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**Background Paper on**  
**Biodiversity Significance of North East India**

**for the study on Natural Resources, Water and Environment Nexus for Development  
and Growth in North Eastern India**

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30 Jun 2006



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## **Acknowledgements**

Forests Conservation Programme wishes to place in record the help and support received from all who contributed in developing this report. Thanks are due to Dr. P.C. Bhattacharya, Dr. Prasahat Bhattacharya and Dr. Lakshyahira and Dr. Bibhab Talukdar in Guwahati, Dr. Kharbuli, Dr. B.K. Tewari, Dr. Barik at NEHU, Shillong Meghalaya, staff at North Eastern Council, Dr. K. Bhattacharya, Director, North Eastern Space Application Centre, Mr.K. Moses, Programme Coordinator, North Eastern Region Community Resource Management Project for upland areas, International Fund for Agricultural Development (IFAD), Shillong in Meghalaya, Dr. G. Sharma, Vice Chancellor Nagaland University and Dr. Kire at Department of Forests, Government of Nagaland and officials of NEPED . We also thank the faculty of Department of Life Sciences, University of Manipur, Imphal.

Thanks are also due to Mr. Tapas Paul and Ms Bela Varma at the World Bank, New Delhi. We thank Sejal Worah, Director Programmes, WWF-India and Mr. Tapas Paul for critically reviewing the manuscripts. We thank Mr. G. Areendran and Mr. Krishna Raj at Indira Gandhi Conservation Monitoring Centre, WWF-India who helped us with the maps.

We also thank Mr. Richard Damania and Ms Kerin Kemper, World Bank US who provided us with an opportunity to voice our concerns for the conservation of biological diversity of the North eastern India.

## 1. THE NORTH EASTERN REGION OF INDIA

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The Northeast region of India comprising of the states of Arunachal Pradesh, Assam, Meghalaya, Manipur, Tripura, Mizoram, Nagaland and Sikkim can be physiographically categorized into the Eastern Himalayas, Northeast hills (Patkai-Naga Hills and Lushai Hills) and the Brahmaputra and Barak Valley plains. At the confluence of the Indo-Malayan, Indo-Chinese and Indian biogeographical realms, the NE region is unique in providing a profusion of habitats, which features diverse biota with a high level of endemism. The region is also the abode of approximately 225 tribes in India, out of 450 in the country, the culture and customs of which have an important role in understanding biodiversity conservation and management issues.

The north eastern region has been in focus for its high biodiversity and this region has been a priority for leading conservation agencies of the world. While WWF has identified the entire Eastern Himalayas as a priority Global 200 Ecoregion while Conservation International has upscaled the Eastern Himalaya Hotspot which initially covered the states of Arunachal Pradesh, Sikkim, Darjeeling Hills, Bhutan, and Southern China to the Indo Burma Hotspot (Myers 2000) which now includes all the eight states of North-East India, along with the neighbouring countries of Bhutan, southern China and Myanmar. The richness of the region's avifauna largely reflects the diversity of habitats associated with a wide altitudinal range. North East India supports some of the highest bird diversities in the orient with about 850 bird species. The Eastern Himalaya and the Assam plains have been identified as an Endemic Bird Area by the Royal Society for Protection of Birds, (ICBP 1992). The global distribution of 24 Restricted-range species is limited to the region. The region's lowland and montane moist to wet tropical evergreen forests are considered to be the northernmost limit of true tropical rainforests in the world (Proctor *et al.* 1998).

The region has been identified by the Indian Council of Agricultural Research (ICAR) as a centre of rice germplasm while the National Bureau of Plant Genetic Resources (NBPGR), India, has highlighted the region as being rich in wild relatives of crop plants. It is the centre of origin of citrus fruits. Two primitive variety of maize, Sikkim Primitive 1 and 2 have also been reported from Sikkim (Dhawan, 1964). Although *jhum* cultivation, a traditional system of agriculture, is often cited as a reason for the loss of forest cover of the region this primary agricultural economic activity practiced by local tribes reflects the usage of 35 varieties of crops.

The region is rich in medicinal plants and many other rare and endangered taxa. Its high endemism in both higher plants, vertebrates and avian diversity has qualified it to be a biodiversity 'hotspot' and this aspect has been elaborated in details in the subsequent sections. IUCN in 1995 identified Namdapha in Arunachal Pradesh as a centre of plant diversity.

The following figures highlight the biodiversity significance of the region (Hegde 2000, FSI, 2003) :

1. 51 Forest types are found in the region broadly classified into six major forest types viz., tropical moist deciduous forests, tropical semi evergreen forests, tropical wet evergreen forests, subtropical forests, temperate forests and alpine forests
2. Out of the 9 important vegetation types of India, 6 are found in the North Eastern region.
3. These forests harbour 80,000 out of 15,000 species of flowering plants . These include
  - 40 out of 54 species of gymnosperms
  - 500 out of 1012 species of Pteridophytes
  - 825 out of 1145 species of orchids
  - 80 out of 90 species of rhododendrons
  - 60 out of 110 species of bamboo
  - 25 out of 56 species of canes

4. In terms of floral species richness the highest diversity is reported from the states of Arunachal Pradesh and Sikkim amongst the North Eastern States as shown in the following table

State	Species richness (flowering plants)
Arunachal Pradesh	5000
Sikkim	± 4500
Meghalaya	± 3500
Assam	± 3010
Manipur	± 2500
Nagaland	± 2250
Mizoram	± 2200
Tripura	± 1600

5. These species belong to about 200 plant families out of 315 recorded from North East India .Some of the families such as Nepanthaceae, Illiciaceae and Clethraceae are unique in the world. These families are reported from the South East Asian countries and are represented by a limited number of species like *Clethra* sp. and *Nepenthus khasiana* in North East India (A. R. K. Sastry pers comm.).
6. According to the Indian Red data book published by the Botanical Survey of India, 10 % of the total flowering plants in the country are endangered. Of the 1500 endangered floral species, 800 are reported from North East India.
7. High biological diversity is often related to the forest cover of a region. Most of the North Eastern states have more than 60% of their geographical area under forest cover, a minimum suggested coverage for the hill states in the country. The percentage of forest cover recorded during the assessments in the years 2001 and 2003 by the Forest Survey of India is as follows:

**Scenario of Forest Cover in North East India (Areas in Sq. km.)**

N.E States	Geographical Area of the state	Forest cover in 2003 (Total)	Percentage Forest Cover in the state	Forest Cover in 2001
Arunachal Pradesh	83,743	68,019	81.22	68,045
Assam	78,438	27,826	24.04	27,714
Manipur	22,327	17,219	77.12	16,926
Meghalaya	22,429	16,839	75.08	15,584
Mizoram	21,081	18,430	87.42	17,494
Nagaland	16,579	13,609	82.09	13,345
Sikkim	7,096	3,262	45.97	3,193
Tripura	10,486	8,093	77.18	7,065

Source:1. State of Forest Report, 2003, Forest Survey of India, Ministry of Environment and Forests, Govt. of India.

8. The faunal diversity is relatively better documented than its floral counterparts for the North Eastern region. However the discovery of newer species like the Tawang Macaque (*Macaca* sp) and range extensions of the Chinese goral (*Nemorhaedatus caudatus*) and leaf deer (*Mentiacus putaoensis*) highlights the dire need for more extensive research and systematic documentation of biodiversity of the North East.

## **2. THE OBJECTIVE AND THE APPROACH**

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The objective of this background paper is to highlight the significance of the biodiversity of the entire North Eastern region in India, critically analyze the key conservation issues and provide a set of broad recommendations for biodiversity conservation. Since meaningful analysis is difficult from isolated studies on biological diversity or any effort that attempted inventorizing the species richness of the region which are otherwise extremely valuable pieces of information, efforts have been made to collate information from studies in the past that were more regional in nature. This report is based primarily on a literature survey of existing information combined with field a few focused field visits and discussions with key informants based in regional research institutions.

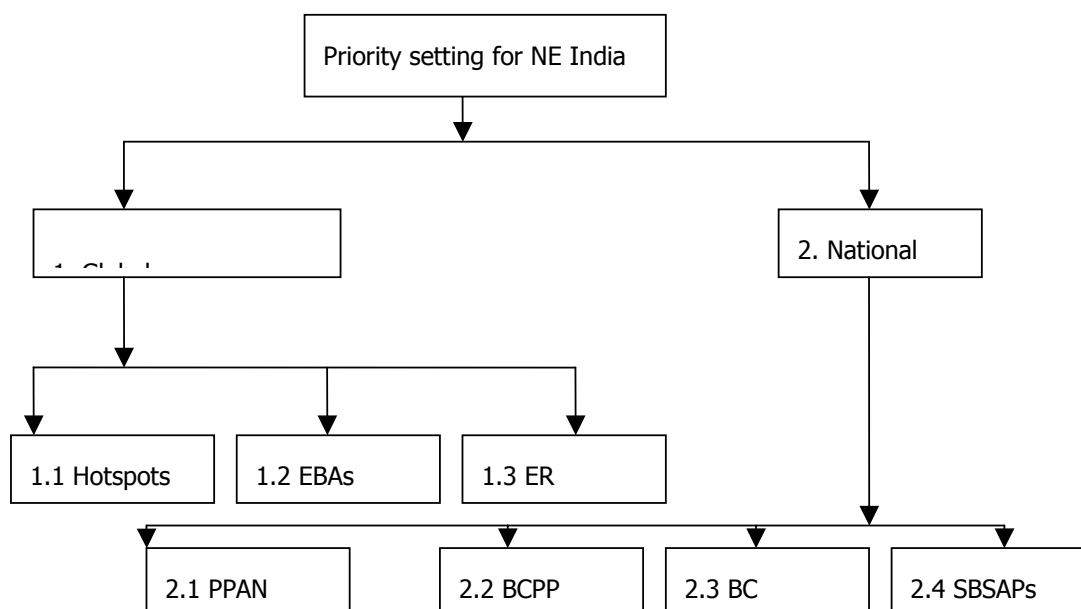
A number of priority setting exercises at both global and national level have been undertaken in the region. These exercises have used both scientific and participatory methods of assessments and therefore the outcomes of these processes can be considered to reflect view points of a large group of stakeholders. Results of these exercises have been synthesized and collated in this document. Priority sites in the North Eastern States for biodiversity conservation were mapped to analyze the extent of agreement in identifying priorities through the different priority processes.

An effort was also made to study the governance structures that affect biodiversity conservation through case studies drawn from the states of Sikkim, Arunachal Pradesh, Assam and Meghalaya to represent the North Eastern region.

### 3. PRIORITY SETTING FOR BIODIVERSITY CONSERVATION

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North East India has still been able to retain its a significant proportion of its biodiversity, possibly due to long years of isolation and difficult terrain but is now under increasing pressure to unleash its resources for economic development. Any development process without taking into cognizance the environmental safeguards may cause irreversible damage to the region. Globally three and nationally five major priority setting exercises have been carried out to highlight the biodiversity significance of the region.. The priority setting processes can help identify key sites and species which are ecologically unique or important from a social, cultural and environmental perspective. These are illustrated in the figure below.



EBA - Endemic Bird Area, ER- Ecoregions, PPAN- Planning for Protected Area network, BCPP- Biodiversity Conservation Prioritisation Project, BC- Biodiversity Characterization, SBSAP- State Biodiversity Strategy Action Plans

A brief descriptopn of the priority setting exercises and their impacts follows in the subsequent paragrapahs:

#### 3.1 GLOBAL PRIORITY SITES IN NORTH EAST INDIA

##### 3.1.1 North East as a part of the Indo Burma 'Hotspot'

McNeely's (1990) categorization of India as one of the twelve megadiversity countries in the world paved the way for its placement on the world's conservation map. Subsequently, Myers (1988, 2000) identified global biodiversity 'hotspots' which were areas of high biological diversity and high endemism but under severe anthropogenic threats. In the initial publications Myers defined the Eastern Himalaya 'hotspot' covering the Indian states of Arunachal Pradesh, Sikkim and Darjeeling district of West Bengal, parts of Nepal , China and Bhutan. A decade later in 2000, the Eastern Himalaya biodiversity 'hotspot' was modified to the 'Indo Burma hotspot' covering central Nepal to



whole of North East India, Andaman and Nicobar Islands, Hainan island in southern China, Myanmar, Thailand and on to Indochina, then south to Isthmus of Kra in the Malaysian peninsula. (Myers 2000). The hotspot is, the second largest and next only to the Mediterranean basin with an area 2,20,60,000 sq km among the 25 identified globally.

All the global hotspots are based on two criteria: species endemism and degree of threat. To qualify as a hotspot an area must contain atleast 0.5 % or 1500 of the world's 300,000 plant species as endemic. It might be pertinent to mention here that all the global hotspots have a minimum of 2500 endemics. The other criteria are number of vertebrate species (excluding fish) and degree of threat through habitat loss. To qualify as a hotspot, the region should have lost 70% or more of its primary vegetation.

#### **Some facts and figures on the Indo Burma hotspot (Myers, 2000):**

Original extent of primary vegetation	2,060,000 sq km
Remaining primary vegetation (% of original extent)	100,000 sq km (4.9)
Plant species	13,500
Endemic plants (% global plants)	7000 (2.3%)
Vertebrate species	2185
Endemic vertebrates (% of global vertebrates)	528 (1.9%)

Since the endemic species are irreplaceable, endemism signifies uniqueness of a region. The following table shows that the extent of endemism in birds, mammals, reptiles and vertebrates (except fish) is exceptionally high and to the tune of around 25% in this 'hotspot'. The only other region in India with a comparably high level of endemism is the Western Ghats, which is also a global hotspot.

Bird sp		Mammals		Reptiles		Amphibians		Total sp. of vertebrates (except fish)	
Total	Endemic	Total	Endemic	Total	Endemic	Total	Endemic	Total	Endemic
1170	140	329	73	484	201	202	114	2185	528

Until the recent past conservation efforts in the hotspots has been locale specific and scattered. WWF-India implemented the Biodiversity 'Hotspots' Conservation Programme in Eastern Himalaya (Arunachal Pradesh and Sikkim) during 1992-2001 (Chatterjee 1995, Anon 2001) Biodiversity conservation initiatives were launched in partnership with institutes like the State Forest Research Institute at Itanagar and State Forest Departments, Govt. of Arunachal Pradesh and Sikkim) To make conservation efforts more visible, the need was felt for larger and robust programmes through multistakeholder involvement. Recently, Conservation International, US, undertook preparation of an ecosystem profile for the Indo- Burma hotspot which was a joint initiative by the Centre of Applied Biodiversity Science, Conservation International, Global Environmental facility, Government of Japan and the World Bank to make investments through an umbrella grant, the Critical Ecosystem Partnership Fund (CEPF). The process involved a wide range of stakeholders the NGOs in particular who collectively shared their experiences to prioritize species and sites for conservation. The CEPF report so prepared in April 2004 identified priority landscape on faunal distribution and emphasized on corridors which are vital for survival of the wild fauna. It is interesting to note that prioritization however was made through distribution of the mega faunal species and flora was not considered for prioritization due to lack of information on distribution. A list of priority sites has been placed as an Annexure to the report.

### **3.1.2 The Global Endemic Bird and Important Bird Areas in North East India.**

The International Council for Bird Preservation, UK identified the Assam plains and the Eastern Himalaya as an Endemic Bird Area. (Bibby et al.1998). The EBA has an area of 220,000 km<sup>2</sup> following the Himalayan range in the countries of Bangladesh, Bhutan, China, Nepal, Myanmar and the Indian states of Sikkim, northern West Bengal, Arunachal Pradesh, southern Assam, Nagaland, Manipur, Meghalaya and Mizoram. Because of a southward occurrence of this mountain range in comparison to other Himalayan ranges, this region has a distinctly different climate with warmer mean temperatures and fewer days with frost and have much higher rainfall. This has resulted in the occurrence of a rich array of restricted range bird species and more than two critically endangered species, three endangered species and 14 vulnerable species of birds within this EBA (Islam and Rahmani 2004). Stattersfield et al. (1998) identified 22 restricted range species out of which 19 are confined to this region and the remaining three are also present in other endemic and secondary areas. Eleven out of the 22 restricted range species found in this region are considered as threatened (Birdlife International 2001), a number greater than in any other EBA of India (Stattersfield et al. 1998).

Endemic Bird Areas may not necessarily include all the important bird areas, therefore to further the need for protecting bird habitats, the Important Bird Area (IBA) programme was initiated by Bird life International to document and advocate the protection and management of a network of sites that are important for the long-term viability of naturally occurring bird populations across the geographic range of those bird species for which a site-based approach is appropriate. Following this concept, a total of 59 IBAs have been identified within the Eastern Himalayas EBA. All these IBAs are distributed among six Biomes namely – Eurasian high montane (Alpine & Tibetan), Sino-Himalayan temperate forest, Sino-Himalayan subtropical forest, Indo-Chinese tropical moist forest, Indo-Malayan tropical dry zone and Indo-Gangetic plains (Islam and Rahmani 2004). The IBAs designated were based on one or more of the following criteria – habitat for globally threatened species of birds (Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Data Deficient and Near Threatened species), area coverage of restricted range species of birds, areas having significant assemblage of biome restricted birds species and significant assemblage of congregator species. IBAs are not always a Protected Area, but sometimes constitute part of the PAs within this region.

Though the Eastern Himalaya EBA has 59 IBAs (list annexed), the conservation outcome remains far from satisfactory. Some of the IBAs are PAs or located within PAs. However, some prominent IBAs are not even located within a Reserve Forest (see maps annexed with this report). Therefore, there is no legal control towards protection of the avian habitats in these non-PA IBAs. When the IBA concept was coined in India, there were suggestions for the incorporation of IBAs as a type of PA under the Wildlife (Protection) Act, 1972 of India. However, that concept was never followed with appropriate authorities. Another school of thought was to declare some of the non-PA IBAs as conservation reserves, wherein the IBA is located on the land/area owned by the government or as community reserves, wherein the IBA is located on private holding. Despite of some initial excitement of getting the communities to participate in conservation of the avian habitats, not much was done either by the government or by any other organization to safeguard these important avian habitats.

