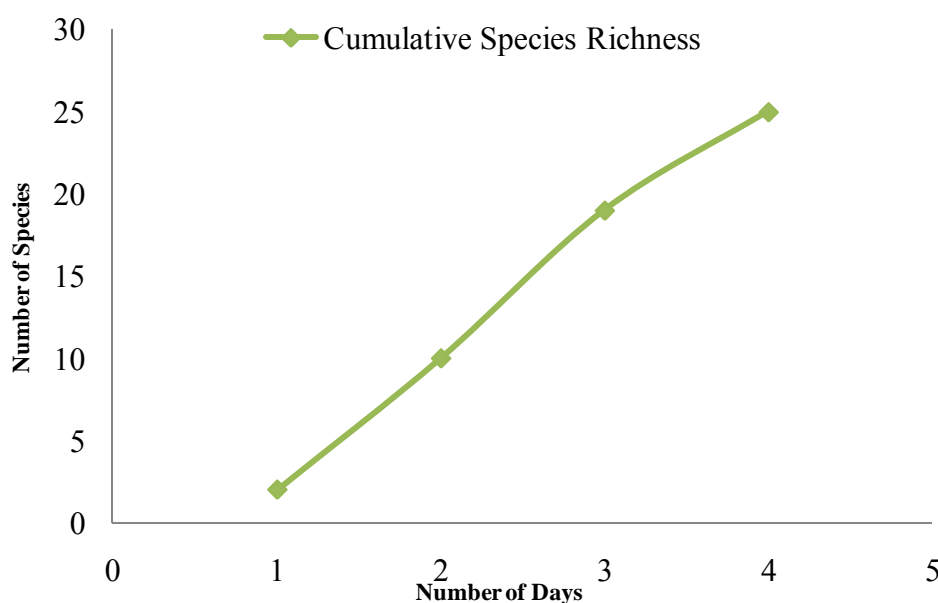


Figure 43: Species accumulation curve for MNP

Manas National Park is known to be the habitat of turtles such as *Cuora amboiensis* (Vulnerable), *Melanochelys tricarinata* (Vulnerable), *Melanochelys trijuga* (near threatened), *Indotestudo elongata* (Endangered), *Pangshura sylhetensis* (Endangered) and *Pangshura smithii* (near threatened).

Habitat patches at Lotajhar and Doimari inside Manas National Park were found to be particularly rich in forest species whereas grassland-wetland areas such as Kuribeel under Bansbari Range were identified as critical turtle habitat in the park.

No chelonian fauna was recorded during this survey. However, Ahmed and Das (2010) recorded *Indotestudo elongata* (Endangered) from Kalamati, *Cuora amboiensis* (Vulnerable) from Seed Farm, *Hardella thurjii* (Vulnerable) from Amlaitenga, *Melanochelys tricarinata* (Vulnerable) from Kalamati areas of Manas Tiger Reserve. Das (1988) reported six species of turtles viz *Cuora amboiensis*, *Melanochelys tricarinata*, *Melanochelys trijuga*, *Pangshura smithii*, *Pangshura tentoria* and *Pangshura sylhetensis* from Manas Tiger Reserve.

Alfred et al. (2006) listed 34 reptiles and 15 amphibian species from Manas National Park. However, they did not provide any locality or source of these records. The list includes species such as *Manouria emys* (distributed south of river Brahmaputra), *Japalura andersoniana* (Dafla Hill endemic), *Macropisthodon plumbicolor* (not known from Northeast India) and *Ptyas nigromarginatus* (high altitude species) that are unlikely to occur in Manas National Park.

In RMNP, we recorded 12 species of amphibians belonging to 10 genera. All recorded species of amphibians were anurans belonging to families Bufonidae (1 species), Dicroglossidae (5 species), Microhylidae (2 species) and Rhacophoridae (4 species). Lizards were represented by 10 species and 8 genera belonging to four families viz., Agamidae (4 species), Gekkonidae (4 species), Scincidae (1 species), Varanidae (1 species). Snakes fauna of RMNP represented by 9 species belonging to 8 genera and four families namely Typhlopidae (1 species), Colubridae (6 species), Elapidae (1 species) and Viperidae (1 species).

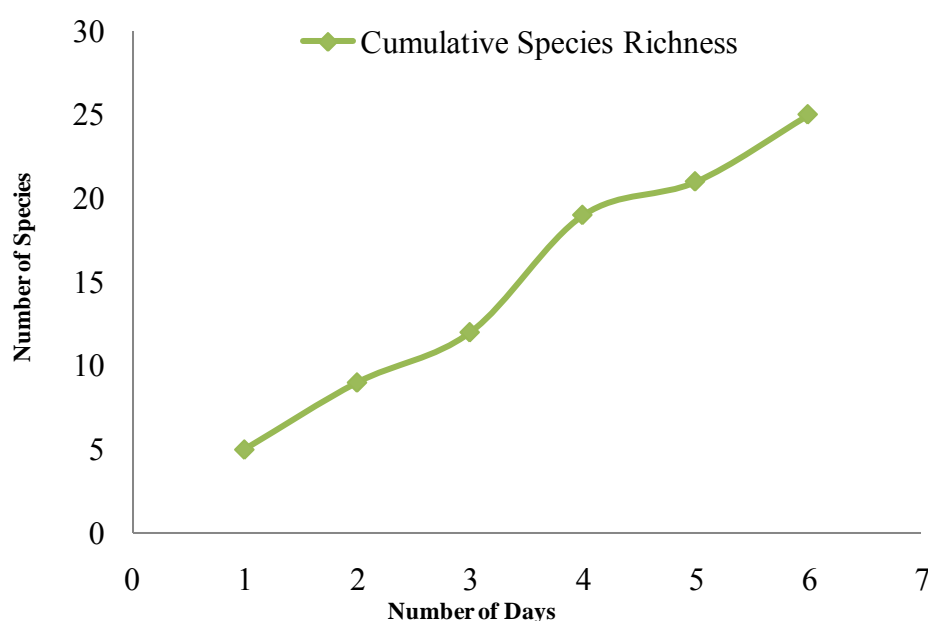


Figure 44: Species accumulation curve for RMNP

31% of all recorded species from RMNP constitute new report for Bhutan. Among amphibians, *Uperodon globulosus* and *Ingerana borealis* are the new addition to Bhutan fauna. Records of *Calotes maria* which is recorded from Meghalaya and Assam is reported in this survey and provides a new country record of the species from Bhutan. Also *Cnemaspis assamensis*, the only day gecko so far known from Northeast India is reported from Bhutan boundary for the first time. Nearest record of the species is from Ultapani Reserved Forest (pers. Obs.). Record of *Ptyctolaemus gularis*, *Varanus salvator* from RMNP also adds to the new country record for Bhutan.

Our examination of the preserved specimen kept at RMNP range office also revealed first country report for two cat snake species namely *Boiga gokool* and *Boiga siamensis*.

The reptile diversity recorded predominantly consisting on Indomalayan genera (*Chrysopelea*, *Cnemaspis*, *Lygosoma*, *Naja*, *Ophiophagus*, *Ptyctolaemus*, *Psammodynastes*, *Python*, *Indotyphlops*, *Rhabdophis*, *Varanus*, *Xenochrophis*) followed by Transitional elements (*Boiga*, *Indotestudo*, *Lycodon*, *Sibynophis*), Tibeto-Yunnanese (*Cuora*, *Gekko*, *Japalura*) and Indian radiation (*Calotes*, *Hemidactylus*, *Melanochelys*).

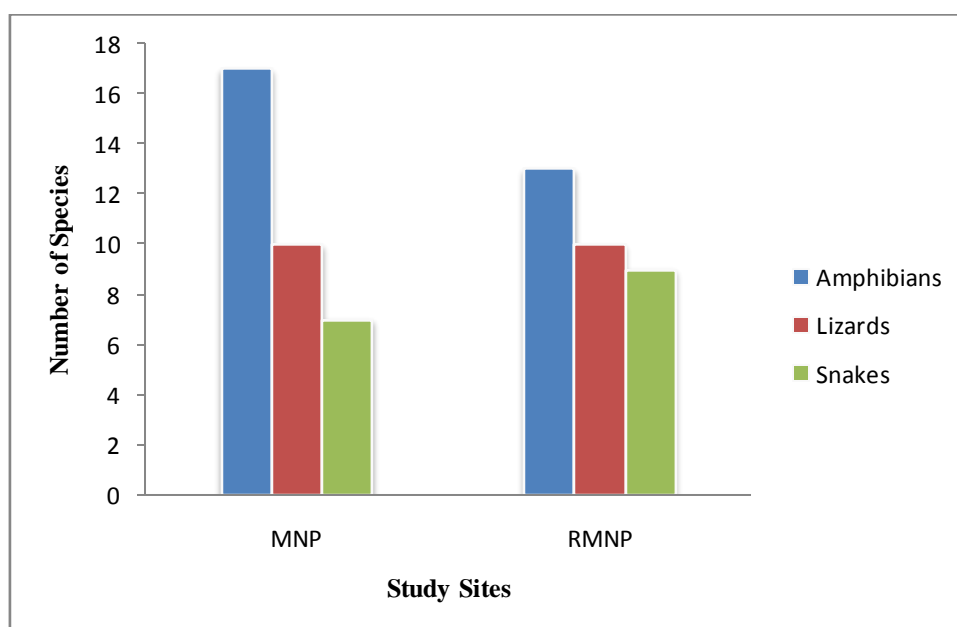


Figure 45: Recorded Species diversity of herpetofaunal species in MNP and RMNP

Das and Palden (2000) reported 7 amphibian and 12 reptilian species from Royal Manas National Park. Of these seven species (*Duttaphrynus melanostictus*, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Cyrtodactylus khasiensis*, *Hemidactylus brookii*, *Calotes versicolor*, *Psammodynastes pulverulentus*) recorded during this survey. Appendix I depict species that are recorded from MNP and RMNP during this study and also earlier records of these species from Bhutan. As reported by Wangyal (2011), we did not consider the validity of the record of *Lithobates catesbeianus* (American Bullfrog) from RMNP as valid and is not listed. In addition to hitherto recorded amphibian species from Bhutan, Frost (2014) mentioned possible occurrence of *Hylarana tytleri*, *Clinotarsus alticola*, *Amolops gerbillus*, *Amolops monticola*, *Amolops formosus*, *Scutigera sikkimensis*, *Nanorana parkeri*, *Nanorana blanfordii*, *Duttaphrynus himalayanus*, *Philautus annandalii* and *Ichthyophis sikkimensis* from Bhutan.

Wangyal et al. (2012) reported five species of Chelonian (*Cuora amboinensis*, *Cuora mouhotii*, *Cyclemys gemeli*, *Melanochelys tricarinata* and *Indotestudo elongata*) as new country records from Bhutan. They also provided a list of fifteen species that are likely to occur in Bhutan. We presume that all of them may occur in RMNP.

Among the recorded species, *Python bivittatus* and *Varanus bengalensis* have been accorded the highest legal protection status, under Schedule I of the Indian Wildlife (Protection) Act, 1972. Four species- *Naja naja*, *Ophiophagus hannah*, *Ptyas mucosa* and *Xenochrophis piscator* are listed in Schedule II, all other snake species are listed under Schedule IV of the Act. Of the recorded species *Varanua bengalensis*, *Melanochelys tricarinata* are under Appendix I of CITES, *Varanus salvator*, *Python bivittatus*, *Hardella thurjii*, *Melanochelys*

trijuga, *Indotestudo elongata*, *Ophiophagus hannah*, are listed in Appendix II of CITES and Only amphibian species *Hoplobatrachus tigerinus* is under CITES II and *Xenochrophis piscator* is under Appendix III of CITES.

Visual encounter survey and opportunistic observation resulted in record of most of the species. Five species (*Sphenomorphus maculatus*, *Hoplobatrachus tigerinus*, *Uperodon globulosus*, *Indotyphlops brahminus* and *Zakerana* sp) were recorded in the pitfall trap.

This rapid biological assessment provides baseline natural history information for all the recorded species that may help in further research and conservation. Our results are based on the survey constrained by time, and presumably represent a small subset of the actual diversity. Considering the scarcity of knowledge on diversity and distribution of herpetofaunal taxa, the present study assumes significance. Extensive and long term field surveys will no doubt significantly add to the herpetofaunal records of this area. This assumption is supported by the sharp slope of the species accumulation curve from the present survey (Fig. 43 and 44). This prevents us from making any approximation of the true species diversity in the study area. We recommend long term herpetofaunal inventory of this rich transboundary landscape to better understand the diversity, biogeography and ecology of herpetofaunal species in this region.

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7. Appendix

Species	MNP	RMNP	Bhutan	Reference
<i>Duttaphrynus melanostictus</i>	✓	✓	✓	This study, Das and Palden (2000)
<i>Uperodon globulosus</i>	✓	✓	✓	This study
<i>Micryletta inornata</i>	✓			This study
<i>Microhyla omata</i>	✓	✓	✓	This study
<i>Microhyla butleri</i>	✓			This study
<i>Euphyctis cyanophlyctis</i>	✓	✓	✓	This study, Wangyal (2013)
<i>Zakerana pierrei</i>	✓	✓	✓	This study
<i>Zakerana teraiensis</i>	✓	✓	✓	This study
<i>Zakerana nepalensis</i>		✓	✓	This study
<i>Hoplobatrachus tigerinus</i>	✓	✓	✓	This study
<i>Ingerana borealis</i>		✓		This study
<i>Leptobrachium smithi</i>	✓			Dutta et al (2013)
<i>Xenophrys parva</i>		✓	✓	Das and Palden (2000)
<i>Amolops marmoratus</i>		✓	✓	Das and Palden (2000)
<i>Humerana humaralis</i>	✓	✓	✓	This study
<i>Hylarana tytleri</i>	✓			This study
<i>Hylarana leptoglossa</i>	✓	✓	✓	This study
<i>Feihyla vittatus</i>	✓			This study
<i>Philautus cf. garo</i>	✓			This study
<i>Philautus</i> sp		✓	✓	This study
<i>Polypedates himalayensis</i>	✓	✓	✓	This study
<i>Polypedates teraiensis</i>	✓	✓	✓	This study
<i>Rhacophorus bipunctatus</i>		✓	✓	This study
<i>Rhacophorus maximus</i>	✓			This study
<i>Calotes versicolor</i>	✓	✓	✓	This study, Wangyal (2011), Bauer and Gunther (1992)
<i>Calotes maria</i>		✓		This study
<i>Japalura variegata</i>		✓	✓	This study, Wangyal (2011), Bauer and Gunther (1992)

Species	MNP	RMNP	Bhutan	Reference
<i>Ptyctolaemus gularis</i>		✓	✓	This study
<i>Cnemaspis assamensis</i>		✓		This study
<i>Cyrtodactylus khasiensis</i>	✓	✓	✓	This study
<i>Gekko gekko</i>	✓	✓	✓	This study, Wangyal (2012)
<i>Hemidactylus frenatus</i>	✓			This study, Bauer and Gunther (1992)
<i>Hemidactylus brookii</i>		✓	✓	This study, Bauer and Gunther (1992)
<i>Hemidactylus garnotii</i>		✓	✓	Das and Palden (2000)
<i>Hemidactylus platyurus</i>	✓			This study, Wangyal (2011), Bauer and Gunther (1992)
<i>Eutropis macularia</i>	✓			This study
<i>Eutropis quadratilobus</i>	✓		✓	Bauer and Gunther (1992)
<i>Eutropis</i> sp.	✓			This study
<i>Eutropis dissimilis</i>	✓			This study
<i>Lygosoma albopunctata</i>	✓			This study
<i>Sphenomorphus maculatus</i>	✓	✓	✓	This study, Wangyal (2012)
<i>Sphenomorphus indicus</i>		✓	✓	Das and Palden (2000)
<i>Varanus bengalensis</i>	✓		✓	This study, Bauer and Gunther (1992)
<i>Varanus salvator</i>		✓	✓	This study
<i>Indotyphlops brahminus</i>	✓	✓	✓	This study, Wangyal (2012), Bauer and Gunther (1992)
<i>Indotyphlops jerdonii</i>		✓	✓	Das and Palden (2000)
<i>Python bivittatus</i>	✓	✓		This study, Wangyal (2012), Bauer and Gunther (1992)
<i>Lycodon aulicus</i>	✓	✓	✓	Wangyal (2012)
<i>Amphiesma stolatum</i>			✓	This study, Bauer and Gunther (1992), Biswas (1973)
<i>Boiga cyanea</i>		✓	✓	This study, Bauer and Gunther (1992)
<i>Boiga ochracea</i>		✓	✓	This study, Wangyal (2011)
<i>Boiga gokool</i>		✓		This study
<i>Boiga siamensis</i>		✓		This study
<i>Chrysopelea ornata</i>		✓	✓	This study, Wangyal (2012)
<i>Dendrelaphis tristis</i>		✓	✓	Wangyal (2012)
<i>Lycodon jara</i>	✓		✓	This study, Wangyal (2012)
<i>Oligodon dorsalis</i>		✓	✓	Das and Palden (2000)
<i>Psammodynastes pulverulentus</i>		✓	✓	This study, Das and Palden (2000)
<i>Ptyas korros</i>		✓	✓	This study, Wangyal (2011)
<i>Rhabdophis himalayanus</i>	✓			This study, Wangyal (2011)
<i>Rhabdophis subminiatus</i>		✓		Wangyal (2012)
<i>Sibynophis sagittarius</i>		✓	✓	Das and Palden (2000)
<i>Xenochrophis piscator</i>	✓		✓	This study, Bauer and Gunther (1992)
<i>Bungarus fasciatus</i>		✓	✓	Das and Palden (2000)
<i>Bungarus niger</i>			✓	Bauer and Gunther (1992)
<i>Naja naja</i>	✓	✓	✓	Das and Palden (2000), Wangyal (2012)

Species	MNP	RMNP	Bhutan	Reference
<i>Ophiophagus hannah</i>	✓	✓	✓	This study, Biswas (1975), Narayan and Rosalind (1989), Wangyal (2011)
<i>Trimeresurus albolabris</i>		✓		Wangyal (2012)
<i>Trimeresurus popeiorum</i>		✓	✓	This study
<i>Cuora amboinensis</i>	✓	✓	✓	This study
<i>Cuora mouhotii</i>	✓	✓	✓	Wangyal et al. (2012)
<i>Cyclemys gemeli</i>	✓	✓	✓	Wangyal et al. (2012)
<i>Melanochelys tricarinata</i>	✓	✓		Das (1988), Wangyal et al. (2012)
<i>Melanochelys trijuga</i>	✓			Das (1988)
<i>Pangshura sylhetensis</i>	✓	✓		Das (1988)
<i>Pangshura smithii</i>	✓	✓		Das (1988)
<i>Pangshura tentoria</i>	✓	✓		Das (1988)
<i>Indotestudo elongata</i>	✓	✓		Ahmed and Das (2010), Wangyal et al. (2012)

ANNEXURE-VII

Quarterly meeting for Conservation Partners of Manas Tiger Reserve

Venue: Conference Hall of Aaranyak, Survey, Beltola

Date: 22 November 2014.

Background: The first quarterly meeting with NGO stakeholders for Manas, India (as envisaged under the Action point of the TraMCA minutes dated 3.09.2014) was held today at Guwahati and was attended by various partners from Aaranyak, WWF-India and Forest Department. There were three main agenda points for discussion.

1. To discuss the road map ahead for annual Tiger monitoring (Phase IV) as per NTCA guidelines for the year 2014-15.

2. To carry out ecological monitoring including rapid population estimation of flagship species as per the requirements of World Heritage Site status annual reporting.

The actions points as discussed are as follows:

1. TIGER AND PREY SPECIES MONITORING (Phase IV): the following methodology and timeline shall be followed

a) **Sign Survey Training** – a hands-on training for frontline staff and volunteers shall be conducted on 22 December 2014 at Bansbari and Bhuyanpara respectively. The staff shall be trained in identifying and locating signs with basic knowledge of GPS and camera trapping.

- ACTION POINT: FDTP to issue letter to Range Officers accordingly for staff deployment.

b) **Sign survey exercise** to be conducted from 25 Dec 2014 it was decided to jointly conduct this exercise with researcher support from Aaranyak and WWF-India. Six teams led by Dipankar Lahkar, Anukul Nath, Alolika Sinha, Bhaskar Barukial, Binita Baruwati and Pallabi Chakraborty, along with concerned camp staff to conduct the exercise.

c) **Data entry and data analysis** of the sign survey data to be conducted from 10-15 January 2015.

- ACTION POINTS: GPS (to be pooled from FDTP, Aaranyak, ATREE and WWF) by Dipankar Lahkar.
- Field camps to be arranged by FDTP Office at Mathanguri, Bansbari, Bhuyapara RO, Kokilabari Beat.
- Vehicles to be arranged and coordinated by Dipankar Lahkar (One from WWF, One from Aaranyak, One each from each RO/FDTP).

d) **Camera Trapping exercise:** It was decided that this year the exercise should begin early and hence be carried out from 5 January 2015 onwards. The tentative methodology (to be finalized in consultation with FD by Firoz Ahmed and Jimmy Borah) will be to divide the area into four blocks; Bhuyapara Block, Bansbari Block, Panbari Block (Random camera placement), Kahitema Block (Random camera placement) for the monitoring.

- ACTION POINT: Pooling in of camera trap resources by Dipankar Lahkar (example: 150 from Aaranyak +100 from WWF +48 from FDTP, Manas).
- Vehicles to be arranged and coordinated by Dipankar Lahkar (One from WWF, One from Aaranyak, One each from each RO/FDTP).
- Manpower to be decided and fixed for each camera trapping team. Each team to comprise of at least one Biologist, one Assistant and one Forest Staff).

- The camera trapping exercise may be extended to RMNP Bhutan and a letter from FDTP, Manas shall be sent accordingly to Park Manager RMNP for training and setting out camera traps.
- A dedicated coordinator (Biologist) for the transboundary tiger monitoring exercise shall be assigned by Aaranyak within the next one month.
- FDTP to provide support for clearing marked transect lines and elephants in areas not accessible on foot.
- Logistics including the cost of researchers etc shall be supported by Aaranyak and WWF-India.

2. ECOLOGICAL MONITORING: the monitoring and rapid surveys for flagship species such as Pygmy Hog, Bengal Florican etc have been undertaken as per the requirements of the World Heritage Site annual reporting. The method normally followed is to invite species experts, NGOs and frontline staff for conducting a time-bound exercise. This year an amount of Rupees Two Lakhs have been especially been sanctioned from the Manas Tiger Conservation Foundation for conducting this exercise on target species. Transboundary monitoring and population estimation can also be carried out with support from RMNP in this case. The Deputy Director, Manas shall lead the team in conducting this exercise in coordination with the NGOs as mentioned below.

- ACTION POINTS : Transects for all prey animals as per NTCA protocol shall be planned and executed by Dipankar Lahkar and Pallabi Chakraborty.
- Swamp deer population estimation, survey design and execution (preferably in last week of Feb) to be led by Alolika Sinha.
- Wild Buffalo, Gaur and Sambar population estimation (preferably in last week of Jan), survey design and execution to be led by Anukul Nath and Alolika Sinha.
- Pigmy Hog, Hispid Hare, Bengal Florican population estimation (preferably in last week of March and first week April), survey design and execution to be led by Bibhuti Lahkar and Namita Brahma.
- Asian Waterfowl Census (in last week of January, also as an awareness generating exercise with local college and school students) survey design and execution to be led by Dr Hiloljyoti Singha, Anukul Nath, Bipul Das, Dipankar Lahkar and Pallabi Chakravarty.
- Land use change data to be collected by surveyor and analysed in RS/GIS unit of Aaranyak. Ground truthing data sheet to be circulated by Bibhuti Lahkar to Dipankar Lahkar.

Note: *The final minutes of the meeting shall be shared with the CWLW by the FD for approval and the required official letters than be issued to NGO partners accordingly.*

The meeting ended with thanks from the Chair and was followed by Lunch sponsored by Aaranyak.

Annexure I (Signature of participants)

22/11/2014 *classmate*

Coordination Meeting of the Conservation Partners of MTK

	Name	Designation	Organization
1	Dr Sonali Ghosh	Deputy Director MTK	Mamam
2	Dr. Bishanti Palit	Landscapes Coordinator	Aaranyak
3	Dr. Bha Kumer Saha	Sr. Project off	WWF-India
4	Jimmy Borah	Senior Coordinator - tiger	WWF-India
5	Anupam Samal	Head, Terrestrial Landscapes	WWF-India
6	Pallabi Chakraborty	Project Officer - Species	WWF-India
7	A.C. Das	Field Director, Mamam Tiger Project	Forest Dept
8	Shyamal Datta	Director (Resource) Aaranyak	Aaranyak
9	Abolika Sinha	Research Scholar	Aaranyak
10	M. Firoz Ahmed	Wildlife Biologist	Aaranyak
11	Anura Lata	Researcher	Aaranyak
12	Dipankar Lahkar	Research Scholar	Aaranyak

Venue - Aaranyak Nao office



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A NOTE ON STATUS OF FOREST DEVELOPMENT AGENCY AND ECO-DEVELOPMENT COMMITTEES IN MANAS NATIONAL PARK

Manas Forest Development Agency

The establishment of Forest Development Agency (FDA) and Eco-Development Committees (EDCs) are mandated under Ministry of Environment and Forests, Government of India guidelines for this purpose. FDAs are to be registered as Federations of all Joint Forest Management Committees (JFMCs) / Eco-Development Committees (EDCs) within a territorial/wildlife forest division under the Societies Registration Act. FDAs for wildlife divisions shall be confined to the territorial jurisdiction of protected area network under their control. Under these guidelines, the Manas Forest Development Agency (MFDA) was registered under the Societies Registration Act 1860 on 28.05.2014 in Assam.

The Manas Forest Development Agency Society shall function as an autonomous body for implementation of specialized schemes like national Afforestation Project (N.A.P) or any other scheme of Centrally Sponsored/Central Sector or State Govt. or any agencies as per terms and conditions laid down by the Govt. of Assam.

Primarily, the F.D.A Society will focus on carrying out activities under the project 'N.A.P' presently as per the guidelines issued vide National Afforestation and Eco-development Board through respective JFMCs/EDCs.

Short term objectives:

- Stakeholdership and pride in conserving and protecting the wild flora and fauna.
- Regeneration and Eco-development of degraded forest and adjoining areas on a watershed basis by developing modern nursery and plantation techniques.
- To promote and regulate eco-tourism activities in and around the Protected Area.
- Augmentation of availability of fuel wood, fodder and grasses from the regenerated areas.
- Securing people's participation in planning and regeneration efforts to ensure sustainability and equitable distribution of forest products from the regenerated lands, and to promote the partnership concept in the management and administration of forest and common property resources.
- Promote Agro-forestry and development of Common Property Resources.
- Promotion of fuel saving devices to encourage efficient use of fuel wood and to reduce the drudgery of rural women involved in collection of wood, as also to improve the environment.
- Conservation and improvement of non-timber forest produce such as bamboo, cane and medicinal plants.
- Encourage production of non-timber products such as wax, honey, fruits and nuts from the re-generated areas.
- Taking up soil conservation measures especially in the downstream catchment areas of rivers emanating from the Protected Area.

- Develop water resources through plantation and water harvesting programme.
- To minimize the extent of livestock grazing and promote high yielding varieties and alternate livelihood support through piggery and fisheries.
- To create awareness and extend environment education and participation in the children and youth of fringe villagers.

Long term objectives :

- Overall protection and conservation of the Protected Area Landscape along with its wild flora and fauna.
- Protection, conservation of natural resources through active involvement of the people including ecotourism in and around the Protected Area landscape.
- Checking and degradation, deforestation and loss of Bio-diversity.
- Ecological restoration and environmental conservation in conformity with Eco-sensitive zonation and landuse planning.
- Evolving village level people's organizations which can manage the natural resources in an around villages in a sustainable manner.
- Fulfillment of the broader objectives of productivity, equity and sustainability for the general good of the people.
- Improve quality of life and self-sustenance aspect of people living in an around forest areas.
- Capability endowment and skill enhancement for improving employability of the rural people.

Eco-Development Committees in Manas National Park

EDCs are required to be formed in the fringe villages of all National Parks in India. The FDA through the EDCs at the village level provides an organic link between the Forest Department and the grassroot level communities. The process of EDC formation in Manas National Park-cum-Tiger Reserve was set in motion with the registration of the Manas Forest Development Agency in May 2014.

In the initial pilot phase during the period from July to December 2014, 8 EDCs were taken up for establishment from Bansbari Range of Manas National Park in Baksa District of Assam. At the onset a series of meetings were held in the fringe villages for spreading awareness and orientation on the importance of eco-development activities towards soliciting the support of the local community. Meetings were held in all these villages which saw wholesome participation of local village population and community-based NGOs. The Manas Park Authorities and forest staff were present in the meetings and addressed the gatherings for motivating the villagers. Support was also provided by Ashoka Trust for Research in Ecology and the Environment (ATREE), a national level research institution which has been involved in conservation and socio-economic activities in Manas National Park. Pilot socio-economic surveys in select villages also included the involvement of academic institution such as the Tata Institute of Social Sciences, Guwahati, Assam.

