

Conservation Status of Hoolock Gibbon (*Bunopithecus gibbon*) in Meghalaya

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1. Introduction

Meghalaya (25°5′-26°10′ N latitude, 89° 47′-92° 47′ E longitude), covering an area of 22,429 km² is located in the North Eastern part of India. Meghalaya (literally meaning the abode of clouds) attained full statehood as the 21st state of India on 21st January 1972 with Shillong as the state capital. It neighbours Assam in the north and east and is surrounded by Bangladesh in the west and south by a stretch of about 400 km of the international boundary.

1.1 Topography and Climate

Meghalaya falls in the 9B (Northeast Hills) Biogeographic Province of 9 Biogeographic Zone. The whole of Meghalaya is a plateau (150-1960m MSL) having western, central and eastern parts, commonly known as Garo, Khasi, and Jaintia Hills. The plateau is marked by great diversities in relief features. It has highly dissected and irregular topography in the northern and western part and steep and regular slopes in the southern part. In the north, the boundary of the plateau is not well defined due to the presence of broken hill ranges (**Fig. 1**).

The Garo Hills is a highly dissected region with an average elevation of about 600 m. An interesting feature of Garo Hills is the presence of Tura and Arabella Ranges running parallel in east-west direction. The Tura range (about 50 km long) runs from Siju to Tura and its highest peak is Nokrek (altitude of 1412 m). The Arabella Range runs parallel to the Tura

Range on its north. It gradually increases in height and join Tura to the South. The remaining parts of the Garo Hills consist of hill ranges running from north to south with highest points varying in height from 450 to 600 m.

The Khasi and Jaintia Hills with old topography and flat skyline have the following three parts based on their physiographic characteristics:

- i. The northern undulating hills,
- ii. The central upland zone and
- iii. The southern plateau.

The northern hills (elevation ranging from 170 to 820 m) generally slope towards the Brahmaputra Valley. Above 490 m elevation most of the hills are flat-topped in appearance. The central upland zone runs from west to east and occupies more than one-third of the central and eastern Meghalaya. The Shillong Peak (1961 m) is its highest point. The southern point of the central and eastern Meghalaya plateau is characterized by steep slopes. The deeply cut valleys divide this section into three parts – the Cherapunjee Platform, the Mawsynram Platform, and the Lynthyrdem Platform. On the Cherapunjee platform there are many small rounded hills made of limestone. These hills have caves with narrow underground tunnels and characteristic karts features. Towards the plains of Bangladesh the face of the plateau at many places is characterized by deep precipices caused by abrupt slope and heavy rainfall.

The Jaintia Hills (eastern plateau) is a contiguous part of the central Meghalaya Plateau but it is relatively lower with an average height of a little more than 1200 m. The three parts of the plateau (northern hills, the central upland (Jowai upland) and the southern escarpment) coincide with three parts of the Central Meghalaya. The central upland (1500 m) extending from east to west acts as a watershed between the Surma Valley in Bangladesh & and the Brahmaputra

Valley in Assam. In general, the Jaintia Hills have more low and level lands than the Khasi Hills (Fig. 2).

The drainage system of Meghalaya is greatly determined by its geological structure and the physiographic features. The Tura range in Garo Hills and the central uplands in Khasi and Jaintia Hills form watersheds, and from these watersheds the rivers flow down towards the

Fig. 1 : Physiographic Divisions of Meghalaya

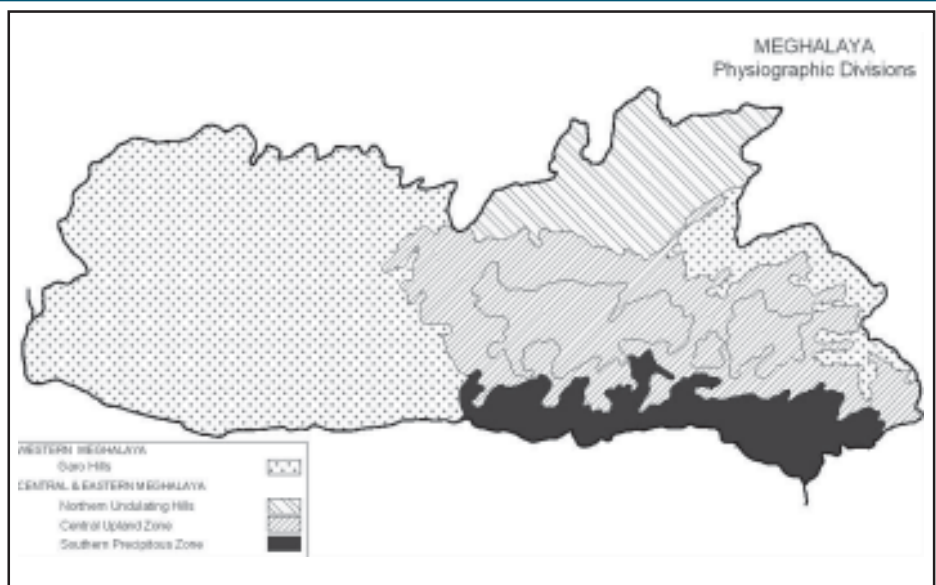
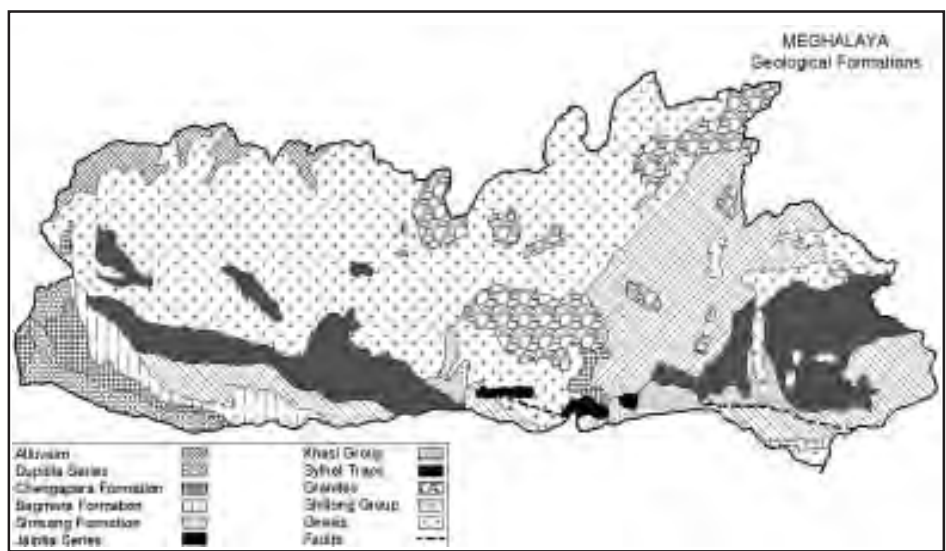


Fig. 2 : Geological Formation in Meghalaya



plains of Bangladesh in the south and the Brahmaputra valley in the north. The important rivers in the Garo Hills (of the northern group from west to east) are the Kalu (navigable), Ringgi, Didak, Didram, Krishnai (navigable) and Dudhnai. Sanda, Bandra, Bhogai, Dareng, Nitai and Simsang are the important rivers of the southern group. Among the rivers of Garo Hills, the Simsang is the longest and is navigable for a distance of about 30 km.

The rivers in Khasi and Jaintia Hills also flow in two reverse directions. The main rivers of the northern groups (Khri, Digaru, Umtrew, Umiew and Myngot) form the boundary of the plateau very irregular. The south bound rivers give rise to deep valleys on the faulted surface of the hills as they leave Meghalaya to enter Bangladesh plains (Fig 3).

The climatic conditions of Meghalaya vary according to the altitudinal changes occurring over the north-western part of India and the Bay of Bengal (formation of high pressure) and the warm and moist wind coming from the south or the south-west. Meghalaya receives most of its rainfall from the south-west monsoon winds. Khasi and Jaintia Hills is

uniquely pleasant while in Garo Hills the summer is humid and warm, and winter is pleasant. During winters, ground frost is common in the table land of Khasi and Jaintia hills. The monsoon winds from the Bay of Bengal strike against the hill ranges in the southern part of the state experiencing heavy rainfall. The Mawsynram-Sohra belt in this region has the highest rainfall record in the world (1392 cm). More rainfall is at windward slopes and less on the leeward side. The average annual rainfall in the south-west is about 400 cm, in the central part between 300 - 400 cm and in the north it ranges from 250 to 300 cm. More than 75% of the rainfall is received within 6 months from April to September. Winter months with only 6cm rainfall are almost dry (Fig. 4).

The state experiences three distinct seasons in Meghalaya. The cold season from October to February records the mean minimum temperature as low as 3.6^o C. The summer season from March to May records the highest mean maximum temperature (33^oC) is recorded in the month of April. The monsoon season is the longest from May until September. Basically four soil types are found in Meghalaya (Fig. 5).