### **3.1.3 The Global Ecoregions of the WWF in North East India**

In 2000, WWF identified 200 global priority ecoregions wherein an ecoregion was defined as "A relatively large area of land or water that contains a geographically distinct set of natural communities that share a majority of their species, ecological dynamics and environment conditions and function together as a conservation unit at conservation and regional scales. (Wikramanayake et al. 2002)

WWF has identified the following priority ecoregions in North-East India:

- Brahmaputra Valley Semi Evergreen Forests
- The Eastern Himalayan Broadleaved Forests
- The Eastern Himalayan Sub-alpine Coniferous Forests
- India-Myanmar Pine Forests

WWF plans to invest a major part of their conservation effort in the priority ecoregions. Since these ecoregions are large areas which in some cases span international boundaries, critical landscapes within some of the ecoregions have been identified for immediate focus. These landscapes are usually mosaics of different land uses for which integrated conservation and sustainable development strategies are developed along with a range of key stakeholders.

Presently WWF is focusing on the following landscapes in the North East (See Map):

- The Western Arunachal Landscape in Arunachal Pradesh
- The Khangchendzongha Landscape in Sikkim and Darjeeling
- The North Bank Landscape and the Kaziranga-Karbi Anglong Landscapes in Assam

The landscapes have been delineated on the basis of distribution of species or forest types and each addresses a range of conservation issues. The diversity of Rhododendrons in Western Arunachal Pradesh, distribution of snow leopard in Khangchendzongha and remnant evergreen and semi evergreen forests in the foothills and North of Brhamaputra which are important corridors for elephant migration in Assam have defined the landscapes boundaries in the region. Meaningful and scientific data on the species and vegetation type distribution using GIS techniques are being made which would provide a baseline and aid analysis of biodiversity with greater rigour at future dates.

Further details on the ecoregions are placed in Annexure 4.

## **3.2 NATIONAL PRIORITY SETTING EXERCISES**

### **3.2.1 Planning for a Protected Area Network**

Planning for a Protected Area Network in India by the Wild Life Institute of India (Rodgers and Panwar 1988) is one of the most comprehensive exercises for designing a scientifically robust and viable network of PAs in India. Identifying ten biogeographic zones, the exercise provided a rationale for existing and proposed set of sites which are of high biodiversity significance. While many of the areas have been included in the PA network, some still continue to remain as proposed sites. Details of the list of existing and proposed PAs have been annexed in this report. (Annexe 5)

Given the fact that the region harbours community owned forests, most of which are in the states of Arunachal Pradesh, Sikkim, Meghalaya and Nagaland, the declaration of additional protected areas will be difficult and would possibly lead to people and park conflicts. This can be substantiated from the fact that inspite of addition of two new categories of Protected areas viz., Community Reserves and Conservation Reserves through the amendment of the Wild life Protection Act, 1972 in 2000, there has been practically no success in declaring community forests areas as Community Reserves.

### **3.2.2 Biodiversity Conservation Prioritization Project (BCPP)**

The Biodiversity Conservation Prioritization Project (BCPP) by WWF-India (1997-2000) was the first exercise of its kind that attempted to identify priority sites and species on the basis of their biological and socioeconomic values and to develop strategies for their conservation at a national scale. The wetlands, grasslands and forest areas that were prioritised in North East India have been annexed within this report. A significant outcome of the exercise was to bring out locations of biodiversity significance beyond the protected area network. Many important locations which were earlier not known widely were identified. BCPP attempted assigning IUCN conservation categories to groups of species like invertebrates, fish, medicinal plants and reptiles using CAMP (Conservation Assessment and Management Planning) approach that relies on both published and unpublished information. Separately, priority medicinal plants species, wild relatives of crop plants, sacred forests and national parks and sanctuaries were identified. (Singh et al. 2000)

Priority sites were identified for three North Eastern states/ locations – Meghalaya, Tripura and the middle hills of Arunachal Pradesh (See maps in Annexure 6).

BCPP also attempted developing Biodiversity registers to develop community strategies for conservation. However, registers were developed only for around ten villages in the state of Assam which was considered to represent the entire North Eastern region (Shrishti Jigyasa Parivar, 2000). The experiences and shortcomings of BCPP certainly shaped up the approach for the National Biodiversity Strategy Action Plan (NBSAP) which is discussed in the subsequent paragraphs

### **3.2.3 Biodiversity Characterisations through GIS techniques**

The only biodiversity characterization at a landscape level for the entire North East of India using Satellite Remote Sensing and Geographic Information System was by the Indian Institute of Remote Sensing (IIRS, 2002) and Department of Space, Government of India. Biological richness maps prepared by the NESAC were a function of disturbance index, terrain complexity, species richness, biodiversity values and ecosystem uniqueness. Areas identified by the North East Space Application Centre (NESAC) under the high biological richness regimes in the North Eastern states have been annexed in this report.

### **3.2.4 State Biodiversity Conservation Strategy Action Plans**

India is a signatory to the convention of Biological Diversity and has a commitment to prepare a National Biodiversity Strategy and Action Plan (NBSAP). Each of the states in India has prepared an action plan that feeds into the NBSAP. These respective State Biodiversity Conservation Action Plans provided an opportunity to compile existing information and highlight the biodiversity status of the states. Unlike the Biodiversity Conservation Prioritisation Project (BCPP) which attempted identification of biodiversity rich sites under different ecosystems like forests, grasslands, mountains and wetlands, the State Biodiversity Strategy and Action Plans (SBSAPs) were developed individually for the states. Priority locations identified by the SBSAPs are in Annexure xx.

## **3.3 OTHER MAJOR INITIATIVES TO HIGHLIGHT AREAS OF BIODIVERSITY SIGNIFICANCE**

The Botanical Survey of India published the Indian Red Data Books on plants to highlight the rare, endangered and threatened species. The Tropical Botanical Garden Research Institute (TBGRI), Thiruvananthapuram through its publication "Hotspots of Endemics of India Bhutan and Nepal" provides an account of endemic plants in Sikkim and Arunachal Pradesh Himalayas, Naga and Manipur Hills, Lushai Mizo Hills, Khasi Jaintia Hills. (Nayar 1996).

Recently, the Foundation for Revitalization of Local Health traditions, Bangalore used the CAMP (Conservation assessment and Management Prioritisation) to develop taxon data sheets for medicinal plants of Arunachal Pradesh, Assam, Meghalaya and Sikkim (FRLHT 2003). Fifty one plant species were assessed out of which 47 were found to be threatened in one or more states. Of these, six were globally threatened<sup>1</sup>. Arunachal Pradesh was found to have five of these species, Assam had one, Meghalaya had two, Sikkim had two and one was common to all the states. WWF-India in collaboration with Smithsonian Institute, US made an assessment of the floral richness of the Pakhui WLS and Nameri National Park. Biodiversity richness was found to be comparable with many of the other regions of the globe.

## **3.4 THREATS TO BIOLOGICAL DIVERSITY OF THE NORTH EAST**

Threats to biological diversity of the North Eastern region have been compiled from the existing literature. The broad categories of threats are as follows:

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<sup>1</sup> These are *Amentotaxus assamica*, *Coptis teeta*, *Gymnocladus assamica*, *Nepenthes khasiana*, *Piper pedicellatum* and *Piper betleoides*.

### 3.4.1 Deforestation and Degradation

The primary vegetation in extensive areas of the Northeast India has been disturbed and modified and in some places destroyed by seismic activities, frequent landslides and resultant soil erosion. While these natural causes have contributed only marginally to the change in vegetation type, human induced activities have led to irreversible transformation in the landscapes and resulted in colossal loss of biodiversity in the entire region. (Ramakanta V, A.K. Gupta and Ajith Kumar unpubl). The region has witnessed excessive logging since the colonial days for revenue generation (Handique 2004). The practice continued until the Supreme Court ban on logging in 1995, however clandestinely it is done in some areas in the reserve forests (Tripura SBSAP). The logging and extractions have also damaged some of the forest patches like the Borduaria preservation plot of Hollong, Mekai.

Except in the Brahmaputra and Barak valleys of Assam where substantial areas are under agriculture, relatively little land is available for settled cultivation. Hence, shifting agriculture or slash-and-burn agriculture is the major land use in Northeast India and extends over 1.73 million ha (F S I, 1999). Different agencies have come up with different figures concerning the total area under shifting cultivation (*jhum*) in the region. This traditional practice has largely been blamed for deforestation in the region. Usage of poison and dynamite has been responsible for depletion of fish stocks from the water bodies.

In the state of Tripura almost entire area of forests of the state has been subjected to severe degradation. FSI in 1989, showed that majority of forest areas (up to 72.73%) are heavy to moderately degraded. In Arunachal Pradesh deforestation has also resulted from excessive logging and timber extraction. Decades ago, harvesting of timber from natural stands was not an issue. Therefore, for economic development, forest based industries were encouraged. In less than 10 years beginning 1982 the number of wood based industries rose up from 93 to 242 which is indicative of the demand for timber resource this has virtually stripped off quality timbers like Hollock and Hollong from the forests along with associated vegetation.

Northeast India has 64% of the total geographical area under forest cover and it is often quoted that it continues to be a forest surplus region. However, the forest cover is rapidly disappearing from the entire region. There has been a decrease of about 1800 sq.km. in the forest cover between 1991 and 1999 (F.S.I. 2000). More worrisome still is the fact that the quality of the forest is also deteriorating, with the dense forests (canopy closure of 40% or more) becoming degraded into open forest or scrub. Though there is a succession of several edaphic formations, a vast area of land has already been transformed into barren and unproductive wastelands. This being the case, the statistics of 'more than 64 % of the total geographic area in this region under forest cover' could be misleading. For example, though the forest cover in Manipur extends to 78% of the total geographic area, only 22% of forest area is under dense forest cover and the rest has been converted to open forests (Ramakanta et al. unpubl.)

While the rest of the states have increased in terms of forest cover, Arunachal Pradesh and Manipur have registered a decline in 2003 in comparison to 2001. Four of the eight states, Arunachal, Assam, Mizoram and Sikkim, lost dense forests as shown in the following table:

State	2001 Assessment			2003 Assessment			Change		
	Dense	Open	Total	Dense	Open	Total	Dense	Open	Total
<b>Arunachal P</b>	55,932	14,113	68,045	53,511	14,508	68,019	-421	395	-26
<b>Assam</b>	15,830	11,884	27,714	13,042	14,784	27,826	-2,788	2900	112
<b>Manipur</b>	5710	11,216	16,926	6,538	10,681	17,219	828	-535	293
<b>Meghalaya</b>	5,681	9,903	15,584	6,481	10,348	16,839	810	445	1,255
<b>Mizoram</b>	8,936	8,558	17,494	7,488	10,942	18,430	-1,448	2,384	936
<b>Nagaland</b>	5,393	7,952	13,345	5,707	7,902	13,609	314	-50	264
<b>Sikkim</b>	2,391	802	3,193	2,362	900	3,262	-29	98	69
<b>Tripura</b>	3,463	3,602	7,065	5,046	3,047	8,093	1,583	-555	1,028

Source: FSI 2003.

### 3.4.2 Agriculture

The economy in the entire Northeast India is agrarian in nature and as mentioned in the preceeding paragraph, little land is available for settled agriculture. Some states like Assam earn revenue through the oil plant. The inaccessible terrain made rapid industrialization in this region difficult, therefore the agriculture has been the main livelihood amongst the hills and the plain tribes. Along with the settled agriculture (e.g. paddy cultivation), '*jhum*' (shifting cultivation) is often carried out by many tribal groups. *Jhumming* is one of the most ancient systems of farming, believed to have originated in the Neolithic period, around 7000 BC (Borthakur 1992). It is intricately linked with the ethos of the social and cultural values of the tribal communities.

Literature available in general has blamed *jhumming* for the adverse effects on ecology and conservation – including, destruction of soil fertility; soil erosion in upper catchments resulting in sedimentation of water bodies, poor yield of crops, destruction of wildlife and natural habitat, and floods.

Along with *jhum* cultivation, there are also other practices like 'bun' cultivation (for growing potato), particularly followed in the hill slopes of Meghalaya, which have the potential to cause both soil and water erosion. Similar instances can be found with settled agriculture that is responsible for causing loss of biodiversity. Large forest patches in the plains, particularly in the tropical wet evergreen forests in Arunachal Pradesh (as seen in Diyum, Chowkham, Miao) have been cleared and converted to agriculture fields. Some of the less arid lands are converted to mustard cultivation. This practice is more prevalent as people from higher reaches have come down to foothills areas to settle new villages

The banning of *jhum* however, in the region has met with little success..In Tripura, *jhumias* (shifting cultivators) do not have any other means to earn their livelihood. It is a necessity for their survival. They are not comfortable with other activities for reasons of unfamiliarity, difficulties connected with those activities, etc. The traditional life style, culture and resistance to the government policies by the local inhabitants have led to non adoption of any suggested alternative to *jhum* cultivation. In the absence of a land use policy (except for the state of Manipur which has a Land reforms and land Revenue Act 1960 for the plains district only) and a clear identity of land ownership, suggested alternatives to *jhum* will remain an academic exercise. The Government of Mizoram launched a programme on New Land Use Policy (NLUP) in 1984 with an objective to put an end to the practice of *jhum*. An analysis of the success of the programme (Garbayal, 1999) revealed that non involvement of the village councils and the inadequacy of the financial support to families practicing *jhumming* were the prime reasons for the programme not being successful in the state. Imposition of the Shifting Cultivation Regulation Act in 1947 or the ban on timber logging has not helped in the improvement or rehabilitation of the *jhum* lands.

### 3.4.3 Encroachment

Encroachment of forestland is a serious threat to forests and its conservation. The situation is alarming in some states and needs strong political will to address the problem. This has not only caused loss of forest area but has also created a tool for perpetual degradation of forest resources. Frontline in 2002 reported the unsuccessful efforts of eviction of encroachers from a reserve forest near Guwahati subsequent to Supreme Court order in January 1998. The issue is politically sensitive and seldom discussed in a transparent manner (Kumar, 2002).

### 3.4.4 Grazing

It is estimated that 60% of the domestic herbivore population graze in the forest. The grazing causes soil compaction and heavy damage to the forest plantations and natural regeneration. This far exceeds the carrying capacity of the forests and is one of the major factors for degradation of forests especially near habitations. Barren and unproductive cattle inspite of having uses like transport, manure, capital etc are generally viewed as a great drain on the resources of the State. There are no grazing grounds as the community land for grazing purpose in many villages have

either been encroached or diverted to other land use. Thus grazing constitutes a threat to forest conservation and biodiversity in the State. Enforcement of strict control or imposition of restriction to such disturbance under present socio-economic conditions is practically impossible. This report provides a case study on the pressure of grazing in the Barsey Sanctuary of Sikkim and the efforts of the Forest Department in Sikkim in reducing the problem through the ecodevelopment committees (Box 3)

The Arunachal Pradesh SBSAP reports that biotic pressures are mostly in the form of grazing, trampling and browsing. This is very prevalent in foot hill regions adjoining Assam where large herds of cattle intrude and damage new regenerations and palatable plants. In most of the young forest plantations this is a growing problem. The *mithun* which is a semi domesticated animal also causes extensive damage to young plantations. In higher elevations similar damage are caused by sheep and yak. Apart from grazing or browsing, these animals are responsible for trampling and damage to young recruits.

#### **3.4.5 Human Wild life Conflict**

The North Eastern Region harbours important corridors for movement of wild animals like elephants and human wildlife conflict is widespread in locations like the foothills of Assam Arunachal Pradesh border along the North bank of Brahmaputra. Human deaths and crop degradation are common and efforts of organizations like the WWF and Aranyak in mitigating the conflicts would remain ineffective unless the natural corridors of movement are firmly secured.

#### **3.4.6 Forest Fires**

Forest fires are common and frequent affecting about 20% of the total forest area (FD, 2000). Such fires at the end of winters are a rule rather than exception. The villagers set fire to forest floor, which is littered with inflammable dry leaves and twigs. Regeneration, (natural as well as artificial), is affected and wildlife is impacted negatively (Semwal et al 2003). The hill forests get burnt due to *jhum* fires going out of control and spreading to the surrounding areas. This is causing immense harm in catchment areas of major rivers. As per assessment of FSI (1993), it is estimated that around 6.16% of the forests are heavy to moderately degraded by fire. (SBSAP Tripura) In places, retrogression of vegetation has already set in. The main constraints in control of forest fires are lack of communication facility for early detection of forest fire and also the lack of fire fighting equipment. Forest fires sweep a large area of forest floor every year, affecting regeneration in natural forests and young crop in the plantations. It poses a serious threat to biodiversity as only hardy species are able to survive /regenerate; habitat is destroyed; and micro flora and microfauna are destroyed.

Forest fires are reported from the Pine forests of Arunachal Pradesh. Resin tappers who are contracted by the village councils often do not take precautions, subjecting the forests to accidental fires. Although fire is an ecological requirement for Pine, accidental or deliberate fires causes immense damage to the forest ecosystems.

#### **3.4.7 Illegal extraction of forest products**

Tripura is surrounded on three sides by Bangladesh, a country which is among those having one of the highest population densities in the world (more than 400 persons per sq. km) but not enough forests to meet the requirement of its people. The border with the Bangladesh is 856 km long and completely porous. This situation has led to large scale smuggling of forest produce across the border. (SBSAP, Tripura) The result has been total elimination of some of the richest forests, including plantations, along the border. This is one of the most vexed problems faced by the Forest Department. The enormity & extent of such illegal feelings can be judged from the annual revenue earned from intercepted illicitly extracted forest produce which is only a small portion (around 10%) of the produce stolen/and smuggled across the border. *Taxus baccata*, a medicinal plant species known for the treatment of ovarian and breast cancer has been overexploited and smuggled heavily from Western Arunachal Pradesh (Chatterjee and Dey 1997)

### 3.4.8 Commercial Plantations

Over an area of 3,000 sq. km. the original mixed vegetation is replaced with monoculture plantations of rubber in Tripura. Tea plantations are coming up in a big way in Arunachal Pradesh. Commercial plantations not only replacing the original vegetation and flora but also adds to the damage through larger influx of people and by adding to pollution through the enormous chemicals, fertilizers and pesticides applied in the plantations. In Lohit district, large areas of tropical evergreen forests have given way to tea plantations. A similar situation is emerging in parts of Tirap and Changlang districts of Arunachal Pradesh.