Subsequent to the initial orientation meetings in the villages, a total of 6 EDCs were established in the fringe villages around Manas national Park during the latter six months of 2014. 2 more EDCs in this pilot phase are expected to be established in the first quarter of 2015. The EDCs formed in the villages include Barengabari, Palsiguri, Rajabil, GohairBhitha, Kahibari and Katajhar. Additional two villages are Madrihora and Kamalabari where EDCs are due to be established. Each of the EDCs has an Executive Committee with elected and nominated members. The committees will be in Office for 1 year, thereafter a general meeting will be held and a new committee formed.

After the formation of EDCs, extensive socio-economic surveys are being carried out to collect baseline data for the villages. Subsequently, Microplanning exercise will be undertaken for the EDCs in order to prioritise development schemes in these villages.

The details of currently established EDCs are mentioned in the table below:

Table 1: List of Eco-Development Committees formed under Manas Forest Development Agency

Sl no	Name of EDC	Revenue village	Total no of Households	Date of formation	Executive Committee Members	Elected members	Nominated members
1	Barengabari	Barengabari	218	12 th August, 2014	16	12	4 (1. Forest Department-Member Secretary from Barengabari Beat, 2. VCDC, 3. MEWS, 4 Adviser cum cashier)
2.	Lahoripara-Langdangpara	Palsiguri	73	16 th September, 2014	13	10	3 (1. Forest Department-Member secretary from Kahibari Beat. 2. MEWS, 3. SungkhurMitingaOnsaiAfai)
3.	Rajabil	Rajabil	125	19 th October, 2014	17	16	1 (Forest Department-Member Secretary from Bhatgali Beat).
4.	Daurabari	GohairBhitha	65	20 th October, 2014	14	12	2 (1 Forest department-Member Secretary from Katajhar Beat)
5.	Kahibari	Kahibari	100	27 th November, 2014	13	10	3 (1 Forest Department-Member secretary from Kahibari beat, 2. MEWS, 3. SungkhurMitingaOnsaiAfai)
6	Katajhar	GohairBhitha	35	15 th December, 2014	12	10	2 (1. Forest Department-Member secretary from Katajhar beat, 2. MEWS)

SURVEY FOR
ENDANGERED
GRASSLAND SPECIES IN
MANAS NATIONAL
PARK

2014

Survey Team Profile

1. Dr. Sonali Ghosh- She is an Indian Forest Service officer and has been serving as Deputy Director in Manas Tiger Reserve since April 2013. She has a master's degree in Wildlife Science and a PhD in Remote Sensing Technology.
2. Dr. Bibhuti Lahkar- He is a researcher of Aaranyak, Guwahati who has worked for many years in the Pygmy Hog Conservation Project in Manas NP and later co-ordinated a number of projects on ecology of grassland species like Pygmy Hog, Hispid hare, Bengal Florican and Elephant migration routes in Manas Tiger Reserve.
3. Dr. Kaushik Deuti – He is a Scientist at Zoological Survey of India, Kolkata.
4. Dr Gitanjali Banerjee Bhattacharya – She is the Program Manager, Central and South Asia Conservation Program at the Zoological Society of London.
5. Mr. Anukul Nath- He is a researcher of Aaranyak, Guwahati working in the Elephant Corridor Monitoring and invasive species Project at Manas NP.
6. Mrs. Namita Brahma – She is a researcher of Aaranyak, Guwahati who has worked on Bengal Florican in Manas NP.
7. Mr. Dipankar Lahkar - He is a researcher of Aaranyak, Guwahati working on assessing the Tiger Populations in Manas NP.
8. Dr. Jyotiprasad Das – He is a project co-ordinator of Aaranyak, Guwahati working in the Elephant Corridor Monitoring Project at Manas NP.
9. Ms. Alolika Sinha – She is a researcher of Aaranyak, Guwahati working on Hog deer in Manas NP.
10. Mr. Charles Leo Prabhu – He is a researcher of Wildlife Institute of India working on tiger populations in Manas NP.
11. Mr. Aysho Sharma Adhikari - He is a researcher of Wildlife Institute of India working on tiger populations in Manas NP.
12. Mr. Bhaskar Barukial- He is a researcher with Aaranyak-Guwahati working in the Tiger Monitoring project at Manas NP.

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23rd March, 2014

Barpeta Road

SURVEY TEAM

Contents

	Page No.
1 Introduction	5
2 Target species profile	
2.1 Hispid Hare	6
a. Literature review and conservation status	6
b. Physical characteristics	6
c. Distribution	8
d. Habitat	9
e. Behaviour and reproduction	9
f. Threats	10
2.2 Pygmy Hog	10
a. Literature review and conservation status	11
b. Physical characteristics	11
c. Distribution	12
d. Habitat	13
e. Behaviour and reproduction	14
f. Threats	15
3 Study Area	16
3.1 Location	16
3.2 Grassland Habitat characteristics	17
3.3 Justification for intensive sampling sites	18
4 Methodology	
4.1 Field methods	19
4.2 Obtaining Satellite data	20
5 Results	
5.1 Pellet survey for Hispid Hare	21
5.2 Sign survey for Pygmy Hog	24
5.3 Fire and Species interaction	25
5.4 Other species sighted	26
6 Conclusion	
6.1 Discussion	27
6.2 Proposed Action Plan	28
Bibliography	30
Field photos	35

Section 1: Introduction

Grassland ecosystems are considered one of the most threatened ecosystems in the world. In India, the *Bhabhar-Terai* grasslands are under constant threat from anthropogenic influences, such as agricultural expansion, livestock overgrazing, uncontrolled fires and fodder-thatch collection. The *Bhabhar-Terai* grasslands that once extended all across the Himalayan foothills in India and Nepal are therefore now mostly confined to Protected Areas such as Manas National Park (Fig 1). The disappearance of grassland habitat is more evident from the decline in population of certain grassland obligate species such as the One-horned Rhino, Swamp deer, Hog deer, Pygmy Hog, Bengal Florican and Hispid Hare.

Previous studies clearly indicate that early succession riverine communities, typically comprising dense tall grasslands, commonly referred to as elephant grass or thatch land is the preferred habitat for these species. These grasslands are a feature of the succession between primary colonizing grasses (particularly tall grasses, on new alluvium deposited by changing water courses), through deciduous riverine forest to the Sal (*Shorea robusta*) forest climax.

Tall grassland may also form an under storey during later stages of the succession, particularly near rivers, or in forest clearings and abandoned cultivation and village sites (Chapman and Flux, 1990, Nath *et.al.*, 2010).

This report is an attempt to present a comprehensive status update on two endangered species (Pygmy Hog and Hispid hare) whose very survival is linked to active management of grasslands in Manas National Park. It also provides an up-to-date literature search and compilation on all the ecological information that is available on these species. Results indicate the potential and need to take up systematic studies and management interventions to protect the grassland habitat and these mammalian indicator species.

Fig 1: The extent of *Terai* (floodplain) grasslands in the Indian subcontinent



Section 2: Target Species Profile

2.1 Hispid Hare

Hispid hare (*Caprolagus hispidus*) belongs to order Lagomorpha and the monotypic genera *Caprolagus* of Family Leporidae and is distributed along the Bhabhar-Terai belt of India, Nepal and Bhutan and possibly a few locations in Bangladesh. The English name is Assam Rabbit or Bristly hare whereas it is known as Sesa in Bodo and Hoha pahu and Khagrakata in Assamese. In comparison to the Indian hare, they have shorter hind legs, smaller ears (5-6 cm) and a shorter tail (3 cm). The skull is with prominent supra-orbital bones and a long nasal region. The genus *Caprolagus* is monotypic *i.e.*, having only a single species the Hispid hare (Maheswaran, 2002).

a. Literature review and Conservation status

The IUCN Red List of endangered species categories Hispid Hare as 'Endangered' under Criteria B2ab (ii,iii,v) ver 3.1 (Maheshwaran and Smith, 2008). It is considered endangered as less than 500 pairs are known to occur in the wild where it exists in an area of occupancy of less than 500 km² (extending over an estimated area of 5,000 to 20,000 Km²) in highly fragmented habitats. The species is experiencing continuing decline in suitable habitat due to increasing agriculture, thatch collection, grass burning and human development (Bell *et al.* 1990, Maheswaran 2002, Jordan *et al.* 2005). It is also listed under Schedule I of the Indian Wildlife (Protection) Act, 1972.

Nation wide surveys to assess actual population status have not been done, although scattered information on behaviour and natural history is available from Indian and Nepal (Bell 1987; Bell *et.al.*, 1990; Maheshwaran, 2002; Aryal *et.al.*, 2012; Tandon *et.al.*,2013).

Bell conducted most of her studies in Nepal and based on which substantial information was made available for its natural history and behaviour. Similarly, Maheswaran's study in Jaldapara was one of the first that brought attention to the declining status in India. Only one study in 2008 has quantified the presence of Hispid hare in Manas (Nath *et.al.*, 2010) based on pellet density survey.

b. Physical characteristics

C. hispidus has a coarse and bristly coat and the ears are very short (5-6 cm) that hardly projects beyond the fur. The coat is dark brown due to a mixture of black and brown hairs and whitish on the abdomen. The tail is about 30 mm (3 cm) long. In body weight, males range from 1.81 – 2.61 kg with a mean of 2.24 kg. Females weigh in average 2.51 kg and are relatively larger than the males. The frontal bones in the skull are very wide and the

occipito-nasal length generally exceeds 85 mm (3.3 in). There is no clear notch in front of postorbital processes.

Key identification features

Hispid hare shares its habitat with the Indian hare. The Indian hare, or Rufous tailed hare, *Lepus nigricolis ruficaudatus* is smaller with a lighter coat and longer narrower ears, and prefers open areas and leaves tracks that are somewhat cat-like. The hispid hare, on the other hand, prefers dense grass cover and is larger and darker brown with shorter broader ears (5-6 cm), which are typically erect while running. The shorter tail (3 cm) is fully brown lacking the white on the underside of the tail of the Indian hare.

Hispid hares deposit symmetrical round slightly flattened dark yellowish-brown (greenish when fresh) pellets in clusters, while the Indian hare's pellets are scattered, shapeless and dark green. Apart from pellets, hispid hares can also be located by observing thatch cuttings that are very sharp and as if cut by a knife (Plate 1).

Plate 1: Field identification characters for Hispid Hare (photos by Dr Kaushik Deuti, Hispid Hare photo: Dr Bhaskar Choudhury)



c. Distribution

Historically, Hispid hares would have extended all along the Bhabhar-Terai belt of the Indian subcontinent. They occupy tracts of early succession tall grasslands and take refuge in marshy areas or grasses adjacent to river banks during the dry season, when these areas are susceptible to burning.

The current distribution in South Asia is sporadic, including the countries of Bangladesh, India, Nepal, and possibly Bhutan. The extent of occurrence of *C. hispidus* is estimated to be between 5,000 and 20,000 km², and the area of occupancy is estimated to be between 11 and 500 km², in highly fragmented populations. It occurs at elevations ranging from 100-250 m (Jordan *et al.* 2005).

C. hispidus has records of occurring in several protected areas, including Royal Suklaphanta Wildlife Reserve in Nepal, Royal Bardia Wildlife Reserve in Nepal, Dudwa National Park in Uttar Pradesh, Pilibhit Forest Division in Uttar Pradesh, Royal Chitwan National Park in Nepal, Valmiki Wildlife Sanctuary in Bihar, Jaldapara Wildlife Sanctuary in West Bengal, Ripu Reserve Forest in Assam, Manas National Park and Tiger Reserve in Assam, Subankhata Reserve Forest in Assam, Barnadi Wildlife Sanctuary in Assam, Khalingduar Reserve Forest in Assam and in Kanha National Park in Madhya Pradesh (Bell, Oliver & Ghose, 1990; Maheswaran 2002; Jordan *et al.* 2005). A survey conducted in 2001 found no evidence of the presence of *C. hispidus* in Buxa Tiger Reserve, where it had been reported as occurring in the 1980s (Maheswaran 2002).

The current status of previously reported occurrences in remnant grasslands of Mymensingh in Bangladesh (Chapman and Flux, 1990; Maheshwaran and Smith, 2008) and Khaling Wildlife Sanctuary in Bhutan is not known.

Within Assam they have been reported from a few Protected Areas, viz., Manas Tiger Reserve, Barnadi Wildlife sanctuary, Subankhata and Khalingduar Reserve Forests and Orang National Park to D'Ering Memorial Wildlife Sanctuary in Arunachal Pradesh (Nath, 2009; Nath *et.al.*, 2010)

Population estimation

Limited information could be obtained about their actual population status although Aryal and Yadav (2010) assumed a world population of approximately 300 individuals throughout its distribution scattered over fragmented landscapes.

Bell in (1990) estimate the density of hispid hare in suitable habitat (unburned tall grassland) as 1/1.47 sq km, whereas Aryal *et.al.*, (2012) estimated a population density of 5.76 individuals/ sq km and a population size of 219 ± 40 hispid hare within the 41 sq km

grasslands of Shuklaphanta Wildlife Reserve in Nepal. Similarly, Tandon *et.al.*, (2013) confirmed the presence of Hispid hare from approx 9 sq km area of Bardia National Park in Nepal with a population density of 0.452 and 0.967/ha before and after the burning seasons.

From the above, it is understood that the species may be doing well locally (given the abundance of fresh and old faecal pellets) within Protected Areas (Maheshwaran, 2002; Nath, 2008) but the extent of habitat fragmentation (including loss of grassland areas outside PAs) and the impact on limited dispersal and breeding constraints during flooding (wet season) may be few factors for their disjunct distribution.

d. Habitat

Based on studies in Jaldapara Wildlife Sanctuary in India (Maheshwaran, 2002) and Nepal (Bell, 1987; Aryal *et.al.*, 2012; Tandon *et.al.*, 2013) it is learnt that they are randomly distributed in flat terrain dominated by thatch grass *Saccharum spontaneum* and that they primarily use tall grassland habitat. In Manas, random distribution of Hispid hare was observed within tall and short grasslands (Nath *et.al.*, 2010). During winter, pellets occurred more in grasslands dominated by *Imperata cylindrica* followed by *Saccharum narenga* indicating the preference of shorter grasslands during winter. However, it is likely that Hispid hare use tall grasslands more frequently than short grassland patches (Maheshwaran, 2002).

Grass clumps also play a vital role in the hare's biology providing them cover and shelter from predators. During the dry season, most grassy areas are subject to burning and the animals take refuge in marshy areas or grasses adjacent to river banks that are not susceptible to burning (Bell *et al.* 1990).

e. Behaviour and Reproduction

There is very limited information available on the reproduction of the species. From the single foetus found in a pregnant female hispid hare in Nepal (Bell, 1987) and the single infant born to a female in captivity in Assam in 1976 (Oliver, 1980) it seems that *C. hispidus* probably has a small average litter size.

Hispid hare is both structurally and behaviourally more of a rabbit than a hare and hence does not live in burrows. The home range of hispid hare is restricted to mean area of 8.2 sq km for males and 2.8 sq km for females within the dense cover provided by unburned tall grassland. Overlapping home ranges revealed by radio-tracking studies in Royal Sukhlaphanta Wildlife Reserve in Nepal suggest that these animals live as pairs, although the total home range of individual males is larger than that of individual females (Bell, 1987). The species is probably monogamous and breeds during the winter (Bell, 1987).

They prefer to feed at night and a single animal can feed up to 18 clumps in one night. Hispid hare consumes the inner core of the stem after carefully removing the outer bark.

19 plant species were identified in hispid hare pellets at Suklaphanta Wildlife Reserve (Aryal *et.al.*, 2012) whereas 23 species were found in Bardia Wildlife Reserve (Tandon *et.al.*, 2013) with 5 most preferred species being *Saccharum spontaneum*, *Imperata cylindrica*, *Dinostachya bipinnata*, *Cynodon dactylon* and *Saccharum munja*. The food plants were proportional to the grass species present in the habitat.

Maheshwaran (2002) found that Indian and hispid hare rarely utilise the same grass patches and that nests (or warrens) were constructed by hares in the breeding season. During winter, the hares usually inhabited higher areas where the grass was very dense, but not tall. In the summer, they moved closer to tall grass patches near streams and waterlogged areas. In Manas, Nath (2010) found 11 nest-like structures which were shallow depressions of about 7.5–10.5cm deep and 17.5–25.4cm wide. The nest bed was carpeted with finely chopped grasses and fresh pellets of both small and large sizes were present nearby indicating active usage of such areas.

h. Threats

Being an obligate grassland species, the primary threat to *C. hispidus* population is the loss of the habitat itself. These can be due to several factors such as encroachment and subsequent land use conversion (to agriculture), extensive grass burning, grass cutting, livestock grazing and spread of invasive species.

The natural spatial and temporal dynamics of the tall grassland habitat, particularly the fire cycles, are critical factors that are important to the conservation of this species (Bell *et al.* 1990, Maheswaran 2002). Fires may be considered as the necessary evil, as they naturally arrest the succession of grasslands into woodlands, although an uncontrolled late burning that coincides with their breeding season may also be quite fatal. Besides, habitat loss, hunting for meat can also be a potential threat in non-protected areas, although any direct correlation has not been made.

2.2. Pygmy Hog

The Pygmy hog (*Porcula salvania*) is a critically endangered species belonging to the Family Suidae. It was previously spread across India, Nepal, and Bhutan, but now only confined to a few areas in Assam. Locally it is called as Nal Gahori, Tukuri Borah in Assamese, Oma Thaoukri in Bodo and Sano Banel in Nepali language. Current world population is estimated at about 150 individuals or fewer (Narayan *et.al.*, 2008). The species was formerly referred to as *Sus salvanius* as it was believed to be closely related to the

Eurasian wild pig (*Sus scrofa*). However, recent mitochondrial DNA studies have revealed that it belongs to a separate monotypic genus *Porcula* (Funk *et al.* 2007)

a. Literature Review and Conservation status

The assessment status of IUCN lists it as Critically Endangered because its population size is estimated to number fewer than 250 mature individuals, with all individuals located in a single subpopulation at Manas Tiger Reserve (Narayan *et.al.*, 2008). Since then, captive bred individuals have also been reintroduced into other Protected Areas such as Nameri and Orang National Parks and Sonai Rupai Wildlife Sanctuary in Assam (Narayan, 2006). The species is also listed under Schedule I of the Indian (Wildlife) Protection Act, 1972. The pygmy hog is the sole host of the pygmy hog sucking louse *Haematopinus oliveri*, incidentally also classified as endangered because of the precarious status of its host (Raman, 2008)

b. Physical characteristics

The Pygmy hog is about 60 cm long, with a shoulder height of about 25 cm and a body weight of 6-8 kg. Males tend to be larger than females. Both sexes are dark grayish brown overall, with rather sparse hair and no distinctive markings. The body is roundish, short-legged and streamlined, well-adapted to moving through tall, dense grasses. The tail is extremely short (about 3 cm). Males have sharp tusks which protrude inconspicuously from the mouth and can inflict gashes as deep as those of the Wild boar. There are no facial "warts" present, but adult males typically develop a "moustache" of long, pale hairs above their upper lip.

Key identification features

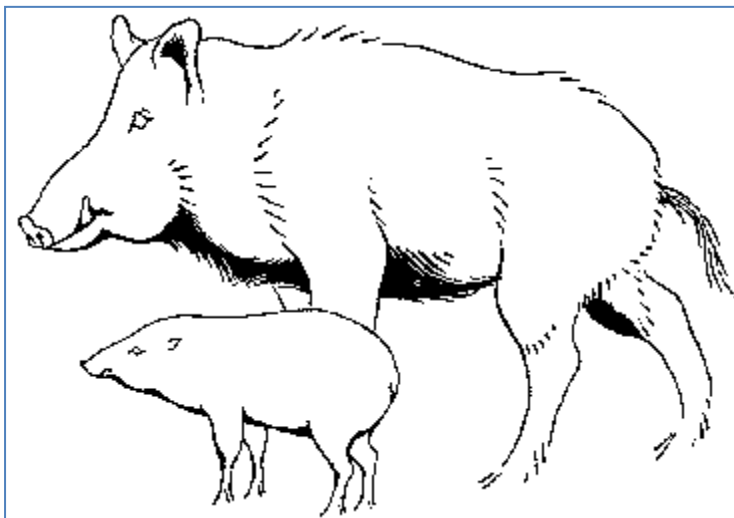


Fig 2: Adult male of the common Wild Pig (*Sus scrofa*) and Pygmy hog (*Porcula salvania*) drawn to the same scale. (Ref : Oliver, 1980)

Although, they may share similar habitats, the pygmy hog is extremely distinct on account of its small size. In fact on a fleeting glance, adult pygmy hogs may be confused with a young wild boar but they lack the characteristic stripe pattern and at that age the latter are also likely be accompanied with the mother.

Plate 2: Field Identification characters for Pygmy Hog (Photos: Dr Kaushik Deuti)



c. Distribution

Although no written records exist but until the beginning of 19th century it is likely to have occurred in tall, wet alluvial grasslands extending in a narrow belt south of the Himalayan foothills from north-western Uttar Pradesh and southern Nepal to Assam, possibly extending at intervals into contiguous habitats in southern Bhutan (Oliver 1980). There were unconfirmed reports from Gorumara NP in West Bengal (Sanyal, 1995). The Bhutan Forest department website also indicates pygmy hog as a protected species as per law and therefore it is likely to occur in grassland patches contiguous with the Manas National Park in India.

The last five decades have been significant towards pygmy hog conservation in India and hence it is relevant to describe it briefly here. In 1964, the renowned naturalist and tea planter E.P. Gee said in his book, *The Wildlife of India*, that “we have perhaps lost the species”. The 1971 rediscovery was credited to another tea planter, J. Tessier-Yandell, who found pygmy hogs being sold in a tea garden market near the Barnadi Reserve Forest in north Assam (Mallinson, 1971; Oliver, 1980). It is learnt that after the rediscovery (that also led to confirmation for hispid hare), an attempt was also made to captive breed the pygmy hogs on a tea plantation between 1971 and 1976 and that a large number of piglets were also born in captivity (Mallinson, 1977), however no subsequent information is available after that. It is only around 1985 that Sanjoy Deb Roy and William Oliver published reports about wild Pygmy Hogs in Manas National Park that their presence was reiterated. An attempt to captive

breed them in an enclosure was also made between 1988 and 1989 but it is likely that they would have perished or escaped by 1992 as no record is available after that.

By end of 1995 it is was more or less confirmed that the pygmy hog population was drastically decimated in the wild and the only viable population was now confined within Manas National Park in the whole world (Narayan and Deka, 2002).

In 1996, a collaborative project titled 'Pygmy Hog Conservation Programme' began conservation breeding with six founder animals from Manas National Park brought to a special facility at Basishtha near Guwahati in Assam. It has since expanded to two captive breeding facilities housing over 60 animals, with reintroductions to the wild beginning in 2008. As per information available in 2013, 74 captive-born hogs have been released in Sonai Rupai Wildlife Sanctuary and Orang National Park, and signs of successful breeding have been observed.

Population status in the wild

An unconfirmed report places the population at 72 for Manas NP and about 50 for Barnadi Wildlife sanctuary in 2002. Similarly, population density in suitable habitat has been estimated at 19 individuals per sq km. There is a need to undertake a comprehensive population estimation of the species in the Manas Tiger Reserve.

d. Habitat

Pygmy hogs occupy typical floodplain habitats, such as secondary successional forests, dense tall grasslands and mixed scrub associations. Grasslands dominated by *Narenga porphyrocoma*, *Saccharum spontaneum*, *S. bengalensis*, *Imperata cylindrica* and *Themeda villosa*, forming characteristic grass associations of 2 to 3 m height is their favourite habitat.

Mary *et.al.*, (2013) found that in Manas, species with highest Importance Value Index (IVI) was *Narenga porphyrocoma* (26.61) followed by *Cymbopogan martenii* (20.25), *Saccharum spontaneum* (19.06), *Imperata cylindrica* (17.98), *Commelina sp.*(17.63), *Arundinella bengalensis* (17.05), *Commelina bengalensis* (15.54). *Narenga porphyrocoma* is mainly used by Pygmy hog for nest building purpose. It also feeds on the root of *Narenga porphyrocoma*, *Cymbopogan martenii*, *Saccharum spontaneum*, *Imperata cylindrica*, and *Arundinella bengalensis*.

Most such communities are subject to wide-scale annual burning and accordingly characterised by a low diversity and a preponderance of a few, fire-resistant grasses and therefore almost certainly may constitute sub-optimal habitats for pygmy hogs. The species is

not found in areas subject to prolonged inundations during the monsoon. (e.g., structurally similar grasslands located in riverine floodplains as in Kaziranga National Park).

e. Biology and Behaviour

Average age of Pygmy Hogs is about 14 years in captivity. They attain sexual maturity between 13 to 33 months. The species seems to have hardly any defence against the varied predators, except sharp instincts, aided by excellent eyesight, olfaction and hearing. The animal freezes on sensing danger and suddenly bolts at high speed. In the thick tall grass they occupy the grass tunnels they use for their movements and their crepuscular activities, all seem to aim at avoiding predation (Deb Roy, 1995).

The animal is omnivorous and consumes roots, tubers, grass, leaves, insects, earthworms, eggs and carrion. Foraging occurs for approximately 6 to 10 hours a day, pausing midday to escape the heat.

It is believed to be non-territorial and lives in small family groups, known as 'sounders' of four to five, comprising one or two adult females and juveniles and occasionally an adult male, usually during the rut (Oliver, 1980). The animals are shy but can be tamed. They tend to forage in small groups. Soft grunting calls are used to maintain contact between individuals within their dense habitat. They often groom each other.

Males are solitary except for during the mating season, which begins towards the end of November. Rival males compete for access to females during this time and use threatening displays; adopting a broadside stance, raising their hair bristles and turning their heads, yawning and curling the lips to show their canine teeth. Reproduction is very seasonal; mating typically occurs very early in the year (January or February) and the vast majority of births occur in late April and May, at the beginning of the monsoon. Pregnant females move away from their group to give birth, usually to a litter of 4-6 piglets after a gestation period of around 120 days. Infants remain hidden in their nests for about one week and develop vague reddish stripes approximately one month after birth. Pygmy hogs are unusual in that both sexes use nests year round. The whole family makes use of the nest constructed in a depression on the ground and lined with grasses. Groups occupy small home ranges of about 25 hectares and regularly use paths that can be seen amongst the tall elephant grasses. Travelling single file, the adults of the group take up the front and the rear of the procession (Oliver, 1980). But even so, the sub-adults are much more prone to predators because of their tiny size (mean weight only about 200 g at birth) and lack of protective capability of their mothers. Deb Roy (1995) observed piglets being taken by birds

of prey and even by a Water Monitor lizard (*Varanus salvator*) at Manas National Park. He noted that the percentage of survival of even one individual per litter is doubtful and it was only in one case that he came across two yearlings following their mother. He therefore concludes that it is a very delicate species and requires very careful handling.

f. Threats

Pygmy hog shares similar habitat characteristics such as the Hispid hare although given its restricted range distribution, it is likely to be more susceptible to even minor modifications in its habitat. By now it is clear that loss from its former range, especially outside Protected Areas is due to loss of habitat and over hunting as it was considered extremely palatable by the tribes (Oliver, 1980, 1981, 1989; Oliver and Deb Roy, 1993; Narayan and Deka 2002). Some forestry management practices, such as promoting timber tree species in grassland areas and indiscriminate use of fire to create openings or to promote fresh growth of grass, have also been detrimental in the long run. These losses strongly reinforced the overwhelming importance of the largest and by the early to mid-1980's, only known surviving population in the Manas (Oliver, 1981, 1989; Oliver and Deb Roy, 1993).

There are many species of tall grasses, which are found in the Indian subcontinent. The most important of these communities for Pygmy Hogs are those which tend to be dominated by *Saccharum munja*, *S. spontaneum*, *S. bengalensis*, *Themeda villosa*, *Narenga porphyrocoma* and *Imperata cylindrica* which form characteristic associations of 1 to 4 m height during secondary stages of the succession on well drained ground. These communities are not, therefore, maintained by prolonged inundation, though they may be maintained by periodic burning. However, as they also include some of the most commercially important thatching grasses, some of these areas (including many of those in protected areas) are harvested annually and virtually all of them are subject to wide-scale annual burning.