Fig. 3 : Drainage System in Meghalaya

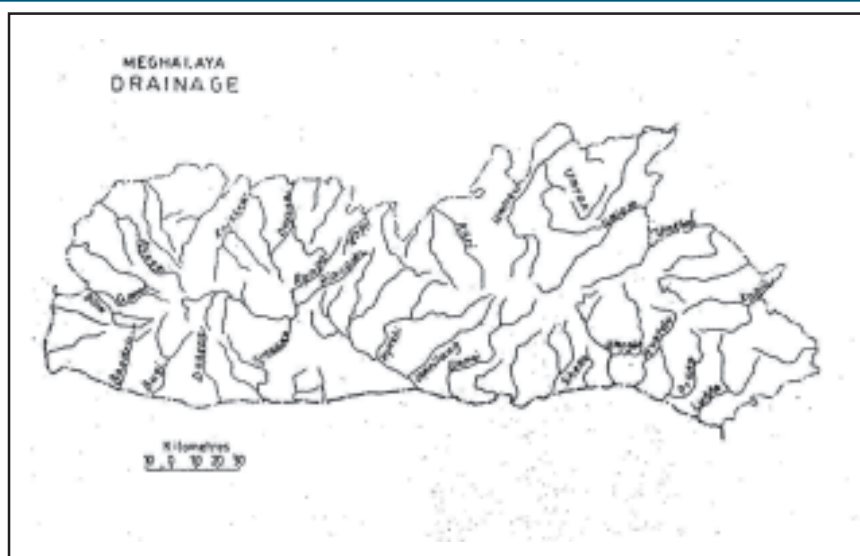


Fig. 4: Rainfall Pattern in Meghalaya

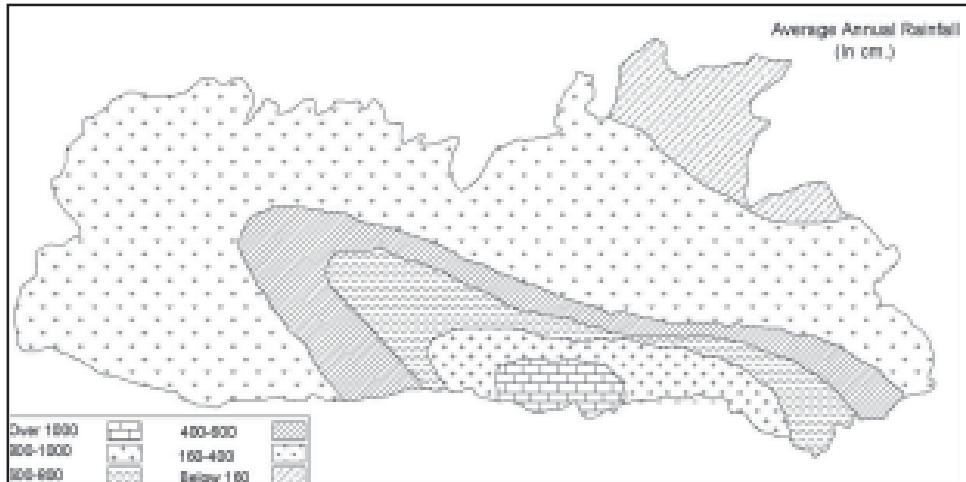
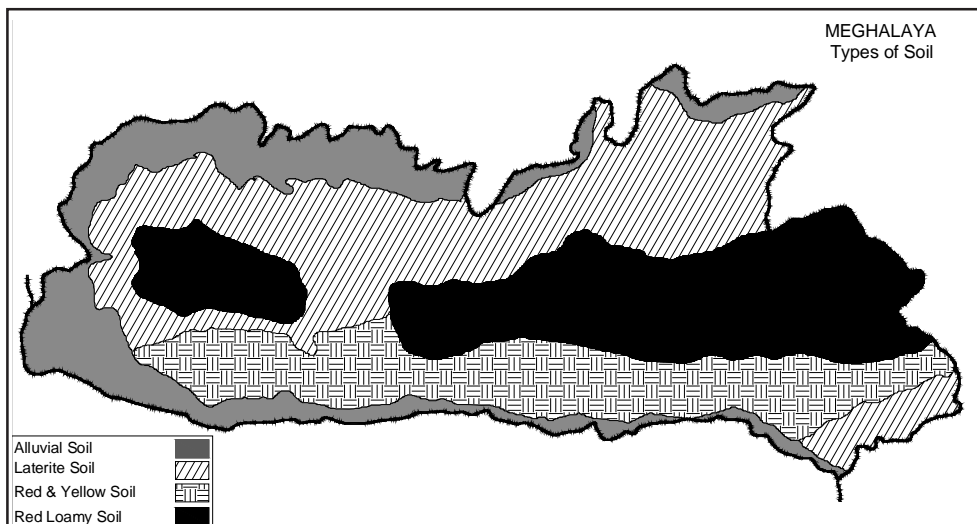


Fig. 5: Soil Characteristics in Meghalaya



1.2 Forest Resources

Due to its varied topographic, edaphic and climatic conditions, the state is endowed with great biodiversity values of flora and fauna. The luxuriant and varied growth of vegetation and other floral elements consists of tropical, sub-tropical, and temperate forests (**Fig. 6**). The forest cover in the state is about 69.8% (15657 km²) and total area of recorded forest is 42.3% (9496 km²) of the total geographical area of the state. The dense forest coverage is 4,044 km² (25.8%) and open forest is 11,613 km² (74.2%) of the total recorded forest. Of the total recorded forests, about 89.5% (8503 km²)

is under the control of the Autonomous District council and only 993 km² (10.5%) is with the forest department in the form of Reserved forests, Protected forests and Protected Areas (267.4 km² as NPs and WLS).

The tropical forests are confined to 1200m elevation and temperate forests are found between 1200 and 1800m elevations. Tropical forests consist of evergreen, semi-evergreen, deciduous, sub-tropical pine forest and grasslands. Sub-montane areas of the Southern parts of Khasi and Jaintia hills and part of South Garo Hills have mostly evergreen and semi-evergreen forests (**Fig 7**).

Fig. 6: Vegetation Structure in Meghalaya



Fig. 7: Broad Forest Types in Meghalaya



The Sal Forests, which occupy the northern part of Khasi Hills and the border areas of Garo Hills, are of very fine quality. The Rongrenggiri Reserve in the Garo Hills is considered to be among the best Sal reserves in India. The subtropical pine forests are confined in some parts of the central Uplands of the Khasi and Jaintia Hills. The bamboo forests grow within the sal and evergreen and semi-evergreen forests. Meghalaya has 14 genera and 36 species of bamboo.

The temperate forests occur above 1800 m altitude where the 'Sacred Groves', as dense virgin forests with distinct stratification represent the 'relic' flora of the region. The state is also bestowed with many tree, shrubs and herbs species that are used as aromatic food and medicinal plants. Apart from this, the state is also very rich in several varieties of colorful orchids. Almost 98 genera and 352 species grow as terrestrial and epiphytic orchids in the state.

1.3 Social, Economic and Cultural Aspects of Meghalaya

About 85% people live in villages with an agrarian economy. However, only a little more than 8% of the total geographical area is available for cultivation and only 13% of the cultivated land produces more than one crop. In spite of favourable rainfall pattern and other climatic conditions, agriculture is not highly remunerative for the people due to rugged topography and less productive soils. The valleys and the border areas forming parts of the Brahmaputra valley are the few productive sites. The valleys have relatively more fertile soil and the lowlands in the border areas are characterized by high temperature and heavy rainfall level land and fertile soils. The topography of the land also governs the

agricultural practices in this state e.g., in the plains areas of this state the farmers practice permanent cultivation where as along the slopes of the hills they practice shifting cultivation. Meghalaya produces a large variety of food crops (60%), cash crops (25%), horticulture crops (9%) and other commercial crops (6%). The major food crops are Rice, Wheat, Maize, Millets and Pulses (Gram, Tur etc.). Among the cash crops, Oil-seeds (Rape and Mustard, Castor, Sesamum and Soya bean), Cotton, Jute, Mesta Potato and Sugarcane, Areca nut, Cashew nut are the main crops. Banana, Papaya, Pineapple, Citrus, Temperate and Miscellaneous fruits are the main horticulture crops. Other commercial crops are Tobacco, Turmeric, Sweet Potato, Chilies, Tapioca, and Ginger.

1.4 Traditional Socio-cultural systems in Meghalaya

Khasi and Jaintia Hills : The people of Meghalaya had their own democratic social institutions since time immemorial. These institutions were handed over from one generation to another and are quite alive even today. It is very important to have a comprehensive understanding of these social and cultural systems as these are very closely woven with the nature and uses of natural resources. In some of the communities, these traditional systems are so strong that even present day's rules and regulations are regarded as subsidiary to them.

The people of Khasi Hills are headed by Syiems or Chiefs, also known as Rajas by the people of the plains from very ancient times. There are many legends with regards to the origin of the system of Syiemship in the Khasi Hills. It was believed that there are basically two types of Syiems. One is those who are called Syiems Blei or Divine Syiems, because they had a divine

origin. These are the Syiem Malngiang, the Syiem Sutnga and the Syiem Shyllong. Others were called Syiem Briew (human Syiem) because they were elected by the people themselves. The Malngiang Syiems were the earliest Syiems that ruled over a great part of the Khasi and Jaintia Hills. The main function of the Syiem was to administer justice.

The system of Syiemship in Jaintia hills district was abolished by the British Government in 1835 and got replaced with Doloiship. The Dolois used to be a mere Myntri and worked under the supervision of the Syiem. The Dolois had the power to run the Government of his province. Religious Dolois also had religious functions to perform. Initially their number was three, which has now increased to 18. The Dolois are elected by the adult male member of the province from the original or founding clan of a village. The Dolois once elected remain in office till the end of his life. The Dolois sometimes have a deputy called Pator. The Pator assists the Dolois in the administration of the province. Both Dolois and Pator act on the advice of the council of Myntris. The Dolois enjoy vast powers concerning judiciary, collection of toll from the markets, religious functions, etc. The institution of Doloiship still occupies a place of great importance in the Jaintia Hills of Meghalaya.

Garo Hills : The Garos have their own traditional institutions of governance, the Nokma and the Lasker.

In the Garo Hills, the head of each clan is known as Nokma or Akhing Nokma, who along with the village council (known as Melaa) has its own area known as the Akhing Land. The head of the clan is called the Nokma. He is also known as the Akhing Nokma. Besides the Nokma, there is the village council known

as Melaa. The Nokma and the council have supreme power over the Akhing Land. The Nokma is usually elected from the members of the clan owning the Akhing Land and occupies an important position in the village. He can be removed if he fails to discharge his functions properly. The Nokma is the head of the village and his presence is essential in all the festivals including marriages and funeral ceremonies. The religious functions in the Garo society actually begin and end in his house. When sacrifices are conducted, the Nokma provides an animal as required according to the custom. The Nokma is also responsible for entertaining visitors to the villages and to provide them with hospitality. His main function is to maintain peace and good governance. He settles disputes arising in the village. This institution still exists today and all in the community have great reverence for it.

Besides the Nokmas, there are Laskers who are elected by the Nokmas and approved by the government. One Lasker had to look after 10-12 Nokmaships. The Laskers are usually the men of great influence and could occupy the position as the chief Nokmas of their villages. At present, the Laskers are appointed by the district Council. A person must have attained the age of 35 to be appointed as Lasker besides having a deep knowledge of the customary laws of the Garos. The Laskers discharge the role of rural magistrates.

A large number of festivals are associated with the cultures of Garo, Khasi and the Jaintia community. These festivals also signify the importance of forests, shifting cultivation, and their association with the animals and plants with their day to day life. Wangala is the biggest of all festivals amongst the Garos that is performed in connection with Jhum cultivation. Behdeinkhlam is the most important festival of the Jaintia.

1.5 The Village Councils

In Meghalaya, Village Durbars replace Panchayats as authorities in the villages. In the Khasi and Jaintia Hills these are Durbar Shnong, while in the Garo Hill these are Melaa. The village council is the apex body in the village comprised of the Headman, the secretary and other members who are either directly elected by the people of the village or nominated according to the system prevailing in the area. In Garo Hills, the village council is headed by Nokma.

The District Councils (DCs): There are 3 district councils in Meghalaya having 30 members elected every 5 years by the people of the respective district. The members of the DCs elect their chairman and Deputy Chairman. The Chief Executive Member, who is elected by the members of the council, heads the DCs. The DCs enable the tribal people living in these hills to preserve their own customary laws, culture, language and social system.

Districts in Meghalaya : There are 7 districts in Meghalaya. The West Khasi Hills districts is the biggest in area and the South Garo Hills is the smallest (Table 1).

Table 1: Districts of Meghalaya

District	Area (km ²)	HQs
East Khasi Hills	2748	Shillong
West Khasi Hills	5247	Nongstoin
Ri-Bhoi	2448	Nongoph
East Garo Hills	2603	Williamnagar
West Garo Hills	3714	Tura
South Garo Hills	1850	Bagmara
Jaintia Hills	3819	Jowai
Total Area of Meghalaya	22429	Shillong

Population density in Meghalaya : The East Khasi district has the highest population density, (Table 2).

Table 2: District wise human population density in Meghalaya (2001)

District	Population (Lakhs)	Density (Person/Km ²)
East Khasi Hills	6.61	234
West Khasi Hills	2.94	56
Ri-Bhoi	1.93	81
East Garo Hills	2.47	95
West Garo Hills	5.16	139
South Garo Hills	0.99	54
Jaintia Hills	2.96	77
Meghalaya	23.06	103

The population of Meghalaya has grown steadily till 70s. After the state got separated from the erstwhile district of Assam, the human population increased in leaps and bounds. Between 1961 and 1971, the population increased almost one and half times and by the year 2001, it has gone up by almost two and half times (Table 3).