### 3.4.9 Replacement of indigenous species with exotics

Due to increase in demand of certain products such as food grain, vegetables, milk and meat, some high yielding varieties of plants and animals have been introduced in Tripura leading to reduced propagation of indigenous varieties. In some cases, the indigenous varieties have been altogether ignored. The current dominance of intensive agricultural production of HYV rice and vegetables has led to significant reduction in genetic diversity of these species. Similarly, new varieties of poultry, fish, livestock and fruits have been brought in the State for mass propagation and higher production.

In Tripura more than 280 species of plants have been introduced in the State. For increasing the productivity, exotic species have been introduced. Cross breeding between local varieties of animals and exotics has been undertaken. Though production has increased, the cross-breeds are susceptible to diseases, sometimes causing huge losses of livestock and birds. The major exotic flora are the water hyacinth, hydrilla, water lily and lotus. Population increase of aquatic insects like *Notonecta* sp., *Ranatra* sp., *Geris* sp., *Nepa* sp., *Lithocerus* sp., *Cybistra* sp., *Dytiscus* sp., *Gyrinus* sp., and dragon fly nymph, are causing management problems (SBSAP Tripura).

In Mizoram the introduction of exotic fish species into the rivers by the state's Fisheries Department have resulted in the reduction of indigenous species in some areas. The unsustainable harvest of fish, crabs and prawns by means of poison, bombs and electric generators causes irreparable damage to aquatic systems. Meanwhile, hunting, trapping, and snaring of wild animals and birds is still rampant in the state.

In Arunachal Pradesh mushrooming of new townships with army establishments have also enabled widespread movement of essential commodities from one place to another. Such transportation facilitates in invasion of alien flora. The recent invasion of *Parthenium*, *Tagetes minuta* and *Xanthium strumarium* in the Tenga valley area is causing an imbalance in the native flora. Damming of one of the lake in the highly fragile ecosystem of the Sela Pass in Tawang district of Arunachal Pradesh for initiating fisheries is interfering with the natural hydrology of the region with unknown ecological consequences.

The Kaziranga National Park in Assam still reels with rapid proliferation of *Mimosa invisa* which has destroyed the native vegetation.

### 3.4.10 Un-coordinated infrastructure development

Some of the developmental pressures are new to the fragile region and is being planned at a pace which does not permit a thorough environmental assessment for the possible ecological impacts. Due to lack of deep environmental awareness in policy-making, many models of development are proving to be unsustainable, and the dimensions of such negative impacts are as yet unclear, as monitoring, baseline data, impact assessment and threat or risk assessment are poorly developed in the states.

In Arunachal Pradesh, activities like road construction which are an essential component of developmental infrastructure have been at times the roads to destruction of biodiversity. It damages not only the area over which it passes but also causes land slides that destroy patches of forests. The construction of roads also leads to depletion of fire wood, poles and timber. After constructions it continues to facilitate extraction of valuable forest resources and encourage settlements in ecologically fragile areas.



There are instances in Arunachal Pradesh where highly endangered species like *Sapria himalayana* located near Yasong in Lohit valley disappeared due to the construction of the road from Hayuliang to Walong. This was recorded by the State Forest Research Institute (SFRI), Itanagar during their exploration. Similarly the road construction in the Eagle Nest foothill section is virtually damaging some of the best species of trees. A research fellow from Botanical Survey of India, Kolkata reported on the threats to a rare *Agapetes* an epiphytic plant. *Pleione macculata* is another important orchid species that is being affected due to this road construction. When the Green Mizoram Programme was started, roadside plantations were undertaken along the Aizawl-Lengpui road. But, before long, due to widening and improvement of the road, many young plants were destroyed by debris. This is a clear indication of lack of coordination between developmental departments and lack of proper planning. Environmental management plans (EMP) have also never been incorporated in developmental plans in the State.

Mining has been a cause of concern in Meghalaya. Coal extraction is done following primitive mining method commonly called rat hole mining. Dumping of coal has been the cause of air water and soil pollution. Water in coal mining areas has been found highly acidic with low dissolved oxygen. (Patiram and Kumar, 2005) In Arunachal Pradesh mining was not known earlier in the state but of late to harness the rich mineral resources mining is being taken up. The oil, coal and lime are some of the resources for which mining is undertaken. So far it is only in the initial stages. However adequate precautions need to be built in at this stage to minimize the impacts.

In the case of Northeast India, linking of the Brahmaputra (and its tributaries) with Ganga has raised many sensitive questions on its feasibility. The idea to link these rivers was mooted in the National Perspective Plan (Ministry of Water Resources 2002) for optimum development of water resources envisaging inter-basin water transfers from surplus to deficit areas. Goswami (2002) viewed that a detailed study encompassing various aspects including social, economic and environmental issues need to be done before pursuing plans to link the Brahmaputra with other basins.

Construction of mega dams spirals controversies in the North Eastern States. Sikkim witnessed mass protests from the citizens which led to the abandonment of Rongchu Hydroelectric project. In Arunachal Pradesh much has been debated on the issue. Construction of dams in the Subansiri also generated controversies. Mega dams in the states have caused inundation of biologically rich areas. It also necessitated township development, influx of people and construction of wider roads to transport huge machinery. All such activities have telling impact on the biodiversity of the regions. The Ranga Nadi Hydel Project has necessitated a new alternative road abandoning the earlier road. It also is required to make the Doimukh Hoj road which was needed for development of the region but not without impact on the flora and fauna. The proposed Tipaimukh dam in Manipur is presently being heatedly debated.

#### **3.4.11 In-migration**

The people of the North Eastern states have managed biodiversity with the traditional wisdom. Influx of populations from the neighbouring states and countries, mostly labourers will have scant regard for the local sentiments and values. In addition the exposure to western cultures and new education system have changed lifestyles affecting the bio resources and its sustenance. There has been large influx of people in Tripura from Bangladesh during the second half of the century. The increase in population has been about 327%, between 1951 to 1991, against a normal present diennial growth rate of about 30%, reducing per capita forest area from 0.97 ha to a present level of 0.18 ha.

North Eastern region particularly the states of Meghalaya and Manipur are known for their sacred groves and forests. Loss of traditional faith has been a cause of loss of forests of reverence in Arunachal Pradesh and Sikkim, *Umang lais* of Manipur and numerous sacred forests of Meghalaya. (Malhotra 1997, Higgins and Chatterjee 2005)

## **4. AN ANALYSIS OF THE CONSERVATION ISSUES**

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Some of the broad preliminary issues that emerge from this study related to biodiversity values, threats, opportunities and management are summarized below.

### **4.1 INFORMATION ON BIOLOGICAL RICHNESS OF NORTH EAST INDIA**

An important finding of this background document is that there have been substantial efforts at both global and national scales to identify biodiversity rich locations across the North East region. The priorities overlap, indicating an general agreement amongst different organisations. Despite the region's recognition as a Biodiversity Hotspot/Priority Ecoregion/ Endemic Bird Area, by various conservation organisations, biodiversity information is generally restricted to species inventories for specific locations (mainly the PAs). Important data such as distributional patterns and population dynamics is unavailable, except for very few species. Since the richness of the region rests on high biological diversity, its documentation and systematic analysis is vital to understand correlations between richness and distributional patterns, relationships between landscape variables and species composition, and impacts of habitat fragmentation, and role of biological corridors, which are vital for determining biodiversity management strategies and options.

The availability of biodiversity information amongst the North Eastern states is not uniform. Arunachal Pradesh, Sikkim, Meghalaya and Assam are more information-rich possibly due to a stronger institutional base which includes the State Forest Research Institute and North East Regional Institute for Science and Technology in Itanagar, G.B.Pant Institute for Himalayan Environment and Development in Itanagar and Gangtok and the North East Hill University at Shillong. There is a need to develop mechanisms for generating more information in the states of Manipur, Mizoram, Nagaland and Tripura. Creation of new institutes like the North Eastern Region Community Resource Management Project for Upland Areas (NERCRMP) a joint project under IFAD, NEC and MODONER and Bio Resources Development Centre (BRDC), Shillong and the Nagaland Empowerment of People through Economic Development (NEPED) might help close some the existing gaps.

The fact that a Centre for Biodiversity for the region could not be established in spite of political assurances was a setback. The recent change in focus by the North Eastern Council from biodiversity to medicinal plants through the Biodiversity cell at the NEHU is a cause of concern.

A mapping exercise undertaken to examine the extent of overlap in priority locations reveals that there is a general understanding and agreement in biodiversity rich locations in the state. However global priorities have been restricted to only few of the North Eastern States. States like Manipur, Meghalaya, Mizoram and Tripura would require much more investment and rigorous documentation. (See maps of Arunachal Pradesh, Tripura and Meghalaya).

There have been reports on the customary laws of 200 tribes in India by the Guwahati Law Institute. The institute has made a modest beginning with 31 tribes including the Apatanis and Mishmis of Arunachal, Khasi and Jaintia

### **4.2 THREATS TO BIODIVERSITY AND OPPORTUNITIES**

There is considerable similarity in the nature of threats to biodiversity across the North Eastern region and the same can be gleaned from the respective State Biodiversity Strategy Action Plans although the intensity may vary in each of the states. There has been a conscious effort to amalgamate the North East with the mainstream economy as a result of which the region is experiencing mounting changes in the social and political environment. There is a need to undertake a thorough analysis of the threats by bringing in all the stakeholders who have a stake in biodiversity of the region. To provide an example encountered during this study, *jhum* cultivation which has been perceived by most of the state action plans and many of the publications referred

during the course of the study, has been considered as an opportunity in Nagaland as an agricultural practice which could be improved upon and preserve the agri-diversity of the region. .

Conflicts between development and conservation coupled with insurgency are likely to have profound impacts on biodiversity conservation.

#### **4.3 NATURAL RESOURCE MANAGEMENT STRUCTURES AND MECHANISMS**

The North Eastern states exhibit a diversity of governance structures and institutions (see boxes 1 and 2). Studies related to natural resource management and the constitutional framework does provide space to these, through the Schedule 5 and Schedule 6. It is a matter of concern that in spite of the constitutional mandate, there has been a gradual erosion of the traditional structures like village councils, autonomous district councils and the traditional knowledge and wisdom associated with the governance. Institutional analysis of these structures barring for the state of Meghalaya and partially for Arunachal Pradesh is practically non-existent. The study revealed that many of the Protected Areas (PAs) in the state do not have a management plan. An assessment of the management effectiveness of protected areas in Sikkim by WWF-India revealed that barring the Maenam Wild life Sanctuary, management plans for the PAs do not exist and are presently under formulation. A similar study in Arunachal Pradesh revealed that working schemes, a necessity for management of the community owned forests (Unclassed State Forests), needs to be in place if communities are to benefit from sustainable use of forests. The experiences drawn from the case studies undertaken in the states of Arunachal Pradesh, Sikkim, Assam and Meghalaya are annexed.

#### **4.4 NGO MOVEMENT**

The fact that the NGO movement has been gaining ground and the collective strength of the NGOs could be treated as an opportunity. The collective impact of the NGOs have certainly led to better understanding of biodiversity and preservation of natural resources of the states. The stalling of the Rothangchu Hydroelectric Project by the people's movement in Sikkim is a case in point. NGOs have their core competencies in their respective and this must be synergized. A selected list of NGOs with their focal areas of work has been annexed to this report.

#### **4.5 OPERATIONALIZATION OF THE STATE BIODIVERSITY CONSERVATION ACTION PLANS**

The State Biodiversity Strategy Action Plans which have been developed through a participatory basis in each of the states, need to be operationalised. While the SBSAPS have the endorsements from the respective state governments, these are yet to become a part of the NBSAP (National Biodiversity Strategy Action Plan).. While some of the SBSAPs need further strengthening, others could be implemented in phases. Sikkim is an example of a state which has formally adopted its SBSAP and is in the process of moving towards implementation.

During the course of the study, it was felt that there not adequate linkage between the State Biodiversity Boards and the Biodiversity Action Plans. Role and functions of biodiversity boards in the states still remain unclear to conservation agencies.

#### **4.6 LEGAL AND POLICY ISSUES**

Many of the initiatives cited in this report remain good sources of information on the biodiversity of the region, however, they have largely failed to influence policy decisions. Many of the states' Protected Areas have been declared on the basis of baseline information collected by research institutes and have not taken into account the priorities, values, rights/ownership and management systems of local communities into account.

Considering the unique forest ownership status in NE region there has been a demand to consider having a separate Regulation/Act apart from what exists at the national level which is designed for the NE Region. Assam went ahead and launched a separate policy for the state and similar efforts are in the pipeline by the Government of Arunachal Pradesh.

Lack of proper understanding of ground situation of NE by policy makers at the national level is a major concern for the area. Some officials at the Ministry of Environment and Forests are yet to be convinced that a separate policy environment is required for the North Eastern region. As mentioned earlier in this report the District Council or Tribal Councils in the region already have traditional laws for Natural Resource Management, there is a need to look into their effectiveness before making any other policy or law. There is an urgent need to address the conflicts between customary and statutory laws and regulations related to forest ownership and natural resource use by local communities.

## **5. RECOMMENDATIONS**

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Based on the information collated and analysed and on discussions with key informants it is apparent that the northeast faces tremendous conservation challenges in the coming years but at the same time offers unique opportunities for conservation. Threats largely emanate from the concerted push for further economic development of the region which, if not planned with long term biodiversity values in mind, could lead to irreplaceable losses due to large scale infrastructure development, agricultural expansion and industrial growth. Other major threats are linked to population increase partly due to in-migration with resultant impacts related to unsustainable use of forest resources for subsistence and commercial purposes.

However, the opportunities for local empowerment and community involvement in conservation are found in few other parts of India. Community ownership of forests provides for a strong incentive to conserve and use these sustainably. Strong local institutions provide an important entry point for power sharing and inclusive management of resources. Progressive policies in some states like Sikkim have already created an enabling environment for conservation. Finally there are many successful models of community managed conservation initiatives and enterprises in states like Sikkim, Assam and Nagaland which can be scaled up across the region with the right capacity and political will.

Since this report is based largely on a desktop review of the biodiversity of northeast India and since it was found that in many areas there was a deficiency of data, the recommendations below pertain mainly to key areas where further data collection and analysis needs to be undertaken in order to develop overall and site specific recommendations for effective conservation and sustainable development of this region.

### **Biodiversity Status and Values**

While some states have a good database of critical biodiversity areas, this information is lacking in others. As development and infrastructure is inevitable in many parts of the northeast, it is critical that an assessment and mapping of high biodiversity value areas is undertaken so that long term threats can be minimized through a better information base for informing development planners.

### **Root causes of Biodiversity Loss**

While the proximal causes of biodiversity loss and threats to biodiversity are believed to be widely known (and often generalized), there is limited understanding of underlying causes. There are perceptions and attitudes prevailing about threats which are, in many cases not substantiated by facts or a thorough analysis. As a result, "solutions" presented to address such threats tend to be generalized and often inappropriate while only dealing with the symptoms rather than the causes of biodiversity loss. There is a need to further understand root causes of biodiversity loss in order to formulate appropriate interventions.

### **Models for Impact Assessment**

With the increasing amount of infrastructure development being planned in the region, there is a need to develop rigorous models and standards for environmental and social impact assessment. This is a general gap at a national level and most EIAs and SIAs are found to be weak and/or biased. This gap needs to be urgently addressed through development of standards and enhancing capacity for undertaking objective and good impact analyses.

### **Economic Valuation of Biodiversity and Payments for Environmental Services**

As an emerging area, some feasibility assessments to see if environmental service payments can work in specific situations need to be undertaken. This will also require developing approaches and methodologies for undertaking economic valuation of biodiversity and forest resources. There could be great potential in using these tools as conservation incentives and also for developing sustainable financing for conservation but this needs to be first assessed in terms of feasibility.

**Tenure, Access and Governance Structures**

Much is written about in general terms about the unique tenure system of the region as well as the local institutional and governance structures. However, this varies tremendously across the region and there is a need to better understand the different systems of tenure and governance and the impacts of these on conservation. The impacts of conflicting policies on conservation also needs to be better understood. This will help in developing an appropriate legal and policy environment that supports biodiversity conservation in the northeast.

**Forest-Based Livelihood Options**

There is a great potential for developing and enhancing forest-based livelihoods in many parts of NE India. However, this requires, in addition to the appropriate policy instruments, a strong scientific basis for determining harvesting and extraction levels, value addition, marketing and benefit sharing. Specific options need to be studies throughout the life cycle from harvesting to benefit sharing in order to develop mechanisms that can enable forest based livelihoods to play a role in economic development as well as an incentive for conservation.

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# Annexure 1

## Biological Diversity of North East India – An Overview

### Introduction

The North Eastern region of India covering nearly 2,62,379 sq. km. area has been divided into two biogeographic zones – Eastern Himalaya and North East India, based on floristic composition, the naturalness of the flora and the local climate (Rodgers and Panwar 1988). The Eastern Himalaya comprising of Arunachal Pradesh and Sikkim is more mesic due to high degree of precipitation resulting from direct confrontation of monsoon laid wind blowing from Bay of Bengal by abruptly raising hills. The North east India biogeographic zone (Assam, Nagaland, Manipur, Meghalaya, Mizoram and Tripura) is most significant one and represents the transition zone between the Indian, Indo-Malayan, Indo-Chinese biogeographic regions as well as a meeting place of Himalayan mountains with that of Peninsular India (Rao 1994).

The North Eastern Region of India lies between 22°N and 29°5'N latitude and 88°00'E and 97°30'E longitudes, and shares international border with Bhutan, China, Myanmar and Bangladesh. The region is geographical 'gateway' for much of India's flora and fauna, and as a result, the region is one of the richest in biological values with vegetation types ranging from Tropical rain forest in the foothills to Alpine meadows and cold deserts. The North-East region of India contains more than one-third of the country's total biodiversity. The region represents important part of Indo Myanmar bio-diversity hotspot, one of 25 global biodiversity hotspots recognized ([www.biodiversityhotspots.org](http://www.biodiversityhotspots.org)).

### Flora

The region has at least 7,500 flowering plants, 700 orchids, 58 bamboos, 64 citrus, 28 conifers, 500 mosses, 700 ferns and 728 lichen species. Some of the important gene pools of citrus, banana and rice have been reported to be originated from this region (Anonymous 1996). About one third of the flora of Northeast India is endemic to this region. The eastern Himalaya support one of the world's richest alpine floras with high level of endemism (WWF and ICIMOD 2001). According to WWF and ICIMOD 2001, the Temperate Broad Leafed forest type in eastern Himalaya is among the most species rich temperate forest in the world.