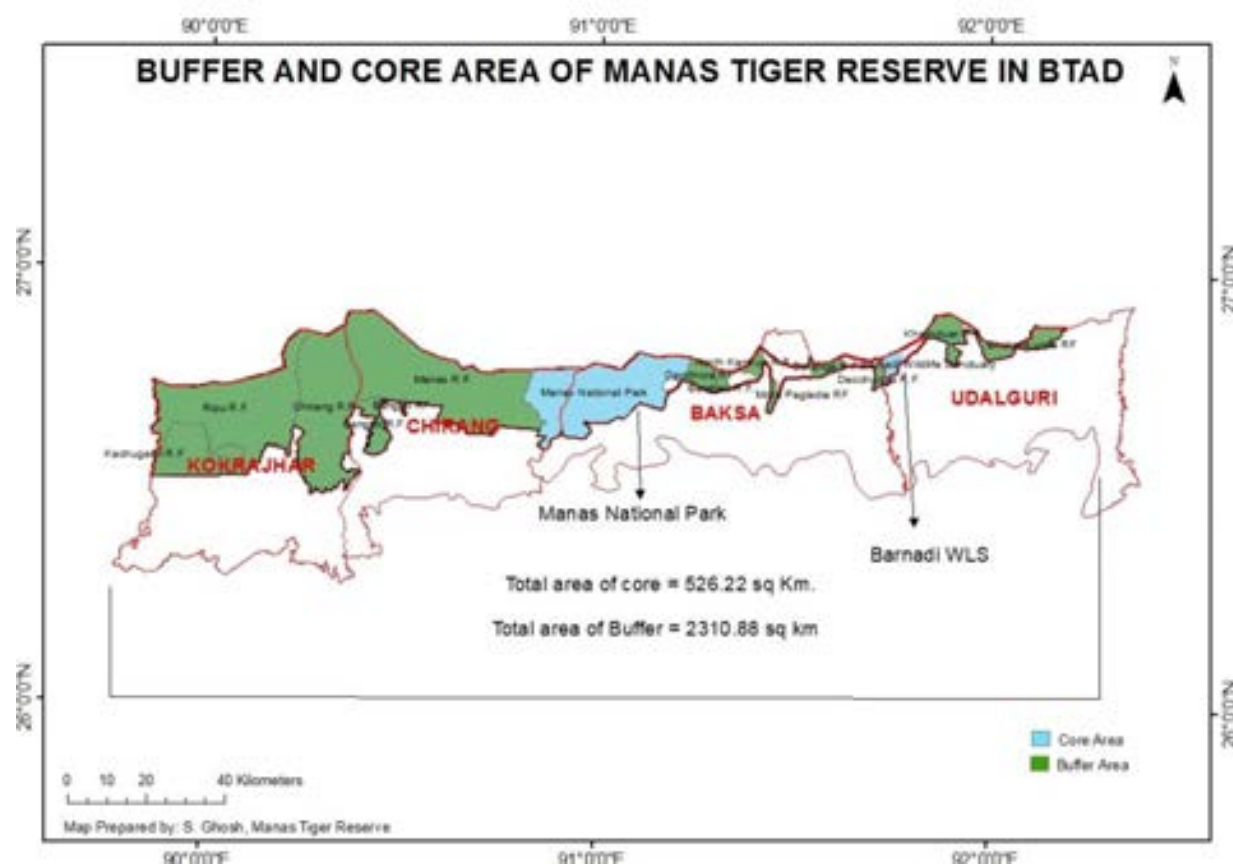
Although it has been suggested by ecologists that any burning be conducted at the beginning of the dry season (in December or early January) in alternate blocks (demarcated by fire-lines) and only once in 2-3 years, most of the grasslands continue to be burnt every year in the dry season as various bio-climatic factors come into play. The later period (March-May) burning is considered as 'hot' burn and is extremely detrimental to all wildlife species.

Section 3: Study Area

3.1 Location

The Manas National Park occupies an area of 500 sq. km., which forms the core area of the Tiger Reserve (2837 sq. km) (Fig. 3). It is located at the foothills of the Bhutan Himalayas in Baksa and Chirang districts of Assam ($26^{\circ}35'-26^{\circ}50'N$, $90^{\circ}45'-91^{\circ}15'E$). It spans on both sides of the Manas River and is restricted to the north by the international border of Bhutan, to the south by thickly populated villages and to the east and west by reserve forests. Elevation ranges from 50 m MSL on the southern boundary to 250 m MSL along the Bhutan hills. The Manas National Park is located at the junction of Indo-Gangatic, Indo-Malayan and Indo-Bhutan realms and is a key conservation area in the Jigme Dorji-Manas-Bumdeling conservation landscape in the eastern Himalayan eco-region (Wikramanayake et al, 2001). It is situated in the eastern duars and has extensive Bhabar and some terai grassland areas that are typical of the Himalayan foothills.

Fig 3: Map of Manas Tiger Reserve, indicating the core areas of Manas National Park and Barnadi Wildlife Sanctuary



3.2 Grassland habitat characteristics:

Micro-climate

The climate can be divided into four distinct seasons on the basis of variation in rainfall, temperature and winds (Borthakur, 1986). These are winter (December-February), pre-monsoon (March-May), monsoon (June-September) and retreating monsoon (October-November). The humidity levels are high and can reach up to 76% relative humidity. It rains from mid-March to October with most rain falling during the monsoon months from mid-May to September, flooding the western half of the Reserve. The mean annual rainfall is 3330 mm. November to February is relatively dry when the smaller rivers dry up and there is an acute water shortage in the Bhabhar areas (Deb Roy, 1991). The mean maximum summer temperature is 37°C and the mean minimum winter temperature is 5°C.

Floristic composition

Based on studies carried out by Sarma *et.al.*, in (2008) the landuse/landcover of MNP has been delineated as follows:

a) Woodland: This comprises of tree species mostly belonging to semi-evergreen forest and moist mixed deciduous forest. The semi-evergreen forest is represented by *Pterospermum acerifolium*, *Dysoxylum binectariferum*, *Phoebe goalparensis*, *Amoora wallichii*, *Sterospermum personatum*, *Chukrassia tabularis*, *Duabanga grandiflora*, *Michelia champaca*, *Linnea coromandelica* and *Sterculia villosa*, while the moist mixed deciduous forest is represented by *Bombax ceiba*, *Lagerstroemia flosreginae*, *Careya arborea*, *erminalia bellerica* and *Gmelina arborea* among others. The area under this category is 233.31 Km² and it is distributed mostly in the northern part and in the extreme south-west of the Park.

b) Savannah grasslands: This type of grasslands is dominated by tall grasses such as *Narenga porphyrocoma*, *Imperata cylindrica*, *Phragmites karka*, *Arundo donax*, *Saccharum spontaneum*, *Themeda arundinacea*, *Saccharum procerum* and *Vetiveria zizanioides* that are interspersed with tress such as *B. ceiba*, *Dillenia indica* and *L. flosreginae*. The total area under this category is 161.98 Km². This land cover type is distributed in the north-eastern part as well as the southern boundary of the Park touching the villages.

c) Alluvial grassland: The area under this category is 44.49 Km². This land-cover type is scattered all over the Park. It is characterized by pure patches of grasslands and presence of water during the rainy season. These alluvial grasslands have been critical to the survival of mega herbivores such as the rhinoceros and swamp deer in the past.

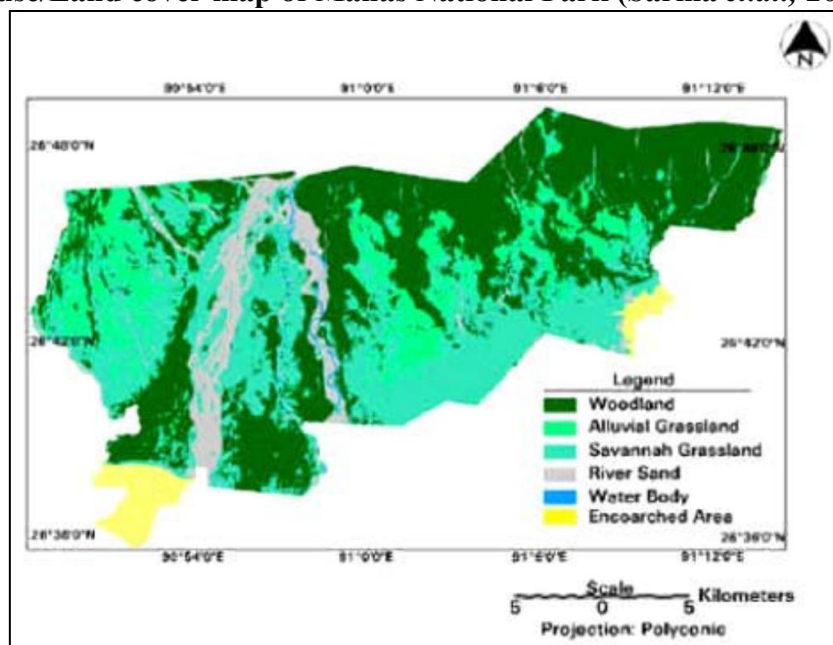
d) Waterbodies: The area under water bodies (numerous small wetlands and rivers) is 3.94 Km². The water bodies are mostly distributed towards the southern boundary near the Bansbari Range, as is typical in a Bhabhar–Terai formation.

e) River Sand: The area under this category is 35.82 Km². River sand banks devoid of any vegetation are mainly concentrated around the dried river bed of Manas. The change in course by the rivers Beki and Manas along with excessive siltation during the rainy season have resulted in the expansion of such areas.

f) Encroached area: The area under this landuse type is 20.47 Km². It is distributed in two major areas at the extreme southwest and extreme southeast part of the Park.

This study also indicated that alluvial grasslands have reduced drastically (by about 46.8%) since 1977. The major causes have been attributed to siltation of existing water bodies, invasion of exotic weeds like *Eupatorium* sp., *Melastoma* sp., *Lea* sp., marked augmentation of *Bombax ceiba* and *Dillenia pentagyna* saplings and or lack of a suitable burning regime in the surrounding savannah grasslands. These grasslands are naturally dynamic and subjected to altered flooding regime due to change in the river course and are subjected to additional disturbances from fire, grass collection, grazing, encroachment and agricultural conversions.

Fig 4: Land use/Land cover map of Manas National Park (Sarma *et.al.*, 2008)



3.3 Justification for intensive sampling:

Based on the background information that was available, it was decided to sample in prime alluvial grassland areas within Manas National Park rather than spreading the effort to the entire landscape.

Section 4: Methodology

4.1 Field Methods

A detailed methodology including areas to survey was calculated apriori based on Google earth maps and local information. 11 camps were identified for survey in the first Phase. Sign surveys and Belt transect (100 x 2 m) were planned after the sign surveys was completed on these 11 locations. However, due to paucity of time, only sign survey based on a fixed data sheet (Annexure 1) was conducted and other plausible areas were also included in the end. Sign survey was particularly designed to look for hispid hare pellets, pygmy hog nests and droppings. Pellets from other herbivores such as Sambar, Hog deer and swamp deer were also recorded.

The details on the selected locations are as follows:

Sl.No.	Name of camp	Range	Approximate Survey Area	Intensive Sign survey trail length (Minimum survey effort)	Team Leaders
1	Kuribeel	Bansbari	3.2 sq.km	5-7 km	Bibhuti and Gitanjali
2	New Buraburi	Bansbari	1.62 sq. km	2-3 km	Anukul
3	Buraburi	Bansbari	0.46 sq.km	1-2 km	Kaushik
4	Rhino Camp	Bansbari	0.96 sq.km	2-3 km	Sonali and Bhaskar
5	Bangale Haathdhowa	Bansbari	3.06 sq.km	3-4 km	Dipankar
6	Uchila	Bansbari	1.4 sq.km	2-3 km	Charles
7	Mainao	Bansbari			Aysho
8	Chorpuli	Bansbari	0.6 sq.km	1-2 km	Namita
9	Rupahi (west)	Bhuyanpara	1.8 sq.km	2-3 km	Jyoti
10	Aboidara	Bhuyanpara	1.6 sq.km	1-2 km	Alolika
11	Kanchanbari	Bansbari			Sonali, Gitanjali and Kaushik
12	Makhibaha	Bhuyanpara			Anukul, Dipankar
13	Betbari	Bhuyanpara			Charles, Aysho

The actual survey was carried out from 19th to 22nd March and the first day was spent in reconnaissance and a visit to all the select locations by the team members. Arrangements were done for logistics (vehicle, ration, data sheets, GPS and cameras, wireless etc.) were made for the smooth beginning of the exercise. For the next two days, areas within the camp locations were intensively searched by walking in a specific direction, usually in a straight

line. The field staff were also made aware of the basic difference in pellets of hispid hare and Indian hare.

Obtaining Satellite Data

Since fire was a critical factor that was impacting the presence of obligate species such as Pygmy Hog and the Hispid Hare, it was necessary to try and find a spatial occurrence of fires if any in the study area.

Fire on the Earth's surface can be detected by space-borne satellite sensors (MODIS sensor onboard the Aqua and Terra satellites) as a thermal anomaly on a regular basis. Active fire locations are processed by the MODIS Rapid Response System using the standard MOD14 Fire and Thermal Anomalies Product and is available free of cost via the website, <http://earthdata.nasa.gov/data/near-real-time-data/firms>. Each active fire location represents the centre of a 1 km pixel that is flagged by the algorithm as containing a fire within the pixel. Dataset corresponding to the study period (October 2013 - March 2014) was downloaded for the Manas National Park. Each fire point contained information on the exact time and day of detection, a global geo reference system location (longitude and latitude), the brightness of the fire and classified confidence level.

Similarly, previously available Land use/Land cover map for Manas National Park for the year 2010 (Based on Landsat TM data of December 2010; Ghosh, 2013) was resampled to Forest/Non-forest areas within the study area. The presence of Pygmy hog and Hispid Hare locations were plotted against it to make preliminary assessments for habitat use.

All spatial and non-spatial data was analysed using MS-Excel and Arc GIS ver 9.3.

Section 5: Results and Discussion

5.1 Pellet Survey for Hispid Hare

Contrary to our expectations, Hispid Hare pellets were found in almost all the sites surveys and that too with a fairly high abundance. Except for Chorphuli and Buraburi camps, majority of locations recorded more than 50 pellet groups in a particular site. No pellet groups were found in Betbari area. Majority of these were old (and also burnt) as the areas surveyed had already been burnt. In a few locations (example Kuribeel and New Buraburi camp) fresh pellets (greenish in colour) and grass cuttings were obtained indicating active habitat use by the species.

Fig 5: Hispid Hare (pellet) occurrence in Manas National Park

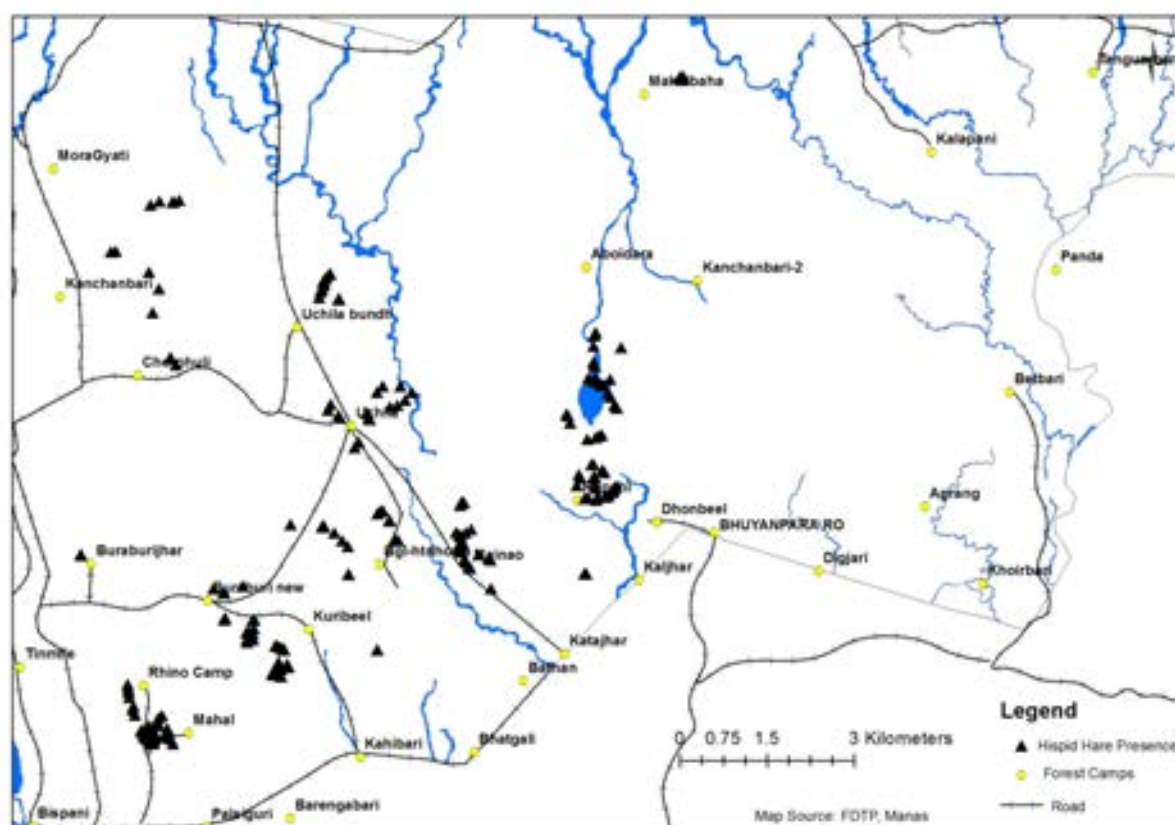
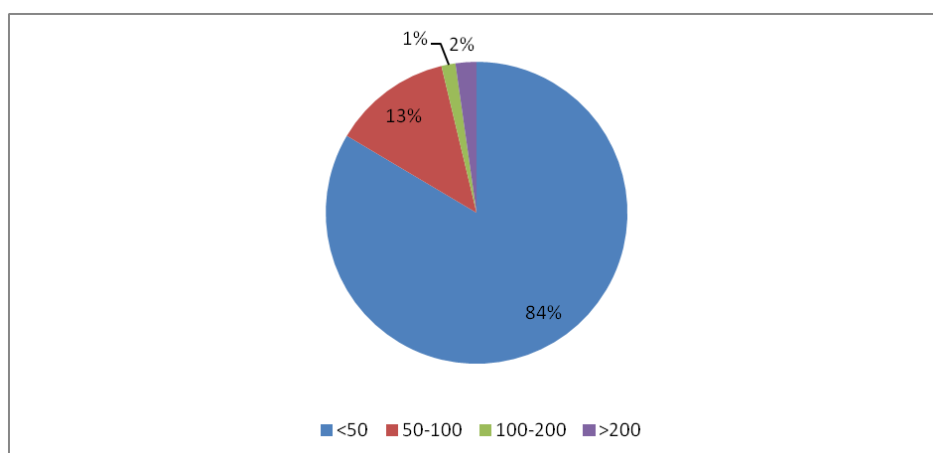


Table 1: Average Pellet frequency recorded for Hispid Hare in Manas National Park

No. Of Pellets	Frequency	Pellet pile	Frequency
<50	224	Fresh	35
50-100	34	Old	224
100-200	4	Degenerated	9
>200	6		

Fig 6 : Percentage of pellet groups recorded for Hispid Hare in Manas National Park



Based on the total km walked, the highest number of pellets were found at Rhino camp, although the total encounter rate/ km was highest in Kuribeel followed by Uchilla Bandh.

Table 2 : Encounter Rate of Pellet pile of Hispid Hare in different camp site.

Sl. No.	Name of the camp	Total Km walked	No. of pellet pile	Encounter rate/km
1	Kuribeel	4.4	37	8.40
2	Rupohi	4.5	33	7.33
3	New Buraburi	6.2	21	3.38
4	Uchilla Bandh	2.2	14	6.36
5	Makhibaha	2	9	4.50
6	Rhino Camp	10.02	50	4.99
7	Bengal	9.46	18	1.90
8	Kanchanbari	5.8	9	1.55
9	Mainao	4.9	31	6.32
10	Uchila	7.33	17	2.31
11	Abaidora	7.67	22	2.86

Table 3 : number of Hispid Hare pellet piles with relation to total km walked at different camp sites in Manas National Park

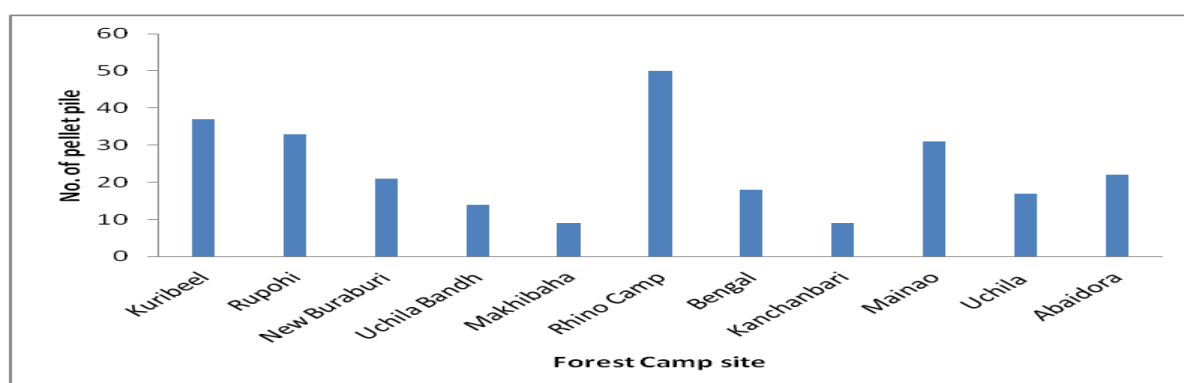
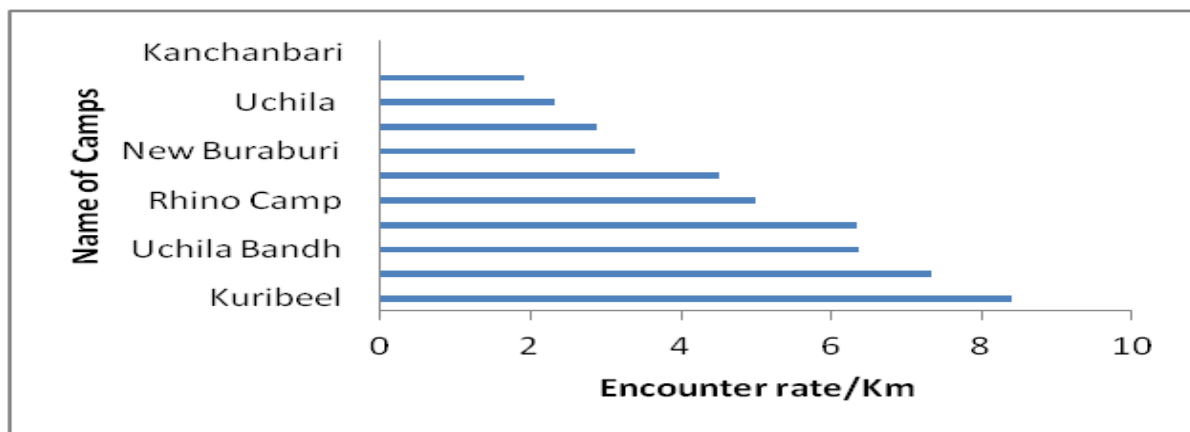
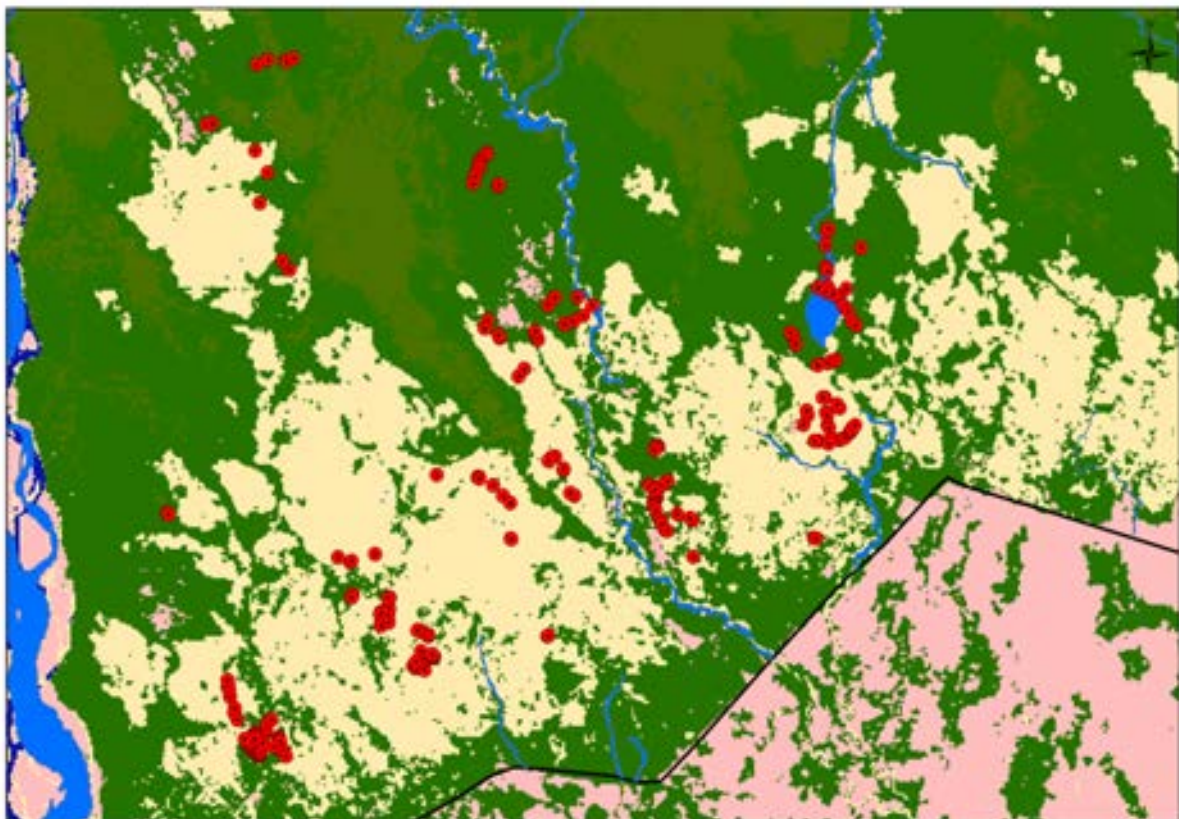


Fig 7 : Encounter rate pellet groups/km for Hispid Hare at Manas National Park



On plotting the Hispid hare presence locations on a forest/grassland map, it was clearly indicated that they showed a habitat preference for the short alluvial grasslands. A few locations that were located at Uchila bundh were at the forest-grassland edge, indicating a temporary refuge in the intervening savannah during the burning season.

Fig 8: Hispid hare distribution in relation to landuse in Manas National Park (Light yellow areas are grasslands)

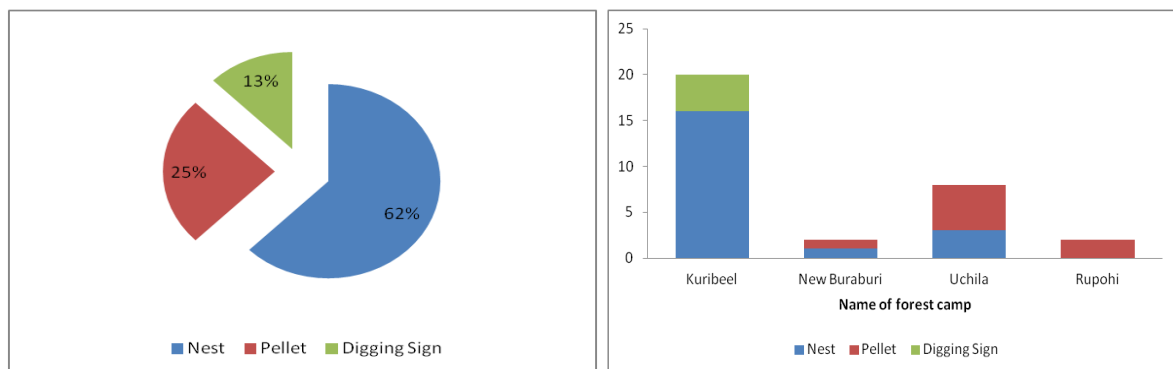


5.2 Sign survey for Pygmy Hog

Inspite of the short duration of the sign survey, it was highly encouraging to obtain active nests and droppings of this critically endangered mammal. Four out of the 14 locations surveyed confirmed the presence of pygmy hog, out of which the highest presence was recorded at Kuribeel, followed by New Bura Buri, Uchila and Rupahi camps.

Sign Type	Name of the Camp			
	Kuribeel	New Buraburi	Uchila	Rupahi
Nest	16	1	3	-
Pellet	-	1	5	2
Digging Sign	4	-	-	-

A total of 20 nests were found out of which at least 3 were actively used by the animals.



Almost all locations of Pygmy hog presence were reported in the grasslands, indicating a clear preference for the species to remain in such areas.

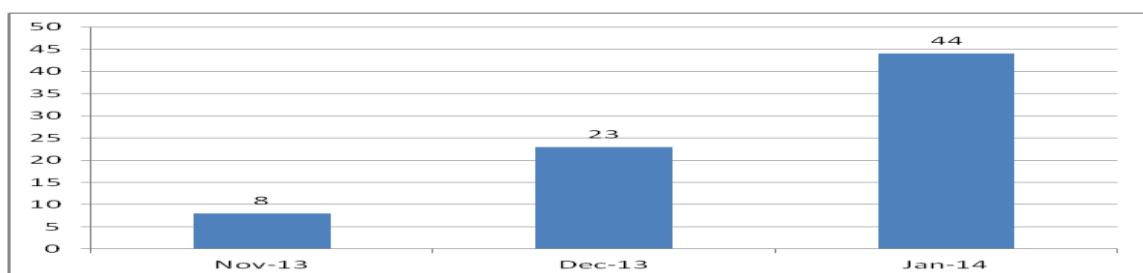
Fig 9: Pygmy hog distribution in relation to landuse in Manas National Park (Light yellow areas are grasslands)



5.3 Fire and Species interactions

A total of 75 incidences of grassland fires were captured by space-borne instruments (MODIS sensor on Terra/Aqua satellite) for Manas National Park between October 2013 - March 2014. Incidentally, all the control burning had been completed by January 2014 in the target area indicating an early burn this time (Map).