Table 3: Rate of Growth of Population in Meghalaya (1901-2001)

Census Year	Population	% Growth of Population
1901	340524	—
1911	394005	15.71
1921	422403	7.21
1931	480837	13.83
1941	555820	15.59
1951	605674	8.97
1961	769380	27.03
1971	1011699	31.50
1981	1335816	32.04
1991	1774778	32.86
2001	2306069	29.94

1.6 The Protected Area Network in Meghalaya

There are 5 PA in Meghalaya. These together make up for only 1.34% of the total geographical area of the state. Of these 5

protected areas, 2 are NP and 3 are WLS. Their area and location are as follows:

1. Balpakhrum National Park (220 km²)
2. Nokrek National Park (47.48 km²)
3. Nongkhylllem WLS (29 km²)
4. Siju WLS (5.18 km²)
5. Baghmara Pitcher Plant WLS (0.02 km²)

The locations of all the 5 PAs with respect to the districts are presented in **Fig. 8**.

2. Survey of Hoolock Gibbon

2.1 Jaintia Hills

Jaintia Hill district (25^o.3'N and 25^o.45'N to 91^o.45'E and 92^o.45' E) was created on 22 February 1972 and is a part of the erstwhile Jaintia Kingdom, which is also known as Sutunga Kingdom prior to recorded history. Jaintia Hill district is situated east of Meghalaya.. The total geographical area of the district is 3819 km². Jaintia Hill district is bounded on the North by Karbi Anglong District of Assam

and on the East by the Cachar Hill District, to the south by Bangladesh and on the West by East Khasi Hill District of Meghalaya. It is inhabited by the Jaintia tribal community of a very ancient ethnic origin. The headquarter of Jaintia Hills is Jowai, which is located about 64 Km from Shillong and is encircled by the majestic Myntdu River (**Fig. 9**).

Jaintia Hills district is the easternmost part of the State bordering Karbi Anglong, North Cachar, Cachar district of Assam and Bangladesh (**Fig. 10**).

In Jaintia Hills district, the forests lie along the bordering areas of the Assam state. It is in these forests that the gibbons are confined. Narpuh Reserve Forest is situated at the Southern part of Jaintia Hills district. There are two Reserve Forest i.e. Narpuh Block – I Reserve Forest and Narpuh Block II Reserve Forest having an area of 62.47 km² and 98.75 km² respectively. Another Reserve Forest namely Saipung having an area of 150.46 km² lies on the eastern part of the district.

Fig. 8: Protected Areas in Meghalaya

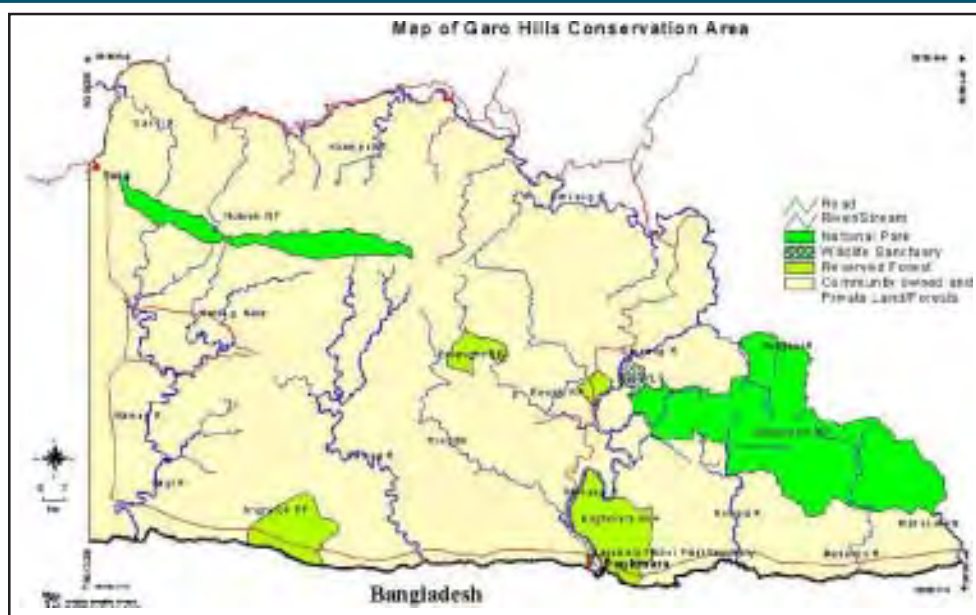


Fig. 9: Location of Jaintia Hills Districts in Meghalaya



2.1.1 Physiography and Climate

Jaintia Hills being a component of the Meghalaya Plateau has its physical feature similar to that of Khasi Hills. The only difference being Jaintia Hills has comparably more flat topography but a mild gradient. The hills slope towards Brahmaputra Valley of Assam in the North and overlook the gentle plain of Bangladesh in the South. The Marangsih peak on the Eastern plateau of Jaintia Hills stands majestically at the elevation of 1631m above mean sea level and is the highest peak in the entire district. The main elevation of the district ranges between 1050m to 1350m. In general, the whole district is full of rugged and undulating terrain with the exception of the deep gorges, steep precipices and narrow valley carved out by the river of Umngot, Myntdu, Lukha.

The climate of this region is directly influenced by the Southwest monsoon and the Northeast winds. There are four distinct seasons; (1)

Fig. 10: Jaintia Hills



Spring from March and April; (2) Summer (Monsoon) May to September, (3) Autumn – October to November and (4) Winter – December to February. Rainfall starts by the 3rd week of May and continue right up to the end of September and sometime well into the middle of October.

2.1.2 People

The people living in Jaintia Hills are called 'Pnar', they are ethno linguistic group of people and the word Pnar encompasses an ethno linguistic and geographical area within the administrative boundaries of Jaintia Hills district. The Pnars are believed to be of Indo-Mongoloid race although speaking a distinct Austric language belonging to the Mon-Khmer group. The people are often described as having a easy going disposition.

In the Pnar society the family is the core of social organization. Though it is mother-centered, yet, the authority of the house or lung lies with the eldest maternal uncle who is the head of the clan and represents the house in all the village matters. But marital and other institutional affairs are based on the matrilineal system. Matriarchy in its true sense does not exist in the Pnar society. In spite of the female

ownership of property the woman's elder brother is the actual head of the household. In cases where there is no female child, the mother is succeeded by her son thus the system can be regarded as matriarchal only by courtesy. Nowadays there has been tremendous change in the way of life of the Jaintia people and it is not uncommon for a man to live together with his wife and children in separate houses and the house is solely run by the father of the house and not by the uncles. Matriliney in a restrictive sense is applicable to the extent that tracing of descent is done through a female side. The father undoubtedly is the head and occupies a distinguished position in a family.

The Pnar or the Jaintia people maintained their unique culture and religion called 'Niamtre'. The British Paramount during the seventeenth century brought about changes in many aspects of the Jaintia society, a good percentage of the people are embracing Christianity as their religion. Apart from Christians, there are other religions too, like the Unitarians, the Muslims etc. The coming of the Welsh Missionaries brought about significant changes in their values system, beliefs, speech, etiquette, food habits, life styles and most importantly in the fields of health, education and economic condition

People of Jaintia hills are engaged in various occupations. Some are working as civil servants, engineers, doctors, laborers, cultivators, traders, potters, basketry, business etc. Originally the main occupation of the Jaintia people is agricultural and it is being practiced in most villages. The Jaintias have a more advanced method of cultivation than many other hill peoples in the northeastern region of India. The process of converting highland into paddy fields was ever increasing with the demand of the people. Irrigation had been resorted to through whatever sources the water could be tapped for this purpose.

2.1.3 Vegetation

Altitude directly influences the vegetation in Jaintia Hills district. One can notice the change in vegetation while traveling from Jowai to Silchar or from Jowai to Passadwar. Sub-tropical pine forest s (*Pinus kesiya*) is found in and around the Jowai, the vegetation changes to Moist evergreen forest and broad leaved forest, when one reaches the Eastern boundary, Southern boundary and Northern boundary of the district which are located at considerable lower elevation. Severe pressure of Jhum cultivation in Jaintia Hills is evident everywhere. A clear testimony to this is the presence of many undulating naked (except some scattered pine patches) hillocks that can be seen in and around Jowai. The usually heavy and very heavy rainfall leaches out the useful nutrient and mineral and renders the land almost barren. Because of the unsuitable temperature regime, no other species grow easily in this leached land. The pine forests hardly support any underground growth of shrubs or herbs. The Eastern, Southern and Northern boundary of this district is rich in forests of different species. The top canopy consists of *Tetramelis nudiflora*, *Toona ciliata*, *Michelia champaca*, *Mesua ferrea*, *Gemelina arborea*, *Ficus Spp*, *Amoora*, *Schinma Wallichii*, *Sterculia Spp*, *Asculais assamica*, *Duabhangana nadefflora*, *Artocarpus Chaplusa*. The middle canopy comprises of *Alstonia scholasis*, *Callicarpa arborea*, *Bidelia spp.*, *Caraya Spp*, *Dillenia indica*. Many orchids, bamboo, cane, fern, lichen, grasses are also present in plenty in the forest as epiphytic and/or under growth.

2.1.4 Fauna

Many endangered species are represented in Jaintia Hill forests. A good population of elephants is present in Narpuh and Saipung Reserve forests and the corridor area connecting this two Reserve forests. A total of 7 species of primates (Sow Loris, Assamese macaque, Rhesus macaque, Pig-tailed macaque,

Stump tailed macaque, Capped Langur and Hoolock Gibbon) have been identified in this area by a survey team from the American Society for Primatologists (ASP).

2.1.5 Hoolock Gibbons in Jaintia Hills

A thorough survey of Hoolock Gibbon was carried out in Narpuh Block – I RF and Narpuh Block – II RF and the corridor area joining the Narpuh RF (Block – II) with the Saipung Reserve Forest for a period of 10 days during the month of May 2003.

Narpuh Block – I Reserve Forest: This falls in Umdhokha beat of Pasadwar Range under Jaintia Hills Wildlife Division. This block has an area of 62.47 km². Narpuh Block – I Reserve Forest is relatively much degraded and under

tremendous pressure from encroachers and jhum cultivators. Only some inaccessible terrain of this Reserve Forest is safe from biotic interference. Hoolock Gibbons are present in this Block and adjacent community and village forests.

An area of 9.19 km² (14.7%) was covered for the survey through 5 transects of 18 km length (Table 4).

These transects traversed through the reserve forests, protected forests, and jhum fields. A total of 4 groups were located based on personal communication by the researcher after visiting these sites. The GPS locations of 4 sites were also recorded (the GPS recording for the fifth site could not be taken due to non-functioning of the battery at that time) (Table 5).

Table 4: Areas Covered in Narpuh Block – I RF

Name of the transect	Status of transect laid	Length of the transect	Surveyed Area
Form Pasadwar to camping site	RF	7Km.	3.99 km ²
From Pasadwar to Khandi Km	PF	4Km.	3.2 km ²
From Khandai Km to jhum field	PF	2 Km.	2.0 km ²
Total Area surveyed			9.19 km²

Table 5: Gibbon survey in Narpuh Block – I Reserve Forest (Area - 62.47 sq. km.)