Nearly 50% of the total flowering plants recorded from India hail from north eastern region of India (Rao 1994). Takhtajan (1969) treats this region as the 'Cradle of flowering plants'. The region is habitat of many botanical curiosities and botanical rarities. *Sapria himalayana* Griff. of the family Rafflesiaceae discovered from Arunachal Pradesh is one of the largest root parasite with crimson flowers measuring 35cm across (Deb, 1957). Among insectivorous plants *Nepenthes khasiana* Hk. f., endemic to Meghalaya and listed in Appendix I of CITES and placed in Schedule VI of the Wildlife (Protection) Act, 1972 and two species of *Drosera peltata* Sm. and *D. burmanii* Vahl. are important.

Many families, represented in India by solitary genus with one or two species are represented in this region, e.g. Coriariaceae, Nepenthaceae, Turneraceae, Illiciaceae, Ruppiaceae, Siphonodontaceae, Tetracentraceae, and a few others (Rao and Murti 1990).

According to Vavilov (1926, 1951), the north eastern region of India forming the 'Hindustan Centre of Origin of Cultivated Plants' is very important for tropical and sub-tropical fruits, cereals etc. Over 50 species of economic plants have their genetic diversity in this region (Zeven and Zhukovsky, 1975). Based on geographical distribution, taxonomical and cytogenetical studies, Chakravorty (1951) suggested Assam-Burma-Siam-Indo-China region as the centre of origin of *Musa*. Out of estimated 800 species consumed as food plants in India (Singh and Arora 1978), about 300 species occur in Eastern Himalaya alone (Rao 1994).

Orchidaceae, the most fascinating and highly evolved groups of plants with 1229 species belonging to 184 genera in India (Singh & Chauhan 1999), about 700 species have been reported from north

eastern region of India. Of these, 545 species belonging to 122 genera are reported from only Arunachal Pradesh (Chowdhery 1998) of which 12 species are under endangered category, 16 species vulnerable and 31 species threatened.

The genus *Rhododendron* of Ericaceae is another remarkable group of showy plants with nearly 98% of the total Rhododendrons reported from India are confined to Himalayan region (Singh *et al.* 2003). In total 72 species, 20 sub species and 19 varieties listed from India, eastern Himalaya region harbors 71 species. Out of 12 species, 2 sub species and 5 varieties of Rhododendron endemic to India, in north eastern region, Arunachal Pradesh has maximum number of endemic species with 9 species and 1 sub species, followed by Manipur and Sikkim with 3 species and 1 sub species and Mizoram with 2 species (Mao *et al.* 2001).

Rattans, commonly known as cane is one of the most important NTFP from North East India. Of 60 species of canes reported from India (Basu 1992, Renuka 1997), north eastern region harbours more than 26 species (Thomas and Haridasan 1999) with nearly 18 species distributed in Arunachal Pradesh (Thomas *et al.* 1998). Out of 150 species of bamboos found in India, 63 species in 22 genera are found in Northeast India, spread over an area of 30,500 sq. km. About 25 species of bamboo are considered rare in Northeast India.

### **Fauna**

The region is equally rich in faunal diversity. An estimated 3,624 species of insects, 50 molluscs, 236 fishes, 64 amphibians, 137 reptiles, 541 birds and 160 mammalian species have been so far described (Anonymous 1998b). The remoteness of the region and difficult terrain make it extremely difficult to document the faunal diversity of the region. However, a new species of barking deer, 'Leaf Deer (*Muntiacus putaoensis*), which was recently discovered in Myanmar, is reported from the forests of Arunachal Pradesh in the year 2003 (Datta *et al.* 2003) and more recently the findings on Tawang macaque (*Macaca munjala*) as a new record for India (Mishra *et al.* 2004), this justifies the above observation that much is yet to be identified, named and studied in Northeast India.

### **Primates**

Three families of primates occur in India with 15 known species, nine of these species occur in North east India (Mohnot 1980 and Roonwal and Mohnot 1977). The Golden Langur (*Trachypithecus geei*) is one of the most localized species, between Manas and Sankosh Rivers in the Himalayan foothills along the Assam - Bhutan border areas. This narrow endemic was discovered in Chakrashilla Hills Reserve in the Dhubri District of Assam (Budruk 1996), and the area has been turned into a wildlife sanctuary. This Schedule I animal is listed in the Appendix I of CITES. In Tripura, within 5.8% of the state's protected area, seven species of primates are distributed (Gupta 1994).

The Stump-tailed Macaque (*Macaca arctoides*) and the Northern Pigtailed Macaque (*M. leonina*) have sympatric distributions in Northeast India and both have become endangered. The Slow Loris (*Nycticebus bengalensis*) is an inhabitant of tropical forests south of the Brahmaputra River in Northeast India. This highly endangered animal is listed as Schedule I animal, and in Appendix I of the CITES.

### **Carnivores**

Of the six largest cats of the world recorded from India, state of Arunachal Pradesh only sustain four of them - the Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Snow Leopard (*Uncia uncia*) and the Clouded Leopard (*Neofelis nebulosa*). Of these, the Indian population of the Clouded Leopard is restricted to the Northeastern region. Tiger has become a very rare animal in the entire region with exception of Assam which is still considered as one of the safest asylum for this large cat. Very little information is available about the status of Snow Leopard in the region. However, Snow leopard has been confirmed to be present in Kangchendzonga National Park of Sikkim (Jackson 2002) and PTTso and Mago Chu Valley of Tawang district of Arunachal Pradesh (Mishra *et al.* 2004) and likely to be present in Dzong Wildlife Sanctuary and Tolung Wildlife Sanctuary of Sikkim; Dibang Valley and Namdapha National Park of Arunachal Pradesh (Jackson 2002).

Red Panda, protected under Schedule I of the Indian Wildlife (Protection) Act, 1972 and listed in Appendix I of CITES and as 'Endangered, by IUCN is also predominantly available in the region. As per IUCN criterion, the approximate total habitat of Red Panda in India is about 25,000sq.km out of which 23,000sq.km is in Arunachal Pradesh. If the lowest average density, i.e., one panda per 4.4sq.km (Yonzon and Hunter Jr. 1991) is taken as a guideline, then there could be around 5000 to 6000 animals in India with bulk (about 90%) in Arunachal Pradesh (Choudhury 2002). All the bear species that occur in India are recorded from the northeastern region. Besides, Northeast India forms the western end of the range for Malayan Sun Bear (*Helarctos malayanus*).

### **Ungulates**

The foothill grasslands and broadleaf forest harbor important population of Asian elephant, one-horned rhinoceros and wild water buffalo. The elephant population in the north bank of the Brahmaputra River in Assam is one of the India's largest and most important (Sukumar 1992). Of the 28000 wild elephants in India, about 33% are found in Northeast India. In fact, Assam alone accounts for more elephants than Myanmar, Thailand, Indonesia or any other country in Asia.

In Northeast India Great Indian Rhinoceros (*Rhinoceros unicornis*) is now restricted to Kaziranga, Pabitora and Orang in Assam. The population at Manas in Assam is believed to have been decimated in recent years. Historical records suggest that both the One-horned Javan Rhinoceros (*Rhinoceros sondaicus*) and the Two-horned Sumatran Rhinoceros (*Didemnocerus sumatrensis*) were once found in parts of Northeast India. Both the species are now extinct from the region.

The Brow-antlered Deer (*Cervus eldi eldi*), locally known as Sangai is endemic to Manipur and one of rarest and the most localized subspecies of deer in the world. The Pygmy Hog (*Sus salvanius*) is the smallest and the rarest wild suid in the world, and only a few isolated wild populations survive in Northeast India. Arunachal Pradesh is home to some fascinating large herbivores such as newly discovered Chinese Goral (*Naemorhedus goral*), Red Goral (*Naemorhedus baileyi*), Takin (*Budorcas taxicolor*) and Serow (*Capricornis sumatraensis*) (Mishra *et al* 2004).

### **Birds**

The Eastern Himalayas and Assam plains are the two endemic bird areas among the 7 such areas identified in the country (Supriya Jhunjhunwala, 2002). This region perhaps supports the highest diversity of bird species in the Orient. From Arunachal Pradesh over 760 bird species have been reported (Borang 2004). The Elliot's Laughing Thrush (*Garrulax ellioti*) and Brown-cheeked Laughing Thrush (*G. henrici*) are two species that have been recently added to the region's list, from Arunachal Pradesh. Both these species had previously been recorded only in China. White-winged Duck, which has been reported from D'Ering Wildlife Sanctuary of Arunachal Pradesh (Kaul 2000) is identified as highly endangered duck. Sangte Valley of Arunachal Pradesh is only habitat for wintering Black Necked Crane (*Grus nigricolis*).

Greater Adjutant (*Leptoptilos dubius*) is a globally threatened bird with the majority of the world's population now found in Assam. Spot-billed Pelican (*Pelicanus philippensis*), Blacknecked Stork (*Ephippiorhynchus asiaticus*), Lesser Adjutant (*Leptotilos javanicus*), and Pale-capped Pigeon (*Columba punicea*), are only to name a few of the globally threatened birds found in the region. Swamp Francolin (*Francolinus gularis*), found in Northeast India, is endemic to the Indian subcontinent. The Bengal Florican (*Houbaropsis bengalensis*) is one of the rarest bustards in the world. Manas National Park has the largest population of this bird in the world. Lesser Fish Eagle (*Ichthyophaga humilis*) is the rarest of the fish and sea eagles, and there are reports of its sightings in Namdapha in Arunachal Pradesh. The highly endangered Rufous-vented Prinia of the eastern population, regarded as a separate species 'Swamp Prinia' (*Prinia cinerascens*), is reported from the Pobitora Wildlife Sanctuary in Assam. Beautiful Nuthatch (*Sitta formosa*) is a resident of primary forests of Northeast India.

### **Lower Vertebrates**

So far 137 species of reptiles have been recorded from Northeast India which has the greatest affinity to the Oriental, Indo – Malayan and Indo – Chinese regions. The Gharial (*Gavialis*

*gangeticus*) found in Brahmaputra River is of great conservation significance. Northeast India has the highest diversity of turtles.

As recently as 2000, a chelonian species -*Amyda cartilaginaea*, was reported from Mizoram as a first record for India, the previous range for this species being from southern Myanmar to central Vietnam, Laos, Cambodia, and Thailand. The black softshell turtle (*Aspideretes nigricans*) was once considered as extinct (IUCN 2002) has been rediscovered recently from Assam Valley (Praschag and Gamel 2002).

20 lizard species from the State of Assam, and 18 species from the tiny state of which is profoundly influenced by the Indo-Chinese connection have been recorded so far. Of the three species of Monitor Lizards found in the region, *Varanus flavescens* is listed in Schedule I under Wildlife (Protection) Act, 1972 and listed in Appendix I of CITES. The Tokay Gecko (*Gekko gekko*) is the largest gecko alive today and is found in northeast India.

Fifty eight species of snakes have been recorded in Assam, 34 from Manipur and 92 from Arunachal Pradesh. *Python reticulatus*, the largest snake in India, is found in northeast India and *Python molurus bivittatus* is the most commonly known in the region. One can expect to sight both the snakes in 'Mouling National Park' in the Upper Siang District of Arunachal Pradesh. King Cobra (*Ophiophagus hannah*) is the most awe-inspiring reptile of the region. *Typhlops jerdoni*, *T. tenuicollis*, *Stoliczkaia khasiensis*, *Elaphe mandarina*, *Oligodon melazonotus*, *Xenochrophis punctulatus*, *Bungarus bungaroides*, *Trimeresurus jerdoni* are just a few examples of very elusive and rare snakes of Northeast India.

So far 64 species of amphibians have been recorded from the Northeast India. A survey of amphibians conducted in the State of Nagaland from 1998 to 2002 has resulted in 19 species as new records for the State and 5 species (*Megophrys wuliangshanensis*, *M. glandulosa*, *Amolops viridimaculatus*, *Rana humeralis* and *Rhacophorus gongshanensis*) as new records for India. Orang Wildlife Sanctuary in Assam is the only known site to have the Orang Sitcky Frog (*Kalophrynus orangensis*) (Anon 2005)

## **Invertebrates**

The Biodiversity Strategy and Action Plan for Northeast Ecoregion suggests that 3,624 species of insects and 50 molluscs are recorded from the region (Tripathi and Barik 2003). Butterflies and moths are by far the best-studied invertebrate organisms in Northeast India, and the region contributes the maximum number of species for the group in the country. A decade ago, 689 species of butterflies were recorded from the State of Sikkim. An ecological study on Mammals, Birds, Herpetofauna and Butterflies carried out in Teesta Basin, Sikkim, revealed nearly 350 species of butterflies in altitudes less than 900 m. In the study area the family Nymphalidae is recorded to be the most species rich forming 50% of the observed species, followed by Lycaenidae and Pieridae (17.2% each). Papilionidae and Hesperidae have relatively low species richness, forming only 8.6% and 7.0% of the species, respectively. As species richness in the study area was found to be far greater than that reported earlier, especially at higher altitudes, this particular study highlights the importance of altitudinal gradients in the distribution of butterflies, and in their conservation.

One of the largest known tropical Lepidoptera is the Atlas Moth (*Attacus atlas*), is not uncommon in many parts of Northeast India. *Prinsepia polyctor ganesa*, which occurs in Northeast India, is one of the most beautiful butterflies in the country, while, *Erysmia pulchella* and *Nyctalemon patroclus* are very beautiful moths that occur in the region. It is pertinent to add that sericulture is an age-old occupation for some people in states like Assam and Manipur, especially in the 'Loi' community in Manipur who have rendered the skill of silkworm rearing and silk weaving to art form.

## **Threats and Pressure on Biodiversity**

- **Dichotomy in Forest Administration**

Most of the forests in Arunachal Pradesh, Manipur, Meghalaya and Nagaland are owned by private individuals, communities and clans and local communities have traditional ownership and user

rights over such forest areas.. The ownership rights over land and resources are further protected by the sixth schedule of Indian Constitution. The acts and rules framed by the state and national governments are therefore not applicable to such forests to ensure their protection (Tripathi and Barik 2003). This necessitates the framing of appropriate policies and laws to effectively manage these forests.

- **Deforestation**

Northeast India has 64% of the total geographical area under forest cover and it is often quoted that it continues to be a forest surplus region. However, the forest cover is rapidly disappearing from the entire region. There has been a decrease of about 1800 sq.km. in the forest cover between 1991 and 1999 (F.S.I., 2000). More worrisome still is the fact that the quality of the forest is also deteriorating, with the dense forests (canopy closure of 40% or more) becoming degraded into open forest or scrub. For example, though the forest cover in Manipur extends to 78% of the total geographic area, only 22% of forest area is under dense forest cover and the rest has been converted to open forests.

Unregulated shifting cultivation, extended over 1.73 million ha (F S I, 1999), by the local tribal populations due to shortening of jhum cycle has been one of the major reason of deforestation, mainly in unclassed and community forests of the region. In the absence of any alternative livelihood source, shifting cultivation continues to be the main stay of sustenance for a vast majority of the forest dwellers.

In 1851, J.D. Hooker, on his expedition to Jaintia Hills had collected seven headloads of live Blue Vanda orchid (*Vanda coerulea*) plants for cultivation in England. Balakrishnan (1981) states that after 100 years, during various field trips stretching from 1965 to 1970, he could hardly spot a dozen plants even in remote forest areas of Nertiang where Hooker had made his collections. This is an indication of the rate at which primary forests and the wealth it carries are being irrevocably destroyed. In all, at present more than 700 species of plants from the Northeast India are facing the threat of survival in the wild (Ramakantha *et al*).

- **Species loss**

Many forest bird species, especially those with ranges restricted to Northeast India declined in abundance or disappeared in successional fallows followed for the shifting cultivation practices in the region, unless regeneration exceeded 10 years (Raman 2001).

Studies conducted on the Phayrer's Langur (*T. phayrei*) revealed that it needs at least 9-10 years fallow period to survive in secondary forest (Gupta and Kumar 1994). However, a progressively shortening cycle of shifting cultivation and degradation of forests poses a threat even for such adaptive animals. Similarly, studies conducted reveal that arboreal mammal species such as Malayan Giant Squirrel (*Ratufa bicolor*), Pallas's Squirrel (*Callosciurus erythraeus*) and Hoolock Gibbon are dependent on tall, undisturbed primary forests or at least, late successional vegetation (25 years old, or more) (Raman 1997). However, it is a stark reality that in most parts of Northeast India, fallow periods have declined to 5-10 years, and in some places may be as short as 3-5 years. With sharp decline in their populations, the role of birds, bats, ungulates and primates as seed dispersers is decreasing, leading to further impoverishment of the primary as well as the secondary forests.

Choudhury, (2003) while describing 'Meghalaya's Vanishing Wilderness' writes that there are good populations of Hoolock (*Bunopithecus hoolock*) in the forests of West Khasi Hills, but those are private and community lands and he is not too optimistic about their future there. It should be a matter of disquiet that only a meagre 4.4% of the geographical area is under State Forest department, the rest being land belonging to other categories like Private Forest, Clan Forests, Community Forests, etc (Ramakantha *et al*/unpublished).