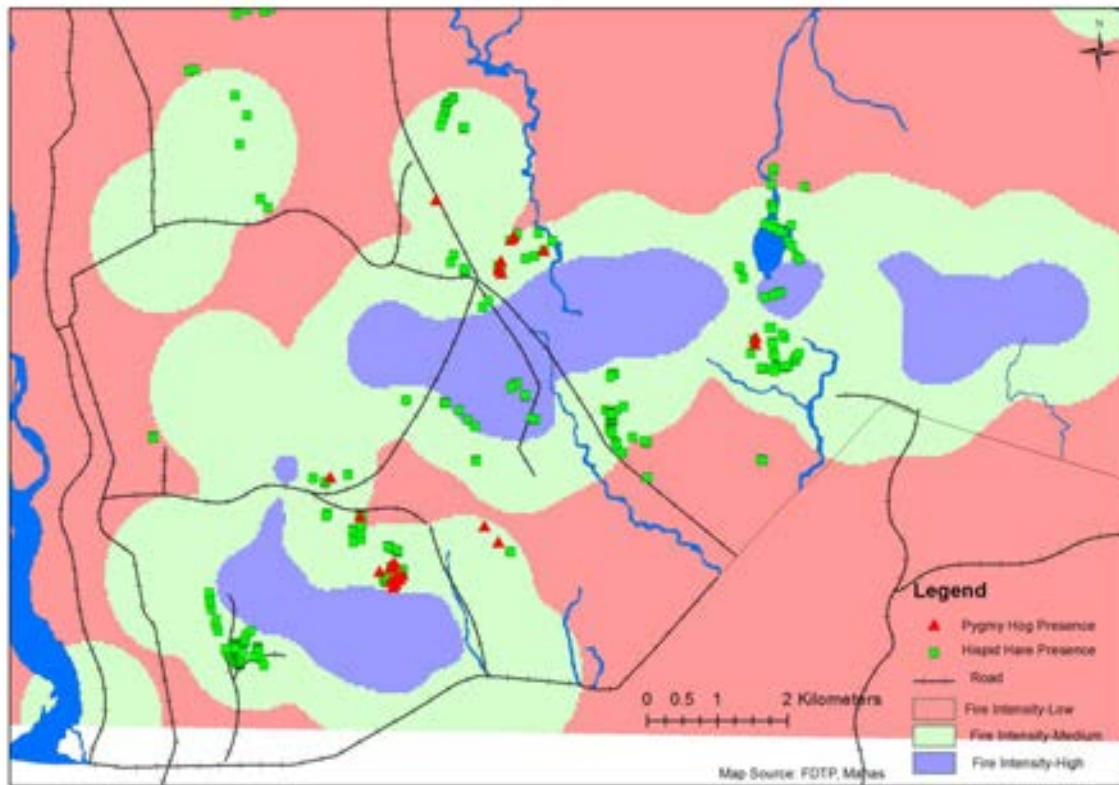
Fig 10: Number of grassland fires recorded between October 2013 - March 2014 in Manas National Park



Fire intensity was calculated based on the frequency of repeated occurrence in the study area and the species presence map superimposed on it. All Pygmy hog presence sites clearly avoided the high intensity burn sites, and were present in areas which had intermediate intensity of burning. This clearly indicated the preference for burnt areas in tall grasslands, albeit with sufficient cover. Hispid hare pellets were also distributed in all the

three strata (High, medium and low burn areas) although they also showed a preference for the intermediate burn areas.

Fig 11: Fire intensity (Sep 2013- April2014) Map and occurrence of Pygmy Hog and Hispid Hare in Manas National Park.



5.4 Other animals sighted and recorded

During the survey, direct sightings for other endangered grassland species such as Swamp deer, Hog deer and Bengal Florican was also obtained. Swamp deer was sighted twice by the survey team at Aboidara and New Buraburi areas, similarly at least 8 Bengal Florican males were sighted at Kuribeel and the Seed Farm areas respectively. Almost all the camp sites had pellet groups for Hog deer and in some cases for Sambar, Barking deer and Wild boar. Elephants, wild buffaloes and Gaur were sighted in large herds at Bura buri where they were actively using the camp site.

Section 6: Conclusion

6.1 Discussion:

The survey for grassland species in Manas National Park brings out important evidence for the presence of Hispid Hare and Pygmy Hog at the study sites. It also indicates the success of non-invasive methods such as sign surveys for regular monitoring of these species.

Plausible threats

1. **Grassland Fires:** As indicated by previous studies the most crucial point is that the season of grassland burning coincides with the breeding season for the target species. The fire not only demolishes the cover and food but can also be fatal for escaping animals. Fire is also lit by illegal graziers who want to bring in their livestock and also for opportunistic hunting of any escaping animals. However, our results clearly show that grassland fires are subject to annual micro-climatic fluctuations that are likely to cause an early/late burn if left to on a 'natural' basis. Active management of fire (as a control burn) in the early winter (Nov-Jan) would require a systematic approach.

Fire is a necessary evil and the main factor governing is the overall climatic response of that particular year. It has been observed that in some years it is very dry and fires sets in early (as in 2013) whereas in other years a winter shower can occur and keep the grass wet and ready only for a late burn. The other issue is the overall attitude and objective using grassland burning as a wildlife management tool. In certain areas of the park (such as Chorphuli) the area tends to be wetter even during the driest months (Feb-March). The general attitude of forest staff, especially Mahouts is that the grass is not ready to be burnt and therefore must be left to dry. Even if they are urged to burn the grass, it remains partially burnt which does not serve the purpose of managing mega herbivores such as rhinos and elephants.

2. **Spread of Invasive species:** A separate study (Bibhuti Lahkar pers comm.) that is currently ongoing at the National Park indicates that a large tract of prime grassland habitat is currently under threat from the spread of invasive species such as *Mikania scandens*, *Lea indica*, *Eupatorium odoratum*, *Plectranthus ternifolius*, *Ageratum conyzoides*, *Mimosa pudica*, *Osbeckia spp.* *Lantana camara* etc. While some of these species may be native to the area and also palatable to other animals, the fact that they 'overpower' grass patches with their spread is a cause of worry. Further, invasion is also happening due to tree species like *Bomax ceiba* and *Dillenia pentagyna* that are likely to be promoted due to periodic burning.

3. **Livestock overgrazing-** In the absence of grazing reserves, the local people also let their unproductive cattle (Cow, Buffalo and Sheep) inside the Park for grazing, which degrades the habitat and cover for wild animals and also results in compacting of soil and promotion of invasive species. Domestic cattle are also a cause of zoonotic diseases that can spread to wild animals.

4. **Thatch collection, fishing and minor forest produce collection** – As indicated, the best grassland areas also provide economically important grasses such as Ekora (*Saccharum ravennae*) which have been traditionally used for construction purposes. Similarly, grassland burning also encourages open ‘access’ to forest areas and villagers are likely to collect medicinal plants and vegetable which are now more or less absent from rural cultivation areas.

5. **Re-introduction and management of other mega herbivores-** Another cause of possible conflict in conservation of Pygmy hog specifically for Manas National Park is the proposed and ongoing plans of reintroduction of other endangered species such as swamp deer and one-horned Rhinoceros in the study sites. Kuribeel has been identified as a translocation site for Swamp deer by the translocation committee and as per the report a large enclosure (about 25 ha) will be cordoned off for the soft release. Since both the animals use grasslands albeit in completely different manner, there is likely to be a detrimental impact of the same.

6.2 Proposed Action Plan

1. **Annual census of endangered grassland species:** Since the grassland areas of Manas NP are well defined and can be covered by existing forest department staff, It is proposed to carry out the annual census of endangered grassland species especially Hog deer, Pygmy Hog, Hispid Hare, swamp deer and Bengal Florican. Non-invasive methods such as the use of pellet-count survey for Hispid hare, nest count survey for Pygmy hog besides using camera traps and finding out populations of both species using genetic studies by collecting pellets and droppings may be incorporated in regular count and monitoring of the target species.

2. **Carry out intensive vegetation studies and mapping** - Research indicates that the Park has lost over 40% of its prime grassland habitat (short alluvial grasslands) due to natural succession promoted by annual burning and flooding. The extent of invasive species is also a critical factor that needs to be studied a spatio-temporal basis. The use of high resolution satellite data (< 3 m) for intensive mapping of landcover categories will help in understanding the dynamics within the landscape.

3. **Undertake an early controlled Burning Plan-** The immediate threats to the relict populations of the Pygmy hog and Hispid hare can be alleviated by a change in the reserve's management practices, from uncontrolled dry season burning of its tall grassland habitat, to a system of carefully controlled rotational burning such that large areas of suitable habitat (providing optimal cover and food) are available throughout the year. Carry out mosaic burning based on prevailing climatic conditions repeatedly during the early period (November - January). A fire season can be declared during the critical months as per sections of Wildlife Protection Act (Feb-May) and levy penalty.

4. **Carry out a systematic plan to remove invasive species** and supplement with grass species - using manual uprooting of invasive and nursery for grass species.

5. **Community awareness and involvement to reduce livestock grazing and thatch collection** from these areas – Unregulated grazing and removal of minor forest produce is an important factor that impacts the quality of prime pygmy hog habitat. The need to control (if not eradicate completely) and monitor the extent shall be very crucial for future conservation. Initiatives shall be taken through Eco-development Committees in the coming year.

6. **Education and Capacity building of forest staff-** The forest frontline staff must be trained and incentivised to carry out regular monitoring of the target species. Simple measures such as use of camera and GPS units for carrying out the monitoring will be the first step in this direction.

7. **Undertake long-term research program-** for examining the effects of each of the several disturbance factors operating on the remaining prime tall grassland habitat of these two highly endangered species (burning, grazing, thatch harvesting) are required to formulate appropriate long-term management plans considering the fact that Manas is the only protected area in the world where these two species have natural wild populations. Thus research into burning, for example, should investigate the effects of timing, frequency of burning and the soil water content of the grass vegetation so that optimal management plans can be developed later for individual areas within the National Park. DNA-Based sampling techniques should also be planned.

8. **A captive breeding program for the Hispid hare** needs to be initiated like that of the Pygmy Hog to provide a nucleus of animals for reintroduction in the wild.

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Annexure 1

Sign-survey (Grassland mammals_MNP) Data sheet

Observer's Name: _____ Date: _____ Start Time: _____

End Time: _____ Begin GPS: Lat: _____ N, Long: _____ E

Range _____ Name of the Camp _____ Data sheet no.

Total Kms. Walked: _____ Km. Time Spent in any other activity _____ Min.

Sl. No.	Lat			Long			Species	Sign Type	If pellet (No. of pellets in a category)				Status of pellet			Remarks
	DD	MM	SS	DD	MM	SS			<50	50-100	100-200	>200	Fresh	Old	Degenerated	

*Please note down the GPS coordinates after every **100m**

FIELD PHOTOS FROM THE SURVEY CARRIED OUT IN MANAS NATIONAL PARK



Survey team in Pygmy Hog habitat



Forest Staff carrying out the signs survey



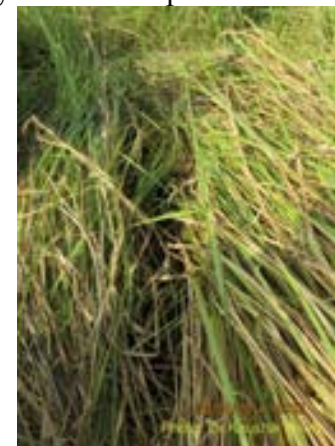
Survey team in Hispid hare habitat



Grass cuttings by Hispid Hare



Hispid Hare Pellets



Pygmy Hog Nest

SURVEY FOR BENGAL FLORICAN IN MANAS NATIONAL PARK

2014

Survey Team Profile

1. Dr. Sonali Ghosh- She is an Indian Forest Service officer and has been serving as Deputy Director in Manas Tiger Reserve since April 2013.
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3. Dr. Bibhuti Lahkar- He is a researcher of Aaranyak, Guwahati who has worked for many years in the Pygmy Hog Conservation Project in Manas NP and later co-ordinated a number of projects on ecology of grassland species like Pygmy Hog, Hispid hare, Bengal Florican and Elephant migration routes in Manas Tiger Reserve.
- 4 Mr. Anukul Nath- He is a researcher of Aaranyak, Guwahati working in the Elephant Corridor Monitoring Project at Manas NP.
5. Mr Rustom Basumatary- He is certified guide for tracking Bengal floricans at Kokilabari Agricultural Farm and is a member of Manas Maozegendri Ecotourism Society, Bhuyanpara.
6. Forest Frontline staff led by Shri Sachin Brahma, Dy. Ranger Kahitema, Shri Bolen Kalita-Fr-II, Shri Jagadish Basumatary-Fr1, Shri Lankeshwar Lahkar-Forest Guard. Shri Dilli Boro among others and Mr. Sikram Raba and Mr. Sukleshwar Nath from MEWS (Manas Ever Welfare Society) for actively taking part in the survey exercise.

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2nd May, 2014

Barpeta Road

SURVEY TEAM

Contents

	Page No.
1 Introduction	5
2 Target species profile	
2.1 Bengal Florican	6
a. Status and Distribution	7
b. Population	8
c. Habitat and Ecology	8
d. Major Threats	9
3 Study Area	10
3.1 Location	19
3.2 Grassland Habitat Characteristics	11
4 Method and Results	
4.1 Justification for intensive sampling sites	13
4.2 Field Methods	13
4.3 Results	13
5 Conclusion	
5.1 Discussion	15
5.2 Plausible threats	15
5.3 Proposed Action Plan	17
Bibliography	20
Field photos	22

Section 1: Introduction

Grassland ecosystems are considered one of the most threatened ecosystems in the world. In India, the *Bhabhar-Terai* grasslands are under constant threat from anthropogenic influences, such as agricultural expansion, livestock overgrazing, uncontrolled fires and fodder-thatch collection. The *Bhabhar-Terai* grasslands that once extended all across the Himalayan foothills in India and Nepal are therefore now mostly confined to Protected Areas such as Manas National Park (Fig 1). The disappearance of grassland habitat is more evident from the decline in population of certain grassland obligate species such as the One-horned Rhino, Swamp deer, Hog deer, Pygmy Hog, Bengal Florican and Hispid Hare.

Previous studies clearly indicate that early succession riverine communities, typically comprising dense tall grasslands, commonly referred to as elephant grass or thatch land is the preferred habitat for these species. These grasslands are a feature of the succession between primary colonizing grasses (particularly tall grasses, on new alluvium deposited by changing water courses), through deciduous riverine forest to the Sal (*Shorea robusta*) forest climax.

Tall grassland may also form an under storey during later stages of the succession, particularly near rivers, or in forest clearings and abandoned cultivation and village sites (Chapman and Flux, 1990, Nath et.al., 2010).

This report is an attempt to present a comprehensive status update on Bengal Florican whose very survival is linked to active management of grasslands in Manas National Park. It also provides an up-to-date literature search and compilation on all the ecological information that is available on the species. Results indicate the potential and need to take up systematic studies and management interventions to protect the grassland habitat and these mammalian indicator species.

Fig 1: The extent of *Terai* (floodplain) grasslands in the Indian subcontinent



Section 2: Target Species Profile

2.1 Bengal Florican

Houbaropsis bengalensis or the Bengal Florican belongs to the Family Otididae which is popularly known as the Bustard family. Fewer than 500 birds are estimated to remain in the Indian subcontinent. It is a globally threatened bustard restricted to lowland dry or seasonally inundated alluvial grasslands and occurring in two disjunct populations; one in northern India and Nepal and the second in southern Indochina (BirdLife International 2001).

This trend in a declining population; that has recently become extremely rapid and is predicted to continue in the near future, largely as a result of the widespread and on-going conversion of its grassland habitat for agriculture, therefore qualifies it as Critically Endangered on the IUCN Red List of Threatened species.

Adult Bengal Floricans range from 66–68 cm (26–27 in) in length and stand around 55 cm (22 in) tall. It shows distinct sexual dimorphism. The adult males have black head, neck and body with white wings which is distinctly visible while flying. However, when standing the white wings are seen as a thin patch on either side of the body. The back is mottled with buff-brown. However, during the breeding season males have a thick bunch of feathers hanging under the breast. On the other hand, the female and immature male is dull brown and molted on the back. The females are slightly larger in size than its male counterparts. Female Bengal floricans had been found to be elusive and cryptically coloured. Consequently, females are less frequently seen than the conspicuous territorial males. They are omnivorous and known to feed on various seeds, grain, tender shoots of grass and insects like grasshoppers, ants, beetles and even frogs.



Fig 1: Painting of Adult Male (standing) and female Bengal Florican

a. Range Description

(main source: IUCN. 2013. IUCN Red List of Threatened Species (ver. 2013.2). Available at: <http://www.iucnredlist.org>. (Accessed: 13 November 2013).

Houbaropsis bengalensis has two disjunct populations, one in the Indian Subcontinent, the other in South-East Asia (BirdLife International 2001). The former occurs from Uttar Pradesh, India, through the *Terai* of Nepal, to Assam and Arunachal Pradesh, India, and historically to Bangladesh. It has declined dramatically and only survives in small, highly fragmented populations. In India, it was widely distributed from Uttar Pradesh, Bihar, West Bengal, to the foothills of Assam and Arunachal Pradesh till recent times. However, at present Bengal Florican is found only in the few protected pockets in India viz. Manas National Park, Kaziranga National Park, Orang National Park, Sonai-Rupai Wildlife Sanctuary, Dibru-Saikhoa National Park and Burachapori Wildlife Sanctuary in Assam, D'Ering Wildlife Sanctuary in Arunachal Pradesh, Jaldapara and Gorumara Wildlife Sanctuary in West Bengal and Dudwa National Park in Uttar Pradesh (Birdlife 2001, Narayan 1992; Brahma, 2009).

Declines have apparently continued in Nepal, even inside the protected Royal Chitwan National Park (Baral *et al.* 2003), but they may have stabilised in India (Rahmani 2001). Surveys and interviews with staff at four protected areas in the North Bank area of Assam suggest that the species has been largely absent from three of them since 2000 (Brahma and Lahkar 2009). An estimate from 2007 put the Nepalese population at just 28-36 mature individuals (restricted to a few widespread sites) (Poudyal 2007), down from 32-60 individuals in 2001. Recent intensive survey effort in Nepal has recorded 47 individuals in and around Koshi Tappu Wildlife Reserve, including 14 birds outside any protected area and an estimate of 60 individuals in total (Baral *et al.* 2013). This is almost double the numbers from a survey of the area in 2012 when around 12 pairs were estimated (Baral *et al.* 2012), but this is due to a more rigorous survey methodology (Baral *et al.* 2013). Previously this site was thought to only support a few individuals (Baral *et al.* 2003). This is the largest population in Nepal (Baral *et al.* 2013) and if numbers from the 2007 survey are still accurate this would put the total number of mature individuals in Nepal at 75-96.

The South-East Asian population occurs in Cambodia and may be extant in southern Vietnam. The population in the Tonle Sap region, which supports the vast majority of the population of Cambodia, was estimated at between 312 and 550 (95% CI) based on surveys in 2012, with only 216 displaying males recorded (C. Packman *in litt.* 2013). This represents a 44% decrease from the previous survey in 2005, and a minimum of 294 displaying males

had been recorded in 2007 (Gray *et al.* 2009). More than 50% of this population occurs on seasonally inundated grasslands within Kompong Thom province (Gray *et al.* 2009). This estimate, based on extent of available habitat in 2005 and known habitat loss between 2005 and 2007, represents a rapid decline owing to habitat loss, from a projected 3,000 individuals in 1997 (T. Gray, T. Evans and Hong Chamnan *in litt.* 2006). Given accelerating post-2005 grassland loss of 28% within 10 grassland blocks holding 75% of the estimated population (Gray *et al.* 2009), and a further 11% of habitat lost in four protected areas in 2008 (Evans *et al.* 2009), projected rates of decline will equate to over 80% during a three generation period (T. Gray, T. Evans and Hong Chamnan *in litt.* 2006). Recent assessment of habitat loss indicates that it has indeed been widespread and extensive between 2005 and 2012, and a number of sites identified as having blocks of grassland in excess of 10 square kilometers now contain little or no grassland (C. Packman *in litt.* 2013). Annual monitoring of Bengal Florican populations in Bengal Florican Conservation Areas (BFCAs) and adjacent areas in Cambodia during March-April 2008-11 indicates that whilst populations in some protected areas are stable, in other locations population declines are ongoing. Outside of protected areas there is likely to be very little suitable grassland habitat remaining (Mahood *et al.* 2012).

b. Population

The population in Cambodia was estimated at 294 displaying males or c.600 individuals in 2009 (Gray *et al.* 2009a), but recently an extensive survey has reported a total of only 432 individuals (95% CI 312-550) (C. Packman *in litt.* 2013). 75-96 individuals remain in Nepal (Baral *et al.* 2013). No recent estimates are known from India but the total global population for this species is likely to fall in the range 250-999 mature individuals. This equates to 375-1,499 individuals in total, rounded here to 350-1,500 individuals.

Population in Manas National Park: Prior to 1985, the Manas National Park was supporting at least 70-80 Bengal Floricans (Gautam Narayan *pers comm*). At this time, it was hailed as the single largest population found in the entire world (Choudhury, 2000). Post 2003, periodic surveys carried out by Namita Brahma have estimated the population to be around 50 individuals indicating a declining trend (Brahma, 2009).

c. Habitat and Ecology

It inhabits lowland dry, or seasonally inundated, natural and semi-natural grasslands, often interspersed with scattered scrub or patchy open forest. Most Indian populations appear to be resident. In Cambodia, it is known to make relatively local seasonal movements in response to the flooding regime of the Tonle Sap lake: in the dry season, the species breeds in

grasslands in the inundation zone of the lake; it then moves to nearby open forest areas during the wet season.

The breeding season of Bengal florican starts from February and lasts till early part of July. During the breeding season the male Bengal Floricans establish individual territories in the open areas in short grasslands. The males preferentially select habitats related to low-intensity human activity, chiefly burned grassland, whereas females primarily select unburned grassland but also use unburned, uncultivated grassland in dry-season rice head-ponds (Gray et al. 2009), although anecdotal evidence suggests that eggs are laid in small pockets of medium to tall grass in recently burnt areas (R. van Zalinge, pers. obs.). The adult males show a characteristic flight display within the territory to attract female Floricans for mating. In one clutch a Bengal florican lays one to two eggs.

d. Major threats

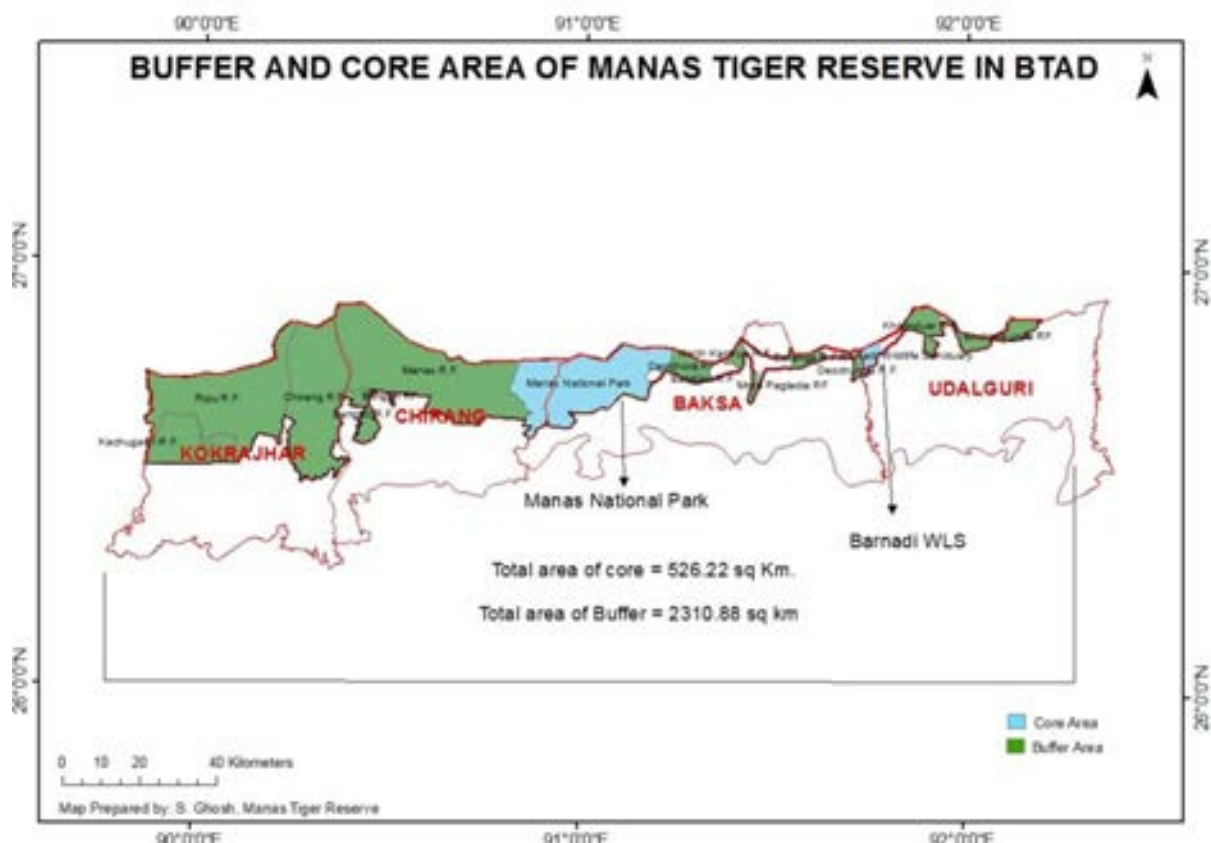
The key threats are the extensive loss and modification of grasslands through drainage, conversion to agriculture and plantations, overgrazing, inappropriate cutting, burning and ploughing regimes, heavy flooding, invasion of alien species, scrub expansion, dam construction and inappropriate and illegal development (Brahma 2009, Evans et al. 2009; van Zalinge et al. 2009). In particular, the spread of dry season rice cultivation in Cambodia is rapidly converting existing grassland habitat. Land sales and concessions are often pushed through despite resistance from local villagers (Evans et al. 2009). Excessive hunting for sport and food may have triggered its decline, but owing to advocacy and law enforcement is no longer a serious threat, at least in Cambodia. At least in South Asia, most populations are small, isolated and vulnerable to local extirpation. Other threats may include human disturbance and trampling of nests by livestock. Detailed research into the species' ecology in Cambodia demonstrated that the effects of human disturbance are weak and annual burning is important for maintaining suitable habitat, supporting the idea that community-based grassland management that maintains traditional agricultural practices will benefit Bengal Floricans. This has implications for management in South Asia, where remaining (and declining) populations are largely confined to strict protected areas in which such practices may not be occurring (Gray et al. 2007). Further study has revealed that, whilst burned grassland is selected by males during the breeding season, unburned grassland and other habitats providing cover are selected by females, demonstrating the need for appropriate grassland management in conservation areas that provides a variety of habitats to ensure the survival of this species (Gray et al. 2009).

Section 3: Study Area

3.1 Location

The Manas National Park occupies an area of 500 sq. km., which forms the core area of the Tiger Reserve (2837 sq. km) (Fig. 3). It is located at the foothills of the Bhutan Himalayas in Baksa and Chirang districts of Assam ($26^{\circ}35'-26^{\circ}50'N$, $90^{\circ}45'-91^{\circ}15'E$). It spans on both sides of the Manas River and is restricted to the north by the international border of Bhutan, to the south by thickly populated villages and to the east and west by reserve forests. Elevation ranges from 50 m MSL on the southern boundary to 250 m MSL along the Bhutan hills. The Manas National Park is located at the junction of Indo-Gangatic, Indo-Malayan and Indo-Bhutan realms and is a key conservation area in the Jigme Dorji-Manas-Bumdeling conservation landscape in the eastern Himalayan eco-region (Wikramanayake et al, 2001). It is situated in the eastern duars and has extensive Bhabar and some terai grassland areas that are typical of the Himalayan foothills.

Fig 2: Map of Manas Tiger Reserve, indicating the core areas of Manas National Park and Barnadi Wildlife Sanctuary



3.2 Grassland habitat characteristics:

Micro-climate

The climate can be divided into four distinct seasons on the basis of variation in rainfall, temperature and winds (Borthakur, 1986). These are winter (December-February), pre-monsoon (March-May), monsoon (June-September) and retreating monsoon (October-November). The humidity levels are high and can reach up to 76% relative humidity. It rains from mid-March to October with most rain falling during the monsoon months from mid-May to September, flooding the western half of the Reserve. The mean annual rainfall is 3330 mm. November to February is relatively dry when the smaller rivers dry up and there is an acute water shortage in the Bhabhar areas (Deb Roy, 1991). The mean maximum summer temperature is 37°C and the mean minimum winter temperature is 5°C.