Location	Group	Group size	Mode of information	Lcoation
Near Umdhokha beat	1	-	PC	N25°07'25.4" E92°14'46.1"
Do	1	-	PC	N25°07'11.9" E092°14'02.0"
Do	1	-	PC	N25°07'18.3" E092°12'49.5"
Khandai Kilometre (Hartali)	1	6(1AM, 1AF, 1 SAM, 2 SAF, 1INF)	PC	N25°09'19.0" E092°11'18.5"
Barkhat	1	-	PC	-
TOTAL	5	-	-	-

PC = Personal communication

- The 1st group was recorded from a very good habitat of semi-evergreen forests. The 2nd and 3rd groups were located in plantation forests dominated with teak. The 4th and 5th groups were located in jhum fields having sparsely distributed trees
- The habitat in case of 1st and 2nd gibbon groups was found deteriorating. The habitat of 4th and 5th groups was severely degraded.
- The first 3 groups were in reserved forest and last 2 groups were in private forests.
- One major factor for the deterioration of the habitat for all the 5 groups was recognized to be the mounting jhuming pressure.
- In case of first 3 gibbon groups, the local forest staff of this block confirmed presence of at least one group based on the songs heard from the respective areas. Similarly, for the remaining 2 groups which were located inside the private forests, the local people confirmed presence of at least one group of gibbons based on frequently heard songs.
- The gibbons songs were heard from both sides of the Mantru river near Umdhoka beat office. The calls appeared to have been originating from the private forests. The private forests are in very good condition without any shifting cultivation. While, intense jhuming pressure is seen in the government forests.
- The sites for 4th and 5th groups were private forests which are totally degraded due to unsustainable collection of fire wood and small timber by the local people. Few remaining big trees act as transit routes for gibbons.
- Hartali area is dominated by private forests used for jhuming and is highly degraded. The area opposite to this is used for areca nut cultivation over 7 sq km, which is characterized by the presence of abundant bamboo and small evergreen forest patches

in between.

- Barkhat area is near the Bangladesh border (only about 10 km.). Gibbon songs were heard by the forest staff at this place about 2 years ago which confirmed the presence of gibbons in this area. From Pasader to ‘30 km’ area a total of 30 km² was covered. The route was full of vegetation and villages with areca nut trees. A total of 145 km² was covered while traversing from ‘30 km’ to Ambrem. The vegetation has thinned out here with complete denudation at Amlerem. An area of 185 km² was scanned between Amlerem and Jowai. The route was having scattered pine trees. Few coal depots are also present indicating that the coal is mined from this area.

2.2 Vegetation Survey in Narpuh Block-I

A total of 21 plots of 10 m radius were surveyed across 5 different transects covering

Name of the Area	Number of plots
Khandi	03
Moomaneng	18
TOTAL	21

a distance of 13 km traversing through the following areas:

The number of plant species in these plots ranged from 3 to 9. In most plots (13, 62%), the number of species was 5 or more (up to 9) and in remaining 8 (38%) plots the number of tree species was less than 5. A total of 7 species were found dominantly present in the surveyed plots. *Saree*, *Ping*, *Lakher*, *Sning*, *Satler*, *Stain*, *Libo*, and *Maatmi* were the most dominant species. Of these *Saree* alone was present in 7 plots.

All the plots were very dense in tree growth

and a total of 121 trees were counted in all the 21 plots. Except in one plot having 4 trees, all other plots were having more than 6 trees. The number of trees ranged between 4 and 7.

Most of the plots (18, 86%) were with medium (25-50%) to very dense (75-100%) canopy cover. Only 3 plots (14%) were with light canopy cover (1-25%). A total of 8 plots (38%) were with very dense (75-100%) canopy cover. The canopy continuity was even better with 19 plots (90%) having medium (25-50%) to very dense (75-100%) canopy continuity. Only 2 plots (10%) were with light canopy cover (1-25%). A total of 11 (52%) plots were with very dense (75-100%) canopy contiguity. Most plots (18, 86%) were having nil (0%) to very poor (1-25%) herbs concentration and only 3 (14%) plots were with medium (25-50%) herb growth. Similar status of shrubs was noted in the plots. Most plots (19, 90%) were having nil (0%) to very poor (1-25%) shrub concentration and only 2 (10%) plots were with dense (50-75%) shrub growth. There were no plots with very dense shrub growth.

The area was having mostly natural forests (18, 86% plots) and few plots (3, 14% plots) were having private forests. There was no plot with a habitat consisting of a mixture of forests and plantations. Similarly, not a single plot was noted in the surveyed area with secondary growth of forests following jhuming in the past.

A total of 20 cut stumps were counted from only 6 (29%) plots across the survey areas, although majority of the plots (15, 71%) were without any sign of cut stumps. Among other types of biotic pressures, grazing and collection of firewood and other forest products was noted in 9 (43%) plots in each case. A total of 10 (48%) plots were having signs of current shifting cultivation. Fragmentation of the habitat was noted from 6 (29%) plots. Overall,

medium to high biotic disturbance was recorded from all the surveyed plots.

No direct sighting of any other wildlife was made from any of the 21 plots during the surveys. However, indirect signs such as pellets, dung, and call confirmed the presence of barking deer, wild pig, and serow from 8 different plots. Therefore, the area was quite rich in wildlife apart from the presence of gibbons.

The vegetation status coupled with the status of canopy cover, canopy continuity, biotic factors, and presence of other wildlife indicate that at least 15 plots are potential gibbon habitat sites. Of these, at least 8 plots having good population of other wildlife species could be the most potential sites. These potential sites will get further strengthened in their status once this proposed WLS is finally notified.

Narpuh Block – II Reserve Forest: This block falls under Umkiang Range of Jaintia Hills Wildlife Division. Narpuh Reserve Forest (Block – II) covers an area of 98.76 km². There is a proposal to declare this block as a WLS by the state government (**Fig. 11**).

The gibbons are present in this block. Due to the steep hills and inaccessible terrain, a major portion of the reserve is totally protected from the encroachers and other types of biotic interference. Only southeastern part of the block has some encroachment otherwise the larger portion of it is free from encroachment activities. The block is also almost free from jhum cultivation. The luxuriant growth of forest across the block provides an excellent habitat to gibbons and other wildlife.

About 9.09 km² (roughly 10%) of the total area was covered through 5 transects of 30 kms. length (**Table 6**).

Fig. 11 : Narpuh Block – II of Jaintia Hills

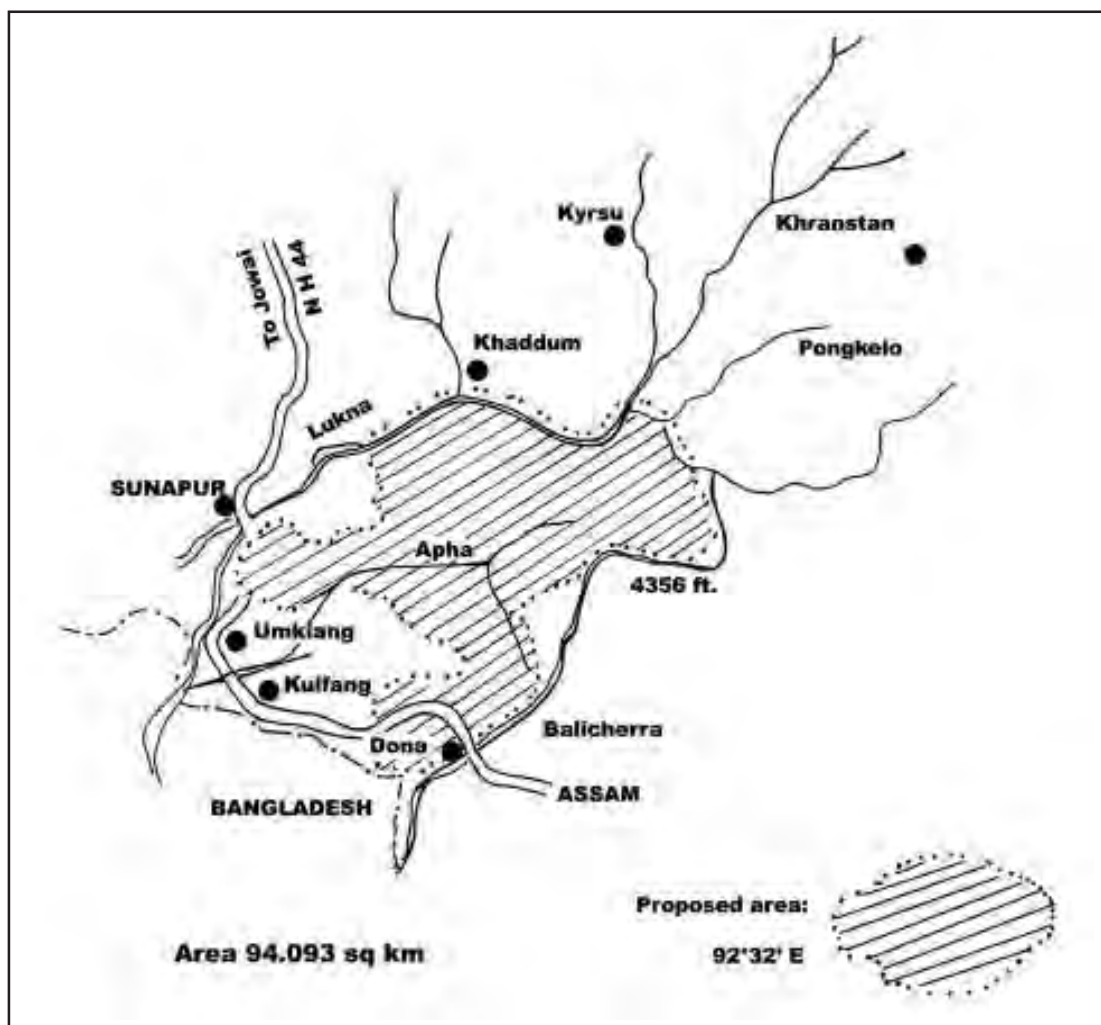


Table 6: Areas Covered in Narpuh Block – II Reserved Forest

Sl. No.	Name of the transect	Length of the transect	Surveyed Area
1.	Form Umkiang RO to Sonapur slide	13 km.	2.6 km ²
2.	From Sonapur slide to camping site	5 km.	3.37 km ²
3.	From camping site to inside RF	3 km.	0.3 km ²
4.	From Umkiang RO to Beat office (Territorial)	6 km.	2.40 km ²
5.	From Beat office to inside RF	3 km.	0.42 km ²
Total Area surveyed			9.09 km²

These transects traversed through the reserved forests, protected forests, private lands and village commons. A total of 5 gibbon groups were located, of which 3 were located through songs and 2 based on the personal enquiry from the staff and local people. The GPS reading of all these sites were also recorded and is presented in the **Table 7**.

- All the 5 groups were located in the semi-evergreen forests.
- The habitat quality for 1st, 2nd, and 3rd groups was excellent. The habitat quality was found deteriorating in case of 4th and 5th groups. (**Fig. 12**).
- The major deteriorating factor is the shifting cultivation at all the identified habitats.
- While first 3 groups were located inside the Reserve Forests, the remaining 2 groups were located in the private forests adjacent to the Narpuh Block.
- The 4th and 5th gibbon groups were located based on personal communication with the local people owing the private forests who confirmed that the gibbon songs are heard very frequently from this locality (**Fig. 13**).