## **Annexure 2**

### **Important Bird Areas of North East India**

#### **Arunachal Pradesh**

1. Chaglagaum-Denning-Walong
2. Chayang Tajo-Khenewa-Bameng
3. D'Ering Memorial Wildlife Sanctuary
4. Dibang Reserve Forest and adjacent areas
5. Dibang Wildlife Sanctuary
6. Ditchu Reserve Forest
7. Eaglenest and Sessa Sanctuaries
8. Itanagar Wildlife Sanctuary
9. Kane Wildlife Sanctuary
10. Koloriang-Sarli-Damin
11. Magu Thingbu
12. Manabum and Tengapani Reserve Forests
13. Mechuka-Monigong-Jorgging
14. Mehao Wildlife Sanctuary
15. Mouling National Park
16. Nacho-Limeking-Taksing-Majha
17. Nafra-Lada Area
18. Namdapha-Kamlang
19. Namsangmukh-Borduria
20. Pakhui or Pakke Wildlife Sanctuary
21. Papum Reserve Forest
22. Sangti Valley
23. Shergaon, Mandla-Phudung and Kalaktang
24. Taley Valley Wildlife Sanctuary
25. The Chapories of Lohit Reserve
26. Thungri-CHanglang-Poshingla Complex
27. Yardi-Rabe Supse Wildlife Sanctuary
28. Zemithang-Nelya

#### **Assam**

1. Amchang Hills
2. Barail Range
3. Barnadi Wildlife Sanctuary



4. Bauwwa Beel
5. Behali Reserve Forest
6. Bherjan-Borajan-Podumoni
7. Bordoibam-Bilmukh Bird Sanctuary
8. Bordoloni-Sampora
9. Chakrasila Complex
10. Chandubi Lake and adjoining areas
11. Deobali Jalah
12. Dhansiri Reserve Forest
13. Dibru-Saikhowa Complex
14. Dipor Beel Bird Sanctuary
15. Dum Duma-Dangori-Kumsong Reserve Forests
16. East and North Karbi Anglong Wildlife Sanctuaries
17. Garampani, Nambor and Doigrung
18. Gibbon Sanctuary
19. Habang
20. Inner Line, Kathakal and Barak Reserve Forests
21. Jamjing and Sengajan
22. Jatinga
23. Jengdia Beel and Satgaon
24. Jhanjimukh-Kokilamukh
25. Kaziranga NP
26. Kurabari-Dalani
27. Langting-Mupa Reserve Forest
28. Laokhowa and Burachapori Sanctuaries
29. Lumding-Marat Longri
30. Majuli
31. Manas National Park
32. Nameri National Park
33. Orang National Park
34. Pabho Reserve Forest
35. Pobitora Wildlife Sanctuary
36. Pani-Dihing Bird Sanctuary
37. Ripu and Chirang Reserve Forest
38. Sibsagar Tanks
39. Son Beel
40. Sonai-Rupai Wildlife Sanctuary
41. Subansiri

42. Tamaranga-Dalani-Bhairab Complex
43. Tirap-Burhidihing
44. Upper Dihing (East)Complex
45. Upper Dihing (West) Complex
46. Urpod Beel

### **Manipur**

1. Nago or Anko Hills
2. Bunning Wildlife Sanctuary
3. Dzuku Valley
4. Jiri-Makru Wildlife Sanctuary
5. Kailam Wildlife Sanctuary
6. Loktak Lake and Keibul Lamjao National Park
7. Shiroi Community Forest
8. Yangoupokpi-Lokchao Wildlife Sanctuary
9. Zeilad Lake Sanctuary

### **Meghalaya**

1. Balpakram Complex
2. Mawphlang Sacred Grove
3. Nokrek National Park
4. Nongkhyllem Wildlife Sanctuary
5. Norpuh Reserve Forests
6. Riat Khwan-Umiam
7. Saipung
8. Upper Shillong
9. Cherapunee: Cliffs, Gorges and Sacred Groves

### **Mizoram**

1. Blue Mountain (Phawngpui) National Park
2. Dampa Tiger Reserve
3. Lengteng Wildlife Sanctuary
4. Murlen National Park
5. Ngengpui Wildlife Sanctuary
6. Palak Lake

### **Nagaland**

1. Fakim Wildlife Sanctuary and Saramati Area
2. Intanki National Park
3. Khonoma Nature Conservation and Tragopan Sanctuary
4. Mount Paona

5. Mount Zanibu
6. Mount Ziphu
7. Pfutsero-Chizami
8. Pulibadze Wildlife Sanctuary
9. Satoi Range

#### **Sikkim**

1. Barsey Rhododendron Sanctuary
2. Dombang Valley – Lachung – Lema – Tsungthang
3. Fambong Lho Wildlife Sanctuary – Himalayan Zoological Park – Ratey Chu Reserve Forest
4. Khangchendzonga National Park and Biosphere Reserve
5. Kyongnosla Alpine Sanctuary – Tsomgo – Tamze – Chola Complex
6. Lhonak Valley
7. Lowland Forests of South Sikkim
8. Maenam Wildlife Sanctuary – Tendong Reserve Forest
9. Pangolakha Wildlife Sanctuary – Zuluk – Bedang Tsho – Nathula Complex
10. Tsho-Lhamo Plateau – Lashar – Sebu La – Yumesamdong Complex
11. Yumtang – Shingba Rhododendron Wildlife Sanctuary

#### **Tripura**

1. Gumti Wildlife Sanctuary
2. Trishna Wildlife Sanctuary

## Annexure 3

### Biodiversity Rich Locations identified through Global and National Priority Setting Exercises.

#### Sites identified by the Conservation International for investments through the Critical Ecosystems Partnership Funds

State	Priority Site	Reason for selection as priority	Corridor
Arunachal Pradesh	D'Ering WLS	Harbors core population of landscape population	North Bank Landscape
	Eagles Nest and Sessa WLS	Important for conservation of the landscape species red panda	
	Mehao WLS	Important for conservation of landscape species	
	Pakke WLS	Important for conservation of landscape species	
	Dibang Valley WLS and Biosphere	Slaters Monal Chestnut breasted partridge, Rusty bellied shortwing	Dibang-Dihang
	Mouling NP	Eerie Tree frog	Dibang -Dihang
	Namdapha and Kamlang NP and WS	Namdapha tree frog , Namdapha flying squirrel, snowy throated babbler	
Assam	Dibru Saikhowa NP and Biosphere Reserve	> 20 species of globally threatened vertebrates, important for conservation species	North Bank landscape
	North and East Karbi Anglong	Important for conservation of landscape species	Karbi Anglong Landscape
	Garampani and Namboor WS	Important for conservation of landscape species	Karbi Anglong landscape
	Jatinga	Tawny breasted Wren Babbler	-
	Kaziranga national park	> 20 species of globally threatened vertebrates, largest population of greater one horned rhinoceros important for conservation species	
	Lumding Endemic Bird Area	Important for conservation of	Karbi Anglong landscape
	Manas Tiger Reserve	Pygmy hog, Tiger, Wild water buffalo. Hispid hare.	MBL
	Nameri NP	> 20 globally threatened vertebrates. Indian Flying frog. Important for conservation of landscape species	North bank landscape
	Orang national park	Orang Sticky frog	
	Ripu Chirang	Golden langur, Bengal Florican, 4 species of turtles	
	Sonai Rupai WS	Golden langur, Bengal florican, 4 species of turtles	North Bank Landscape
	Upper Dihing (East and Kakojan	White winged Duck, White bellied Heron, Baikal Teal	JJL
	Jamjing and Sengagan IBA	Important for conservation of landscape	North Bank Landscape

State	Priority Site	Reason for selection as priority	Corridor
<b>Maniur</b>	Dzuko	Keeled Box Turtle, Hume's pheasant, Blyth's tragopan	-
	Siroi	Manipur Bush Quail, Humes Pheasant, Blyth's tragopan, Hoolock Gibbon	-
<b>Megahalaya</b>	Cherrapunjee cliffs, gorges and sacred groves (including Mawswami)	Khasi Hillas Toad X'mas Bush frog	-
	Khasi Hills (including Shillong Peak NP)	X'mas Bush frog, Tawny breasted Wren Babbler	-
	Rongrenigiri	Kashmir cave bat	-
	Siju caves	Kashmir cave bat	-
	Tura Nokrek range (includes NP)	Garo Hills Bush frog, Northern frog	-
<b>Nagaland</b>	Itanki National park Maratlongiri and Dhansiri	Important for conservation of landscape species	KKL
<b>Sikkim</b>	Khangchendzonha NP	Important for conservation of landscape species	KSC
	Maenam WS	IUCN red listed plants, especially Rhododendrons	KSC
	Sikkim and WB Bengal	Wooly flying Squirell	KSC

## Annexure 4

### Sites Prioritized by Biodiversity Conservation Prioritization Project (BCPP)

Biodiversity Conservation Prioritization Project (BCPP) by WWF-India (1997-2000) was the first exercise of its kind that attempted identifying priority sites and species on the basis of their biological and socioeconomic values and develop strategies for their conservation at a national scale. The wetlands, grasslands and forest patches that were prioritised in the North East India were:

#### A. Priority wetlands (Samant 2000)

**Arunachal Pradesh:** Wetlands of Mehao, Lali and Namdapha. While the former two emerged as low priority, wetlands in Namdapha was placed in a category of high ecological and socioeconomic potential but having poor data availability.

**Assam:** Beels of Assam, Dibru Flood plain, Dipore Flood plain, Wetlands of Manas, Sareawar beel, Sonai Rupai, Kaziranga,, laolkahowa and Orang. All emerged as low priority wetlands, Dipore and Manas featured amongst the wetlands with high ecological and socioeconomic potential but poor in data availability

**Manipur:** Wetlands Ikop, Keibul Lemjao, Kharung, Loktak and Phumlen were prioritised. Loktak since its status of Ramsar emerges as a wetland of very high priority and all others were placed in data deficient category.

**Sikkim:** All wetlands in Sikkim emerged as low priority

#### B. Grasslands

(Rahmani 2000 and Choudhury 2000) attempted identifying grasslands of high biological diversity and socioeconomic significance.

##### Assam

- Priority 1 Kaziranga, Manas, Orang, Pabitora, Bornadi, Dibru Saikhowa
- Priority 2 Lowkhowa, Burachapori, Sadiya plains in Tinsukia
- Priority 3 Jamjing and Bordalini in Dhemaji and Lakhimpur. Kochmora in Sonitpur, Pani-Dihang in Sibsagar and Nameri in Sonitpur

##### Arunachal Pradesh

- Priority 1: D'Erring WLS,
- Priority 2 Dibang Valley,
- Priority 3 Namdapha in Changlang, Deopani & Kerim in Debang valley, Chapories of Lohit River, grasslands between Sesseri and Sibia rivers

#### C. Forests:

The BCPP attempted identifying priority locations only in three North Eastern States: , Meghalaya and the lower and middle hills of Arunachal Pradesh and Tripura. 16 locations were prioritised in Meghalaya as shown in the map that follows. (Roy 2000). Possibly the locations prioritized by Gupta 2000 have been included in the States Biodiversity Conservation and Action Plan.



## STATE LEVEL BIODIVERSITY PRIORITY SITES IN MEGHALAYA



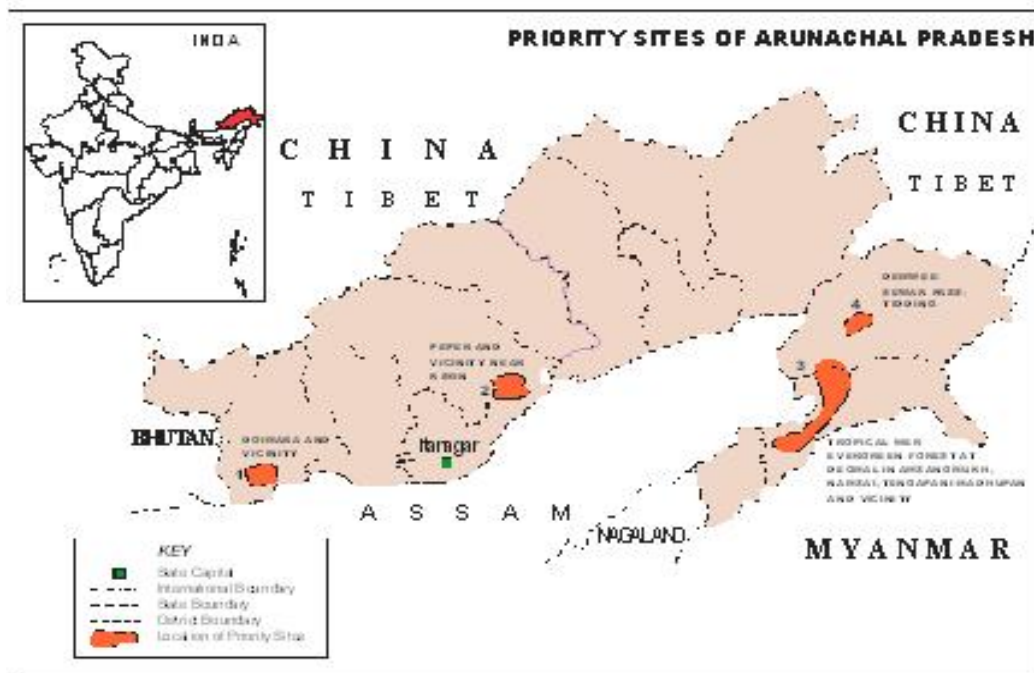
Note: Site H is located in an area that is disputed between Meghalaya and Assam

- A - Nartiang, Jowai, Jarain, Umtapoh, Shangpung, Raliang, Khliehriat, Sutunga, Thadlaskein, Laskein, Myrso
- B - Jakrem, Mawblong, Mawsynram, Cherrapunjee, Shella, Sohrarim, Pyousia
- C - Bunnihat, Umling, Lailad, Nongpoh, Umtesor, Umtyangar, Nongkhylliem, Mairang
- D - Umsning, Sumer, Umsaw, Umtham, Umwai, Umran, Barapani, Umsing, Shillong, Laikor Peak, Mawphlang, Mawkdok, Nongkrem, Laitlynkot
- E - Anogiri, Jengjal, Rongram, Selbalgiri, Tum, Damalgiri, Adugiri, Kherapara, Barengapara, Dalu, Thebrangiri, Assingir
- F - Dawki, Muktapur

- G - Songsak, Rongrenggiri, Williamagar, Darugiri, Rongjeng, Damra, Dainadubi, Manikganj, Simseng, Manda, Tasak, Dambu
- H - Garampani, Kopili
- I - Siju, Baghmara
- J - Balphakram, Kanai, Mahadeo, Maheshkola
- K - Sonapahar, Nongstoin, Rambari
- L - Sonapur, Umkiang
- M - Mawpat (within and around)
- N - Balat, Rankor, Nongkhlaw
- O - Phulbari, Digranggiri, Duragiri, Rongsagiri
- P - Garobadha (within and around)

The following areas for conservation significance in the middle and lower hills of the state Arunachal Pradesh ( Haridasan 2000):

1. Doimara and Vicinity located in the West Kameng district of Arunachal Pradesh
2. Pe Per and vicinity near Kimin situated amidst the tropical semi evergreen forest belt in papum pare and Lower Subansiri districts border towards south of lower Subansiri
3. Tropical wet evergreen forests at Deomali, Namsangmukh, Namsai, Tengapani, madhupan and vicinity located in Lohit and Tirap districts.
4. Demwee- Sewak pass – Tiding situated in Lohit district , along the Tezu-Hayuliang road.



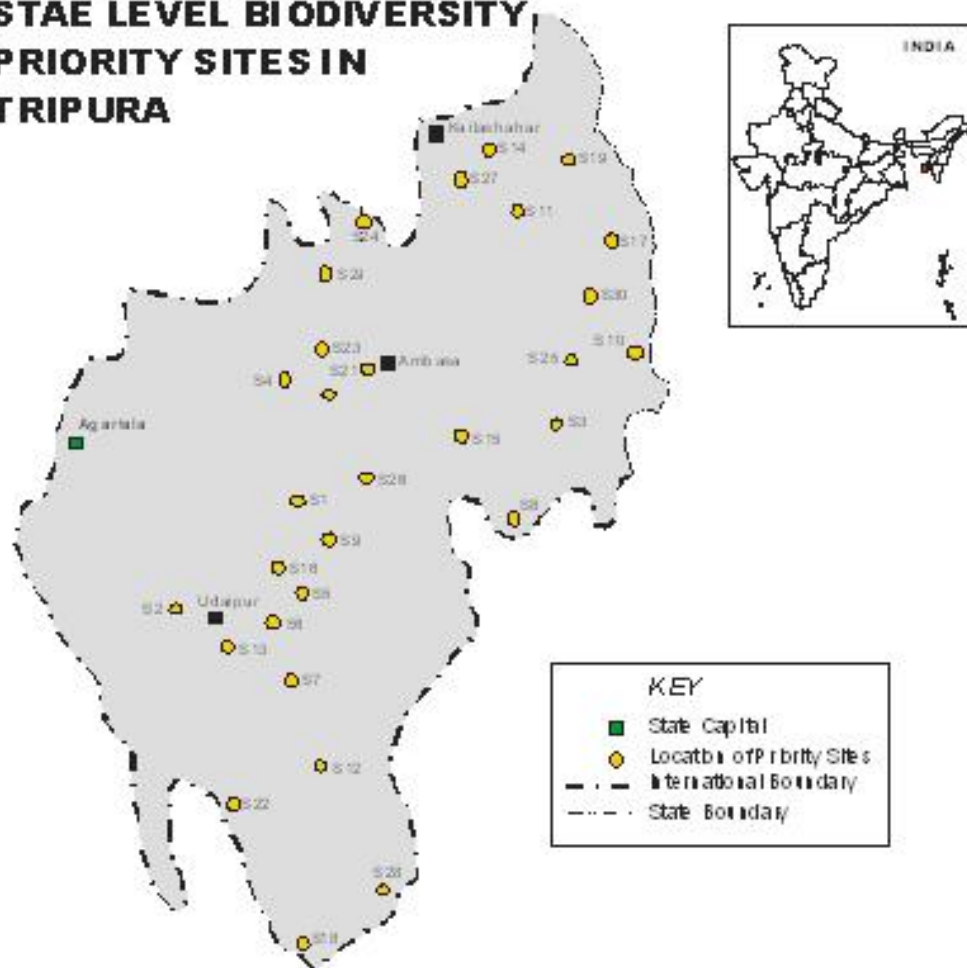
John Singh et al (2000) in the same exercise suggested PAs in Chumbi valley (Area between Sikkim and Tibet) and Temperate, subalpine and alpine habitats at the junction of India, Tibet and Myanmar in Arunachal Pradesh.

Rodgers and Panwar (2000) who also jointly authored the report 'Planning a protected area network for India (see section 2.1 this report) recommended creation of Tolung and Dzongri WLS and Lado, Tawang and Walong wild life sanctuaries in Sikkim and Arunachal Pradesh.

Gupta (2000) identified 30 conservation areas in the state of Tripura. Barring Haijala in the South district all the conservation areas are located in the 18 different reserve forests.