Floristic composition

Based on studies carried out by Sarma et.al. in (2008) the landuse/landcover of MNP has been delineated as follows:

a) Woodland: This comprises of tree species mostly belonging to semi-evergreen forest and moist mixed deciduous forest. The semi-evergreen forest is represented by *Pterospermum acerifolium*, *Dysoxylum binectariferum*, *Phoebe goalparensis*, *Amoora wallichii*, *Sterospermum personatum*, *Chukrassia tabularis*, *Duabanga grandiflora*, *Michelia champaca*, *Linnea coromandelica* and *Sterculia villosa*, while the moist mixed deciduous forest is represented by *Bombax ceiba*, *Lagerstroemia flosreginae*, *Careya arborea*, *erminalia bellerica* and *Gmelina arborea* among others. The area under this category is 233.31 Km² and it is distributed mostly in the northern part and in the extreme south-west of the Park.

b) Savannah grasslands: This type of grasslands is dominated by tall grasses such as *Narenga porphyrocoma*, *Imperata cylindrica*, *Phragmites karka*, *Arundo donax*, *Saccharum spontaneum*, *Themeda arundinacea*, *Saccharum procerum* and *Vetiveria zizanioides* that are interspersed with tress such as *B. ceiba*, *Dillenia indica* and *L. flosreginae*. The total area under this category is 161.98 Km². This land cover type is distributed in the north-eastern part as well as the southern boundary of the Park touching the villages.

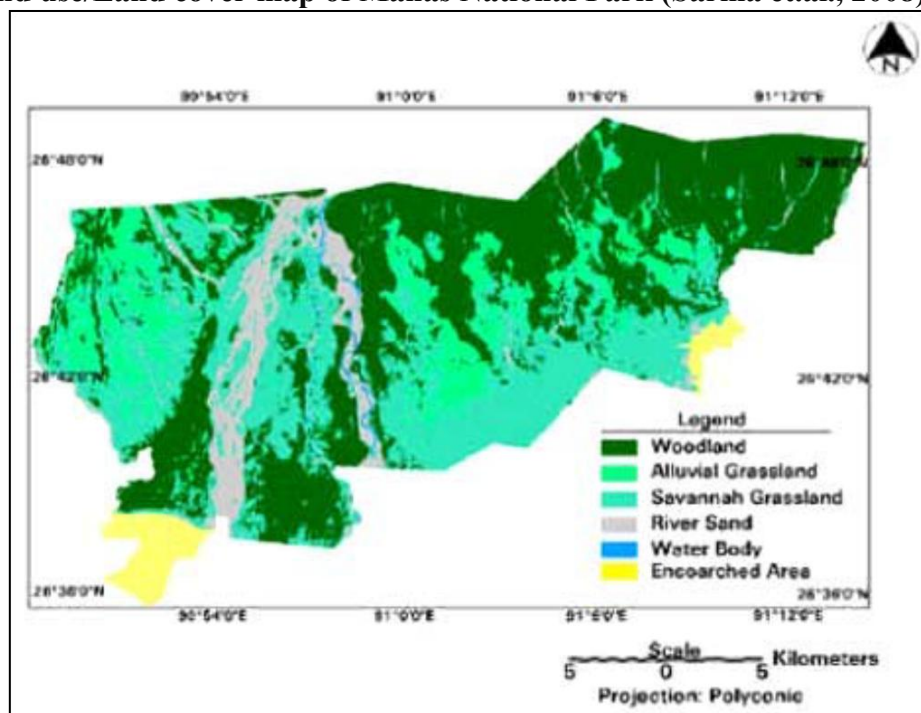
c) Alluvial grassland: The area under this category is 44.49 Km². This land-cover type is scattered all over the Park. It is characterized by pure patches of grasslands and presence of water during the rainy season. These alluvial grasslands have been critical to the survival of mega herbivores such as the rhinoceros and swamp deer in the past.

d) Waterbodies: The area under water bodies (numerous small wetlands and rivers) is 3.94 Km². The water bodies are mostly distributed towards the southern boundary near the Bansbari Range, as is typical in a Bhabhar–Terai formation.

e) River Sand: The area under this category is 35.82 Km². River sand banks devoid of any vegetation are mainly concentrated around the dried river bed of Manas. The change in course by the rivers Beki and Manas along with excessive siltation during the rainy season have resulted in the expansion of such areas.

f) Encroached area: The area under this landuse type is 20.47 Km². It is distributed in two major areas at the extreme southwest and extreme southeast part of the Park. A comparison of satellite data in the last 30 years indicated that alluvial grasslands have reduced drastically (by about 46.8%) since 1977 (Sharma et.al., 2008). The major causes have been attributed to siltation of existing water bodies, invasion of exotic weeds like *Eupatorium* sp., *Melastoma* sp., *Lea* sp., marked augmentation of *Bombax ceiba* and *Dillenia pentagyna* saplings and or lack of a suitable burning regime in the surrounding savannah grasslands. These grasslands are naturally dynamic and subjected to altered flooding regime due to change in the river course and are subjected to additional disturbances from fire, grass collection, grazing, encroachment and agricultural conversions.

Fig 3: Land use/Land cover map of Manas National Park (Sarma et.al., 2008)



Section 4: Methods and Results

4.1 Justification for intensive sampling:

Based on the background information that was available, it was decided to sample in prime alluvial grassland areas within Manas National Park rather than spreading the effort to the entire landscape.

4.2 Field Methods

The method adopted was a participatory one, in which forest frontline staff, invited experts from Aaranyak (Dr Bibhuti Lahkar and Ms. Namita Brahma) along with local NGOs (MEWS and MMES) were involved. A short training on identification and behaviour of the bird was given on the first day to all participants. A simple data sheet along with sampling time details were provided during this training. It was decided that Bengal Floricans will be surveyed by counting birds at lekking sites and identifying male territories. The survey technique concentrated on the males, as they have a prominent aerial display. Females are more easily overlooked, so their numbers were estimated, assuming one female for every male.

A block count method was adopted wherein all forest camps within grassland areas were alerted to undertake the Bengal Florican sighting survey on the specified days (1st to 3rd May, 2014). Observations were to be carried out from vantage points in the morning (06h30–09h30) and afternoon (16h30– 19h00), when the species was most active. Existing watchtowers were used to obtain better views of the grasslands. Some areas were observed from elephant-back and from motor vehicles. The survey team could not complete the final count at Kokilabari Agricultural Farm which was scheduled on 3rd May, 2014. However, expert opinion and regular monitoring by Rustom Basumatary from MMES in the area helped in obtaining the total number.

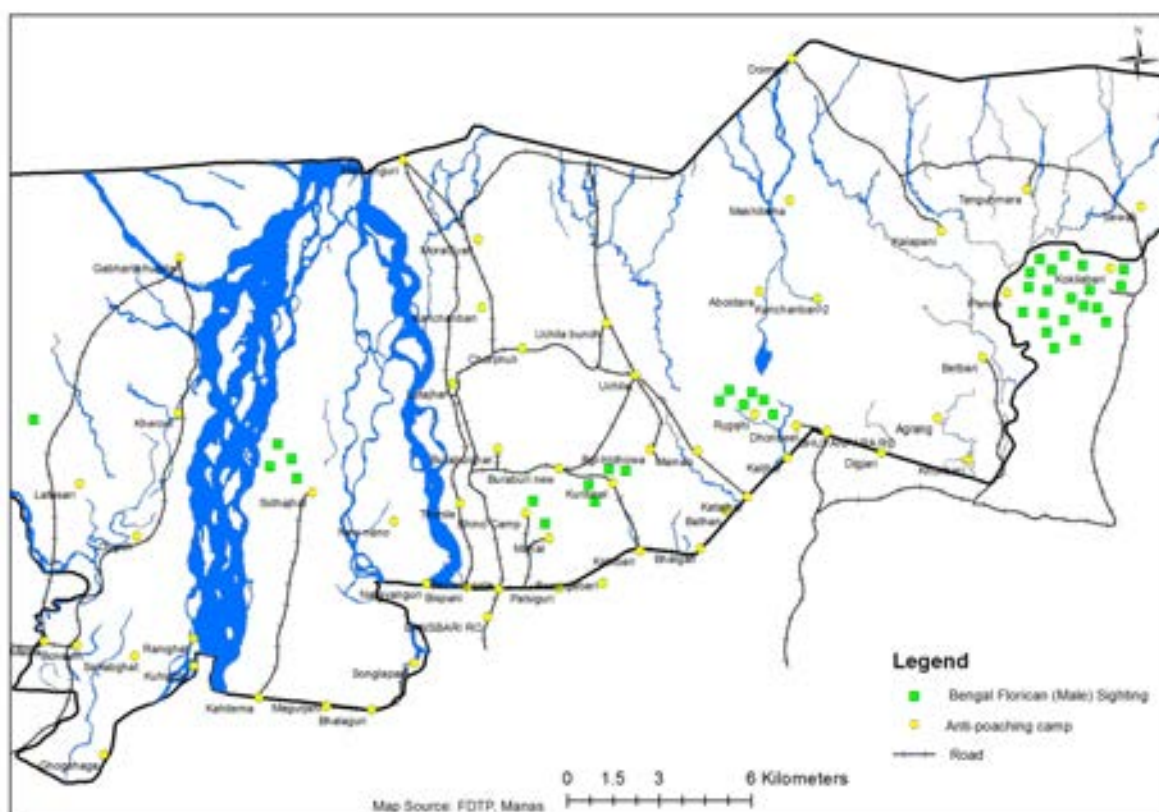
4.3 Results

Contrary to our expectations, Bengal floricans were sighted well and within a short time period. We confirmed territorial sites for 32 males and 5 females and with this the population is projected to be anywhere between 37-60 which is similar to previous years information available.

The details on the selected locations and the results obtained are as follows:

Sl.No.	Name of nearest camp	Range	Florican(Males) display sites
1	Kuribeel	Bansbari	4
2	Rhino Camp	Bansbari	2
3	Rupahi	Bhuyanpara	6
4	Aboidara	Bhuyanpara	-
5	Sidajhar	Kahitema	4
6	Lafasari	Panbari	1
7	Maozi/Panda	Bhuyanpara	15 + 5 (Females)

Fig 4: Bengal Florican Male display sights reported in Manas National Park in April-May 2014



Section 5: Conclusion

5.1 Discussion:

The short survey for grassland species in Manas National Park brings out important evidence for the presence of Bengal Florican at the study site. It also indicates an increasing trend since the last survey carried out in 2009 which is encouraging (Brahma, 2009). The survey also brought in new information from unsurveyed areas in the past such as Kapurpora and Lafasari grassland areas in Kahitema Beat and Panbari range respectively. Within the Park, highest concentration of Bengal floricans were found at Kuribeel and Rupahi grassland areas. Four floricans were also observed at Kapurpora area however it could not be ascertained if they had also established breeding territories out there. No floricans could be sighted in areas such as Digjari-Khoirbari and Agrang where floricans had been reported earlier (Brahma, 2009).

However, the highlight of the survey has been the phenomenal presence of atleast 20 Bengal floricans in the Kokilabari Agricultural Farm. It also highlights the need to protect agro-biodiversity sites such as KAF for long term conservation of the species. Estimated population of Bengal Florican is now around sixty individuals in and around Manas National Park in Assam.

The survey also clearly indicates the success of the method wherein the collaboration between forest frontline staff along with invited experts and local guides was instrumental in obtaining a quick result.

While it is estimated that around 40% of the Bengal Florican population has been lost since 1989-1990 (Brahma, 2009); grass height seems to be the main factor for the establishment and maintenance of the territory for the endangered bird. It is assumed that they are very site selective in establishing their territory. The decline in wet alluvial grasslands is therefore a cause of concern besides several other factors as states below.

5.2 Plausible threats

1. **Grassland Fires:** As indicated by previous studies the most crucial point is that the season of grassland burning coincides with the breeding season for the target species. The fire not only demolishes the cover and food but can also be fatal for escaping animals. Fire is also lit by illegal graziers who want to bring in their livestock and also for opportunistic hunting of any escaping animals. However, our results clearly show that grassland fires are subject to annual micro-climatic fluctuations that are likely to cause an early/late burn if left to on a

‘natural’ basis. Active management of fire (as a control burn) in the early winter (Nov-Jan) would require a systematic approach.

Fire is a necessary evil and the main factor governing is the overall climatic response of that particular year. It has been observed that in some years it is very dry and fires sets in early (as in 2013, fig) whereas in other years a winter shower can occur and keep the grass wet and ready only for a late burn. The other issue is the overall attitude and objective using grassland burning as a wildlife management tool. In certain areas of the park (such as Chorphuli) the area tends to be wetter even during the driest months (Feb-March). The general attitude of forest staff, especially Mahouts is that the grass is not ready to be burnt and therefore must be left to dry. Even if they are urged to burn the grass, it remains partially burnt which does not serve the purpose of managing mega herbivores such as rhinos and elephants.

2. Spread of Invasive species: A separate study (Bibhuti Lahkar pers comm.) that is currently ongoing at the National Park indicates that a large tract of prime grassland habitat is currently under threat from the spread of invasive species such as *Mikania scandens*, *Lea indica*, *Eupatorium odoratum*, *Plectranthus ternifolius*, *Ageratum conyzoides*, *Mimosa pudica*, *Osbeckia spp.* *Lantana camara* etc. While some of these species may be native to the area and also palatable to other animals, the fact that they ‘overpower’ grass patches with their spread is a cause of worry. Further, invasion is also happening due to tree species like *Bomax ceiba* and *Dillenia pentagyna* that are likely to be promoted due to periodic burning.

3. Livestock overgrazing- In the absence of grazing reserves, the local people also let their unproductive cattle (Cow, Buffalo and Sheep) inside the Park for grazing, which degrades the habitat and cover for wild animals and also results in compacting of soil and promotion of invasive species. Domestic cattle are also a cause of zoonotic diseases that can spread to wild animals.

4. Thatch collection, fishing and minor forest produce collection – As indicated, the best grassland areas also provide economically important grasses such as Ekora (*Saccharum ravennae*) which have been traditionally used for construction purposes. Similarly, grassland burning also encourages open ‘access’ to forest areas and villagers are likely to collect medicinal plants and vegetable which are now more or less absent from rural cultivation areas.

5. Re-introduction and management of other mega herbivores- Another cause of possible conflict in conservation of grassland species specifically for Manas National Park is the

proposed and ongoing plans of reintroduction of other endangered species such as swamp deer and one-horned Rhinoceros in the study sites. Kuribeel has been identified as a potential translocation site for Swamp deer by the translocation committee and as per the report a large enclosure (about 25 ha) will be cordoned off for the soft release. Since both the species use grasslands albeit in completely different manner, it is necessary to study the impact of such an artificial intervention before planning out the same.

5.3 Proposed Action Plan

1. High priority Community Reserve status to Kokilabari Agricultural Farm- Koklabari

Agriculture Farm (KAF) (N 26°45'15.6" E 091°11'38.3") is situated on eastern boundary of Bhuyanpara Range of Manas National Park. KAF was set up in the year 1971 and its total area is about 9 sq. km. A joint venture of Central Government and State Government, it was named as the Central Seed Farm and presently it is known as Koklabari Agriculture Farm (KAF). The land was taken on lease from the forest department for thirty years. At that time the KAF was second largest seed farm that supports people from 57 villages for their livelihood. In the year 2001, the thirty years lease expired and because of prevailing civil unrest in the area at that time, the lease was not extended and the farm was abandoned. However, agricultural activities in the farm areas have been continued by the local villagers in a co-operative basis with support from BTAD government. The suitability of KAF for Bengal floricans was evident as early as 2003 when conservation agencies started working in the area and sightings of displaying males were reported on a regular basis. Villagers also rescued Bengal florican eggs and awareness was spread for protection of the breeding birds. Hunting also gradually declined with more awareness and social intervention. It is therefore suggested that this unique feat by local villagers to afford protection is recognised and formalised through declaration of a community reserve. New initiatives are also required in terms of the ban of use in pesticides and burning especially during the breeding and display month.

2. Carry out annual census of Bengal Floricans: Since the grassland areas of Manas NP are well defined and can be covered by existing forest department staff, It is proposed to carry out the annual census of Bengal Floricans. It is a beautiful bird with a spectacular breeding display and therefore certain areas can be opened to a collective/ volunteering method for survey. This will serve the purpose of eco-tourism as well as providing conservation education.

3. Carry out intensive vegetation studies and mapping - Research indicates that the Park has lost over 40% of its prime grassland habitat (short alluvial grasslands) due to natural succession promoted by annual burning and flooding. The extent of invasive species is also a critical factor that needs to be studied a spatio-temporal basis. The use of high resolution satellite data (< 3 m) for intensive mapping of landcover categories will help in understanding the dynamics within the landscape.

4. Undertake an early controlled Burning Plan- The immediate threats to the relict populations of Bengal Floricans within the National Park can be minimised by a change in the reserve's management practices, from uncontrolled dry season burning of its tall grassland habitat, to a system of carefully controlled rotational burning such that large areas of suitable habitat (providing optimal cover and food) are available throughout the year. This mosaic burning based on prevailing climatic conditions must be carried out during the early period (November - January). A fire season can be declared during the critical months as per sections of Wildlife Protection Act (Feb-May) and penalty can be levied accordingly..

5. Carry out a systematic plan to remove invasive species and supplement with grass species - using manual uprooting of invasive and supplementing the area with productive grass species.

6. Community awareness and involvement to reduce livestock grazing and thatch collection from these areas – Unregulated grazing and removal of minor forest produce is an important factor that impacts the quality of prime pygmy hog habitat. The need to control (if not eradicate completely) and monitor the extent shall be very crucial for future conservation. Initiatives shall be taken through Eco-development Committees in the coming year.

7. Education and Capacity building of forest staff- The forest frontline staff must be trained and incentivised to carry out regular monitoring of the target species. Simple measures such as use of Binoculars, Camera and GPS units for carrying out the monitoring will be the first step in this direction.

8. Undertake long-term research program - While information on Bengal floricans is available during the breeding season (Feb – may), there are unconfirmed reports of ranging pattern (for example, one juvenile was sighted in the Aie River bank during the Asian Waterfowl census in Jan 2014) for other months. Continued annual monitoring of the population in key sites and the identification of non-breeding sites would therefore be

necessary. The use of platform transmitter terminals (PTT)s for tagging Bengal Floricans recently in Dudhwa Tiger Reserve has provided useful information (Dr Rahmani, pers comm). Similar exercise can be undertaken for some birds in the Kokilabari Agricultural Farm to understand their ranging pattern. There is also a need to conduct research on Bengal Florican breeding productivity, and habitat utilisation in breeding and non-breeding areas. Overall grassland conservation awareness initiatives will also be useful in the long run.

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PHOTOS FROM THE FIELD DURING THE BENGAL FLORICAN SURVEY (APRIL-MAY 2014) IN MANAS NATIONAL PARK



Survey team with forest staff at Rupahi Camp



Survey Team at Kaupurpora grasslands



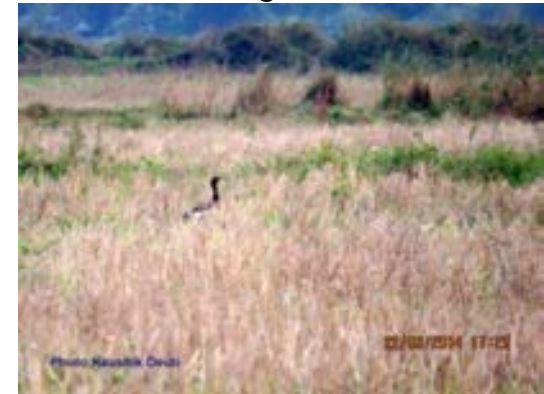
Rustom Basumatary, expert tracker at Kokilabari Agricultural Farm



A large roosting colony of Lesser adjutant storks (>39) found along with Bengal Floricans in Kokilabari Agricultural Farm



Bengal Florican male display site in partially burnt grasslands under Bhuyanpara Range



Typical habitat for Bengal Florican in Kokilabari Agricultural farm

**Monitoring and control of invasive species in the grassland ecosystem of
Manas National Park**

Chromolaenaodorata and *Mikaniamicrantha* are among the world's most invasive plants species. The grasslands of Manas are being invaded by the spread of these two invasive species and as a result the habitat is degrading. Owing to this serious concern, there has been a strong recommendation from UNESCO to develop and implement invasive species management for Manas. Therefore, a study has been initiated from November 2013 by Aaranyak in collaboration with Assam Forest Department with the following objectives- i. *Base line data collection and mapping*; ii. *Establishment of surveillance scheme*; iii. *Implementation and validation of immediate control measures* and iv. *Institutionalization of monitoring protocol in the management practice*.

Initially, a systematic grid based approach was followed to survey the presence/absence and intensity of occurrence of invasive plant species in the grasslands of MWHS. The study area has been gridded with regular sized grid cells of 2 X 2 km. A team of five people surveyed each grid intensively. The two major IAPs identified for Manas are *Chromolaenaodorata* (henceforth *Chromolaena*) and *Mikaniamicrantha* (henceforth *Mikania*). Besides, the study also reported the presence of *Mimosa invasa* on southern boundary adjacent to the tea plantation area.

Within the grids, GPS co-ordinates for the presence of *Mikania* & *Chromolaena* were recorded. Furthermore, the spread of each species was noted on ocular estimation of plots of various radii viz., 1-3 m, 3-5 m, 5-10 m, 10-20 m, 20-50 m & >50 m. The areas with high intensity of invasive species were mapped in the field using *GPSmap 62s*. Based on this field survey, it has been found that an area of 205.10 ha of grassland has been completely invaded by *Chromolaena* (where not a single tussock of grass was found) in the southern boundary of central and eastern range of Manas. In case of *Mikania*, 75 ha of area was found where the occurrence was >50 m radius plots. In addition to that, the study found that there is a certain pattern to the invasion of these two species. Both the species dominate along roadside inside MWHS.

Based on these preliminary results, three experimental plots subjected to three different treatments have been established in the grasslands of Manas. The three different treatments are- manual uprooting of invasive, cutting & burning and only cutting. For each treatment type control plots have been established. Upon establishment of these plots, abundance of each plant species was estimated using subplots of (10 x 10) m. Twenty-five such (10 x 10) m plots were laid within one ha plot.

The first plot (26°39' 59.5", 91°00' 23.5") has been established in an area where *Imperata cylindrica* grass was dominant species, but currently *Chromolaena* has taken over. Within this plot, the *Chromolaena* plants were manually uprooted and the plot was fenced. In the second plot (26°40' 08.7", 91°00' 03.5"), which is in the assemblage of *Saccharum-imperata-arundinella*, the invasive species are cut and burnt. In the third plot (26°39' 33.4", 91°00' 29.5"), the invasive plants are cut above the ground. Based on this study result, the best suited method to control the invasive will be identified and recommended. Additionally, another one ha plot has been established where burning will be avoided to see the influence of invasive species. The experimental plots are regularly monitored by the team so as to record the occurrence of species after the application of each treatment.

Nature Guide Training at Manas National Park- A Report 10th – 13th October, 2014



**Submitted By:
Field Directorate,
Manas Tiger Project
Barpeta Road-781315**

1. Background:

Eco Tourism or Nature Tourism is big business worldwide. It is especially prevalent in and around Protected Areas such as National Parks and Sanctuaries. Ecotourism has the following seven characteristics

- Involves travel to natural destinations
- It minimizes impact on nature.
- Builds environmental awareness.
- Provides direct financial benefits for conservation.
- Provides financial benefits and empowerment for local people.
- Respects local culture.
- Supports human rights and democratic movements.

2. Eco-Tourism in Manas National Park

Manas National Park is one of the important tourist destinations in Lower Assam. On an average 30,000 tourists visit the Park annually. Majority of the visitors are locals, from Guwahati and Assam; West Bengal and neighboring states. A number of foreigners have also been visiting the park in recent years. Visitors to Manas mainly come for its outstanding natural beauty and the wilderness experience that it offers. Specialist tourists such as birdwatchers also throng the area in a particular season. Currently, the low volume of tourists and less number of resorts/lodgers offer sustainability in eco-tourism practices, however it may increase in the coming years and therefore need an orientation towards best practices in ducting eco-tourism activities.

3. Justification for Undertaking a Nature Guide Training

A trained Nature guide is a first step towards following the principles of Eco-tourism, and is aimed at orienting the tourist visiting the Park towards better appreciation of nature. 64 fringe villages have been identified in the fringes of Manas National Park that may have a direct impact on the Protected Area. Nature guide training to unemployed youth from these villages is aimed at provided alternative livelihood support and self-sufficiency. It is expected that the model will be successful for implementation in other Protected Areas.

4. Objectives of Nature Guide Training

- To provide a professional platform to the youth from local community and ensure sustainability in Tourism activities.
- To enhance visitor experience at Manas.
- To ensure law enforcement and principles of ecotourism in the Park.

5. Training details

The selection of candidates was based on the following criteria:

- The training to be aimed at local youth in the fringe of Bansbari (central) Range as this is the prime tourism circuit in the area.
- Must be in the age group of 18 – 40 years.
- Should at least have a matriculation certificate OR be able to speak, read and write any other additional language than his/her own mother tongue.
- First preference shall be given to unemployed youth (especially women) residing within 1 km of the boundary of the Park.

The training was conducted from 10th October to 13th October 2014.

Day One: 10th October 2014

- 8.30 a.m. to 11.15 a.m.: Registration and distribution of note pads etc. Overview of the course, expectations and course design by Dr. Sonali Ghosh, Mr. Indrajit Sengupta, Mr. Bubul Nath and Mr. D.D.Boro. An overview of Manas Tiger Reserve and the various categories and designations associated with the Protected Area were also explained by Dr. Sonali Ghosh.
- 11.30 to 1.00 p.m.: A lecture on showcasing Indigenous culture and tradition by Mr. Chandrakanta Basumatary and Ms. Namita Brahma was taken up in this session. The resource persons highlighted the need to explain household things such as handloom, traditional utensils etc to the tourists. They also gave details on meaning of various traditional artifacts and culture that is associated with nature and Manas Tiger Reserve.
- 2.00 p.m. to 3.00 p.m.: In this post-lunch session, the class was divided into ten clusters based on experience of each individual and gender. This ensured further ice-breaking and also made the participants open up to the group. This was followed by a nature guide basics session that was taken up by Mr. Indrajit Sengupta and Mr. Samar Jordar. Discussions on dress, code of conduct, body language and language skills were discussed and demonstrated.
- 3.00 p.m.- 6.00 p.m. A technical session of bird-watching and animal tracks and signs was taken up by Dr. Bibhuti Lahkar, Ms. Alolika Sinha, Ms. Namita Brahma, Mr. Anukul Nath, and Mr. Bipul Das. Pictorial identification and familiarization with animal tracks and signs in the forests was emphasized.

Day Two: 11th October 2014

- 4.30 a.m. to 9.00 a.m. Field trip on birdwatching, identification of common trees, animal signs and general management of Manas National Park. Ten teams lead by their resource persons viz, Dr. Sonali Ghosh, Dr Bibhuti Lahkar, Mr. D.D.Boro, Mr. Rustom Basumatary, Mr. Abidur Rahman, Mr. Bipul Das, Ms. Alolika Sinha, Ms. Namita Brahma, Mr, Indrajit Sengupta, Mr. Samar Jordar and Mr. Bubul Nath were taken in open Gypsies for the jungle tracking and Safari in various tourism areas of

the Park. Chance sightings of Rhino, elephants, rare birds were the highlight of the trip.

- 11.00 to 1.00 p.m: A lecture on legal provisions and Do's and Dont's inside the National Park, role and responsibilities of Nature guides were discussed by Dr. Bibhuti Lahkar and Mr. D.D.Boro. experience sharing of best practices and concern of forest department was also shared.
- 2.00 p.m. to 4.00 p.m.: An innovative session on motivation, personality development, and tourism entrepreneurship was taken up by Prof Arindam Talukdar, Asst. Professor from Bajali Govt.College. The session was highly interactive and the participants were able to share their apprehensions and views.
- 4.00 – 5.00 p.m: A recap of the training session so far was undertaken and doubts if any, were also cleared. A visit and motivational talk by Field Director, Manas Tiger Project, Shri A.C.Das, IFS was the other highlight of this session.