Fig. 12: Hand sketch of Narpuh Block Survey locations

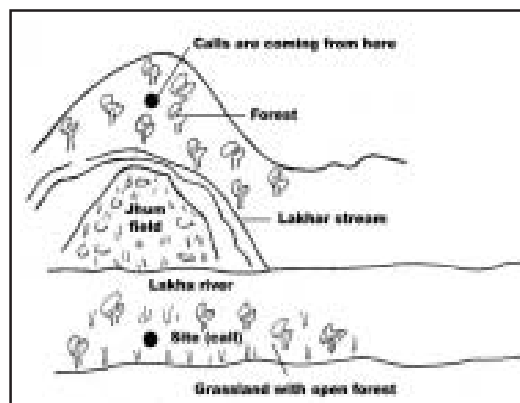


Fig. 13: Hand sketch of Narpuh Block Survey locations

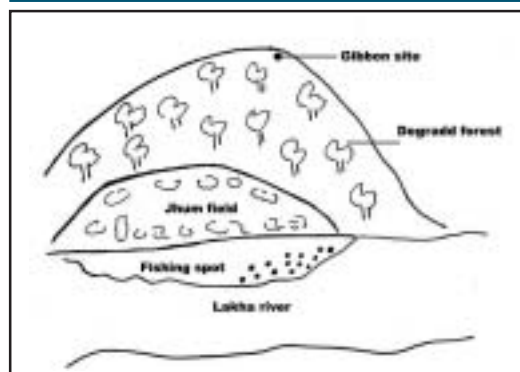
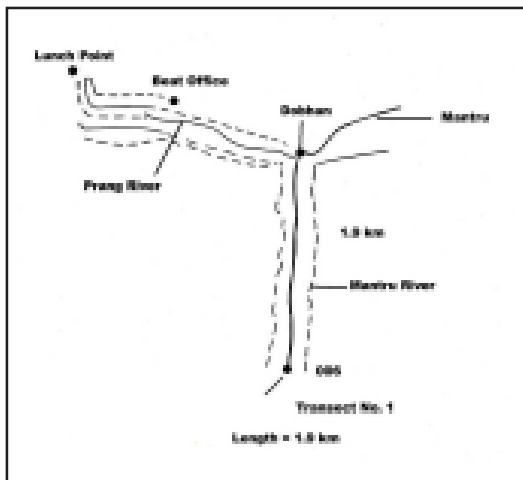


Table 7: Narpuh Block – II reserve Forest (Area - 98.76 km²)

Serial number	Location	Group	Group size	Mode of information	Location
1	Lakhar	1	-	Song	N25°06'21.9" E092°24'21.2"
2	Inside Reserve forest	1	-	Song	N25°08'11.3" E092°25'20.2"
3	Do	1	-	Song	N25°06'20.0" E092°24'08.7"
4	Chynplong	1	-	PC	N25°07'05.2" E092°20'05.0"
5	Near Dona village	1	-	PC	N25°04'07.3" E092°24'57.2"
TOTAL	TOTAL	05			

PC = Personal communication

Fig. 14: Hand sketch of Narpuh II Block Survey locations



2.3 Vegetation Survey in Narpuh Block-II

A total of 11 plots of 10 m radius were surveyed across 5 different transects covering a distance of 30 km. across the Umkiang area. The area was quite rich in plant species as the number of plant species in these plots ranged from 4 to 24. In 6 plots (55%) the number of species was 5 or more (up to 24) and in remaining 5 plots (45%) the number of tree species was less than 5. In 2 plots the number of tree species was ore than 15. A total of 5 species were found dominantly present in the surveyed plots. *Dienswing*, *Saree*, *Ping*, *Kathal*, and *Teak* (*Tectona grandis*) were the most dominant species. Of these *Ping* was most common and was recorded from 5 plots out of the total 11 surveyed plots.

All the plots were very dense in tree growth and a total of 234 trees were counted in all the 11 plots. In all the plots the number of trees was more than 10 and ranged between 10 and 60.

All the plots (11, 100%) were with medium (25-50%) to very dense (75-100%) canopy cover.

Of these 7 plots were with dense (50-75%), 3 plots with medium (25-50%), and one plot was with very dense (75-100%) canopy cover. The canopy continuity was even better with 10 plots (91%) having medium (25-50%) to very dense (75-100%) canopy continuity. Only 1 plot (9%) was with light canopy continuity (1-25%). A total of 5 (56%) plots were with very dense (75-100%) canopy contiguity and 4 (36%) plots with dense canopy contiguity. Most plots (9, 82%) were having nil (0%) to very poor (1-25%) herb concentration and only 2 (18%) plots were with medium (25-50%) herb growth. However, the status of the growth of shrubs in these plots was little better. While 6 (55%) plots were having nil (0%) to very poor (1-25%) shrub concentration, remaining 5 (45%) plots were with medium (4 plots, 25-50%) to dense (1 plot, 50-75%) shrub growth. There was no plot with very dense shrub growth.

The area was having mostly natural forests (9, 82% plots) and only 2 plots (18%) were having plantations of different species. There was no plot with a habitat consisting of the mixture of forests and plantations. Similarly, not a single plot was noted in the surveyed area with secondary growth of forests following jhum in the past.

A total of 11 cut stumps were counted from only 4 (36%) plots across the survey areas, although majority of the plots (7, 64%) were without any sign of cut stumps. Among other types of biotic pressures, grazing and collection of firewood and other forest products was noted in 7 (64%) plots in each case. Only 2 plots were seen having signs of current shifting cultivation. The fragmentation of the habitat was noted from 6 (54%) plots. Overall, medium to high biotic disturbance was recorded from all the surveyed plots.

No other wildlife was sighted either directly or their presence was confirmed through indirect evidences.

Going by the vegetation density, canopy cover, canopy continuity, and scale of biotic disturbance, almost 7 plots can be attributed the status as potential gibbon habitat in this area. These potential areas must be surveyed thoroughly for presence of gibbons and suitable mechanisms need be developed to enhance the habitat quality.

2.4 Corridor between Narpuh Block – II RF and Saipung RF outside the proposed WLS

The corridor area between Narpugh Block II RF and Saipung RF is also an excellent habitat with very less encroachment and jhum pressure. The Forest Department is contemplating to declare this corridor area as a WLS. This would further provide a good protective coverage to the viable population of gibbons in this area. The gibbons were located in many groups outside the corridor and within the proposed sanctuary area. Near a village called Mokympat,

as many as seven gibbon groups were located within an area of about 12 km². However, this area is under the control of a traditional administrative community called Ilaka Dolo Sutunga. Although, encroachment and jhum cultivation may not be regarded as significant, logging pressure is extremely high in the gibbon habitat.

The corridor area outside the proposed WLS was also surveyed for gibbon populations. The calls were emanating from as far as 2 km. radius from the observation point. Therefore, the area of corridor covered for this survey turned out to be about 12.56 km². Besides this, the survey area was also calculated by multiplying the length of the transect covered from camp I to Moullin village and Moullin village to camp II with the sighting width. The area from Camp I to Moullin was 4.90 km², and from Moullin to camp II a total of 1.20 km² area was covered. During this survey, a total of 18.16 km² area was surveyed (**Table 8**).

- The first 6 groups were located in the Community Forests under Ilaka Dolo Sutunga. The 7th gibbon group was

Table 8: Corridor between Narpuh Block – II RF and Saipung RF, but outside the proposed WLS

Serial number	Location	Group	Group size	Mode of information	Location
1	Moomaneng down	1	-	Song	N25°15'00.6" E092°30'35.0"
2	Moomaneng up	1	-	Song	N25°14'55.6" E092°32'26.5"
3	Moomaneng Further down	1	-	Song	N25°14'47.6" E092°30'48.3"
4	Kdait (at the boundary of the corridor area)	1	-	Song	N25°13'19.8" E092°31'47.4"
5	Kdait (from corridor area)	1	-	Song	N25°13'18.0" E092°31'17.7"
6	Kondre (Khlieh lotnger)	1	-	Song	N25°15'48.6" E092°29'38.2"
7	Moullin	1	-	Song	N25°14'51.7" E092°29'54.7"
TOTAL		07			

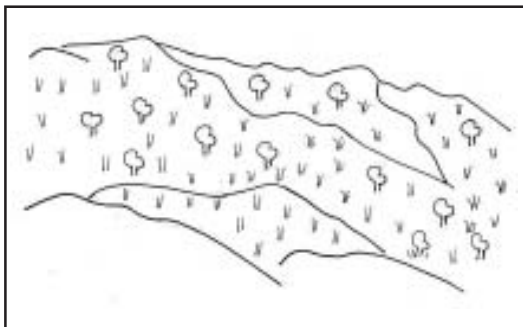
found in a private forest below Moullin village (Fig. 15).

Fig. 15: Hand sketch of Survey locations in Narpuh RF II



- All the 7 groups were occupying semi-evergreen forests. The evergreen forest in case of 7th group was also experiencing pressures from the limestone quarries.

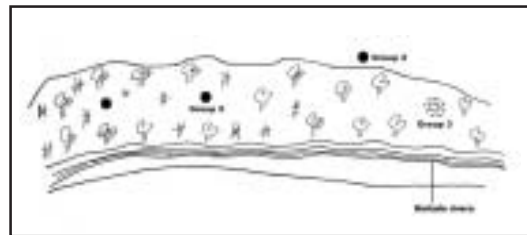
Fig. 16: Hand sketch of Survey locations in Narpuh RF II



- Jhuming and logging were found to be two major factors for deterioration of the habitat (Fig. 17).

A total of 7 gibbon groups were located in this survey. These groups were located based on the songs heard from a distance of approximately 2 km from the observation point. The age/sex composition of the group could not be ascertained as the groups were

Fig. 17: Hand sketch of Survey locations in Narpuh RF II



not physically seen. The presence of the groups was, however, also ascertained from the local staff and local people. The details are tabulated below:

Consolidated result of survey in Jaintia Hills: A total area of about 36.44 km² was surveyed in the Jaintia Hills and 17 groups of gibbons were located. Of these total number of groups, 10 groups were located based on the songs and remaining 7 based on personal communications with the local staff and local people. The age and sex composition of the groups could not be verified.

2.5 Nongkhyllum Wildlife Sanctuary

Nongkhyllum Wildlife Sanctuary (NWLS) is a small (29 km²) sanctuary located in Ri-Bhoi district of Meghalaya (91° 40'E and 91° 51 ½'E longitude to 25° 50' N and 25° 55' N latitude). It has a very strategic location being surrounded by Nongkhyllum Reserve Forest, private and community forests and the forests under Khasi Hill Autonomous District Council. All these areas provide a buffer zone of about 319.25 km² around the sanctuary. With the presence of a mix of government and community forests, the Sanctuary supports great biodiversity even within the small area of its jurisdiction. Nongkhyllum WLS comprises of Nongpoh Wildlife Range under Khasi Hill Wildlife Division with its headquarters at Shillong. The Nongpoh range has three beats, namely, Umtasor, Audit Point and Lailad.

Nongkhyllum WLS is well connected with the state capitals of Assam and Meghalaya. A number of metalled roads connect the NWLS with the Shillong-Guwahati highway (NH-40). The Beat Offices of the NWLS at Lailad, Umtasor and Adit Point can also be approached from Umling, Quinine and Zero Point respectively, which are connected with the national highway.