## STATE LEVEL BIODIVERSITY PRIORITY SITES IN TRIPURA



### KEY

- State Capital
- Location of Priority Sites
- - - International Boundary
- - - State Boundary

### STATE LEVEL PRIORITY SITES

S1- Kira	S11- Kacharichhara	S21- Kamla chhara
S2- Kalapania	S12- Kalsi	S22- Malumbani
S3- Lalchhara	S13- Harjala	S23- Tulas khkh
S4- Harbang	S14- Unnakoti	S24- Chhotosurma
S5- Latmachhara	S15- Joychandrapara	S25- Satnala
S6- Maharani	S16- Debbari	S26- Kiranpara
S7- Gajee	S17- Bangshul	S27- Satarmia Howr
S8- Thalchhara	S18- Harbatali	S28- Baishnabpur
S9- Paharpur	S19- Juri	S29- Bidyabill
S10- Jampui	S20- Simulchhara	S30- Bhurpara

### D. Priority species

Rana and Chatterjee (2000) and Sastry and Chatterjee (2000) provided a list of priority medicinal plants and wild relatives of crop plants for the North eastern region.

BCPP also made an attempt to collate information of many other elements of Biodiversity including the invertebrates, amphibians, fishes etc for which information is scanty. The Conservation Assessment and Management Prioritization (CAMP) methodology was followed which attempted developing Taxon data sheets for assigning IUCN Conservation criteria to these through

a body of subject experts. Species identified as Critically Endangered (CE) , Endangered (E), Vulnerable, Threatened, Near Threatened , Extinct and data deficient.

## Annexure 5

### Biodiversity Characterization at Landscape Level in North East India

(Using Satellite Remote Sensing and Geographic Information System by the Indian Institute of Remote Sensing and Department of Space (IIRS), Government of India)

#### Priority sites identified by IIRS

**Arunachal Pradesh:** Highlighting the fact that Tropical forests are acclaimed world over for their biodiversity richness and uniqueness, NESAC deduced that rich forests occur in Namdapha national park and border areas of West Kameng, East Siang and Lohit districts. Alpine pastures and temperate conifer area also indicate high richness.

**Assam:** Assam has two famous valleys Assam and barak river valleys supporting famous vegetation association like *Dipterocarpus macrocarpus* – *Shorea assamica* – *Mesua ferrea* in the Assam valley and *Mesua ferrea* – *Dipterocarpus turbinatus* – *Palaquium polyanthum* in the Barak valley.

**Manipur:** Highest biological richness in Manipur is reported in Chingpi in Churachandrapur, Dzuku and Maram in Senapati, Tegnopaul area in Chandel and northern inaccessible hills of Tamenglong district.

**Meghalaya-** Important Biorich sites in Meghalaya are the Nokrek and Balpakram National park

**Mizoram:** Areas under high biological richness regime have been mapped in the report but not categorically spelt out.

**Nagaland:** The Biological richness map is provided in the report indicated high biodiversity in high altitude inaccessible hills Tuensang, Phek, Mon and Kohima.

**Sikkim:** Highest biological richness spot on the inaccessible mountains, transition zone of broad leaved hill forest and east Himalayan wet temperate forest and along difficult river courses in all the four districts of Sikkim. Some of the location names showing higher biological richness were:

- East Sikkim: Pangthang, Rumtek, Rongli, Nathula
- North Sikkim: Namprikdang mountains nearby Mangan
- South Sikkim: Rabangla area
- West Sikkim: Barsey, Dentam and Barsey.

It is pertinent to mention here that the states of North Eastern region have their respective remote sensing centres. It will be useful to compile and collate information available through these centres. Information generated through GIS techniques by the institutes and organizations outside the state like the Salim Ali Centre for Ornithology and Natural and Wildlife Institute of India.

## Annexure 6

### The Global Ecoregions of the WWF in North East India

Ecoregions are defined as "A relatively large area of land or water that contains a geographically distinct set of natural communities that share a majority of their species, ecological dynamics and environment conditions and function together as a conservation unit at conservation and regional scales. (Wikramanayake et al. 2002)

The WWF identifies the following ecoregions in the North eastern regions:

**Brahmaputra Valley semi evergreen forests** which lies along the alluvial plains of the Brahmaputra river. Despite the long history of habitat loss and degradation the ecoregion still harbors an impressive biodiversity in small fragments of habitat that lie scattered throughout. Most of the ecoregion lies within the eastern state of Assam but small sections extend into neighboring states of Arunachal Pradesh and Nagaland and into southern states of Bhutan. The northeastern region represents the area where the northward migrating Deccan Peninsula first made contact with the Eurasian continent during the tertiary period and is a gateway of species exchanges between the Indian and Malayan funas. (Rodgers and Panwar, 1988). The wide Brahmaputra river is a biogeographic barrier for several species. The golden langur (*Semnopithecus geei*), hispid hare (*Caprolagus hispidus*) and pygmy hog (*Sus salvanius*) are limited to north bank of this river, where as hoolock gibbon (*Hylobates hoolock*) and stump-tailed macaque (*Macaca arctoides*) are limited to the south bank. Most of the ecoregion's original semi evergreen forests have been converted to grasslands by centuries of fire and small patches of semi-evergreen forests remain only along border of the Indian states of Assam and Meghalaya. Biodiversity features of this region harbors India's largest elephant (*Elephas maximus*), the world's largest population of the greater one horned rhinoceros (*Rhinoceros unicornis*), tigers (*Panthera tigris*). The ecoregion overlaps with a high priority (level 1 Tiger Conservation Unit) that extends north to include the subtropical and temperate forests of the Himalayan foothills. – not understood Pygmy hog and hispid hare are confined to the grassland habitats. Other threatened mammals include swamp deer (*Cervus duvauceli*), gaur (*Bos gaurus*), clouded leopard (*Pardofelis nebulosa*), capped langur (*Trachypithecus pileatus*), Asiatic black bear (*Ursus thibetanus*) and sloth bear (*Melursus ursinus*). Brahmaputra river also harbours the Gangetic dolphin (*Platanista gangetica*). The bird fauna is richer with more than 370 species and 2 species are near endemic (Reference required. Otherwise, stick to the statement of this region having 850+ bird species). The ecoregion overlaps with Birdlife International's EBA, Assam plains which contains three restricted range bird species. Endemic and near endemic bird species include the Manipur bush quail (*Perdica manipurensis*) and the Marsh barbler (*Pellorneum palustre*).

**The Eastern Himalayan Broadleaved Forests** is globally outstanding for both species richness and endemism especially for its flora. It contains several localized areas of floral richness and endemism- floral hotspots which are especially rich in rhododendrons and oak. . The 125 mammal species known to occur here include four species that are endemic to the region (which are these four species, Reference Req'd). Three of the species are shared with adjacent ecoregions but the Namdapha flying squirrel is a strict endemic whose range distribution is limited to the broadleaved forest. The golden langur is limited to the broadleaved forests to the north of Brahmaputra river. Despite being shared between this ecoregion and the adjacent Himalayan subtropical forests the golden langur has a limited range distribution. Other threatened species include tiger, red panda (*Ailurus fulgens*), takin (*Budorcas taxicolor*), serow (*Nemorhedus sumatraensis*), Vespertilionid bats, Assamese macaque (*Macaca assamensis*), stump-tailed macaque, wild dog (*Cuon alpinus*), clouded leopard, Irrawaddy squirell (*Callosciurus pygerythrus*). Red Panda is reduced to patches of mature fir forests with a bamboo under-storey (Reference req).

The bird assemblage includes several threatened species including rufous-necked hornbill (*Aceros nipalensis*), Sclater's monal (*Lophophorus impejanus*), Blyth's tragopan (*Tragopan blythii*), white-bellied heron (*Ardea insignis*) and Ward's trogon (*Harpactes wardi*) and can be considered as indicators of habitat integrity.

**The Eastern Himalayan sub-alpine coniferous forests** represent the transition from the forested ecoregions of the Himalayas to treeless alpine meadows. Several Himalayan birds and mammals exhibit altitudinal seasonal migrations and depend on contiguous habitats that permit these movements. The ecoregion represents the belt of the conifer forest between Kali Gandaki river in Nepal and into the state of Arunachal Pradesh in India. The ecoregion lies within the ecotone between the Indo Malayan and Palearctic zoogeographic zones. Although not endemic species, the red panda and the Himalayan musk deer (*Moschus chrysogaster*) are characteristics of mature fir forests represented by the ecoregion. The red pandas usually are limited to *Abies*-ringal bamboo forests between 3000-4000m where precipitation is high (Reference?). 200 birds species are known from this region of which 6 are considered endemic to the region (Reference?). Four species (Please name these) are shared with the adjacent ecoregions and two are known only from the sub alpine coniferous forests in the northeastern part of Arunachal Pradesh (Grimmet *et al.*, 1998)

**Mizoram- Manipur Kachin Rain Forests** has the highest bird species richness of all ecoregions within the Indo pacific region. Biological Distinctiveness: Globally outstanding. This large ecoregion represents the semi evergreen sub montane rain forests that extends from the mid ranges of the Arakan Yoma and Chin Hills north into Chittagong Hills of Bangladesh, the Mizo and Naga Hills of the Indo Myanmar border into the northern hills of Myanmar. It divides the Brahmaputra and Irrawady valleys through which Asia's largest rivers flow.

The semi evergreen forests are characterized by several species of the Dipterocarps that includes, *Dipterocarpus alatus*, *D. turbinatus* and *D. griffithii*. The region includes two near endemic species : the bat *Pipistrellus joffrei* and murid rodent *Hadromys humei* (Reference?). The lower forests in Nagaland harbour two primates: the stump-tailed macaque and the pig-tailed macaque (*Macaca nemestrina*). The forests of Manipur may still harbour the critically endangered Eld's deer or thamin (*Cervus eldii*) (Corbett and Hill 1986). The region also includes the threatened species including the red panda, Asian elephant, clouded leopard (*Pardofelis nebulosa*), gaur, Goral (*Nemorhaedus goral*), large Indian civet (*Viverra zibetha*), Assamese macaque, capped langur, Hoolock Gibbon, stripe-backed weasel (*Mustela strigidorsa*) and smooth coated otter (*Lutrogale perspicillata*).

#### **India –Myanmar Pine Forests:**

Biological distinctiveness: Regionally outstanding

This ecoregion is one of the only four tropical or subtropical conifer forest ecoregions in the Indo pacific region. Though not rich in biodiversity they contain species unique to these ecosystems. These forests are found in the north- south Burmese-java Arc. The Arc is formed by the parallel folded mountain ranges that culminate in the Himalayas in the north. Moving south are Manipur and the Chin Hills. The outer south western fringe of mountain ranges forming the arc is the Arakan Yomas, the southern continuation of the folded mountains ranges branching of the Himalayas. The uniqueness lies in the association of Pinus with the Dipterocarps

## Annexure 7

### Existing and Proposed Network of Protected Areas in North East India

State	Existing Protected Area	Proposed Protected Area
<b>Arunachal Pradesh</b>	Pakhui WLS Itanagar WLS Mouling NP D'Ering WLS Namdapha NP Dibang WLS Eaglenest WLS Itanagar WLS Kamlang WLS Kane WLS Mehao WLS Sessa Orchid WLS Tale Valley WLS Yordi-Rabe Supse WLS	Tawang WLS Tawang NP Kalaktang WLS Lado WLS Lado NP Palin WLS Karsinganala WLS Raneghat WLS Walong WLS Walong NP Tirap Evergreen NP
<b>Assam</b>	Kaziranga NP Manas NP Orang NP Garampani WLS Laokhowa WLS Dibru-Saikhowa NP Nameri NP Barnadi WLS Bherjan-Borajan-Podumoni WLS Bordoibam-Bilmukh WLS Burachapori WLS Chakrashila WLS Deepor Beel WLS East Karbi Anglong WLS Garampani WLS Gibbon WLS Karbi Anglong WLS Laokhowa WLS Nambar Daigrong WLS Pabitora WLS Pani-Dihing WLS Sonai-Rupai WLS	Ripu-Chirang WLS Karwa WLS Hollongapar WLS Desangmukh WLS Zamzing WLS Poba WLS Digboi WLS Tinkhopani NP Dhansiri-Kaki WLS Dhansiri-Kaki NP Barail WLS Inner-Line Forest WLS Barak WLS
<b>Manipur</b>	Keibul-Lamjao NP Kailam WLS Yangoupokpi-Lokchao WLS. 4. Zeilad WLS	Dzuko WLS Dzuko NP Siroi WLS Siroi NP Imphal Botanic garden WLS Taret Lakhao WLS
<b>Meghalaya</b>	Balphakram NP Nokrek Ridge NP Siju WLS Baghmara WLS Nongkhyllem WLS	Tura Arabella NP Rongrengri WLS Nongkhlaw NP Shillong Peak NP Mawsmi WLS Garampani WLS Saipung Link WLS

<b>State</b>	<b>Existing Protected Area</b>	<b>Proposed Protected Area</b>
<b>Mizoram</b>	Murlen NP Phawngpui Blue Mountain NP Dampa WLS Khawnglung WLS Lengteng WLS Ngengpui WLS	Rengdil WLS Twai WLS Palak WLS
<b>Nagaland</b>	Intanki WLS Pulicbadze WLS Fakim WLS Rangapahar WLS	Intanki NP & WLS Kisa WLS Dzuko-Pulicbadze WLS Shiloi WLS Macaque WLS
<b>Sikkim</b>	Kangchendzonga NP Maenam WLS Fambong WLS Singba WLS Kyongnosla WLS Barley Rhododendron WLS	Dzongri WLS Tolung WLS Nimphu WLS Kitam WLS Pangola NP
<b>Tripura</b>	Trishna WLS Charilam WLS Gumti WLS Rowa WLS Sepahijala WLS	Central Catchment WLS

## Annexure 8

### Essential Elements of the State Biodiversity Strategy and Action Plans

India is a signatory to the convention of Biological Diversity and has a commitment to prepare for herself a National Biodiversity Action Plan. Each of the states in India has prepared an action plan that feeds into the NBSAP. Although many of the states have officially launched their respective SBSAP's, the official endorsement by the Ministry of Environment and Forests is yet to come, nevertheless the respective State Biodiversity Conservation Action Plans was an opportunity to compile the existing information and highlight the biodiversity status of the states. Unlike the Biodiversity Conservation Prioritisation Project (BCPP) which attempted identification of biodiversity rich sites under different ecosystems like forests, rangelands and grasslands, the State Biodiversity Strategy Action plans were developed individually for the states.

The subsequent paragraphs provides a gist of the draft State Biodiversity Strategy Action Plans in the North Eastern states. This includes a summary of the biodiversity significant site, species requiring conservation attention, threats and key concerns.

#### **Arunachal Pradesh**

- It is estimated that over 5000 species of flowering plants occur in this territory (of both vascular and non-vascular origin). Out of which, 238 are endemic to the state.
- The vegetation/forests are classified under 6 major categories i.e. tropical, subtropical, temperate, subalpine and alpine vegetation, secondary forests and aquatic vegetation; each comprising subtypes primarily based on altitude and climatic factors.
- The state is rich in its agro- biodiversity and has been a centre of origin for a number of crop plant species.
- Orchids are often associated as the 'Jewels of Arunachal Pradesh'. The state houses 500 species out of 1000 species, which are estimated to occur in India.
- It's the nature's repository of medicinal plants.
- Out of 16 primates in the world, 7 are found in Arunachal Pradesh.
- The state has amazingly rich avifauna with over 650 bird species.
- The state is unique in having traditional rights of various tribes over land, water and forest within their jurisdiction. Each tribe as a community exercises control over the natural resources within their surrounding inhabited traditionally by them and sustainable use the resources for shelter, cultivation, food and other day to day multifarious uses.
- Problems resulting in biodiversity loss reported are:
  1. Deforestation.
  2. Jhum cultivation.
  3. Tea plantations.
  4. Timber felling – though it has got decreased after the T.N. Godavarman Case.
  5. Forest Fires.
  6. Unscientific methods of harvesting.
  7. Hunting.
  8. Soil erosion.
  9. Encroachment problem.
  10. Urbanization.

**The priority conservation sites:** The conservation sites have been identified on the basis of biodiversity richness, habitat of rare and endangered species, economic importance plants and animals and ecological situation. The following are the conservation priority site as identified by SBSAP of Arunachal Pradesh.



- **Doimara:** It is located in the West Kameng district of Arunachal Pradesh. This reserve forest patch extends from the foot hills in the east, which is adjacent to Orchid Sanctuary. This area is a source of many valuable forest products, however due to exploitation of timber, cane, bamboos, jigate bark, etc. this site becomes vulnerable. The widening of road leading from Missamari to Tenga poses challenges for biodiversity conservation. The forest types are Tropical riparian forests, Semievergreen forest, Tropical evergreen forests, Subtropical forest, etc. These forests provide refuge to some of the rare and endangered plants like, *Hodgsonia macrocarpa*, *Entada purseatha*, etc.
- **Shikar hills:** It is located in West Siang District of Arunachal Pradesh, which is a mountain landscape clothed with pristine forests. It extends from Kaying in south-east to Yapin in North-west. The forests are comparatively undisturbed due to the difficult terrains. However it is also a favorite spot for hunting and trapping for animals. The forest types range from subtropical broad leaved forests, temperate broad leaved forests and temperate mixed conifer forests, bamboo breaks etc. Few of the rare species found are *Calamus inermis*, *Livistona jenkinsiana*, etc.
- **Chessa:** The forests extending from Chessa to Kankar Nallah falls under the Drupong Reserve Forests. The forest is of tropical semievergreen type however there are also evergreen types of vegetation found. This forest is also a shelter for rare species of plants of Arunachal Pradesh. Few of the rare flora species are *Entada purseatha*, *Dipteris wallichii*, etc.
- **Tengapani-Madhuban-Wakro:** It is located in Lohit districts of Arunachal Pradesh at the south bank district of Brahmaputra. Kamlang wildlife sanctuary and Namdapha national park are close to this place. The vegetation is broadly tropical wet evergreen type dominated by Dipterocarpaceae like *Dipterocarpus retusus*, *Shorea assamica*, etc. This site is rich in NTFP, wild edibles and crop relatives, rare and endangered plants, etc. These forests are perhaps some of the highly endangered vegetation types in the State. It is also habitats of Hoolock gibbon, which is a non human ape, tiger, elephants, etc. Various rare plants found here include *Sapria himalayana*, *Cyathea* spp., *Angiopteris evecta*, etc.
- **Demwee-Sewapass-Tidding:** It is located in Lohit district, about 10 km towards east of Tezu. The major vegetation type is tropical semievergreen. By and large the forests are undisturbed, however there is evidence of human pressures. Timber, bamboo, cane, medicinal plants are some of the economic products from these forests. There is diversity of oak, bamboos, canes is remarkable *Schizostachyum fuchsianum* is a unique poisonous bamboo found here. *Albizia arunachalensis* is a rare tree found here. The place is also known for increased wild life activity.
- **Likabali-Garu-Gensi:** It is located in West Siang district are rich in tropical and sub tropical forests. Apart from the rare species of cane, new species of bamboo such as *Schizostachyum arunachalensis* is reported. There is need to preserve this rich biodiversity area from external pressure.
- **Dichu-Melinja-Hotspring:** It is located in remote area of Lohit district. The vegetation range from subtropical pine forests to temperate broad leaved, temperate conifer to alpine forests. Some of the unique plants found here are *Picea spinulosa*, *Abies densa*, *Abies spectabilis*, *Larix* sp., etc. This is the habitat of Takin, Goral, Bhoral, Red Panda, Musk deer, etc.
- **Mithumna-Mailang:** It is very important conservation priority site in respect of temperate flora. There are many rare plants particularly epiphytes. The unique feature is the distribution of *Amentotaxus assamica* a rare Gymnosperm newly reported in India. The area is under pressure of predominance of increasing jhum cultivation in surrounding area.
- **Mayodia:** It is located near Roing, which is a hill ridge with temperate or sub tropical vegetation. There are number of oak, Magnolias, Fir, Tsuga and other temperate elements. It is famous for *Coptis teeta* and *Taxus baccata*. The area is also known for wild animals such as Mishmi takin, Serow, Goral, Pheasants and other birds.
- **Mandla-Phudung:** It is located in West Kameng district. It is located in West Kameng district, which is known for temperate plants. Conifers, Magnolias and Rhododendron are the special

feature of the vegetation. *Taxus baccata* was found there before however it disappeared from the district.