Day Three: 12th October 2014

- 9.30 a.m. to 11.00 a.m: General recap of the training so far and experience sharing as a nature guide was done by Mr. Samar Jordar who has been working as a professional guide at Sundarbans Tiger Reserve for last thirty years. This was followed by a session on Rhino reintroduction at Manas as a special case study for tourism by Mr. Deba Kumar Dutta. Bird and butterfly identification was discussed by Mr. Abidur Rahman and Mr. Bipul Das respectively.
- 11.30 to 1.00 p.m: An innovative lecture cum demonstration on First Aid basics was done by Capt (Dr.) Vipul of 8 Grenadiers, Army Regiment. Captain Vipul emphasized on three main aspects of first aid related to General unconsciousness, breathlessness etc, fracture. Dislocation and snake bite in an emergency situation. Step by step method on CPR (Cardio-Pulmonary Resuscitation) techniques was also demonstrated.
- 1.30 p.m. to 2.15 p.m.: A session on captive elephant management, animal rescue and the role of a nature guide in collating information was then discussed by Dr Prabhat Basumatary, FVO Manas Tiger Project.
- 3.00 p.m. to 4.30 p.m.: Aspects of Tourism potential and current tourism trends in BTC were discussed in detail by Ms. Bhuma Rani Borgayary, Asst. tourism Information Officer, Department of Tourism Govt of BTC. She gave insights into socio-cultural aspects of tourism that were attracting tourists to BTC and also the ways and means in which homestays and local culture and tradition could be highlighted.
- 4.30 – 6.00 p.m. A recap of the sessions undertaken so far was done, This was followed by a general discussion on the exam schedule and the choice of medium (English/Bodo/Assamese) for replying to answers. Roll numbers were accordingly provided to candidates.

Day Four: 13th October 2014

- 8.00 a.m. – 9.00 a.m.- One hour written examination was conducted and answer sheets were sent for evaluation.
- 9.00 – 10.30 a.m. – evaluation of exam papers in Bodo medium was done by Ms. Namita Brahma, Mr. D.D.Boro and Mr. Rustom Basumatary. Assamese and English answer sheets were evaluated by Dr. Bibhuti Lahkar, Mr. Anukul Nath, Mr. Bubul Nath and Mr. Alolika Sinha.
- 11.00 a.m. – 1.00 p.m.- The final marks were awarded and accordingly certificates were provided. Mr. Sukleshwar Nath secured first position with 89 marks, Mr Dhanjit Das secured second position with 87 marks and Md. Mohibul Islam secured third position with 85 marks. The highest scorer among women candidates was Ms. Karabi Das with 80 marks.
- The certificates and training it was handed to 60 successful candidates by Honbl'e Deputy Chief of BTC, Shri Kampa Borgayary in presence of other guests of honour, CF(Wildlife), Govt of Assam, Shri Hridesh Mishra, IFS and Field Director, Manas Tiger Project, Shri A.C.Das, IFS
- This was followed by a stakeholder meeting with Tourism agencies such as Resort owners, District administration, representatives from newly constituted Barengabari, Daoraibari and Rajabil EDCs, NGOs (Aaranyak, ATREE, WWF-India and WTI), CBOs (Manas Maozegendri Ecotourism Society, Manas Agrang eco-tourism society, Manas Bhuyanpara Ecotourism Society, Swmkhwr Mithinga Onsai Afat, MNP Protection Panbari Eco-tourism Society, Kahitema United Social Welfare society), Manas Ever Welfare Society (MEWS) and Manas Jeep Safari Association among others.
- The various representatives could put in their views and Honbl'e Deputy Chief of BTC, Shri Kampa Borgayary summed up the meeting by giving an inspiring speech on his vision and mission for tourism in BTC. He encouraged all the stakeholders to join hands in promotion of Manas as a World Tourism Destination.

6. Conclusion

A total of 60 participants could be successfully trained, the details of which have been presented at Annexure 1. More than 65% percent of the students obtained marks more than 50 which is a very encouraging sign. The fact that within a short period of three days, the participants could be oriented towards nature guiding and in turn conservation was indeed a good sign. The list of successful participants have also been shared with the local resorts and it is expected that the participants shall be able to find some gainful employment in the ensuing tourism season. Some of the challenges that were faced while conducting this training were

- Oversubscription: A total number of 120 participants arrived on the first day. Since it was a free training, it could also possibly be one of the reasons that attracted a number of overtly casual participants. A strict attendance register after every session ensured that the number was finally reduced to half. A nominal fee (say Rs 200) in future may also help in eliminating such casual persons.

- Lack of syllabus and training material: No fixed manual or syllabus was available when the training was envisaged. It was somewhat trial and error method, and in the end it is expected that this report shall serve as a guiding material for subsequent trainings.

7. Acknowledgements and sponsorships:

Food: Lunch on 10th and 12th October were sponsored by WWF-India and Wildlife Trust of India respectively. Breakfast and boarding and lodging for outstation Resource Persons (at discounted rates by MEWS) was sponsored by ATREE.

Nature Guide Kit: A Backpack and Cap to each of the successful candidate was sponsored by Saving Tigers. T-shirt was sponsored by Manas Tiger Conservation Foundation.

Logistic support (Gypsies) on 11th October was provided by Manas Jeep Safari Association, ATREE, Aaranyak, and Park authorities.

Books: The following books were provided to each of the participants:

1. Swallowtail butterflies of Manas Biosphere of Northeast India- a pictorial guide by Kushal Choudhury, Hillojyoti Singha, Hemanta Kumar Sahu.(2012), Aaranyak, Guwahati, India.
2. A handbook of scientific and assamese names of Plants- 2nd Revised Eedition. Dr Ananta Borah (2013), Aaranyak, Guwahati, india (*Donated by Aaranyak*).
3. Birds of Manas National Park (2006) Dr. Anwaruddin Choudhury.Gibbon Pocket Guides (Provided at discounted rates by Dr. Anwaruddin Choudhury).
4. *Banyaprani Surakhyar Aini Hatiputhi* (in Assamese) (2013) Bhupen Talukdar. Star Printers, Rajgarh, Guwahati (*Donated by Wildlife Trust of India*).
5. Amphibians and Reptiles of Northeast India- a photographic guide by M.Firoz Ahmed, Abhijit Das, S.K.Dutta(2009). Aaranyak, Gguwahati, India (6 copies donated by Aaranyak).
6. Manas Tiger Reserve- a handbook for Nnature Guides and Forest frontline Staff (2014) by Sonali Ghosh. Published by Field Directorate, Manas Tiger Project, Barpeta Road., Assam.

**ANNEXURE 1 : LIST OF SUCCESSFUL CANDIDATES OF NATURE GUIDE TRAINING
(10-13 OCTOBER, 2014 AT BANSBARI, MANAS NATIONAL PARK)**

Sno	Name	Address	Contact no	MARKS
1	ANANTA SUTRADHAR	KHOIRABARI	8486717767	80
2	ANANTA SWARGIARY	KANTHAL GURI (SALBARI)	9508438256	15
3	ANSUMA GAYARY	KANTHAL GURI (SALBARI)	8474046480	42
4	ANUJULUS GAYARY	BARENGABARI	9577683098	46
5	ARUN BASUMATARY	LABDANGURI	9613122961	72
6	BABUL DEKA	GYATI GAON	9957994395	56
7	PULEN SUTRADHAR	MAYANGPARA	8752882824	PASS
8	BIJOY BASUMATARY	MAYANGPARA	7399674081	82
9	BIPUL BASUMATARY	KANTHAL GURI (SALBARI)	7896916193	59
10	BIROT BASUMATARY	BHUYANPARA (MBES, NGO)	9864630055	51
11	DEORAJ MUSHAHARY	GYATI GAON	9954125636	65
12	DHANANJOY DAS	BANSBARI	8011838909	51
13	DHANESHWAR DAS	BARENGABARI	9859666820	29
14	DHANJIT DAS	GYATI GAON	9957757482	87
15	DHANJIT DAS	BARENGABARI	9957503093	57
16	DILIP BORO	GYATI GAON	9954331117	69
17	DIPAK DAS	BARENGABARI	9613285101	52
18	GAURI PRADHAN	GYATI GAON	7399674066	50
19	HEMAN BASUMATARY	MADLIJHORA	7399792800	43
20	JAGADISH BRAHMA	PALCHIGURI	7399364584	51
21	JAGANNATH DAIMARY	THAKMAPARA	9508060371	61
22	JAWAHARLAL BASUMATARY	BARENGABARI	8751901601	73.5
23	JEMMY BORO	RANDHANIPARA	7896170758	PASS
24	JOHN BRAHMA	KHAMARDWISA	8753993206	76.5
25	KANAK BASUMATARY	DAORAIBARI	9707522451	39
26	KANAK CH. DAIMARY	RAJABIL	9508754258	52
27	KRISHNA LAMA	GYATI GAON	7896058953	57
28	LAKHIRAM URANG	RAJABIL	9957330546	PASS
29	LAKSHMAN MUSHAHARY	MAYONGPARA	9401346773	75
30	MADAN CH. GAYARY	KAHIBARI, SALBARI	9859637588	PASS
31	MAHANTA SUTRADHAR	BARENGABARI	9613802413	71
32	MAHESH PRADHAN	FATEMABAD TEA ESTATE	7399151319	55
33	MANIL DAIMARY	RAJABIL	9613519205	51
34	MD. MOHIBUL ISLAM	KUTHURIJHAR	8402004379	85
35	MOHAN SUTRADHAR	BLUE HILLS lodge	7896701051	49

Sno	Name	Address	Contact no	MARKS
36	NAVAJIT ROY	GYATI GAON	9957067133	PASS
37	NIJWM MUSHAHARY	KAHIBARI, SALBARI	9613817305	71
38	PANKAJ DAS	GYATI GAON	9957100638	48
39	RAJEN PATHAK	GYATI GAON	8472070923	82
40	RAJU GORH	GYATI GAON	9957015101	54
41	ROSHAN SWAUSI	KUTHURIJHAR	9859858893	72
42	SANSUMA SWARGIARY	KANTHAL GURI	9577567098	32
43	SATISH BASUMATARY	RAJABIL	7399820115	40
44	SHANKARDEV DAS	BARENGABARI	9859307435	34
45	SMTI JUNU CHETRY	GYATI GAON	9859614565	61
46	SMTI KARABI DAS	BANSBARI	7399694678	80
47	SMTI PROMITA DEKA	GYATI GAON	7753996033	64
48	SMTI. PRANITA RANI BASUMATARY	RAJABIL	7399987723	56
49	SUKLESHWAR NATH	GYATI GAON	9577463726	89
50	SUKLESHWAR PATHAK	BARENGABARI	9859664764	48
51	SUKRAM DAIMARY	THAKUMAPARA, RUPAHI	9613217219	60
52	SULENDAR BARAIK	MAYANGPARA	7399623215	43
53	SUNIL NARZARY	BARENGABARI	7854723860	39
54	SUNIL WARY	MADLIJHORA	9854489439	54
55	TAPAN KOSH	GYATI GAON	7896736996	60
56	TIKENDRA KALITA	BARENGABARI	7399259836	71
57	TULSHI SARKAR	GYATI GAON	8134933966	37
58	UMANANDA DAS	BARENGABARI	9613560240	26
59	UMESH DUTTA	GYATI GAON	9957100996	64
60	UTKAL SAHA	ATHIABARI GAON	8486914312	50

ANNEXURE 2: QUESTION PAPER WITH ANSWERS

NATURE GUIDE TRAINING, FINAL EXAMTIME : One Hour, Date : 13.10.2014

Name :

Medium: BODO/ASSAMESE/ENGLISH

Roll No:

Total Marks : 100

Final Marks

1. What is the state bird, animal, flower and tree of Assam?
Deo hanh or white-winged wood duck, Rhino, Kopophul, Hollong
2. What is the local name of Bengal florican and which month is the best time to see them in Manas National Park (e.g. Jan-Feb, July-Aug, March-April)?
Ulu Moira or Dau trilling
3. What is the total area of Manas National Park and total area of Manas Tiger Reserve (in Square Kilometrs)?
500 sq km., 2837 sq km
4. When was Manas established as a) Proposed Reserved Forest b) world heritage site c) National Park d) Biosphere Reserve
1905, 1985, 1990, 1989
5. When was Manas put in 'Danger' tag and when was it reinstated?
1992, 2011
6. How many ranges are there in Manas National Park? What are their names?
Three (Panbari, Bansbari and Bhuyanpara)
7. What is the full form of IRV 2020 and BTC ?
Indian Rhino Vision 2020, Bodoland Territorial Council
8. Which is the only protected area for golden langurs in the world that is found in BTC?
Chakrashila wildlife sanctuary
9. How many species of wildlife are listed under schedule 1 (highest protected category) of Indian wildlife protection act, that are found in Manas? Name any three
22 species (includes tiger, elephant, rhino, wild buffalo, bison, hispid hare, pygmy hog, Bengal florican etc.)
10. What is the name of the elephant reserve that has overlapping area with Manas Tiger Reserve?
Chirang-Ripu Elephant reserve
11. How many National Parks are there in Assam? Name Any three?
Five (Manas, Kaziranga, Orang, Nameri and Dibru-Saikhowa)
12. When was project tiger launched and how many tiger reserves are there in India?
1973, 47
13. What is the total population of rhinos in Manas? How many calves have been born in Manas?
31
14. How many tigers have been reported in Manas National Park as per the last camera trap field survey done in 2011-12?
18-23
15. After Rhino reintroduction, which other charismatic species will next be translocated to Manas from Kaziranga ?
swamp deer or *Dol harina*

16. Name any four cat species that inhabit manas as copredators along with the Tiger?
Leopard, Clouded leopard, golden cat, marbled cat, leopard cat, fishing cat, jungle cat
17. How is an adult male elephant without tusks popularly known as? What is the total population of elephants in Manas National Park?
Makhna, 800 plus
18. Name any two Protected Area that have links with manas tiger reserve, hence making it the single largest tiger conservation landscape in the world?
Buxa (West Bengal), Royal Manas (Bhutan), Nameri (Assam), Pakke and Namdapha (Arunachal) and Hukang Valley (Myanmar)
19. What is the name of present Field director, Manas Tiger Reserve? Name the first field director of Manas National Park?
Shri A.C.Das, Shri S.Debroy
20. How many Natural world heritage sites are there in India ? Name any two ?
7; Manas, Kaziranga, Bharatpur), Nanda devi, Sundarbans, Great Himlayan (National Parks) and Western Ghats (39 serial sites).
21. Name any two rare birds found in Manas National Park ? Name any two butterflies found in Manas National Park?
Example Bengal florican, swamp francolin, black breasted parrotbill etc
Common Mormon, Common sailor, Peacock Pansy etc.
22. Name any four trees found in Manas National Park?
Example: Oxy, Outenga, Semul, Sida etc.
23. What is the faeces of Cat family ? Deer Family ? Primate family ? elephant ? called?
A) SCAT B) PELLET C) DROPPING D) DUNG
24. How many years is the minimum punishment for any violation (example Fishing, hunting) as per the Wildlife (Protection), Act 1972 inside a National Park ?
SEVEN YEARS
25. Name any one traditional dress and traditional food of tribals residing in the vicinity of Manas National Park?
Example A) DOKHNA B) ONLA

ANNEXURE 3: FORMAT OF CERTIFICATE



GOVERNMENT OF ASSAM
BODOLAND TERRITORIAL COUNCIL
OFFICE OF THE FIELD DIRECTOR, MANAS TIGER PROJECT
BARPETA ROAD, ASSAM

This is to certify that Shri/Smt......has successfully completed the Nature Guide Training conducted at Bansbari , Manas National Park from 10th to 13th October, 2014.

(Field Director)
Manas Tiger Reserve

(Deputy Director)
Manas Tiger Reserve



MANAS TIGER CONSERVATION FOUNDATION

ANNEXURE 4: PHOTOGRAPHS FROM THE TRAINING SESSION



Nature Guide Training, 11th October, 2014, Maray National Park



12.10.2013 15:07



12.10.2013 13:05



Nature Guide Training, Maray National Park (10-13 October 2014)

ANNEXURE 5: TRAINING MANUAL PROVIDED TO NATURE GUIDES

**A Handbook for Nature Guides and Forest
Frontline Staff**

October, 2014

Published by:

Field Directorate

Manas Tiger Project, Barpeta Road

Assam, 781315

Contents

Page No.

Acknowledgements

Chapter One: Definition and Terminologies

- 1.1 Eco Tourism
- 1.2 Responsible Tourism
- 1.3 Sustainable Tourism
- 1.4 Community Based Tourism
- 1.5 Wildlife Tourism
- 1.6 Impacts of Eco-Tourism
- 1.7 Protected Areas
- 1.8 Other designations

Chapter Two: Ecotourism in Manas Tiger Reserve

- 2.1 Overview of Manas Tiger Reserve
- 2.2. Overview of Manas National Park (Core)
- 2.3 Flora
- 2.4 Fauna
- 2.5 How to reach
- 2.6 Climate
- 2.7 Best time to visit
- 2.8 History of Manas National Park
- 2.9 Places of Tourist interest
- 2.10 Core Area (Barnadi Wildlife Sanctuary)

Chapter Three: Tracking Flagship species in Manas Tiger Reserve

- 3.1 Tiger
- 3.2 Common Leopard
- 3.3 Clouded Leopard
- 3.4 Great One horned Rhinoceros
- 3.5 Wild Buffalo
- 3.6 Asian Elephant
- 3.7 Pygmy Hog
- 3.8 Hispid Hare
- 3.9 Bengal Florican
- 3.10 Gaur or Indian Bison
- 3.11 Swamp Deer
- 3.12 Hog Deer
- 3.13 Sambar
- 3.14 Barking Deer
- 3.15 Golden Langur

Chapter Four: How to become a responsible Field Naturalist

- 4.1 General Thumb Rules
- 4.2 Reading Pugmarks
- 4.3 Restrictions and Permits in National Parks
- 4.4 Duties of a Nature Guide or accompanying Forest guard
- 4.5 Basics of First Aid

ACKNOWLEDGEMENTS

The constant guidance and leadership of Honbl'e Deputy Chief of BTC, Shri Kampa Borgayary is gratefully acknowledged. It was his idea to undertake a nature guide training for local youth and for that we always remain indebted.

Seniors in the Forest department including the PCCF cum Chief Wildlife Warden, Govt of Assam Shri R.P.Agarwalla, IFS; Council Head, Forests BTC, Shri A.Swargiary, IFS; Secretary Forests, BTC Shri .P.K.Hazoary,ACS; and Field Director, Manas Tiger Project Shri A.C.Das, IFS are gratefully thanked for their moral support.

Manas Tiger Reserve is a unique biodiversity-rich landscape that has several national and international conservation designations including the UNESCO World Heritage Site, Biosphere Reserve, National Park, Elephant Reserve, Transboundary Tiger Conservation landscape and Important Bird Area. It therefore has immense ecotourism potential that is currently being harnessed in certain locations. The USP of Manas ecotourism or nature tourism is however the showcasing of indigenous or community based tourism and conservation initiatives.

This handbook has been published on the occasion of the 'Nature Guide Training and Workshop' session that shall be held from 10th to 13th October, 2014 at Bansbari, Manas National Park. The funding for undertaking this workshop has been duly approved from the Manas Tiger Conservation Foundation.

The handbook aims to give an overview on certain important aspects related to primarily becoming an effective Naturalist in the field. The information is mostly pooled in from available published resources in hardcopy and also from online resources. Special mention and acknowledgement is therefore made of the survey reports on animal census that have been summarised in the chapter and also a WWF publication titled 'Reading Pugmarks-a pocket book for forest guards' that was available on the internet and some of the sections have used for its illustration.

The handbook is expected to complement the books; "Birds of Manas National Park by Dr Anwaruddin Choudhury", Swallowtail butterflies of Manas Biosphere Reserve by Dr Kushal Choudhury"; "A handbook of scientific and Assamese names of Plants by Dr. Ananta Borah" and other field guides that shall be distributed to participants on successful completion of the course. It is expected that it is of some use to college students, budding nature guides, naturalists and forest frontline staff, who can turn in the pages to look at Manas at a Glance!

Dr. Sonali Ghosh,IFS

Deputy Director, Manas Tiger Reserve

Dated:10th October, 2014

CHAPTER ONE

DEFINITION AND TERMINOLOGIES

1.1 Eco Tourism- According to the definition and principles of ecotourism established by The International Ecotourism Society (TIES) in 1990, ecotourism is "Responsible travel to natural areas that conserves the environment and improves the well-being of local people." Ecotourism has the following seven characteristics

- Involves travel to natural destinations
- Minimizes impact
- Builds environmental awareness
- Provides direct financial benefits for conservation
- Provides financial benefits and empowerment for local people
- Respects local culture
- Supports human rights and democratic movements.

Some further general characteristics of ecotourism have been identified by UNEP and the World Tourism Organization as:

- involving appreciation not only of nature, but also of indigenous cultures prevailing in natural areas, as part of the visitor experience
- containing education and interpretation as part of the tourist offer
- generally, but not exclusively, organized for small groups by small, specialized and locally owned businesses (while recognizing that foreign operators also market and operate ecotourism)
- minimizing negative impacts on the natural and socio-cultural environment
- supporting the protection of natural areas by generating economic benefits for the managers of natural areas
- providing alternative income and employment for local communities

1.2 Responsible Tourism

Responsible Tourism is tourism 'that creates better places for people to live in, and better places to visit'. Responsible Tourism:

- Minimises negative economic, environmental and social impacts.
- Generates greater economic benefits for local people and enhances the well being of host communities.
- Improves working conditions and access to the industry.
- Involves local people in decisions that affect their lives and life chances.
- Makes positive contributions to the conservation of natural and cultural heritage embracing diversity.
- Provides more enjoyable experiences for tourists through more meaningful connections with local people, and a greater understanding of local cultural, social and environmental issues.
- Provides access for physically challenged people.
- Is culturally sensitive, encourages respect between tourists and hosts, and builds local pride and confidence.

1.3 Sustainable Tourism

Sustainable tourism is the concept of visiting a place as a tourist and trying to make only a positive impact on the environment, society and economy.

1.4 Community Based Tourism

Community-based ecotourism is a form of ecotourism that emphasizes the development of local communities and allows for local residents to have substantial control over, and involvement in; its

development and management, and a major proportion of the benefits remain within the community. The main characteristics of community based tourism are:

- **Identity:** Respect and preserve all the characteristics of the environment, help residents reclaim historical practices, revitalize productive activities, highlight the ethnic background of the population, and highlight the unique aspects of the locality, such as topography, climate, architecture, cuisine and handicrafts.
- **Roots and Customs:** Highlight local cultural practices so that communities share their cultures and traditions with tourists with authenticity. Invaluable educational opportunities such as home stays and town-hall-style round of talks are encouraged so that tourists and local community members can mutually share cultural aspects such as food, music, folklore, and goods. Both visitor and community cultures will always be treated with appreciation and respect.
- **Ecological Consciousness and Harmony:** The conservation of nature and rigorous concern with the environment influence the development of infrastructure for community-based ecotourism activities (i.e. building houses, roads, showers, etc.).
- **Local Control:** Community members actively make decisions on strategies and acceptable levels of tourism based upon the community's culture, heritage and vision. Strategies also equip local communities with the tools and knowledge necessary for decision-making, and to build effective structures to enable the community to influence, manage and benefit from ecotourism development and practice.
- **Sustainable Economic Development:** Stimulate the local economy by generating income through the sustainable use of natural resources.

1.5 Wildlife Tourism

Wildlife tourism, in its simplest sense, is watching wild animals in their natural habitat. Wildlife tourism is an important part of the tourism industries in many countries including many African and South American countries, Australia, India, Canada, Indonesia, Bangladesh, Malaysia and Maldives among many. It has experienced a dramatic and rapid growth in recent years worldwide and is closely aligned to eco-tourism and sustainable-tourism. Wildlife tourism is also a multi-million dollar industry offering customized tour packages and safaris.

1.6 Impacts of Eco-Tourism

a) Positive impacts

- Habitat restoration by eco-lodges and other tourism operations- Many owners of eco-accommodation or wildlife attractions preserve and restore native habitats on their properties
- Financial donations- Some wildlife tourism contributes monetary donations to conservation efforts through informal (donations) and formal (green tax) means.
- Quality interpretation- A good wildlife guide will impart a deeper understanding of the local wildlife and its ecological needs, which may give visitors a more informed base on which to subsequently modify their behaviour (e.g. not throw out plastic bags that may be eaten by turtles) and decide what political moves to support.
- Research and monitoring- Some wildlife tourism operations contribute to monitoring of wildlife numbers or general research relevant to conservation
- Anti-poaching- Bringing tourists regularly into some areas may make it more difficult for poachers of large animals or those who collect smaller species for the black market

B) Negative impacts

Wildlife tourism can cause significant disturbances to animals in their natural habitats. The growing interest in travelling to developing countries has created a boom in resort and hotel construction, particularly on rain forest and mangrove forest lands. Wildlife viewing can scare away animals, disrupt their feeding and nesting sites, or make them more tolerant and tame towards the presence of people. In Kenya, for example, wildlife-observer disruption drives cheetahs off their reserves, increasing the risk of inbreeding and further endangering the species.

1.7 Protected Areas

- **Tiger Reserve-** A protected Area as declared by the State Government through powers vested under the Wildlife (Protection) Act, 1972 Amendment 2006; under Section 38V); It includes core or critical tiger habitat areas of National Parks and sanctuaries, that are required to be kept as inviolate for the purposes of tiger conservation and a Buffer or Peripheral area where a lesser degree of habitat protection is required to ensure the integrity of the critical tiger habitat with adequate dispersal for tiger species, and which aim at promoting co-existence between wildlife and human activity with due recognition of the livelihood, developmental, social and cultural rights of the local people. There are currently 47 Tiger Reserves in India.
- **National Park-** A protected Area as declared by the State Government through powers vested under the Wildlife (Protection) Act, 1972 (Section 35 or 36); which is of adequate ecological, faunal, floral, geo-morphological, natural. or zoological significance, for the purpose of protecting, No rights and concessions can be allowed inside a National Park. At present there are 102 National Parks in India.
- **Wildlife Sanctuary-** A protected Area as declared by the State Government through powers vested under the Wildlife (Protection) Act, 1972 (Section 26 A or 38); which is of adequate ecological, faunal, floral, geo-morphological, natural. or zoological significance, for the purpose of protecting, Only limited human activity in terms of declared rights and concessions such as grazing may be allowed. At present there are more than 517 Wildlife sanctuaries in India.
- **Reserved Forest -** means the forest declared to be reserved by the State Government under sec.20. Of the Indian Forest Act, 1927 (16 of 1927). Several Rights and concessions to local people may be accorded. Settlements including forest villages may also be permitted in certain areas.

1.8 Other designations

- **World Heritage Site-** A place (such as a forest, mountain, lake, island, desert, monument, building, complex, or city) that is listed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as of special cultural or physical significance. Natural World heritage Site refers to the sum total of the elements of biodiversity, including flora and fauna and ecosystem types, together with associated geological structures and formations (geodiversity).At Present there are a total of 197 Natural World Heritage Sites,. India has 7 Natural World Heritage Sites that include Manas National Park, Kaziranga National Park, Nanda Devi and Valley of Flowers National Park, Keoladeo National Park, Sundarbans National Park, Western Ghats (39 protected areas) and Greater Himalayan National Park.
- **Biosphere Reserve-** An area recognised to protect larger areas of natural habitat (other than a National Park or Wildlife Sanctuary), and often include one or more National Parks and/or preserves, along buffer zones that are open to some economic uses. Protection is granted not only to the flora and fauna of the protected region, but also to the human communities who inhabit these regions, and their ways of life. At present there are 18 Biosphere Reserves in India (example Manas Biosphere Reserve).
- **Elephant Reserve-** An area recognised to protect larger areas of natural habitat (other than a National Park or Wildlife sanctuary) and often include one or more National Parks and/or Reserves, along buffer zones especially to ensure long term survival of viable conservation reliant populations of elephants in their natural habitats by protecting the elephants, their habitats and migration corridors. At present there are 25 Elephant Reserves in India (example Chirang Ripu Elephant Reserve).

- **Important Bird Area-** An Important Bird Area (IBA) is an area recognized as being globally important habitat for the conservation of bird populations. The program was developed and sites are identified by Bird Life International. These sites are small enough to be entirely conserved and differ in their character, habitat or ornithological importance from the surrounding habitat. . Currently there are about 10,000 IBAs worldwide (example, Manas National Park).

CHAPTER TWO

ECO-TOURISM IN MANAS TIGER RESERVE

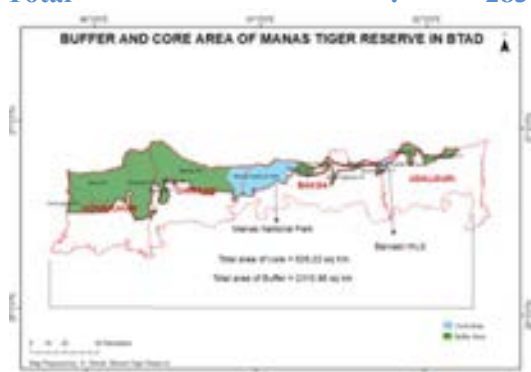
2.1 Overview of Manas Tiger Reserve

Manas Tiger Reserve (MTR) Reserve spans across the districts of Kokrajhar, Chirang, Buxa and Udalguri in north-west Assam. To the north, it is separated from the Royal Manas National Park of Bhutan by the River Manas and its tributaries- Beki and Hakua; while to the west, it is separated from the Buxa Tiger Reserve of West Bengal by the River Sankosh. Manas, with its spectacular landscape is one among most stunning pristine wildlife habitats in the world. The area has a unique distinction of being a Natural World Heritage Site, a Tiger Reserve, an Elephant Reserve, Biosphere Reserve and Important Bird Area.