Physiography and Climate: The underlying rocks are mainly metamorphic. They comprise mainly of quartzite and crystalline gneiss with a little mica. The soil in the ridges and steeper slopes are shallow and comprise of coarse grained sandy loam. The lower, gentler slopes are overlaid with red soil of great depth. The low lying areas along the river banks, stream banks and valleys comprise mainly of clayey loam. Most portions of forests that are untouched by fires and free from grazing and biotic interference have thick layers of humus covering the ground.

The NWLS area comprises of hills and valleys along which numerous streams. These streams join the rivers Umtrew, Umtasor and Umsaw which surrounds the area. The altitude ranges from 200 m to 800 m. The highest point is Mawkyndah (965 m). Steep hill slopes uncommonly occur only along certain portions of the banks of Umtrew and Umtasor Rivers. Huge outcrops of rocks at many places make the terrain very rugged.

Two major perennial rivers viz. Umtrew and Umran drain the NWLS area. The Umtrew River runs west & north along the boundary of the Sanctuary and the reserve. River Umran runs east to west through the middle of the area. Besides the above two major rivers there are streams and numerous small nallahs and drains which are seasonal. Umpursheh, Umling, Umthingeh, Um Ranulang, Umshiabu

and Umpuh are major seasonal streams. A natural pond called Birbah attracts a variety of migratory birds every year. The pond is perennial in nature though the water level recedes during dry period.

Hot weather prevails from March till mid May with strong winds from the South. The rains start from later half of May till October which causes a sharp rise in temperature. Winter starts from November till February. July being the hottest month may have temperature rising to about 34°C, while in January it may dip to the level of around 9°C. This area does not experience extremes of heat, drought and frosts. During the hot weather, conventional showers occasionally aided by hailstorms provide relief from the heat. Being a rain shadow area, however, rainfall from the monsoon winds from the South is moderate at best. The annual average rainfall is around 1813mm.

Vegetation: The original undisturbed vegetation of NWLS is of Tropical Mixed Evergreen type. In the Northern portion of NWLS the vegetation is mostly moist deciduous. Towards the southern portion the deciduous components are gradually replaced with evergreen species including sub-tropical and temperate species. As a whole, the general woody vegetation presents a homogeneous appearance mixed with bamboo forest and grassy slopes. The vegetation presents a three storey appearance where large trees with spreading crowns and tall boles form the top canopy. These trees also provide shelter to a variety of epiphytes. The forests conform to the following types as classified by Champion and Seth:

1. Type 2B/ISI North Indian Tropical Semi Evergreen Forest.

2. Type 3C/ C3b Moist Mixed Deciduous forests.
3. Type 3C/C1 (a) (ii) Khasi hills Sal.
4. Type 2B/ISI- North Indian tropical Semi Evergreen Forest.

A. **Woodland forest:** Sal is the dominant tree species in the area. The other tree species as its associates are *Lagerstroemia parviflora*, *Schima wallachi*, *Acrocarpus fraxinifolius*, *Alstonia scholaris*, *Bombax ceiba*, *Artocarpus chaplasha*, *Bischofia javanica*, *Castanopsis hystrix*, *C. indica*, *C. tribuloides*, *Cinnamomum temala*, *Elaeocarpus floribundas*, *Lannae coromandelica*, *Garuga pinnata*, *Anthocephalus cadamba*, *Tetramedis nudiflora*, *Toona ciliate*, *Syzygium* spp., *Callicarpa arborea*, *Careya arborea*, *Emblica officinilis*, *Gmelina arborea*, *Gynocardia odorata*, *Mallotus philippensis*, *Sapium* spp. etc.

B. **Scrub Forest:** This type comprises of dense mixture of *Bamboosa tulda*, *Dendrocalamus hamiltonii* with medium sized and lower level vegetation. The sapling of woodland level trees are mainly *Alpinia malaccensis*, *Hollarbena antidysentrica*, *Amomum* spp., *Colocasia esculenta*, *Castanopsis speciosa*, *Globba multiflora*, *Oxalis corniculata*, *Phragmites karka*, *Zingibor zerumbet*, *Z. capitatum*, *Z. cassununen*, *Cyperus* spp. etc.

C. **Shrubs:** The common large woody shrubs are *Abroma augusta*, *Allophyllus cobbe*, *Antidesma acuminatum*, *Aporosa roxburghii*, *Boehmeria platyphylla*, *Casearia vereca*, *Clerodendrum bracteatum*, *Croton caudatus*, *Eurya acuminata*, *Glycosmis mauritiana*, *Holmskioldia sanguinea*, *Itea*

macrophylla, *Ixora acuminata*, *Leea aspera worthi*, *Maoutia puya*, *Mussaenda macrophylla*, *M. roxburghii*, *Pavetta indica* etc.

D. **Herbs:** The common herbs are *Achyranthes aspera*, *Amaranthus spinosus*, *Celossia argentica*, *Cyathula prostrata*, *Echinochola hirta*, *Comphostemma perviflorum*, *Orthosiphon incurvus*, *Phyllanthus debilis*, *Houttuynia cordata* etc.

E. **Grass:** The gregarious grasses are *Arundinella bengalensis*, *A. nepalensis*, *Centebecca lappacea*, *Digitaria adscendens*, *Echineclea cruspavenis*, *Ichnanthus vicinus*, *Lapthatherum gracile*, *Oplismenus compositus*, *Panicum bravifolium*, *P. paludesum*, *P. flavidun*.

F. **Lianas and Climbers:** The common liana species is *Butea parviflora*. The other woody climbers are *Derris elliptica*, *Entada purseatha*, *Millettia cinerea*, *M. pachycarpa*. The common shrubby twiners are *Mucuna macrocarpa*, *Aspidepteris elliptica*, *Byttneria grandifolia*, *Combretum punctatum*, *Dalhdusea bracteata*, *Iodes baokeriana*, *Natsiatum herpeticum* and *Roytsia suaveglens*, *Uncaria pilosa* and *U. sessilifructus*. Tendril climbers found in the sanctuary are *Smilax prolifera* and *Heterosmilax indica*. *Raphidophora* spp.

NWLS also has varieties of hydrophytes and parasitic plants. The Sanctuary is also rich in epiphytic plants or orchids growing on the tree trunks. The important orchid species in the Sanctuary are *Dendrobium*, *Eria*, *Bulbaphyllum caelogyne*, *Vanda* spp., *Cymbidium* and *Papilionantha* spp. The occurrence of large number of flowering plants in the area reflects the richness of the flora of the region and this supports

the earlier observation of botanists such as Hecker and J. Joseph of the unusual richness of the species in Khasi Hills.

Fauna: Nongkhyllum WLS forms one of the last remaining undisturbed wildlife habitats in this region and is still rich in endemic faunal wealth, many of which are not reported from elsewhere. In addition to the rich haul of avifauna, about 50 species of mammals and 25 species of reptiles have also been reported from this area. Around 30 rare and endangered species listed in Schedule I of the Wildlife (Protection) Act, 1972 can be found in this Sanctuary. Globally endangered mammals such as the Asian elephant, Himalayan black bear, tiger, clouded leopard, gaur, capped langur, hoolock gibbon and slow loris are also represented in this Sanctuary. Among the rare and threatened birds reported in this area are rufous necked hornbill, the darter, Gordon's or Blyth's baza, painted stork, lesser or Himalayan grey headed fish eagle, black or king vulture, long billed vulture, white backed vulture, white legged falcon, white cheeked hill partridge, wood shrike, tawny fish owl, Blyth's king fisher, drongo and grey sibia. The great crested grebe, black necked grebe, red necked grebe, Indian shag, little grey heron, tiger or Malay bittern, great adjutant stork and black headed gill were recorded for the first time in Meghalaya during 1996-1998 survey. The forest wagtail was recorded for the second time and that too after almost a century.

Common herbivores in this area are elephant, gaur, sambar, serow, and barking deer. Sloth bear, Himalayan black bear, binturong, civets and mongoose are the common omnivores. Among the primates, rhesus macaque, Assamese macaque and slow loris are commonly present, though presence of stump-

tailed macaque is not confirmed. The globally endangered capped langur and hoolock gibbons are present in isolated pockets of undisturbed forests in NWLS. The clouded leopard is a rare and highly endangered cat species and is found in NWLS. Other carnivores found in the NWLS are the tiger, leopard, leopard cat, jungle cat and wild dogs. This area is also represented by many reptilian species such as monitor lizard, Khasi Hills fresh water tortoise, water monitor, Indian rock python, cobra, vipers and other species of snakes. The streams and rivers also support a considerable variety of aquatic fauna including fish. The golden mahseer which has disappeared from other rivers and streams due to excessive fishing, silting of river beds and pollution of water, can still be found in the river Umtrew. The Khasi Hills terrapin or Khasi Hills fresh water tortoise, now found only in a few rivers, can still be seen on the Umling stream. Migratory flocks of teals, pintails and cormorants (great cormorant) visit the Sanctuary every year.

2.5.1 Survey of Hoolock Gibbon

The survey of gibbons was carried out in NWLS, Nongkhyllum Reserve Forest, fringe villages and some private and community forests for a period of about 15 days. All together about 28.05 km² area was traversed following foot line transects. Presence of gibbons was recorded using both direct and indirect methods. An extensive sampling of vegetation in 10 m radius plot was also done to assess the condition of the habitat. During survey as many as 15 groups were recorded from NWLS, Reserve Forest and from adjacent private and community forest patches.

Distribution and Group Size of Hoolock Gibbon in Nongkhyllum WLS : A total of 28.05 km² area

under NWLS was surveyed traversing through 5 transects of 50.20 km length (Table 9).

Due to dense vegetation growth on both sides of the transect length, the sighting distance was very less, and at places it was as less as one meter. Out of a total of 15 gibbon groups recorded in this area, 12 were noted based on their songs and 3 were actually sighted. The 3 groups had 12 individuals including 3 adult males, 3 adult females, 2 sub-adult males, 1 juvenile and 3 infant. The age and sex composition of the groups spotted through their songs could not be ascertained. A total of 10 groups were recorded from the Sanctuary area, 4 groups from the adjoining reserve forests, and only 1 group was recorded from the private forests. The GPS readings were noted in each case. The details of the survey results are presented below in Table 10.

- Out of 15 groups located in this Sanctuary, 10 were located inside the Sanctuary, 4 groups in reserve forests and only 1 group was located in a private forest at Umla.
- The gibbon groups inside the Sanctuary and reserve forests were occupying the moist deciduous to semi-evergreen forests. The habitat in the private forest was also of semi-evergreen nature.
- The biotic pressure for gibbon groups inside the Sanctuary and reserve forests was almost negligent. However, the private forest at Umla was experiencing pressures from grazing, firewood collection and jhuming.