- **Nagula-PTSO:** It is located in Tawang district at extreme north. It has mostly conifer trees, *Rhododendron* shrubs and alpine meadows. There are some prominent high altitude lakes. There are some interesting plants such as *Ponerorchis* spp., *Boeschniakia*, *Sassaurea obvelata*, etc. There is also increased defence presence where the pressure on biodiversity is mounting. Many high altitude medicinal plants are found such as *Fritillaria cirrhosa*, *Aconitum*, *Rheum*, etc. This is a very unique place for conservation that needs immediate attentions.
- **Chander-Thungri:** It is located in West Kameng district near Munna camp. This temperate zone has divergent vegetation types like temperate broad leaved forests, temperate conifer forests, temperate bamboo breaks, temperate grass land, *Rhododendron* shrubs etc. Yak are reared in the region and utilised the place for forage and grazing. A large number of medicinal plants are also collected from this site.

### Assam

- The terrestrial natural ecosystems of Assam are mainly forest ecosystems covering both the hills and the plains, besides the grassland ecosystem dominated by both grasses and forests mainly of secondary nature.
- The state has as many as 3513 freshwater wetlands. Assam is dominated by two river plains - the Brahmaputra plains (56,480sq. kms) drained by the river Brahmaputra and its 43 tributaries and the Barak plains (6962sqkms) drained by the river Barak and its tributaries. In the floodplains of these rivers there are a large number beels, swamps and marshes known as *jaloh*, *doloni*, *hola*, *pitoni*, etc. Interestingly, all these waterbodies comprise a vast sheet of water with varying shape, size and depth with abundant flora and fauna. The wetlands provide best habitats for the migratory birds, which use to visit the aquatic bodies in large numbers.
- The vegetation of Assam is primarily of tropical type covering areas of evergreen, semi-evergreen, deciduous forests and grasslands. Stretches of riparian forest found along the riverbanks are also very important. Due to incomplete reporting particularly from certain areas, like North Cachar hills including the Barail ranges, parts of Tinsukia district that contains patches of tropical rain forest and parts of Kokrajhar district; the exact number of species in Assam still remains uncertain. However, the available records and enumeration lists suggest that there are 3017 species of flowering plants (Baishya, 1999). Obviously, with more exploration in future the number of species will definitely increase.
- Assam is rich in bamboo diversity, where 10 genera and 42 species can be found.
- Of the total 50 Red Data Book species belonging to 20 families of northeastern states, the state houses 45 species belonging to 19 families.
- Report from Botanical Survey of India state that 102 species of flora belonging to 75 genera is endemic to the state.
- About 193 species of mammals and more than 958 species and subspecies of birds are so far reported from Assam (Choudhury, 2000). The state possesses 16 important wildlife areas, which houses nearly 44 types of endangered and rare species of mammals and 14 types of reptiles and amphibia.
- Hoolock gibbon and Golden Langur are endemic to Assam.
- Assam holds the entire known world population of the Pigmy hog, 75% of the world population of the Indian rhinoceros and Wild water buffalo and a sizable population of Asian elephants and Tigers.
- Diversified habitat and occurrence of various ecological associations have significantly enriched the avian diversity in Assam with more than 900 avian species belonging to 302 genera and 68 families.
- Assam harbours 17 endemic species (Saikia and Kakati, 2000) belonging to 3 families. The endemic species found in Assam are Monipur Bush Quail-*Perdica manipurensis*, Marsh Babbler-*Pellorneum palustre*, Snowy-throated Babbler-*Stachyris oglei*, Beautiful Sibia-*Heterophasia pulchella*, Blackbreasted Parrotbill- *Paradoxornis flavirostris*, Blyth Tragopan-*Tragopan blythii*, Chestnut breasted Partridge-*Arborophila mandellii*, Grey Sibia-*Heterophasia gracilis*, Rustybelied Shortwing-*Brachypteryx hypertyra*, Tawny-breasted Wren Babbler-

*Spelacornis longicaudatus*, White-naped Yuhina-*Yuhinia bakeri*, Yellow-vented Warbler-*Phylloscopus canator*, Streaked throated Barwing-*Actinodura waldeni*, Chestnut backed laughing thrush-*Garrulax nuchalis*, Wedgebilled wren babbler-*Sphenocichia humei* and Browncapped Laughing Thrush- *Garrulax virgatus*.

- Assam is exceptionally rich in citrus and banana germplasm. It is considered by many to be the 'Creator Center' of citrus flora of India. Another unique feature of the state is occurrence of aquatic fruits like makhana or gorgon fruit (*Eurale ferox*).
- According to Assam Remote Sensing Application Center, and the Space research Center, Ahmedabad, 1367 wetlands out of 3513 in Assam are under severe threat due to invasion of aquatic weeds and developmental activities. many wetlands of the state are in a process of eutrophication, indicating total unproductivity of the waterbodies due to both natural and human factors. The extensive growth of water hyacinth (*Eichhornia crassipes*), one of the most cumbersome aquatic weeds of this region, is becoming a constant threat to the productive wetland. Also *Ipomea* sp., an introduced species, is causing concern for the species of the ecotone regions.
- Other causes for degradation of aquatic bodies and obstructing the growth of aquatic plants are overfishing, excessive collection of fodder and food items, overgrazing in the fringe areas, agricultural and industrial activities around, large scale encroachment for construction, etc. Collection of aquatic plants or their propagules for commercial purpose by unscrupulous businessmen is also another cause for the decrease of population of many aquatic plant species.

### **Manipur**

- There are types of forest ranging from that of the tropical to that of the sub-alpine ones. In fact, though small in area, the forest of Manipur represents the types of forest in the northern hemisphere except that in tundra. Since Manipur belongs to the region, which locates at the confluence of two tectonic plates (the Burmese and Indian). The region has been the Vavilovian centre of origin of a variety of angiospermic plants. It has, also, been enriched, very much, with considerable in flow and out flow of flora and fauna between the south-east Asian countries and the Indian sub-continent through this region.
- The region is a living museum of tribes speaking thirty-one different dialects. The culture of Manipur is an amalgamation of multiple cultures specific to the tribes thriving in this region.
- The state has 29 scheduled tribes, Meitei Pangals and the Meiteis. The Meiteis constitute the major group of the people in the valley districts. The scheduled tribes occupy the hills.
- The state witnesses a situation of legal pluralism in regard to land law. The state passed Manipur Land Reforms and Land Revenue Act in 1960. The Act lays out three aspects of land reforms – tenancy, ceiling and smallholdings, and survey and land records. The Act is enforced only in the plain districts, which cover only about one-tenth of total state area. The hill districts are kept under the jurisdiction of customary laws.

Problems related to biodiversity in the SBSAP are:

- Loss of habitat: The Lakes in the state are on the verge of eminent loss in their own ways. Erosion of catchments area and siltation, eutrophication are the major contributing factors to loss of wetland habitat.
- Encroachment is an eminent threat to the existence of wetlands of Manipur. Increase in number of phoomdi dweller, shallowing of and filling of lake boundaries by earth filling for settlement purpose, encroachment for farming purpose, etc are common practice. This accentuates to be serious problem in wetland management.
- There is a wide information gap pertaining to the biodiversity management and conservation between the Government or concerned authority with the public including the army, legislature etc. Information relating to the Govt.'s measures to tackle the illegal hunting, poaching, destruction of habitats including chemical poisoning or to conserve biodiversity specific areas are either irrelevant to the local commitments or are seen unnecessary hindrance to their activities.

- The various provisions and implications of the Indian wildlife Act, 1972 and (Manipur Rules 1974), the Forest conservation Act 1980, the Environment Protection Act 1986 etc, fail to reach every nook and corner of the State. It appears to be the laws only for those urban and sub-urban populations. The people of remote areas particularly in the hills have no knowledge that there are rules and regulations to protect wildlife.

SBSAP Manipur has recommended conservation of the following areas:

1. Forests at source of the Barak river (Senapati, Tamenglong and Churachandpur district)
2. Forests of Siroi in Ukhrul
3. Forests of the Khong- Tenepu
4. Dzoku valley (Senapati District)
5. Kailam range (Churachandpur district)
6. Yangoupokpi Lokchao Sanctuary (Chandel district)
7. Dipterocarpus forests of Chandel District
8. Forests around Zeliad lake (Tamenglong district)

### **Meghalaya**

- Geographical position of Meghalaya as it appears favoured immigration and introduction of different species.
- Considered to be the centre of origin for Citrus.
- More than 35% of Indian mammal species are found in this state.
- Presence of Sacred groves in the state –setting examples on traditional way of forest management.
- Due to temperature and climatic difference, the state is supposed to be the storehouse of various exotic and endangered species. Plant species like *Nepenthes khasiana* (Pitcher Plant), Orchids like, *Vanda* spp, *Paphiopedilum* sp. And *Cymbidium* sp, Trees like *Taxus baccata* etc. are being exploited randomly either as ornamental items or for medicine. To sustain their livelihood numerous flower vendors are seen selling the endemic floral species including orchids in the city of Shillong. As a consequence to this over collection and exploitation of ornamentals and medicinal species, disturbance of their habitat and deforestation, there is a danger of biodiversity loss in the state.
- Though known as the wettest place in the world (eg. Cherrapunjee), the state suffers from the problem of water scarcity.

Problems resulting in biodiversity loss reported are:

1. Loss of forest cover due to deforestation.
2. Mining and Quarrying.
3. Jhumming.
4. Charcoal Making.
5. Limestone and coal processing.
6. Fuel wood and timber extraction.
7. Construction of reservoirs and Dams.
8. Pollution of water bodies.

### **Mizoram**

- The foothills and valleys have tropical forest, while the mid-altitudes have sub-tropical moist climate, and the upper reaches temperate climate.
- The rock system is weak and unstable, prone to frequent seismic action. Soils vary from sandy loam and clayey loam, to clay, generally mature but leached due to steep gradient and heavy rainfall. Soils are porous with poor water-holding capacity, deficit in potash, phosphorous, nitrogen and even humus; excessive leaching makes them acidic to neutral.

- Traditional slash-and-burn shifting cultivation (jhum) is practiced by a large number of people, resulting in the destruction of forest cover and soil erosion.
- Timber and bamboo are among the important forest products.
- Flora and Fauna: No comprehensive, systematic survey and documentation of the flora of Mizoram has yet been carried out.
- There are many unauthorized settlements, both in reserved forests and unclassed forests, which need to be regularized.

Loss of biodiversity is due to:

- Habitat loss, hunting and over-exploitation of resources, introduction of exotic species in river ecosystems, poisoning and other factors including progressive disempowerment of local communities, population growth and destabilization of Mizo traditional management systems, have caused this loss.
- Some elements of the loss, which have remained undetected or severely under-studied, include decline of the sub-species and varieties. This silent erosion is not necessarily due to anthropogenic factors, but often due to complex and less understood environmental factors. Thus, for conservation measures to be implemented effectively, it is imperative to have a basic understanding of the flora and fauna of the state, beginning with status surveys.

### **Nagaland**

- Nagaland is also known to be the northern most tropical forest formation of the earth and the forests are classified as the Northern Tropicval wet evergreen forests, northern tropical semi evergreen forests, northern sub tropical broadleaved wet hill forests, northern montane wet temperate forests and temperate forests. World's tallest Rhododendron arboretum, tallest rice and hottest chilli are reported from Nagaland as per the Guinness Book of World Records. *Bulbophyllum rothchildianum*, endemic to India which was last reported in 1895 was rediscovered by Sapu Chaingkija et al in 1992 in two locations in Nagaland: longsa and Chare. (NEPED 2006)
- Despite the fact that Nagaland is small state, it possesses a variety of forest types distributed throughout the state. (From evergreen to temperate types).
- No comprehensive inventory of the flora and fauna of Nagaland is available.
- Nagaland is a storehouse of traditional and indigenous ecological knowledge (IEK). More than fifteen major tribes inhabit the state, each having its own distinct dialect, culture, food habit, life style, customs and rituals. These characteristics make Nagaland one of the richest treasures of IEK in the Indian sub-continent.

Threats to Biodiversity are due to:

1. Intensification of Agriculture.
2. Shifting cultivation.
3. Privatization of forests.
4. Deforestation.
5. Urbanization.
6. Introduction of exotic species.
7. Hunting and Poaching.
8. Forest fire.
9. Hydel Projects – the Doyanag and Lokimero projects are bound to cause adverse impacts on the biodiversity of Nagaland.
10. Over-exploitation of Medicinal Plants.
11. Use of pesticides.
12. Lack of awareness

A State Biodiversity Board has been recently created for the state.

## **Tripura**

- The land use is not constant. It keeps on changing on the basis of needs and aspiration of people. Forestry makes the dominant land use in the State followed by agriculture. But over the years the proportion of forests has decreased while that of agriculture has increased. In nineteenth century land under agricultural use was less than 10% but by the end of twentieth century, it has expanded to 27% of the area of the State.
- Aquatic ecosystem mainly rivers – Raima and Sarma, are affected by increasing siltation, which accentuated in the lost of diversity year after year.
- The rights and concessions of forest products amongst the local people (whose sustenance depend on collecting the 3Fs – Food, Fodder and Fuel) are not addressed properly under the spirit of public participation. As a result, unscrupulous practice gets promoted in conducting unregulated removal of forest produces.
- Plantations are encouraged at a wider scale. However, there is a large gap between potential and actual productivity, and generally poor actual productivity in natural forests is due to anthropogenic stress and this is a matter of concern because, rising demand and poor productivity lead to vicious cycle of low productivity to resource degradation of more area to further lower productivity.
- 14% of species found in Tripura is endemic, whereas rest 86% is available throughout India.
- The Phayre's leaf monkey (locally known as 'Chashma Banar') has a very restricted distribution in India, and is found in Tripura.
- Tripura has pretty high agro- biodiversity with 47 indigenous types of rice.
- Tripura have got 5 biotypes of maize, being the Secondary centre of origin of maize.
- The Jampui hill is considered to be the centre of origin of *Citrus macroptera* – fruits of which are used by the local people for home consumption and medicinal purposes.

Causes for biodiversity loss are

1. Forest degradation.
2. Shifting cultivation.
3. Influx of people from Bangladesh.
4. Grazing.
5. Forest fires.
6. Smuggling of forest and other products.
7. Presence of weed/introduction of exotic species.
8. Inbreeding practice amongst the local cattle breed.
9. Plantations- Monoculture.
10. Use of chemical fertilizers.
11. Hunting.
12. Developmental projects without any proper EIA study.
13. Lack of awareness.
14. Lack of coordination amongst the institutions.

## **Sikkim**

- It is a land of vast variation in altitude within very short distances ranging from around 3000m to 8598m. Elevation plays a prime role in fashioning the ecoregions of the state. Lowland forests of Sikkim are home to several endangered species of birds.
- Lantana and Eupatorium are major weed in this region.
- Forest fires are more pronounced followed by illegal felling of trees.

Problems leading to biodiversity loss are:

1. Deforestation.
2. Hunting/Poaching
3. Chemical Fertilizers.

4. Pollution.
5. Garbage problem.
6. Change in food habits.
7. Introduction of exotic species in agriculture
8. Defense activity in forested area, as situated near China.
9. Impact of tourism.
10. Lack of effective policing.

## **Annexure 9**

### **Wetlands of North-Eastern India**

**Archana Chatterjee**

Freshwater Conservation Programme, WWF-India

Wetlands are the land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. The term groups together a wide range of habitats that share a number of common features, the most important of which is continuous, seasonal or periodic standing water or saturated soils.

The Ramsar convention defined wetlands as "areas of marsh, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".

Wetlands all over the world are threatened directly due to reclamation for development activities, reduction in function due to pollution, water demand, change in hydrologic regime, over exploitation of wetland resources and also due to underlying causes such as market failure, information failure and intervention failure (Shine and de Klemm 1999). In this scenario, fundamental knowledge on location, characteristics, functions, values, threats and assessments of status of wetlands are prerequisite for developing sustainable conservation programme for wetlands.

The North – eastern states of India harbor some of the spectacular and biologically rich wetlands of India. Some of these wetlands have been explored but most of them are still unknown. With increasing human pressure and prevalent underlying causes these wetlands are under increasing pressure. With increasing infrastructure development and other pressures in this region, there is a danger of losing this natural heritage, the species it supports, the ecosystem services it provides as well as the spiritual and cultural ties the local population has with these wetlands.