Evolutionarily, it is the entry point of tigers into India and combined with Buxa-Nameri-Pakke-Namdapha TRs and Protected areas in Bhutan and Myanmar; forms the single largest tiger conservation landscape for Bengal tigers (*Panthera tigris tigris*) in the world.

Area of the tiger reserve: Core :526.22 sq.km Buffer/peripheral area : 2310.88 sq.km

Total : 2837.31 sq.km.



2.2. Overview of Manas National Park (Core)



As per the tourism guidelines circulated by Govt of India, National Tiger Conservation Authority, only 20% of the core zone is available as a tourism zone. This is to minimise the disturbance caused to wildlife by vehicular movements etc. In case of Manas National Park, tourism is

restricted to forest roads that criss-cross the park (during the dry season) especially in the plains. Walking or trekking is not allowed in the grassland area due to the presence of large herbivores. The best way to observe wildlife is therefore by a slow moving open vehicle such as a Maruti Gypsy. Trekking trails are however permitted in the immediate peripheral areas (e.g Subankhata, Daodhara, Manas RF areas) and can be especially rewarding for bird-watching.

Statement of Significance

The UNESCO World Heritage Site programme recognises 'Natural' World Heritage sites based on 4 criteria. Manas qualifies in three criteria out of the four to become one of the most diverse sites in the entire world! The criteria and a brief justification are as follows.

- **Criterion (vii): To contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;**.....For Manas, the tumultuous river swirling down the rugged mountains in the backdrop of forested hills coupled with the serenity of the alluvial grasslands and tropical evergreen forests offers a unique wilderness experience.
- **Criterion (ix): to be outstanding examples representing significant on-going ecological and biological processes;**..... At Manas, the monsoon and river system form four principal geological habitats: Bhabar savannah, Terai tract, marshlands and riverine tracts. The dynamic ecosystem processes support broadly three types of vegetation: semi-evergreen forests, mixed moist and dry deciduous forests and alluvial grasslands
- **Criterion (x): to contain the most important and significant natural habitats for in-situ conservation of biological diversity**.....Manas provides habitat for 22 of India's most threatened species of mammals. In total, there are nearly 60 mammal species, 42 reptile species, 7 amphibians and 500 species of birds, of which 26 are globally threatened. Plant diversity that includes 89 tree species, 49 shrubs, 37 under shrubs, 172 herbs and 36 climbers. Fifteen species of orchids, 18 species of fern and 43 species of grasses

2.3 Flora

The Forests of Manas Tiger Reserve range from Semi evergreen forests, *Bhabar Sal (Shorea robusta)* type forest, moist mixed deciduous forests, alluvial grassland savannah woodlands, Riparian fringing forest and *Khair-Sisoo* forests. In general, the vegetation comprises of Sal trees, scrub forests and old plantations (in buffer areas) and semi-evergreen and mixed deciduous forests, interspersed with grasslands and riparian vegetation (in core area of Manas National Park). The wide ranging species is primarily due to its unique tropical climate and the elevation gradients that support such vegetation.

Grasslands as refuge of mega-herbivores:

The vast expanses of grasslands in Manas National Park and parts of adjoining Manas RF and in Barnadi Wildlife sanctuary support a large number of mega herbivores such as Elephants, Rhino, Gaur, Wild Buffalo and swamp deer. These grasslands also harbour the world's only native population of Pygmy Hog in the world. Altogether they are the second largest grassland area left in northeast India. The tall grass and reeds also called the elephant-grass or the wet savanna grassland grow up to a height of over 5 metres during rainy season. *Narenga porphyrocoma* (Barenga), *Phragmites karka* (Khagori), *Erianthus spontaneum* (Ekora), *Imperata cylindrica* (Ulu kher), *Saccharum spontaneum* (Kohua) and other *Saccharum* species (Kher) are the main grass species. *Arundo donax* (Nal) is found in some pockets. *Aplinia allughas* (Tora) herb grows abundantly in the grassland area.

2.4 Fauna of Manas National Park

The Manas National Park harbours 61 species of mammals, 450 species of birds, 42 species of reptiles, 9 species of amphibians, 79 species of fishes and more than 200 species of butterfly and 100 species of invertebrates. Manas NP supports (IUCN listed) one critically endangered, seven endangered, ten vulnerable mammals; five critically endangered, two endangered, eighteen vulnerable

birds and four endangered and nine vulnerable reptiles. The avifaunal diversity of Manas is very rich as there is a confluence of wide range of habitats. Over 476 bird species has been recorded so far in this (IBA) Important Bird Site.

The rich assemblage at MTR is due to its unique bio-geographical location which is at the confluence of Indo-Malayan, Indo-Chinese and Australasian animal pathways making it an important refuge for several endemic and charismatic wildlife species. It also provides an ideal habitat ranging from high altitude Himalayan dense canopied forests to the sub-tropical woodlands and alluvial floodplain grassland and riverine ecosystems in the lower elevations.

Table 1: List of (Critically endangered, Endangered, Near threatened and Vulnerable) fauna of Manas Tiger Reserve as per IUCN Red Data list and the Wildlife (Protection), Act, 1972

Sno	Common Name	Zoological Name	IUCN category	WLP (Schedule)
1	Pygmy Hog	<i>Porcula salvanius</i>	Critically Endangered	I
2	White-bellied Heron	<i>Ardea insignis</i>	Critically Endangered	I
3	Slender-billed Vulture	<i>Gyps tenuirostris</i>	Critically Endangered	I
4	White-rumped Vulture	<i>Gyps bengalensis</i>	Critically Endangered	I
5	Bengal Florican	<i>Houbaropsis bengalensis</i>	Critically Endangered	I
6	King Vulture	<i>Sarcogyps calvus</i>	Critically Endangered	IV
7	Orchid Tit butterfly	<i>Chliaria othona</i>	Data deficient	I
8	Golden Langur	<i>Trachypithecus geei</i>	Endangered	I
9	Tiger	<i>Panthera tigris</i>	Endangered	I
10	Fishing Cat	<i>Prionailurus viverrinus</i>	Endangered	I
11	Asian Elephant	<i>Elephas maximus</i>	Endangered	I
12	Indian Water Buffalo	<i>Bubalus arnee</i>	Endangered	I
13	Hispid Hare	<i>Caprolagus hispidus</i>	Endangered	I
14	Chinese Pangolin	<i>Manis pentadactyla</i>	Endangered	I
15	White-winged Wood Duck	<i>Cairina scutulata</i>	Endangered	I
16	Narrow-headed Softshell Turtle	<i>Chitra indica</i>	Endangered	I
17	Assam Roof Turtle	<i>Pangshura sylhetensis</i>	Endangered	I
18	Indian Wild Dog/ Dhole	<i>Cuon alpinus</i>	Endangered	II
19	Hog deer	<i>Axis porcinus</i>	Endangered	III
20	Yellow Tortoise	<i>Indotestudo elongata</i>	Endangered	IV

21	Short-nosed Vine Snake	<i>Ahaetulla nasuta</i>	Endangered	IV
22	Greater Adjutant Stork	<i>Leptoptilos dubius</i>	Endangered	
23	Leopard/Panther	<i>Panthera pardus</i>	Near Threatened	I
24	Asiatic Golden Cat	<i>Pardofelis temminckii</i>	Near Threatened	I
25	Great pied Hornbill	<i>Buceros bicornis</i>	Near Threatened	I
26	Large Indian Civet	<i>Viverra zibetha</i>	Near Threatened	II
27	Malayan Giant Squirrel	<i>Ratufa bicolor</i>	Near Threatened	II
28	Striped Keelback	<i>Amphiesma stolata</i>	Near Threatened	II
29	Banded Krait	<i>Bungarus fasciatus</i>	Near Threatened	II
30	King Cobra	<i>Ophiophagus hannah</i>	Near Threatened	II
31	Spot-billed Pelican	<i>Pelecanus philippensis</i>	Near Threatened	IV
32	Oriental Darter	<i>Anhinga melanogaster</i>	Near Threatened	IV
33	Painted Stork	<i>Mycteria leucocephala</i>	Near Threatened	IV
34	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Near Threatened	IV
35	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	Near Threatened	IV
36	Ferruginous Duck	<i>Aythya nyroca</i>	Near Threatened	IV
37	Grey-headed Fish Eagle	<i>Ichthyophaga ichthyaetus</i>	Near Threatened	IV
38	Lesser Grey-headed Fish Eagle	<i>Ichthyophaga humilis</i>	Near Threatened	IV
39	Cinereous Vulture	<i>Aegypius monachus</i>	Near Threatened	IV
40	Pallid Harrier	<i>Circus macrourus</i>	Near Threatened	IV
41	Laggar Falcon	<i>Falco jugger</i>	Near Threatened	IV
42	Black-bellied Tern	<i>Sterna acuticauda</i>	Near Threatened	IV
43	Blyth's Kingfisher	<i>Alcedo hercules</i>	Near Threatened	IV
44	Rufous-vented Prinia	<i>Prinia burnesii</i>	Near Threatened	IV
45	Rufous-rumped Grassbird	<i>Graminicola bengalensis</i>	Near Threatened	IV
46	Brahminy Blind Snake	<i>Ramphotyphlops braminus</i>	Near Threatened	IV
47	Burmese Rock Python	<i>Python molurus bivittatus</i>	Near Threatened	IV

48	Common Water Snake	<i>Enhydryis enhydryis</i>	Near Threatened	IV
49	Common Wolf Snake	<i>Lycodon aulicus</i>	Near Threatened	IV
50	Green Cat Snake	<i>Boiga cyanea</i>	Near Threatened	IV
51	Checkered keelback Water Snake	<i>Xenochropis piscator</i>	Near Threatened	IV
52	Indian Rat Snake	<i>Ptyas mucosa</i>	Near Threatened	IV
53	Ornate Flying Snake	<i>Chrysopelea ornata</i>	Near Threatened	IV
54	Common Otter	<i>Lutra lutra</i>	Near Threatened	
55	Himalayan Keelback	<i>Rhabdophis himalayanus</i>	Near Threatened	
56	White-lipped Pit Viper	<i>Cryptelytrops albolabris</i>	Near Threatened	
57	Brown roofed turtle	<i>Pangshura smithii</i>	Near Threatened	
58	Chital Fish	<i>Chitala chitala</i>	Near Threatened	
59	Capped Langur	<i>Trachypithecus pileatus</i>	Vulnerable	I
60	Clouded Leopard	<i>Neofelis nebulosa</i>	Vulnerable	I
61	Marbled Cat	<i>Pardofelis marmorata</i>	Vulnerable	I
62	Sloth Bear	<i>Melursus ursinus</i>	Vulnerable	I
63	Great Indian Rhinoceros	<i>Rhinoceros unicornis</i>	Vulnerable	I
64	Gaur/ Indian Bison	<i>Bos gaurus</i>	Vulnerable	I
65	Swamp deer	<i>Rucervus duvaucelii</i>	Vulnerable	I
66	Rufous-necked Hornbill	<i>Aceros nipalensis</i>	Vulnerable	I
67	Malayan Box Turtle	<i>Cuora amboinensis</i>	Vulnerable	I
68	Spotted Pond turtle	<i>Geoclemys hamiltonii</i>	Vulnerable	I
69	Water Monitor Lizard	<i>Varanus salvator</i>	Vulnerable	I
70	Yellow Monitor Lizard	<i>Varanus flavescens</i>	Vulnerable	I
71	Bear Cat or Binturong	<i>Arctictis binturong</i>	Vulnerable	I
72	Himalayan Black Bear	<i>Ursus thibetanus</i>	Vulnerable	II
73	Smooth Indian Otter	<i>Lutrogale perspicillata</i>	Vulnerable	II
74	Sambar	<i>Rusa unicolor</i>	Vulnerable	III
75	Eastern Imperial Eagle	<i>Aquila heliaca</i>	Vulnerable	IV
76	Greater Spotted Eagle	<i>Aquila clanga</i>	Vulnerable	IV

77	Pallas' Fish Eagle	<i>Haliaeetus leucoryphus</i>	Vulnerable	IV
78	Lesser Kestrel	<i>Falco naumanni</i>	Vulnerable	IV
79	Swamp Francolin	<i>Francolinus gularis</i>	Vulnerable	IV
80	Manipur Bush Quail	<i>Perdica manipurensis</i>	Vulnerable	IV
81	Wood Snipe	<i>Gallinago nemoricola</i>	Vulnerable	IV
82	Dark-rumped Swift	<i>Apus acuticauda</i>	Vulnerable	IV
83	Marsh Spotted Babbler	<i>Pellorneum palustre</i>	Vulnerable	IV
84	Jerdon's Babbler	<i>Chrysomma alirostre</i>	Vulnerable	IV
85	Black-breasted Parrotbill	<i>Paradoxornis flavirostris</i>	Vulnerable	IV
86	Slender-billed Babbler	<i>Turdoides longirostris</i>	Vulnerable	IV
87	Bristled Grass Warbler	<i>Chaetornis striata</i>	Vulnerable	IV
88	Hodgson's Bushchat	<i>Saxicola insignis</i>	Vulnerable	IV
89	Finn's Weaver	<i>Ploceus megarhynchus</i>	Vulnerable	IV
90	Yellow-breasted Bunting	<i>Emberiza aureola</i>	Vulnerable	IV
91	Red-necked Keelback	<i>Rhabdophis subminiatus</i>	Vulnerable	IV
92	Common Mock Viper	<i>Psammodynastes pulverulentus</i>	Vulnerable	IV
93	Lesser Adjutant Stork	<i>Leptoptilos javanicus</i>	Vulnerable	
94	Peacock Softshell Turtle	<i>Nilssonina hurum</i>	Vulnerable	
95	Tricarinate Turtle	<i>Melanochelys tricarinata</i>	Vulnerable	
96	Bengal Monitor Lizard	<i>Varanus bengalensis</i>	Vulnerable	
97	Assam Snail Eater	<i>Pareas monticolus</i>	Vulnerable	

2.5 How to reach

Manas Tiger Reserve extends from one end of BTC in Kokrajhar district to the other in Udalguri District. There are a total of 23 forest blocks that make the entire Manas Tiger Reserve. Manas National Park is divided into three ranges for administrative purposes (Bhuyanpara, Bansbari and Panbari). Almost all the forest areas have fair weather roads that link to the main NH31.

Manas National Park, the core of MTR is located at a distance of about 176 km from Guwahati Airport. Most of the main trains stop at Bongaigaon which is at a distance of about 51 km from Barpeta Road (Park headquarters). Bansbari Range is about 17 km by road from Barpeta Road. The eastern range of Bhuyanpara can be directly approached from Pathshala township, whereas the western range of Panbari can be directly approached from Bijni township.

2.6 Climate

The climate of the area is tropical ‘monsoon’ type with a hot wet summer and a cool dry winter. Winter rains are also not uncommon. Annual rainfall varies from 2500 to 3500 mm. The temperature generally ranges from 6 degree Celsius (winter) to a maximum of 37 degree Celsius (summer). The humidity levels can however reach upto 95 percent in the peak of the monsoon season thereby making it very difficult to undertake safaris during most of the day time.

2.7 Best Time to Visit

November to April is a good time to visit. The tall grasslands become dry by this time and are therefore burnt in December –January. This gives greater visibility and fresh fodder that attracts the herbivores such as elephants and Gaur in herds thereby giving a very satisfying visitor experience. As compared to Kaziranga, major tourist attraction in Manas National Park (Mathanguri) is accessible even during the peak of the flood season.

2.8 History of Manas National Park

- 19th Century: The area was designated as the hunting grounds for the Coochbehar Royals and the Raja of Gauripur.
- 1905: The then British government recommended protection of Manas along with Kaziranga and Laokhowa, which were declared as Game Reserves.
- 1907: Notified as Reserved Forest.
- 1928: Upgraded to North Kamrup Game Sanctuary. declared a Sanctuary for Rhino (36,000ha);
- 1955: sanctuary area enlarged to 39,100ha;
- 1950: Notified as a Wildlife Sanctuary.
- 1964: Pygmy Hog rediscovered in Manas.
- 1972: An area of 888 ha from the sanctuary transferred to Central Seed Farm (Kokilabari), popularly known as Kokilabari farm.
- 1973: Declared as one of India’s first nine Tiger Reserves.
- 1985: Designated a World Heritage Site.
- 1989: Declared a Biosphere Reserve under UNESCO’s Man & Biosphere (MAB) programme.
- 1990: The Kahitama RF, Kokilabari RF and Panbari RF added to be notified as National Park.
- 1992: Listed as World Heritage Site in Danger due to high incidents of poaching as a result of a prolonged period of insurgency and armed conflict.
- 2001: Manas National Park declared as core zone of Chirang-Ripu Elephant Reserve.
- 2005- Manas celebrates 100 years of existence.
- 2006- Rhino translocation begins under India Rhino Vision 2020.
- 2007-08: Critical Tiger habitat of Manas Tiger Reserve enhanced to 840.04 sq km and declared under the Wildlife (Protection) Act, 1972 (as amended in 2006).
- 2011: Manas Wildlife Sanctuary reinstated as a UNESCO World Heritage Site in recognition of conservation efforts including signs of recovery of the natural heritage values.
- 2014- Transboundary assessment of tiger numbers in Royal Manas and Manas National Park indicate the presence of 25 tigers, thereby making it an important ‘source’ site for conservation.

2.9 Places of Tourism interest within Manas National Park

1. **Bansbari-Mathanguri-** This is the most popular destination route inside Manas National Park. Along this 17 km long stretch one can witness the gentle change in vegetation from the grasslands at Pahufield to the savannah-type woodland areas near Kanchanbari to the semi-evergreen and moist mixed deciduous forests at Mathanguri. Mathanguri is possibly derived from the term ‘Math’ ‘Guri’ (that could mean end of embankment or at the base of a religious site). The location has a heritage rest house called as Upper Bungalow. The work for this bungalow was started in 1927 and since then it

has been maintained in its original wooden structure. Overlooking the Bungalow is the Manas River that flows in through the eastern side (Royal Manas where it is known as Dangme Chu) and splits into two separate rivers called the Beki and Hakua (Bholkaduba). These and five small rivers drain the Reserve which lies on a wide low-lying alluvial terrace below the foothills of the outer Himalaya and then finally meets the Brahmaputra 64 Km to the south.

2. Kuribeel-Uchila- Bengale-hat-dhowa- The vernacular term *Beel* means a waterbody and as the name signifies this area has pure patches of low lying flood-plain alluvial grasslands ideally suited for specialists such as Pygmy Hog, Swamp francolin and Bengal florican among others. Bengale-Hath Dhowa is also known by its other name of Fort, the name of the camp signifies an event in history which is related to Mughal invasion and their subsequent retreat. Uchila is centrally located in the tall grassland area and is especially known for its bird life.

3. Rupahi-Aboidara-Kanchanbari – this area possesses the prime grassland habitat in the eastern range of Bhuyanpara. Bengal Florican males have been known to perform their spectacular breeding displays that can be easily viewed from the Rupahi watchtower in the month of March-April. Kanchanbari area is good for swamp deer and Black breasted parrotbill, Jerdon's Babbler and Swamp francolin sightings

4. Doimari- the highest point of the Park provides breathtaking view of the Bhutan foothills and is ideally suited for locating hornbills and elephants. The jungle pools along this road are potential habitat for the State bird of Assam (White winged wood duck).

5. Kokilabari-Alabari- the site for Park's first community conservation initiative (Manas Maozegendri Ecotourism Society, MMES) that began its conservation activities in 2003 and the famed seed farm with a sure-shot sighting of Bengal Florican at any time of the year.

6. Kahitema-Sidajhar- once famed for its grasslands and a legacy houseboat at Kapurpora, the area still boasts of a sizeable number of grassland avifauna in the Park area. The numerous beels along the Kahitema-Sidajhar road attract a number of migratory waterfowl in the winter.

7. Kheroni-Lafasari-Gabhrukunda- The western range of the Park, is known for its outstanding species richness and beauty. Until recent years, Gabhrukunda also had a forest rest house. Large tracts of bouldery river beds characteristic of the *Bhabhar* tract and the Bhutan hills make for an astonishing natural beauty.

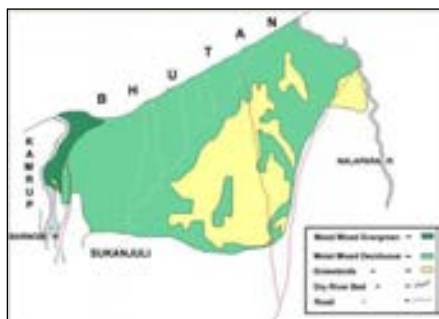
Table 2: Summary of Tourist visitors in Manas National Park

Years	Number of Visitors			Total
	Foreign	India	Day Visitors	
2000-01	Nil	1005	-	1005
2001-02	11	3219	-	3230
2002-03	21	300	-	321
2003-04	88	215	-	303
2004-05	234	13648	-	13882
2005-06	289	22029	2567	24885
2006-07	69	1689	10071	11829
2007-08	239	2127	7419	9785

2008-09	139	9597	8177	17913
2009-10	503	503	9231	10237
2010-11	129	4793	12074	16996
2011-12	177	13167	10863	24207
2012-13	218	15890	13114	29222

2.10 Core Area (Barnadi Wildlife Sanctuary)

Barnadi Wildlife Sanctuary along the foothills of Indo-Bhutan border; is the eastern buffer zone of Manas Tiger Reserve with an area of 26.21 sq.km. It is an important elephant corridor and is famous for being one the two places to harbour a natural population of Pygmy hog in the world. Bogamati alongside the Barnadi River is already a favourite destination with picnickers.



BARNADI WILDLIFE SANCTUARY

2.11 Manas Tiger Reserve (Buffer areas)

1. Jamduar

The first of the ‘Dooars’ in Assam, Jamduar is a scenic spot on the bank of River Sankosh in Kokrajhar. This is also the westernmost point of Manas Tiger Reserve (Buffer) that connects it to protected areas in West Bengal (Buxa Tiger Reserve) and Bhutan (Phibsu Wildlife Sanctuary). Jamduar is a historic place as this is where the famed naturalist E.P.Gee discovered and described the Golden Langur for the first time in 1956. The habitat has rich diverse forests of moist Sal trees that were once harvested and scientifically managed through ‘German-model’ of silvicultural practises. Each of the forests was divided into compartments and blocks where parallel ‘ride lines’ were maintained at each mile. A tram line to bring in forest labourers and bring out harvested timber was also maintained and the remnants of the same are visible in certain areas. At present the major eco-tourism activities popular in the area are nature trails, bird watching, boating and experience of traditional cultures.

2. Ultapani

As the name suggests, the area is famous for its evergreen patch of forest and a stream that flows north-westwards. The river originates from a lake named ‘Mach bhandar’ which literally translates into a place plentiful of fish. The road to Ultapani from Kokrajhar via Bishmuri is a treasure trove for butterfly watching. More than 150 species of butterflies have been reported from this area. It is also an ideal place for watching all the four species of hornbills.

3. Kalamati

Kalamati literally translates into black soil as the area is rich in ‘minerals’ that act as a natural salt-lick area for wild animals. Located in the heart of Manas RF, the scenic spot is around 24 km away from Bongaigaon via the village Koilamoila under Chirang Forest Division. The large and open tracts of riverine grasslands at the Bhutan foothills make for an enchanting experience.

4. Subankhata

This scenic spot is located at a distance of about 35 km from Barama town on NH31. Located at the foothills of Bhutan, Chowki (Subankhata) is unique in having a century-old traditional water harvesting system which is also called the ‘Dong Bundh’ system. Through this community management system, more than 13 village committees are able to protect the main channel of Pagladiya River, thereby preventing floods and ensuring water for crop irrigation throughout the year.

5. Bhairabkunda

This picnic spot is located at a distance of 22 Kms from Udalguri town by road, on the Indo Bhutan border. It is a tourist destination with enormous beauty surrounded by hills, rivers and greenery. River Dhansiri, one of the major tributary of Brahmaputra River originates from here. It is also an important pilgrim destination.

CHAPTER THREE

TRACKING FLAGSHIP SPECIES IN MANAS

3.1 Tiger



- Local name: Bagh (Assamese/Hindi), Musa (Bodo)
- Scientific Name : *Panthera tigris*
- Size: 2.6 – 3 metres, It is the largest cat species, in the world.
- Weight: 135-230 kgs
- Behaviour: Primarily nocturnal, tigers mostly feed on large and medium-sized animals, preferring native ungulates such as Sambar weighing at least 90 kg. Adult tigers are solitary and highly territorial. Although a dominant male tiger may share its territory with 2-3 females. Breeding usually takes place between November to April and the gestation period lasts for about 102 days. The average litter size is 2-3 cubs at one time.
- Habitat: Prefers undisturbed forest tracts and grasslands.
- Population status in Manas: Camera-trap based sampling of tigers in Manas in 2012-13 has revealed the presence of 18-23 tigers in the core area of the Park. Some of the tigers are known to move across the landscape into Bhutan.
- Conservation threats: Poaching, habitat destruction and loss of prey (especially large deer).

3.2 Common Leopard



- Local name: Nahor Putuki Bagh (Assamese), Tendua / Cheeta Bagh/ (Hindi), Lwkhra (Bodo)
- Scientific Name : *Panthera pardus*
- Size: 1.85-2.15 m

- Weight: 39-68 kgs
- Behaviour: The most adaptable of the big cats, it is also known to survive near human habitations. Nocturnal in behaviour, although the melanistic form of common leopard (also called Black Panther) has been frequently sighted in Manas during the day.
- Habitat: prefers undisturbed forests by managing to co-exist with the tigers, although is also known to survive in scrub forests and tea gardens.
- Population status in Manas: Camera-trap based sampling of tigers and their co-predators in 2010-11 has revealed the presence of about 27 leopards in the core area of the Park.
- Conservation threats: Poaching due to man-animal conflict, habitat loss.

3.3 Clouded Leopard



- Local name: Ghodaputki Bagh (Assamese)
- Scientific Name : *Neofelis nebulosa*
- Size: 60-110 cm
- Weight: 11-20 kgs
- Behaviour: The smallest of the 'big cats', clouded leopards is considered one of the fiercest cats for its body size. It is nocturnal in behaviour and is known to prefer trees as its resting and feeding place. Because of this reason, it is likely to hunt arboreal animals such as Golden langurs, civets and small birds. Very little information was available on its distribution and behaviour until recently. The rescue and rehabilitation of two clouded leopard cubs from Chirang RF under Manas Tiger Reserve in 2009 was one of the first such conservation rehabilitation in the world.
- Habitat: prefers undisturbed tracts of evergreen and semi-evergreen forest.
- Population status in Manas: Camera-trap based sampling of tigers and co-predators in 2010-11 has revealed the presence of about 16 clouded leopards in the core area of the Park.
- Conservation threats: Habitat loss, poaching.

3.4. Greater One-horned Rhinoceros



- Local name: Gorh(Assamese), Ganda (Bodo), Gairda (Hindi)
- Scientific Name : *Rhinoceros unicornis*
- Size: Height at shoulder: 170-185 cm
- Weight: 1500-2100 kgs
- Behaviour: A relatively primitive animal with poor eyesight but a strong sense of smell and might. Except humans, an adult rhino has virtually no other enemy in the wild. Completely herbivorous, they tend to follow regular paths (dandis) when foraging. They also use the same spot to defecate forming large 'toilets'.
- Habitat: prefers alluvial grasslands with swampy areas for wallowing.
- Population status in Manas: Prior to 1989, about 100 rhinos had been estimated in the Park. The population suffered a big loss due to poaching in the subsequent years. The multi-

stakeholder IRV2020 (Indian Rhino Vision 2020) was launched by the government in the year 2006 and since then wild rhinos (adult and captive bred) have been translocated into Manas. 11 Rhino calves have been born in the Park, whereas 7 rhinos have also been poached. As of October 2014, there are a total of 31 Rhinos in the Park.

- Conservation threats: Poaching primarily for its Horn which is nothing but a mass of hair (Keratin) and has no medicinal properties. All trade in rhino body parts is banned.

3.5. Wild Buffalo



- Local name: Bonoria moh (Assamese), Hagrani Mwisu (Bodo), Arna (Hindi)
- Scientific Name : *Bubalus arnee*
- Size: Height at shoulder: 155-180 cm
- Weight: 800-1200 kgs
- Behaviour: Large, black and robust, with flat sweeping horns, the wild buffalo is considered to be one of the most dangerous animals to encounter in the wild. It has the maximum horn spread for any member of the family bovidae and the horns grow throughout their life. The very large horns, white 'stockings' in the legs and the faint white 'v' mark on the neck are some of the characters that distinguish it from the domesticated variety.
- Habitat: prefers alluvial grasslands with swampy areas for wallowing.
- Population status in Manas: As per studies by Dr Anwaruddin Choudhury, a noted wildlife conservationist, the wild buffalo population in Manas is considered to be of one of the purest genetic strain in the entire world. A population of about 250 plus was estimated for Manas National Park in 2008.
- Conservation threats: Cattle grazing, loss of grasslands and hybridization with domestic buffaloes.