Table 9: Areas covered in NWLS, Reserved Forests an adjacent Villages

Name of the Transect	Transect Length (km)	Status of land	Area (km ²)
From Lailad IB to Audit Point through villages	17.5	Private forest, proposed extension area and villages	12.25
From Lailad IB to Burlong	7.5	Reserve Forest & Wild Life Sanctuary	3.20
From Burlong to Audit Point	16	Reserve Forest & Wild Life Sanctuary	8.40
From Audit Point to Umtasor IB	8	Reserve Forest	3.20
From Bend Point to Broken Tunnel of Stage 4	1.2	Reserve Forest	1
TOTAL	50.2		28.05

Table 10: Distribution and Group Size of Hoolock Gibbons in Nongkhyllum WLS

Locality	Status	Group Nos.	Group size	Mode of information	Location
NE side from the entry point to WLS from Audit Point Beat.	WLS	1	-	Song	N 25° 51' 38.2" E 091° 48' 33.2"
-do-	Boundary of WLS	1	-	Song	N 25° 50' 28.6" E 091° 47' 26.4"
Durbar Khala	WLS	1	-	Song	N 25° 51' 16.7" E 091° 48' 07.4"
-do-	-do-	1	-	Song	N 25° 51' 17.7" E 091° 48' 32.4"
-do-	-do-	1	-	Song	N 25° 51' 15.3" E 091° 48' 00.2"
Santanat	WLS	1	-	Song	N 25° 50' 31.3" E 091° 46' 59.5"
Makunda	RF	1	3 (AM-1/AF-1/Inf-1)	Sighting	N 25° 50' 29.0" E 091° 47' 44.9"
Makunda	RF	1	-	Song	N 25° 50' 56.1" E 091° 47' 40.9"
Umdhan	WLS	1	-	Song	N 25° 51' 35.8" E 091° 47' 44.5"
Umdhan	WLS	1	-	Song	N 25° 51' 19.1" E 091° 47' 52.1"
Umla	Private Forest	1	-	Song	N 25° 48' 41.0" E 091° 44' 57.2"
Umskain	RF	1	-	Song	N 25° 48' 39.6" E 091° 49' 00.6"
Near Bend Point	RF	1	5 (AM-1/AF-1/SAM-1/Juv-1/Inf-1)	Sighting	N 25° 48' 43.6" E 091° 46' 45.4"
Western side of sanctuary	WLS	1	-	Song	N 25° 50' 11.1" E 091° 45' 00.4"
Near Lailadrym village	WLS	1	4 (AM-1/AF-1/SAM-1/Inf-1)	Sighting	N 25° 55' 10.4" E 091° 46' 29.7"

2.5.2 Vegetation Survey in Nongkhyllum Wildlife Sanctuary

A total of 81 plots of 10 m radius were surveyed across 5 different transects covering a distance of 50 km traversing through the following areas:

Name of the Area	Number of plots
Rongkhongri	4
Songmarangri	2
Ribugri	3
Audit Point, Khasi Hills	9
Binbah Lake	7
Umreling	12
Burlong	9
Salt lick	3
Lailad	4
Proposed Extension Area	4
Sarfalang	1
Lungsali	3
Nongkrai village	6
Mousakar	10
Power House	4
TOTAL	81

The numbers of plant species were poorly represented in these plots and their number in all the plots ranged from 1 to 11. Only in 26 (32%) plots the number of species was 5 or more (up to 11) while in most of the remaining plots (55, 68%) the number of tree species was less than 5. As many as 18 (22%) plots were without any tree growth. A total of only 19 species were dominantly present in the surveyed plots. In 43 (53%) plots alone the dominant species was bamboo. These plots were only having bamboo as secondary growth following shifting cultivation in the recent past and no tree species was noted in these plots. Second dominant species was *Mekdi sal*, which was noted as dominant species in 15 (19%) plots. *Bolsum*, *Khasia badam*, *Bolsii*, *Bolsigum*, *Teak*, *Maatmi*, etc. are other dominant species and were present in remaining 23 (28%) plots.

Although 18 plots were found without tree growth and were mostly having bamboo and grasslands. However, remaining 63 plots were very dense in tree growth and a total of 352 trees were counted from these plots. In 50 plots, the number of trees was 5 or more and only in 13 plots there were less than 5 trees. The number of trees ranged between 1 and 40.

Most of the plots (65, 80%) were with medium (25-50%) to very dense (75-100%) canopy cover. Only 26 plots (20%) were with no canopy cover (0%) to light canopy cover (1-25%). A total of 18 plots (22%) were with very dense (75-100%) canopy cover. The canopy continuity was even better with 67 plots (83%) having medium (25-50%) to very dense (75-100%) canopy continuity. Only 14 (17%) plots were having no canopy continuity (0%) to light (1-25%) canopy continuity. A total of 40 (49%) plots were with very dense (75-100%) canopy contiguity. A total of 36 (44%) were having nil (0%) to very poor (1-25%) herb concentration and remaining 45 (56%) plots were with medium (25-50%) to very dense (75-50%) herb growth. Only 7 (9%) plots were with very dense herb growth. The status of the growth of shrubs was even much poorer. Most plots (79, 98%) were having nil (0%) to very poor (1-25%) shrub concentration and only 2 (2%) plot was with medium (25-50%) to dense (50-75%) shrub growth. There was no plot with very dense shrub growth.

The area was having mostly natural forests (79, 98% plots) and only in one plot each a mixture of natural forests and plantations and grasslands respectively was noted.

A total of 136 cut stumps were counted from only 15 (19%) plots across the survey areas, although majority of the plots (66, 81%) were without any sign of cut stumps. It indicates

that there were some pockets which were highly disturbed due to severe biotic pressures. Other types of biotic pressures included grazing (36, 44% plots) and collection of firewood and other forest products (36, 44% plots). Shifting cultivation and fragmentation was noted from 7 (9%) plots each. Overall, medium to high biotic disturbance was recorded from few surveyed plots, while majority of the plots were free from any kind of biotic disturbance.

Among other animals, capped langurs, snakes, and rhesus macaques were sighted from 9 different plots. Indirect signs such as pellets, dung, fallen trees, pug marks, trails, and calls in 23 plots confirmed presence of barking deer, wild boar, elephants, sambar, clouded leopard, capped langur, and bison.

2.6 West Garo Hills

Garo Hills, which is conglomerate of three districts viz., East Garo Hills, West Garo Hills and South Garo Hills stretches out between 25°8'N to 26°1'N latitude and 89°50'E to 90°59'E longitude. The total area of the three districts is 8167 Sq. Kms. Garo Hills is bounded in south by Mymensing district and a part of Rangpur district of Bangladesh, by a district of Assam on the North and the West and by the West Khasi Hills District of Meghalaya in the east.

The area is predominantly hilly except for some plain areas in the southern and western parts. The elevation of the hills starts sharply from the southern plain areas and after attaining their highest elevation at Tura and Arbella Ranges, slope downs and merges with the plains of the Brahmaputra in the North. The Tura Range occupies the southern portion stretching across from west to east. Another parallel range is Arbella which runs from West to central part of Garo Hills. A good number of high peaks

in the Garo Hills are part of Tura Range. The physical features of Garo Hills are grouped into three regions: (a) The Northern Sub-montane regions (b) The Central Plateau region and (c) the Southern Hills slope region.

The climatic condition ranges from sub-tropical to semi-temperate at the higher elevations. The climatic condition is marked by fairly high temperature in summer and cold winter from November to February. The hot summer days are normally moderate with much precipitation as Garo Hills lie in the rain belt. There are three distinct seasons viz. the winter season (temperature 10°C to 21°C; rainfall 2mm to 17mm), summer season (temperature remains as high as 24°C to 36°C; rainfall dry) and the rainy season (temperature 24°C to 26°C; rainfall 200mm to 700mm). Garo Hills are famous for coal and limestone. Deposits of other minerals like clay, glass-sand, iron ores and radioactive minerals are also located here.

During the British era, Garo Hills region was well-known for its impenetrable thick forests. Over the years the forests in certain parts have shrunk due to biotic pressures. Current estimate puts the forest cover only at 58% and of this only 29% is considered as dense forests and remaining 71% of total forest cover is degraded and open canopy forests.

Garo Hills harbour a large number of wildlife species in its extremely thick forests. Many endangered and rare floral and faunal species are found inside the NP and WLS, Biosphere Reserves and numerous community forests scattered all over the Garo Hills. Presently there is one Biosphere Reserve, two NP, one WLS, and many Reserve and Community Forests. A part of the Garo Hills along with many PAs has been declared as Elephant Reserve to provide corridor linkages to the scattered

populations of elephants in these areas. Among other endangered faunal species, gibbons that are mainly confined to West and South Garo Hills are facing an extremely difficult situation and uncertain future. In the past, the dense forests with contiguous canopy covers in this part of Garo Hills provided perfect habitat for large populations of gibbons inhabiting these areas. Moreover, due to sparse human population density, the jhuming was also not as intensive as it is now. Jhuming was based on the traditional methods in which the ecologically sound principles were adopted to ensure perfect regeneration of vegetation on the fallow lands. Over the years, an increase in human population led to reduction in the per capita land available for jhuming, reduction in the jhum cycle, reduction in the fertility of the jhum lands, degradation of the fallows due to poor vegetation regeneration opportunity following reduction in the jhum cycle. A combined result of all these activities resulted into non-traditional cultivation practice bringing in severe damage to the ecology of the area, including flora and fauna. The gibbons being a habitat specialist species was affected the most.

The West Garo Hills harbour diminishing population of gibbons within PA, Reserve Forests, villages, and the songachans (the abandoned villages). In addition to the above areas, gibbons are also reported from Arbella Hill Range in West Garo Hills, Rarnagre Hill ranges in Chokpot areas and in the Midinkgre and Renigre areas of the South Garo Hills

2.6.1 Nokrek Biosphere Reserve

Nokrek Biosphere Reserve (NBR) came into existence from 1st September 1988. The NBR (820 km²) is located between 25° 20' N to 25° 29' N latitude and 90° 13' E and 90° 35' E longitude. NBR overlaps with three districts

of Garo Hills and forms the main catchment area of all the major rivers of the Garo Hills. This is the only biosphere reserve in Meghalaya which extends up to South and East Garo Hills District. The core area of the NBR has been declared as Nokrek NP. The Nokrek National Park and the NBR are the home of the gibbons. The entire NBR is hilly with altitude ranging between 200 m and 1400 m. The Nokrek peak with a height of 1412 m is the highest peak in entire Garo Hills. There are 128 villages located within the NBR. The villages are scattered with small number of families. Almost 85% of the families practice shifting cultivation in the NBR area.

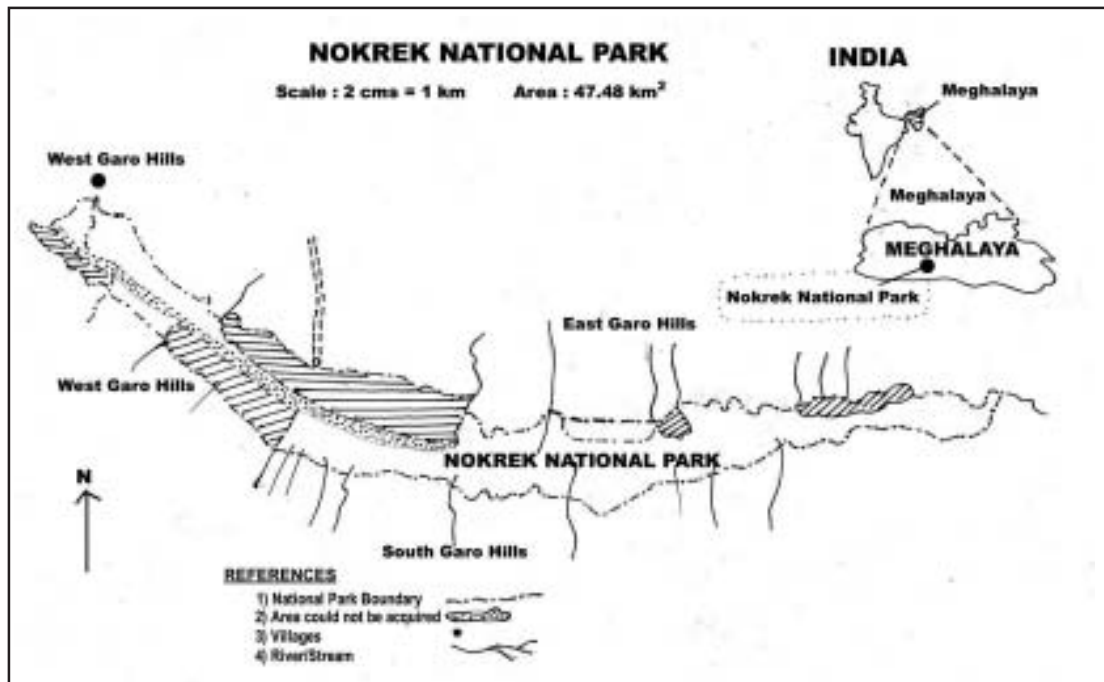
2.6.2 Nokrek National Park

Within NBR, an area of 47.48 km² has been acquired from 28 A'King lands (clan lands) and declared as Nokrek NP (NNP), which acts as core area of the biosphere reserve (Fig. 18).