A short account of wetlands in north eastern states of India : Sikkim, Meghalaya, Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura is provided below:

#### **Arunachal Pradesh**

Arunachal Pradesh has 806 wetlands of the size 2.5 ha and above with an area of about 560 sq km). Arunachal has three Endangered and 14 Vulnerable fish species, two each of endangered and vulnerable and five near threatened species of freshwater turtles, and seven threatened and one near threatened species of birds. SACON study surveyed 18 wetlands and prioritized eight of these for designation as Ramsar sites. WWF-India National Consultation on high altitude wetlands, prioritized following wetlands from Tawang district: PT Tso, Oriangdukpu, Sangetsar and Paradise lake. Further field surveys by WWF-India team recorded that most of the water bodies found in high altitude area (lakes, marshes etc.) of West Kameng and Tawang districts are considered as sacred by the Monpa Buddhist Community settled in the area. Important among these is the Bangajang lake complex comprising around 10-12 lakes in Tawang district, and the stretch Gurchok to Gurjang in West Kameng district hosting some 6-7 good wetlands. Sangti marshes is an important wintering site for the highly endangered Black-necked Crane.

#### **Assam**

Assam, the sentinel of the east, hosts around 3500 freshwater wetlands of the size 2.25 ha and above, covering 1012.29 sq km. Most of these wetlands are in the floodplains of the rivers Brahmaputra and Barak and their tributaries. These wetlands are in form of beels, swamps and marshes hosting a rich array of flora and fauna. Two species of endemic aquatic plants, two critically endangered, seven endangered and 26 Vulnerable species of fishes, five near threatened, six vulnerable species of freshwater turtles. 133 species of birds have been recorded from the 35



major wetlands in Assam. SACON study prioritized 75 wetlands, 25 of these being the potential candidates for designation as Ramsar Sites. One of them Deepor Beel has already been designated as a Ramsar site.

### **Manipur**

Manipur is home to the Paradise flower-Shiroy lily (*Lilium macklinae*), which is not found elsewhere in the world and has the only habitat for Sangai, the Dancing deer in the famous wetland Keibul Lamjao national park. The State has 155 wetlands of 2.5 ha and above in size covering a total area of 529 sq km. Manipur has seven endangered and 15 vulnerable species of fishes, one endangered, two vulnerable and three near threatened species of freshwater turtles, and three threatened and two near threatened species of birds. Six wetlands were prioritized out of which Loktak lake is already a Ramsar site. The others are Pumlun pat, Ikop pat, Kharung pat, Zeilad lake complex and Waithou lake.

### **Meghalaya**

Meghalaya has 98 wetlands of the size 2.25 ha and above, covering a total area of 22.21 sq km. There are four Endangered and 14 Vulnerable species of fishes, eight species of freshwater turtles, two of which are Endangered, and two Near threatened species of birds. About forty seven species of wetland birds have been recorded. Three wetlands have been prioritized as potential Ramsar sites, namely, Birbah lake, Umiam lake and Tasek lake complex. Some other important wetlands on priority list are Chidampong and Bolgisim, Kopilli reservoir, Umtru lake and Kyrdekullai lake.

### **Mizoram**

The State does not have large wetlands, the total area of wetlands of the size 2.25 ha and above is only 1.5 sq km. Mizoram has four endangered and 11 Vulnerable species of fishes, two endangered, three near-threatened and one vulnerable species of turtles and one each of threatened and near-threatened species of birds. Three wetlands namely, Palak dil, Mampui dil and Tam dil have been prioritized for designation as wetlands of national and international importance.

### **Nagaland**

Wetlands cover around 9.16 sq km area in this narrow strip of rugged mountainous State. Four Endangered and 18 Vulnerable species of fishes, one each of an endangered and near threatened species of freshwater turtles and one threatened species of bird reported. Three wetlands namely, Shilloi lake, Doyang reservoir and Dzudu lake have been prioritized by SACON.

### **Sikkim**

Sikkim has 160 wetlands of the size 2.25 ha and above, covering 19.85 sq km. These support four endangered and fifteen vulnerable species of fishes, three species of freshwater turtles- one of which is Vulnerable and one Near threatened, and two threatened species of birds. SACON study has prioritized four wetlands namely Thepley Tso, Khechiperi, Batangcho and Tsomgo lake. At a National Consultation on WWF-India, the following wetlands were prioritized:

1. West District Lake Complex (Phutso Karpo, Tso Domdo, Khecheopalri)
2. Tsomgo-Kupup-Snathang Complex
3. Khangehung Tso-Tso Lhamo-Suru Dongmar-Gyam Tsona Complex

### **Tripura**

408 wetlands of 2.25 ha and above covering an area of 98.95 ha have been recorded. Tripura has two Endangered and 12 Vulnerable species of fishes, and one near-threatened species of bird. Dumbur lake and Rudrasagar lake have been prioritized of which Rudrasagar is already designated a Ramsar site. Trishna wetlands, Sattar Mia's Haor, Batapura lake and College Tilla lake have been recommended for designation as community reserves.

## **Annexure 10**

### **Case studies (Box Items)**

#### **Box 1**

##### **The village councils of Arunachal Pradesh**

Different tribal communities of Arunachal Pradesh have their own village council like Mnomas of Mompas, Blu of Sherdukpens, Kebangs of Adis etc.. The state is considered a legal pluralist test as both customary laws enforced by village council and statutory law framed by state and Central Government govern different spheres of life. Till dates most of the issues/disputes are solved by village council and hardly any cases are referred to the local government judiciary system.

Arunachal Pradesh Protection of customary laws bill of 1994 seeks to provide for the protection of customary rights and laws and social practices followed by the tribal communities of Arunachal Pradesh. The bill further provides protection of customary rights including ownership and transfer of land with its resources and the properties thereon enjoyed by the indigenous people of Arunachal Pradesh

The traditional village councils are efficient to manage the natural resources within their jurisdiction in sustainable manner. All the villagers have to take permission from the village councils for extraction of any resources from such areas. The system of governance has been evolving with time as per requirement. In the past when most of the forests resources were plenty, there were very few rules to ensure sustainable and equitable sharing of resources. However, like among the Sherdukpen community, the village council has framed specific rules on extraction of Chirata by putting a ban on extraction before the month of October to ensure sustainable utilization of grazing areas. However, after independence, introduction of 'Gaonbura' system appointed by district administration and the recent Panchayati Raj System, resulted in a situation where the village communities face dual governance- from traditional as well as modern. Little understanding of the statutory laws complicate the matters further.

For eg the traditional system of demarcation of the forests to *Tsos* by Mompas, their system of sharing of forests resources amongst different communities was lost once administrative boundaries were made in their traditional forests.

The traditional village councils are still revered by the villagers and can serve as important vehicles for conservation. We need to understand the system better and attempt synergizing what is traditional and the modern.

#### **Box 2**

##### **Role of autonomous councils in biodiversity conservation**

(Sonali Ghosh)

Sonali Ghosh is a forest officer serving in Assam and is currently writing a book on Manas.

Autonomous District Councils and Regional Councils in northeast have been constituted under the sixth schedule of the Constitution which means that they have legislative, administrative and financial powers over 40 subjects including forests. The need to come up with the councils was to bring about social and economic change in tribal areas and carry forward the central government's agenda for peace and development in this remote and 'lesser known' region.

The council can make laws for allotment and use of land (other than reserved forests) for purposes of agriculture, grazing and other residential and non-residential purposes; use of water resources for agriculture and for regulation of shifting cultivation within the autonomous districts.

Presently North-East India has, sixteen District Councils – three in Assam, three in Meghalaya, three in Mizoram, one in Tripura and six in Manipur. Interestingly Nagaland, does not have any autonomous District Councils of their own till date.

With a plethora of customary laws, land ownership status and administrative control, the issue of biodiversity conservation in these councils is complex and not well understood.

If the forest cover as depicted by latest satellite imageries is any indication then a healthy forest cover in these councils is an encouraging trend. However the rate of change in this forest cover, subsistence hunting and extraction of forest produce such as bamboo through permits needs to be analysed and documented.

From my experience of working in Assam and Mizoram, the councils have understood the need to protect and preserve the biodiversity in their councils because it is one of the only major natural resource that they have.

For instance, BTAD (Bodoland Territorial Areas district) in lower Assam extends over 8,970 sq kms and covers important Protected Areas such as Manas Tiger Reserve, Orang National Park, Barnadi and Chakrashila Wildlife sanctuaries and several other Reserve Forests. Although forests and wildlife still come under the purview of the state and centre respectively but since its inception in Dec7, 2003 the BTAD has made sincere efforts in documenting and reviving the conservation measures in these areas. They are also being projected as the next ecotourism destinations. The centenary celebration of Manas in Dec 2005 was one such effort that brought into focus the need to rejuvenate a depleted landscape.

Ingenious ways for conservation have already been initiated in Manas such as formation of the conservation volunteer's corps whose members are mainly ex-poachers. Several local youth organizations are also working full time to protect Manas by creating awareness and environment consciousness.

All these are a step in the right direction especially when the earlier means had failed. The district council is patronizing these efforts but the current political instability and the priority to agriculture and development over forests and conservation are some of the causes of concern.

In my opinion the councils deserve a chance and also the right encouragement and direction. With little help from the centre and the state, land reforms and codification of customary laws, the district councils can perhaps be the best model of self governance and biodiversity conservation.

### **Box 3**

#### **Impact of 'ban on grazing' at the Barsey Rhododendron Sanctuary, Sikkim**

The Barsey Rhododendron Sanctuary (BRS) lies in the southwest corner of the state of Sikkim spreading over 104km<sup>2</sup> with an altitudinal gradient of 2200m – 4100m. During the year 2000, high impact pastoralism was practiced by 288 households in this sanctuary. They owned 5,370 cows, 370 buffaloes, 506 yaks and 135 sheep which grazed within the sanctuary throughout the year. The livestock density was 61 livestock / km<sup>2</sup> and the cattle shed density 4.5 / km<sup>2</sup>. Due to trampling by the cattle, 576 ha of land was made barren. Collection of close to 42,000 pole-sized timbers and 22 ton of firewood and 26 ton of fodder was noted from BRS every year. Because of this biomass collection, it led to degradation of forest and catchments of the hill streams within that. Not only this was illegal following the Wildlife (Protection) Act of India, 1972, this grazing was also causing a lot of ecological damage in the sanctuary. In order to tackle this, the state forest department along with NGOs like The Mountain Institute and the members of the Eco-Development Committees started phasing out of the cattle and the shepherds from the BRS. By 2005, 276 of these herders (272 cow herders, 1 yak herder and 3 sheep herders) have phased out from this profession. Of the 12 herders still remaining, 10 are yak herders and 2 are cow herders. Of the total 6,324 livestock units grazing within the sanctuary in the year 2000, there has been a 93% reduction and by 2005 only 463 livestock units remain. The livestock density has reduced by 96% from 61 livestock / km<sup>2</sup> in 2000 to 4.45 livestock / km<sup>2</sup> in 2005. Similarly the cattle shed density has also reduced by 96% from 5.54 cattle shed / km<sup>2</sup> in 2000 to 0.23 cattle shed / km<sup>2</sup> in 2005. As

the figures indicate a cattle sanctuary has been now slowly converted in to a safe haven for wildlife. There has been 93% reduction in the intensity of livestock grazing within the sanctuary from 2000- 2005. The positive impacts on the wildlife habitats of BRS by the herders is better natural regeneration of the forests, more biomass availability, rejuvenation of the springs and increase in wildlife populations. There has been revival of many mountain springs which currently meets the drinking water needs for many villages adjoining BRS.

## Annexure 11

### NAMES OF NGOs WORKING ON BIODIVERSITY CONSERVATION IN NORTH-EAST INDIA

State	Name	Contact Address	Areas
<b>Arunachal Pradesh</b>	OJU WELFARE ASSOCIATION	P.O. NAHARLAGUN, PIN-791110 Ph: 91-360-44453, 44784	Wasteland Development, Livestock Development, Agriculture Development, Afforestation
	FUTURE GENERATION OF ARUNACHAL	POST BOX 151, VIVEK BUILDING, VIVEK VIHAR, PIN – 791110 Ph: 91-360-243-844 E-mail: <a href="mailto:kanno@future.org">kanno@future.org</a> <a href="http://www.future.org">http://www.future.org</a>	Community based activities, Environment related activities
	NORTH EAST INDIA BIODIVERSITY RESEARCH FOUNDATION.	STATE FOREST RESEARCH INSTITUTE, ITANAGAR Ph: 91-09436059798	Biodiversity related activities
<b>Assam</b>	DOLPHIN FOUNDATION	BLUE HILL, JYOTINAGAR, GUWAHATI, PIN – 781 021 Ph: 91-361-2657506 E-mail: <a href="mailto:dolphin_foundation@yahoo.com">dolphin_foundation@yahoo.com</a>	Biodiversity Conservation – conducted survey (census) on River Dolphin; Grassland Conservation Program.
	MEGAMIX NATURE CLUB	DHAKUAKHANA, LAKHIMPUR. PIN – 787 055 Ph: 91-3752-254905 E-mail : <a href="mailto:debojit.p@rediffmail.com">debojit.p@rediffmail.com</a>	Working on Bats, and Awareness program on Conservation.
	AARANYAK	"EVERGREEN", SAMANWOY PATH (SURVEY), PO: BELTOLA, GUWAHATI PIN – 781 028 Ph: 91-361-2228418 E-mail: <a href="mailto:aaranyak@vsnl.net">aaranyak@vsnl.net</a> , <a href="http://www.aaranyak.org">www.aaranyak.org</a>	Wildlife Conservation, Promoting Community-based conservation, Scientific and Policy research on conservation
	ECOSYSTEMS-INDIA	2-D, NIRVANA ENCLAVE, BASHISTHAPUR BYLANE No. 3, GUWAHATI. PIN – 781 028 Ph: 91-361-223-1312/1412, 91-94350-16247/16248 E-mail: <a href="mailto:ecosystems@sify.com">ecosystems@sify.com</a> , <a href="mailto:mail@ecosystems-india.org">mail@ecosystems-india.org</a> <a href="http://www.ecosystems-india.org">www.ecosystems-india.org</a>	Carried study on Assam Haathi Project; Awareness Initiative on Conservation in Manas National Park.
	GREEN HERITAGE	P.O. BOX – 21, NORTH LAKHIMPUR PIN- 787 001 Ph: 91-3752-242882	Scientific research on Wildlife Conservation; Study on Indigenous and Forest dwelling tribes.
	ASSAM VALLEY WILDLIFE SOCIETY	PERTABGHUR TEA ESTATE, P.O. CHARIALI, DISTT. SONITPUR. PIN – 784 176	Biodiversity Conservation
<b>Manipur</b>	CHASED AVENUE TRIBAL WOMEN DEVELOPMENT ORGANISATION	GOSHEN HOUSE OFFICERS COLONY, SANJENTHONG, IMPHAL -795 001 Ph: 224927	Tribal Development, Afforestation
	DUILON JOINT FARMING MULTIPURPOSE COOPERATIVE SOCIETY LIMITED	DUILUAN NAMTHAN, WAIRANGBA-PART II, DISTT.TAMENGLONG – 795 014	Social Forestry
	FOREST REPLENISHING SOCIETY	WINO BAZAAR, UKHRUL – 795 142 Ph: 03870-222674	Soil Conservation, Social Forestry, Tribal Development

State	Name	Contact Address	Areas
Meghalaya	MOTHER EARTH	TRIPURA CASTLE, TRIPURA CASTLE ROAD, SHILLONG -799 003 Ph: 0364-223345	Wildlife Trade Control, Animal Rights, Eco-Development
	IFAD		
Mizoram	CENTRE FOR ENVIRONMENT PROTECTION (CEP)	C-54, PHULMAWI RUN, TUIKUAL NORTH, AIZAWL PIN – 796 001 Ph: 91-389-2316744 E-mail: cep_mizo@lycos.com	Biodiversity Conservation.
	ENDANGERED SPECIES PROTECTION GROUP	A-88/1, TUIKUAL SOUTH, AIZAWL PIN- 796 001. Ph: 91-389-324483	Protection of endangered species of flora and fauna.
Nagaland	ASSOCIATION OF TRIBAL WELFARE DEVELOPMENT(ATWD)	POST BOX 117, WOODLAND, NAHARBARI, DIMAPUR	Social Forestry, Agro Forestry, Tribal Development
	NAGALAND INSTITUTE OF HEALTH, ENVIRONMENT AND SOCIAL WELFARE	C/O PARA MEDICAL TRAINING INSTITUTE, KOHIMA. Ph: 0370-21385, 21738	Forest Conservation, Wildlife Protection – Hornbill And Tragopan
Sikkim	PARYAVARAN SAMRAKSHAN SAMITEE	DALAPCHAND BUSTY, P.O. DALPCHAND, VIA RONGLI BAZAR, DISTT. EAST SIKKIM PIN – 737 131	Biodiversity Conservation
	SIKKIM DEVELOPMENT FOUNDATION (SF)	TASHI KHAR, CHUNGYAL COMPLEX, M. G. MARG, GANGTOK, SIKKIM. PIN - 737101 MR. KARMA TAKAPA Ph: 03592-220960	Participatory projects with communities
	THE MOUNTAIN INSTITUTE - INDIA	DEVELOPMENT AREA, NEAR NEPALI SAHITYA PARISHAD, GANGTOK. PIN - 737101 MR. SANDEEP TAMBE Ph: 03592-227942	Livelihoods initiatives and capacity building of CBOs
	KHANGCHENDZONGA CONSERVATION COMMITTEE	YUKSOM, WEST SIKKIM MR. P. G. BHUTIA Mobile: 9434241087	Livelihoods initiatives at the village level, capacity building of the ecotourism service providers
	SINDRABONG KHANGCHANDZONGA ECOTOURISM SOCIETY	SINDRABONG, WEST SIKKIM MR. NIMA T. BHUTIA Ph: 03592-227942	Alternative livelihoods for herders
	MUTANCHI LOM AAL SHEZU	DZONGU, NORTH SIK MR. MIKA LEPCHA Mobile: 9434061387	Sustainable development for tribals in Dzongu area
	SIKKIM PARYAVARAN SAMRAKSHAN SANGHA	BIKMAT, SOUTH SIKKIM MR. GOKUL RAI 9434027154	Agriculture and horticulture development in villages
	SAHASS (SAHAYATA SANGH OF SIKKIM)	RONGLI, EAST SIKKIM MR. PURAN GURUNG 9832078839	Improvement of health services and capacity building of villa