3.6. Asian Elephant



- Local name: Hathi
- Scientific Name : *Elephas maximus*
- Size: Height at shoulder: 245-275 cm
- Weight: 3000 kgs
- Behaviour: The largest land mammal, the conservation of Asian elephant has been of socio-cultural relevance in India since historic times. Usually living in herds (except for adult male bulls) Elephants migrate over large distances in search of water, food and security. The oldest female (known as the matriarch) leads the herd. Young ones are cared for by other females called as 'aunties'. Only the males bear external tusks (also called as Tusker) although adult tusk-less males (also called as Makhna) are more commonly encountered in northeast India.
- Habitat: mixed deciduous and evergreen forests, scrub and grassland.

- Population status in Manas: Manas National Park forms the core of Chirang-Ripu Elephant Reserve. In 1981, the Department estimated about 1200 elephants in the Manas Tiger Reserve comprising an area of 2837 sq km (Census report, 2008). Again in 2002, department census revealed the presence of 500 elephants in the Park (Census report, 2008). Now the Park holds more than 780 elephant (Census report, 2008). Recent census by the department reported an estimated population of approximately 780 elephants in the Park with a density of 1.68 per km² in the year 2008.
- Conservation threats: Poaching primarily for its tusk (ivory), habitat loss and human animal conflict.

3.7. Pygmy Hog



Adult male of the common Wild Pig (*Sus scrofa*) and Pygmy hog (*Porcula salvania*) drawn to the same scale. (By : W.L.R Oliver, 1980)

- Local name: *Nal Gahori*, *Tukuri Borah* (Assamese), *Oma Thaoukri* (Bodo), *Sano Banel* (Nepali)
- Scientific Name: *Porcula salvania*
- Size: 50-70 cm
- Height at shoulder: 25 cm
- Weight: 6-9 kg.
- Behaviour: The pygmy hog is rounded in shape and has a very short tail. They are known to live in groups (called sounders) of 5-10 animals. They make nests by layering short grasses and these are used throughout the year for sleeping during the night.
- Habitat: they are extremely selective of short alluvial grasslands
- Population status in Manas: Current world population is estimated at about 150-300 individuals. A survey in March 2014 has given highly encouraging results of its presence and breeding. It is therefore reconfirmed that prime grassland areas in Manas are still an ideal habitat for pygmy hogs in the world.
- Conservation threats: loss of short alluvial grasslands due to burning, cattle grazing and weeds.



3.8. Hispid Hare



Source: "CaprolagusHispidusJASB" by J. Hendrie, text: Edward Blyth - Journal of the Asiatic Society 14 1845. Licensed under Public domain via Wikimedia Commons - <http://commons.wikimedia.org/wiki/File:CaprolagusHispidusJASB.jpg#mediaviewer/File:CaprolagusHispidusJASB.jpg>

- Local name: Sesa (Bodo), Hoha pahu or Khagra kata(Assamese)
- Scientific Name: *Caprolagus hispidus*
- Size: 40-50 cm
- Weight: 2.2-3 kgs
- Habitat: they show a preference for short alluvial grasslands and the edges of grassland-woodland interface.
- Population status in Manas: A survey in March 2014, indicated a good presence of Hispid Hare in prime grassland areas of Manas. The overall population is estimated to range between 300-400 individuals although the distribution is likely to be patchy .
- Conservation threats: Uncontrolled grassland burning (after March), thatch collection, livestock grazing and the resultant spread of weeds and disease.



3.9 Bengal Florican



Source: "BengalFlorican" by Richard Lydekker - Lydekker, R. 1895 The Royal Natural History. Volume 4. Frederick Warne and Co. (from www.archive.org). Licensed under Public domain via Wikimedia Commons -

<http://commons.wikimedia.org/wiki/File:BengalFlorican.jpg#mediaviewer/File:BengalFlorican.jpg>

- Local name: Ulu Moira (Assamese), Dao Trillinga (Bodo)
- Scientific Name: *Houbaropsis bengalensis*
- Height: 55-60 cm
- Weight: 1.2 -1.9 kg (Females are heavier than the males)
- Physical characters: The male has black plumage from the head and neck to underparts. There is a conspicuous large white patch from the wing coverts to the remiges which is more visible during flight. Females are larger than the males and have a brownish colour that helps them in providing a perfect camouflage in the grasslands. Immature birds look like females
- Behaviour: They are solitary and highly territorial especially during the breeding season in Feb-April. Lekking (grouping) behaviour is also observed during this time when males compete with rival males in attracting the females. A sort of courtship dance is performed which is quite spectacular and of tourism interest particularly in the Kokilabari Agricultural Farm.
- Habitat: *Bengal Florican is a critically Endangered bird, restricted to the grassland areas in North and northeast India.*

- Population status in Manas: In 1990, around 80 birds were estimated in Manas thereby making it is the largest known population of Bengal Florican in any single locality. The survey in April 2014 indicated the presence of at least 60 individuals (combined in Manas National Park and Kokilabari Agricultural Farm).
- Conservation threats: Uncontrolled grassland burning (after March), thatch collection, livestock grazing and the resultant spread of weeds and disease.

3.10 Gaur or Indian Bison



- Local name: Bon goru or Methun (Assamese), Gaur (Hindi)
- Scientific Name: *Bos gaurus*
- Height at shoulder: 165-195 cm
- Weight: 800-1200 kg
- Behaviour: A shy animal with an acute sense of smell, it usually lives in herds of 5-30 animals. Adult dominant males tend to be solitary. The dung is similar to that of domestic cattle although, it is more flattened and liquidy in nature.
- Habitat: forest and grassland areas especially close to water.
- Conservation threats: poaching, livestock grazing and the resultant spread of weeds and disease.

3.11 Swamp deer



- Local name: Dal Harina (Assamese), Barasingha (Hindi)
- Scientific Name: *Rucervus duvaucelii*
- Height at shoulder: 115-135 cm
- Weight: 170-180 kg
- Behaviour: as the name suggests, it is a deer that tends to live in herd of 5-30 individuals. The antlers reach a massive proportion and upto 12 branches (called tines) in some cases. Only the male bears the antlers. There are 3 distinct and disjointed sub species that are found in Kanha National Park (Hard ground barasingha), Dudhwa-Corbett areas in north India and the other in Manas and Kaziranga.
- Habitat: prefer swampy grassland areas in Manas National Park
- Population status in Manas: Survey in March 2014, indicate the presence of atleast 25-30 individuals in three distinct areas of the Park.
- Conservation threats: Poaching

3.12. Hog Deer



- Local name: Hugori Pahu (Assamese), Para (Hindi)
- Scientific Name: *Hyelaphus porcinus*
- Height at shoulder: 61-71 cm
- Weight: 36-50 kg.
- Behaviour: the deer derives its name from the pig/hog-like (head down) manner in which it runs through the grassland area.
- Habitat: tall grasslands and forest swamps
- Conservation threats: Poaching, uncontrolled grassland burning (after March), thatch collection, livestock grazing and the resultant spread of weeds and disease.

3.13. Sambar



- Local name: Khar pahu (Assamese), Sambar(Hindi)
- Scientific Name: *Cervus unicolor*
- Height at shoulder: 150 cm
- Weight: 225-320 kg
- Behaviour: Unlike other deer found in Manas, Sambar prefers forest areas and also tends to be nocturnal in its feeding behaviour. Is known to live in herds of 2-8 animals, although dominant males tend to be solitary. The animals in Manas tend to have a distinct 'sore path' (bleeding on the throat) during the dry season.
- Habitat: Forest and savannah areas
- Conservation threats: Poaching

3.14. Indian Muntjac or Barking deer



- Local name: Sagoli pahu (Assamese), Kakar (Hindi)
- Scientific Name: *Muntiacus muntjac*
- Height at shoulder: 50-75 cm
- Weight: 14-28 kg
- Behaviour: The deer gets its English name from its unique alarm call that sounds like a dog barking. It usually lives solitary or in pairs.
- Habitat: Moist mixed forests, forest edges including tea gardens and scrubland.

- Conservation threats: Poaching

3.15 Golden Langur:



- Local Name: Sonali Bandor (Assamese), Mwkra gophur (Bodo).
- Scientific Name: *Trachypithecus geei*
- Height at shoulder: 50-75 cm
- Weight: 14-28 kg
- Behaviour: This unique primate gets its English name from its coat colour which is cream to golden in colour. The species is named in honour of E.P.Gee who discovered it at Ripu RF in 1956. Revered as the King of all monkeys, the langur has a highly restricted distribution between two rivers (Sankosh and Manas) in Manas Tiger Reserve and in Royal Manas National Park (upto 2400 metres elevation) in Bhutan.
- Habitat: Evergreen, semi-evergreen forests
- Population status on Manas Tiger Reserve: A survey conducted in 2008-09 indicated a total of 5141 individuals in two distinct populations (Manas Tiger Reserve and Chakrashila Wildlife Sanctuary and adjoining areas) The Reserve forest areas of Ripu-Chirang are some of the best places to sight them. Within Manas National Park, they are confined till the western range of Panbari.
- Conservation threats: Habitat loss and fragmentation.

CHAPTER FOUR

HOW TO BECOME A RESPONSIBLE FIELD NATURALIST

4.1 General Thumb rules to become a good field naturalist

Before proceeding for a safari or a forest patrol, it is advisable to carry following items with you to get the best out of each safari:

1. Wear comfortable clothes and shoes. The colour should preferably be green, khaki, grey or camouflage so as to 'match' with the surrounding.
2. Leech guards or simple 'rolling up of the socks' can help in averting discomfort due to leech bites.
3. Small notebook, measuring scale (to measure pug marks, tracks etc.) , and a pen are a must to take down field notes.
4. A small backpack with a water bottle, an emergency snack (example biscuits) a small medical first-aid kit are a must. A raincoat or an umbrella in case of rainy season and a sweater or a jacket comes handy during the winter season.
5. Invest in good Field guide books such as for birds, butterflies and plants.
6. A camera and binoculars will aid in better identification and for record keeping. Keeping spare batteries and memory cards is also essential.

4.2 Reading Pugmarks

Why are pugmarks important?


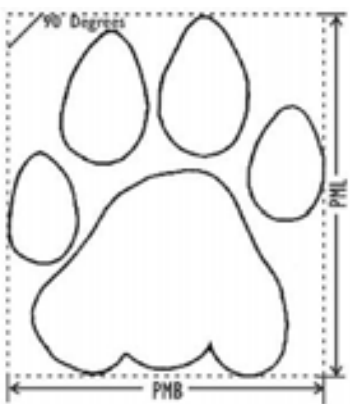
Pugmarks are recorded whenever an animal moves through the jungle over suitable ground. Pugmarks are easy to find indirect evidence of an animals presence. With some basic training and an honest approach, the information contained in the pugmarks can be easily recorded through traces and plaster casts for analysis at a higher level. If analysed skilfully and honestly, pugmarks can provide





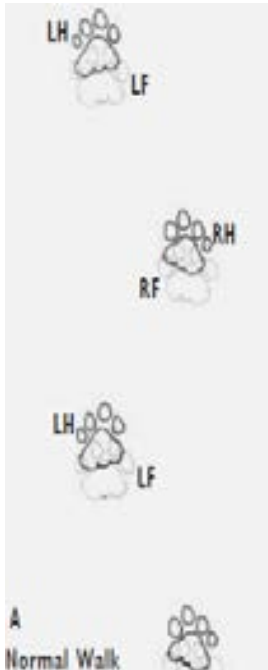
reliable data of: Presence of different species in the area of study; Population of large cats; Sex ratio of large cats. While indentifying individual animals; the higher the skill, the greater is the accuracy.


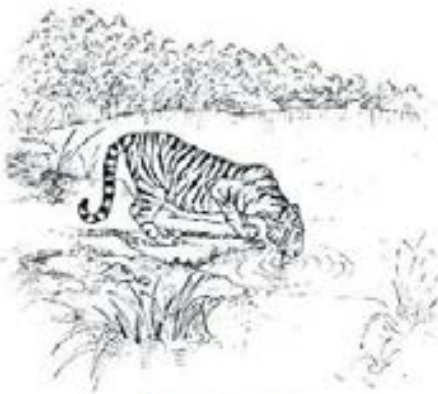


- While claw marks are visible in a dog's pugmark, in cats, unless they are walking over slippery or very steep ground, or are startled, claw marks are not visible.
- In the dog family (except in the case of hyaena), the gap between the top of the pad and the two middle toes is distinctly more than what is found in cats.
- Animals that run down their prey in a dog like manner have large toes when compared to their pad size. Animals that catch their prey by stealth, such as in cats, have large pads when compared to their toe size.
- Toes are comparatively larger in dogs. Pad comparatively larger in cats

Table 3: How to read a Tiger's pugmark

 <p>A Tiger's paw</p>	<ul style="list-style-type: none"> • A tiger's paw consists of a pad and four toes. • A fifth toe commonly called the dew claw is placed high on the front limbs only. • Dew claws are retractable and are a part of the tiger's weaponry. • Ordinarily, the dew claw does not touch the ground. • The pad is 3-lobed at the rear end.
 <p>Measuring a pugmark</p>	<ul style="list-style-type: none"> • Pugmark Length or PML is the measurement from the tip of the • Farthest toe to the base of the pad along the line of walk. • Pugmark Breadth or PMB is the measurement between the outer • Edges of the first and last toe. • The above are measured by drawing a box (all corners at 90 degrees) touching the extreme ends of the pugmark.

 <p>Right front Pugmark</p>	 <p>Right hind pugmark</p>	<ul style="list-style-type: none">• Front pugs are larger than hind pugs.• In a front pug, the forward most points of the two middle toes are almost at the same level.• In hind paws, the forward most points of the two middle toes are distinctly at different levels.• In male tigers, the PMB of the front pug is mostly greater than its PML.• Since front pugs are used for killing prey, injuries if any are sustained on front paws. Wherever existing, these may be visible on front pugmarks and may serve as a conclusive.• Identification feature of a specific animal.
 <p>Male Tiger</p>	 <p>Female Tiger</p>	<ul style="list-style-type: none">• The pugmark of a male almost fits into a square and the shape of toes in a male is more rounded.• The pugmark of a female fits into a rectangle and the shape of toes in a female is elongated.• If the difference between PML and PMB is less than 1.5 cms, the pugmark is likely to be that of a male.• If the difference between PML and PMB is more than 1.5 cms, the pugmark is likely to be that of a female.
		<ul style="list-style-type: none">• Stride measurements help in distinguishing between tigers with similar size pugmarks.• The length of stride helps in distinguishing pugmarks made by tiger cubs from those made by adult leopards.

 <p>Dusty forest roads, tracks and animal trails</p>  <p>Near water-holes</p>	<p>Search for tiger pugmarks along:</p> <ul style="list-style-type: none"> • Dusty or damp ground. • Forest paths and roads. • Animal trails. • River and stream beds. • Near water holes. • Dry nala beds. • In the vicinity of natural salt licks.
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4.3 Restrictions and permits for Tourists inside Manas National Park

1. Abide by park rules.
2. Try to blend with the surroundings. Avoid wearing bright colours and high heels .
3. Do not blow horn, play music, or make loud noises.
4. Keep strictly to the road.
5. Obtain a entrance permission before entering the park.
6. Don't enter inside the park with arms/ explosives/crackers.
7. Do not carry any inflammable item with you during park safari.
8. Officially, authorized guide is essential to be taken during the safari.
9. Do not carry any kind of radio or musical item with you during the safari.
10. Drive under recommended speed limit of 20km/hr during park safari.
11. Dismounting & eating during park safari is strictly not allowed.
12. Carry sufficient drinking water with you during park safari.
13. Do not offer any eatable item to birds or animals.
14. Do not chase or tease any animal or bird.
15. Wait for your turn to elephant ride and follow instructions of mahout.
16. Don't carry away any forest property with yourself after the safari as it will be considered criminal offence.
17. Let the animal cross the road first as they have first right in forest area.
18. Smoking or littering inside the park is strictly forbidden.
19. Keep your all senses open during park safari and avoid loud conversation.
20. Follow park safari time table strictly.

Other regulations within the National Park:

- No entry after sunset and before sunrise. Night driving is prohibited in the Reserve.

- Pets, transistors, tape-recorders, stereos are not permitted.
- No arms and ammunitions are allowed.
- Carelessly throwing and leaving trash litter is strictly prohibited.
- Kindling fire in the forest is prohibited.
- Fast driving (>20 km/ hr.) and blowing of horn is strictly prohibited.
- Shouting, teasing or chasing of animals are prohibited.
- Staying in rest houses without reservation is prohibited.
- Hunting and fishing are strictly prohibited.
- Use of flash camera to take a snap of wild animals is not allowed.

4.4 Duties of Nature Guide or accompanying Forest guard

Naturalist/Guides are generally freelancer young men and women who have passed a written & oral test of their knowledge of flora & fauna of park. Their attentiveness, way of expressing knowledge & communication skill vary somewhat but knowledge level is always good indeed. Most of the freelancer naturalists are from local tribal areas, making use of their natural skill & knowledge of local flora & fauna which is an added advantage over in-house naturalists of resorts. The general duties and responsibilities of a trained nature guide is as follows:

1. Guide will accompany the assigned safari vehicle, throughout the safari i.e from entrance to exit of safari vehicle.
2. It is the duty of guide to inform all necessary instructions & rules to the accompanying tourists and ensure that they are all followed during the safari.
3. In case of any violation of rule, guide will be held responsible and will be penalized accordingly.
4. It is moral responsibility of guide to provide all important wildlife information to accompanying tourists like areas inside tiger reserve, history of the park, population of animals, description of trees/grass/mammals/birds etc.
5. In case of any emergency inside the tiger reserve, he will lead the vehicle to resolve the emergency. For example, if a safari vehicle fails inside the national park, it is the duty of guide to get down and inform the nearest camp for required assistance.
6. It is the moral responsibility of a guide to see that no rules of park management are violated by other safari vehicles also.
7. It is the duty of the guide to make sure that jeep driver is driving the vehicle as per prescribed rules of park management.
8. In case any accompanying visitor is breaking the park rules like by smoking, using mobile phone or throwing litter, teasing animal, feeding animal etc, guide have right to object the tourist from doing so.
9. Safari guide or naturalist plays key role in animal tracking inside the tiger reserve by making use of all his/her experience, senses & knowledge.

Table 3: Tariffs (Rupees) for Tourists to Manas National Park (as on 31.03.2014)

Sno	Items	Indians	Foreigners
1	Vehicle entry fee		
	a) LMW	300	300
	b)MMV	375	375
	C)HMF	450	450
2	Tourist Entry Fee	50	1000
3	Excursion on Educational tour		-

	a).Pupils	15	
	b)Students (College)	20	
	c) Teachers	50	
4	Camera charges (Amateur)		
	a)Still	50	500
	b)Video	500	2500
5	Camera charges (Professional)		
	a)Still	1000	2000
	b)Video	5000	10000
6	Elephant riding (per hour)		
	a)Adult	250	1200
	b) Student & below 12 years	120	750
7	Jungle Safari (Jeep)		
	1 to 2 hours in the specified zone	500	1000
8	River Rafting (Mathanguri to Bispani= 18 km); seating capacity of one raft = 6		
		2000	3500
9	Lodging at Mathanguri		
	a) Upper Bungalow	1200	2500
	b)Dormitory (Tourist)	210	750
	c) Dormitory (Student)	120	
10	Researcher entry fees etc.	As per Wildlife (Protection) Act	

4.5 Basics of First Aid

I. Introduction

a. Good Samaritan Principle/Law: Generally protect you from liability as long as you act in good faith, do only what you are skilled / certified in doing, and are reasonably careful. If you decide to help, you must not leave until someone more trained takes over.

b. Consent

An adult must agree or give permission for care. Implied consent is assumed when an adult is unresponsive, with a child, or with a person of diminished mental capacity like Alzheimer's disease.

c. Universal Precautions

A way to limit the spread of disease by preventing contact with blood and bodily fluids with personal protective equipment (goggles, gloves, rescue barrier mask). To observe UP means you always assume victim's bodily fluid is infected. Use an alcohol-based cleanser to clean your exposed skin, if not available use soap/water. Proper removal of contaminated gloves: peel down edge at wrists so it is folding over exposed glove making it right side in with contaminants trapped on the inside.

Emergency Response

a. Do not move a victim unless you have to drag by back of underneath shirt or armpits with neck supported by your forearms, moving them in the direction of the long axis of the body to protect the spine. Never twist or pull sideways. Use your back not your legs to lift. Consider victim's weight & need help.

b. Action Steps (ABC's)

i. **Airway** – position victim face up on hard flat surface then open airway by head tilt chin lift

ii. **Breathing** – look, listen, and feel for breath on your face and visible chest rise 5-10 sec.

If No breath – begin CPR with 2 breaths; If Breath – check rest of injuries.

iii. **Circulation** – look for movement, blood pumping out of a wound...if found control bleeding with direct pressure, look for normal color (use exposed wrist to feel head for temperature), continue ABC's.

iv. **Recovery Positions** – Do not move unless you have to but these are used if you must leave a victim alone to get help so he doesn't aspirate on his vomit, to maintain normal body temperature (may need to roll to get blanket beneath them) or for responsive victim's who's wound's are being managed and are just waiting on Emergency Medical Services.

- Uninjured victim – place one arm out on floor on the side/palm up/elbow bent, roll top arm & leg crossed over to floor.
- Injured victim (HAINES)=high arm in endangered spine position – place one arm out above head on ground, roll victim over so head/neck are supported by arm above him, other arm should be crossed over body onto floor, legs both can be bent up slightly.

2. Bleeding, Shock, and Soft-Tissue Injuries

a. External bleeding – observe universal precautions, alert 108 & begin ABC's if needed, begin first aid. Apply direct pressure; Rip/cut away clothing. Place absorbent pad on the bleeding area. Apply pressure bandage by wrapping an elastic or rubber bandage/glove around wound, not so tight you can't get a finger under. Treat for shock.

b. Internal bleeding – (point tenderness, blood pools to surface with discoloration/hardness, blood from nose/ears/mouth/eyes/ears/vagina/rectum) observe universal precautions, alert 911, begin ABC's if needed, treat for shock.

c. Shock - victim appears restless, cool moist skin, pale or bluish color (lips), shivering, intense thirst, nausea, vomiting, and shallow breathing, below normal body temp. Rest on ground flat on back. Maintain open airway (ABC's). Cover victim with blanket and call 108.

3. Burns

i. Major burns (3rd Degree- dissolved flesh)- Cut away clothing, do not remove stuck clothing, Liquid chemical flush with water, dry chemical brush, off with protection. Remove jewellery, Separate fingers/toes with dry sterile dressing. Lightly cover with dry sterile dressing. Attend to ABC's/108, treat for shock.

ii. Minor (1st– discoloration, 2nd – blisters)- Cut away clothing, do not remove stuck clothing. Cool heat burns with cool water for 20-30 minutes or until pain is relieved. Cover with dry sterile dressing. Protect burn from friction. If a 2nd degree burn covers more than 2-3” or located on hands, feet, face, groin, buttocks, or major joint treat like a major burn. Watch for signs of infection, call doctor. DO NOT: break blisters, apply ointments/creams, ONLY apply ice.

4. Bone, Joint, and Muscle Injuries

a. Closed fracture, strain, sprain, dislocation

Place hands above & below break to immobilize (make padded splint/sling); apply Ice pack and Remove jewellery if any.

b. Open fracture

Cover with sterile dressing; Apply gentle pressure around exposed bone; call 108. DO NOT: move victim, ask victim to move injury, attempt to straighten deformity or push bone back under skin, allow victim to bear weight on injury, remove shoes or helmet from injury.

d. Spinal injury - assumed with major trauma like auto accidents, diving, or lightning strike/force of any kind. Signs: confused, pain, numbness, burning, tingling, loss of sensation in hands/fingers/feet/toes, weakness, paralysis, loss of bladder control. Call 108. Apply ABC's, HAINES or flat on back position. Place hands on both sides of head, Keep head, neck and spine in line or as found. DO NOT: remove helmet, ask victim to move or test for pain response

5. Medical Emergencies

a. Asthma – disease which the air passages in the lungs become narrower from swelling and extra mucus; signs are coughing, wheezing, trouble breathing and asthma is worse with the cold and during exercise. Provide Inhaler – remove cap, shake, press down & breathe in slowly 3-5 sec., hold breath 10 sec. Ask for Nebulizer (smaller children)- place machine/air compressor on sturdy surface, put liquid medicine into nebulizer cup (screws on bottom of mask), reassemble mask to top of nebulizer cup, place mask over child's face, turn on machine, take slow breaths holding each for 2-3 sec., continue until liquid is gone about 10 min. If the patient is not better in 15-20 minutes, DO NOT give more medication, call 108.

b. Allergic Reaction/Anaphylaxis – sudden, severe allergic reaction that involves whole body including blocked airway. Epinephrine/EpiPen auto-injector – prescribed medication for single use must be used by removing cap, holding perpendicular to body, hitting into side of upper thigh for a count of 10, remove from skin and discard, call 108 (if victim is unable, you must do for him even if unconscious).

c. Poisoning-

- If poison has been swallowed, call 108. Try to learn about what, how much, when, weight of the poison. DO NOT give anything to eat or drink.
- If poison has made Skin contact, then remove clothing, rinse skin with water. Perform ABC's, and call 108.
- For poisonous bites/stings, remove jewellery/constrictive clothing, wrap extremity tightly to constrict blood vessels to slow poison, and call 108. For Minor stings use ice pack and home remedies like Benadryl, vinegar, tobacco paste, toothpaste over sting.
- If poison is Inhaled-Get victim to fresh air, perform ABC's and call 108 (DO NOT perform rescue breaths on victim of inhaled substance).

6. Heat and Cold-Related Illness/Injury

a. **Heat Exhaustion** – and patient is still conscious, heavy sweating. Then get into cool place, Loosen / remove clothing. Give Gatorade or water. Apply wet cloths, fan, & cold compresses near arteries.

b. **Heat Stroke** – if unconscious then call 108. Gently pour Water all over body and apply. Ice pack over (neck, groin, armpits, wrists). Place in recovery position to protect airway.

7. Snake Bite

Although it is a true fact that snakes can be dangerous, you have to remember that they usually keep to themselves. So, if you've found a snake in your yard or inside your home, worry not. The snake can be easily identified – all you have to do is remember to make note or photograph the length shape (slender, heavy, thick), head (flat, rounded, arrowhead), eyes (round versus vertical pupil) and then consult with a guide book or a professional.

Signs and Symptoms

The most common symptoms of all snakebites are emotionally based symptoms such as overwhelming fear, panic and emotional instability. This may be because of all the hype surrounding snakes and possible death or injury from bites which in turn may cause symptoms such as nausea, vomiting, diarrhoea, vertigo, fainting, tachycardia (fast heart beat) and cold and clammy skin.

External symptoms-

Most snake bites, whether by a venomous snake or not, will have some type of local effect. There can be minor pain and redness in over 90% of cases, although this varies depending on the site. Bites by vipers and some cobras may be extremely painful, with the local area sometimes becoming tender and severely swollen within 5 minutes. The bite area may also bleed and blister. Pit viper bites may include lethargy, weakness, nausea, and vomiting. Then over time may develop more life-threatening symptoms such as low blood pressure, rapid breathing, severe tachycardia (heart beats very fast), altered perception of what is happening around them and respiratory failure (breathing difficulty or breathing stops). If this happens CPR should be applied.

First Aid for Snakebites

Call 108 immediately if possible. Remain calm; remember most snake bites are not fatal. Minimise movement if possible. If you are hiking alone you may have to hike out for help. If you are bitten on the arm or finger remove any rings, bracelets or watches. Loosen any tight clothing in case swelling occurs. Apply a pressure bandage to the bitten limb. If the bite is to the trunk, head or neck, apply firm pressure to the bitten area. Do not restrict chest movement as breathing will be affected by this. Splint or use a slings on the bitten limb to restrict movement. If there is no bandage or equivalent to apply a pressure bandage make note of any inflammation by tracing the edge of the swelling with a pen or the like near/around the bite and mark the time clearly next to it. If it progresses make a new tracing noting the time of each new mark besides that new tracing. This will give valuable information to medical help as to the development of the swelling. If possible, lie down and keep the bitten extremity at body level. Raising it can cause venom to travel through the body quicker. Holding it down, can increase swelling. When possible arrange for transport to the nearest hospital emergency room, where anti-venom for snakes common to the area will often be available and given if required.

Some definite No No's for Snake Bite First Aid

NO aspirin or other pain relievers. NO tourniquets. This cuts blood flow completely and may result in loss of the affected limb. DO NOT try to suck the venom out of the wound or cut into the bite with a knife. Such measures have not been proven useful and may cause further injury (see below explanation). DO NOT apply a cold compress or ice on the bite. Research has shown this to be potentially harmful. DO NOT raise the wound above the heart. Raising it can cause venom to travel into the body. Holding it down, can increase swelling. DO NOT use electric shock or a stun gun on the bite area. This method is under study and has yet to be proven effective. It could harm the victim. DO NOT wash the snake bite area – latest recommendations for snake bite treatment strongly recommend against cleaning the wound. Traces of venom left on the skin/bandages from the strike can be used in combination with a snake bite identification kit to identify the species of snake. This speeds determination of which anti-venom to administer in the emergency room.