This is a unique example in the entire country where community forest has been declared as a NP. NNP possesses almost undisturbed natural primary forests. NNP was declared a national park on October 1985. The Tura Range has been recognized and protected for an important watershed by its indigenous people since the beginning of this century. This park constitutes the core of the Nokrek Biosphere Reserve. It represents the IUCN Management category - II (National Park). It occupies the Tura Range which lies east of Tura town in the district of West Garo Hills approximately at 25° 23'-25° 32'N and 90° 19' – 90° 40'E. The altitude ranges from 600 m to 1,412m (the Nokrek Peak).

Physical Features and Climate : The Tura Range constitutes the backbone of the Garo Hills which lie at the western end of the Patkai Range of Assam. This central ridge is oriented along a north-west/south-east axis. Numerous rivers and

Fig. 18: Nokrek National Park



streams originate from these hills and flow over narrow, rocky beds to join the Brahmaputra or Meghna rivers. Southern slopes are very much steeper than northern ones. The terrain is rocky and in many places the ridge is devoid of top soil.

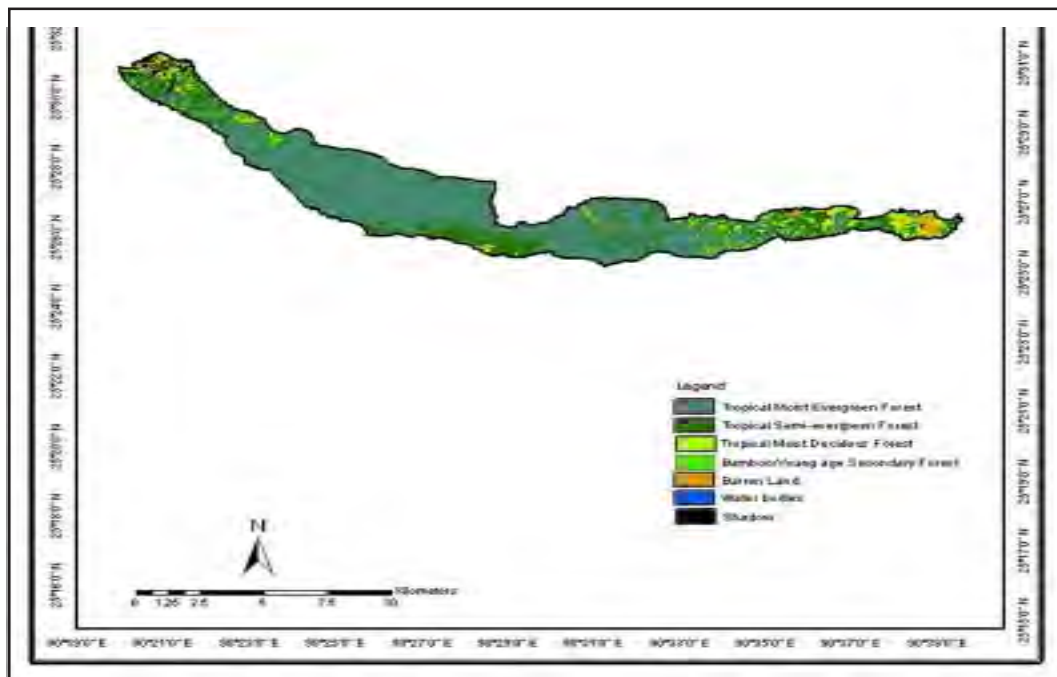
Climatic conditions in the Garo Hills are tropical, characterized by high rainfall and humidity in the summer monsoon (April-October) and a moderately cold winter. Mean maximum temperature ranges from 25^o C in winter to 30^o C in summer. Mean annual rainfall is 3112mm spread over 113 days, with June and July as the wettest months.

Vegetation: The area supports broadleaved evergreen and semi-evergreen forest, with brakes of bamboo at lower altitudes. Vegetation on southern slopes is limited to occasional patches of moist deciduous forests, dominated by birch *Betula* species at higher altitudes and secondary scrub and forests at lower altitudes. Secondary moist deciduous forests occupy the old jhum area. The forests consist of mainly

miscellaneous species like *Mesua ferrea*, *Castonopsis* spp., *Aporosa wallichii*, *Schima wallichii*, *Betula*, *Rhus javanica*, *Glycodium* etc. The presence of rare species like *Citrus indica* and *Nepenthes khasiana* add more importance to this area. Many important medicinal plants are believed to occur in this area.

Fauna : The area forms an important part of the ranges of herds of Indian elephant *Elephus maximus* (E). Other mammals include jackal *Canis aurgus*, wild dog *Cunon alpinus* (V), sloth bear *Melursus ursinus* (I), Asiatic black bear *Sylenarctos thibetanus*, large Indian civet *Viverra zibetta*, small Indian civet *Viverrcula indica*, binturong *Arctictis binturong*, leopard cat *Felis bengalensis*, jungle cat *F. chaus*, Asiatic golden cat *F. temmincki* (I), tiger *Panthera tigris* (E), leopard *P. pardus* (I), clouded leopard *Neofelis nebulosa* (V), various cervids, gaur *Bos gaurus* (V), etc. The avifauna includes a variety of pheasants such as hill partridge, kalij pheasant, common pheasant, and grey peacock-pheasant.

Fig. 19: Vegetation Types in Nokrek National Park



Biotic Pressure: The centre of the NP is uninhabited. Peripheral areas are settled by 28 Nokmas depending on forest resources for their livelihood. They practice jhum and keep livestock (cattle, water buffalo, pigs and poultry). Over 80% of the population in the district consists of Scheduled Tribes, predominated by Garos. Other tribes are Hajongs, Koches, Ranhas, Salus and Nanais (Gogoi, 1981).

2.6.3 Management

The area is the principal watershed for the district. The forests are largely undisturbed and contain pockets of *Citrus indica*, which is known from only a few other locations in other states in northeast India. The area is also an important refuge for a variety of threatened mammals, including migratory herds of elephants. Vegetation on the lower slopes of the Tura Range has been heavily disturbed due to shifting cultivation. Considerable damage is caused by elephants marauding crops (Gogoi, 1981).

2.6.4 Survey of Hoolock Gibbons in West Garo Hills

An extensive survey of gibbons was carried out in West Garo Hills covering Nokrek BR, part of Nokrek NP, villages both inside and outside the BR, both on foot and by vehicle. Secondary information was also collected from the local forest staff and the villagers regarding the presence of gibbons. Only a part of Nokrek National Park and BR was surveyed because of 'out-of-bound' status of many areas following unfavourable law and order situation. The survey was carried out in the months of January to March for a period of three months and covered an area of 179.54 sq km (Table 11).

The findings of the extensive survey undertaken for assessing the population and conservation status of gibbons are presented in Table 12.

Table 11: Areas covered in the West Garo Hills during gibbon survey

Sl. No.	Name of the area	Status	Surveyed area (Km ²)
1	Dadengri-Magalpara	Motorable road	4.8
2	Magalpara	Songacham	0.2
3	Magalpara and its adjacent area	Village	2.0
4	Magalpara-Bugonggri	Motorable Road	3.0
5	Dadengri- Songmarangri	Foot Path	5.0
6	Songmarangri	Songacham	0.10
7	Ribugri	Songacham	0.102.
8	Ribugri-Dadengri	Foot Path	5.6
9	Dadengri-Rongmachugri	Motorable Road	15.2
10	Rongmachugri-Rongkhongri	Foot path	0.6
11	Rongkhongri	Songacham	0.1
12	Rom-Romsensalgri	Foot path	2.0
13	Romsensalgri	Songacham	0.1
14	Ringsanggri	Village	2.0
15	Selbalgri	Village	3.3
16	Bibragriand +Tushigri	Village	4.2
17	Missimagri	Songacham	1.5
18	Ringsanggri-Bibragri	Village route	10.0
19	Ringsanggri-Rombhagri	Motorable Road	12.75
20	Rombhagri	Songacham	0.2
21	Rombhagri-Chinabat	Motorable Road	2.25
22	Silchotchigri	Village	2.8
23	Oragitok— Chandigri	NH	1.7
24	Chandigri	Songacham	0.02
25	Ringsanggri-Anogri	National Highway	21.0
26	Waribokgri	Village	3.2
27	Baljek	Songacham	0.1
28	Jengialgri-Megapgri-Ringgigri	Village Road	10.0
29	Dolongri – Dittigri	Village Road	9.3
30	A'chugri	Village	1.3
31	Duragri	Village	2.75
32	Khanthragri	Village	1.02
33	A'chugri – Duregri- Khanthragri	Village Road	5.0
34	Tura peak	PA	2.30
35	Tura-Asanang	National Park	14
36	Rongram-Dadengri	Sub-way	30

Table 12: Distribution, Group size and Group composition of gibbons in the West Garo Hills including Nokrek National Park and Nokrek Biosphere Reserve

Locality	Status and Position	Grp No.	Group Size	Mode	Location
Rinsangri	Village Outside PA	1	5 (AM-1,AF-1,SAM-1,Juv-1,Inf-1)	S	N 25° 35' 02.9" E 090° 17' 26.9"
Selbalgri	Village Inside PA (Nokrek BR)	2	5 (AM-1,AF-1,SAM-1,Juv-1,Inf-1)	S	N 25° 34' 36.2" E 090° 17' 35.6"
			4 (AM-1,AF-1,SAM-1,Juv-1)	S	N 25° 34' 03.2" E 090° 17' 24.8"
Bibragri	Village, Inside PA (Nokrek BR)	1	2 (AM-1, AF-1)	S	N 25° 32' 16.5" E 090° 17' 28.4"
Rombhagri	Village, Inside PA (Nokrek BR)	1	3 (AM-1, AF-1, Inf-1)	S	N 25° 33' 23.4" E 090° 21' 24.5"
Silsochtigri	Village, Inside PA (Nokrek BR)	2	The Nokma counted 7 individuals	PC	N 25° 33' 06.4" E 090° 22' 46.7"
Thebogri	Village, Outside PA	1	-	PC	N 25° 35' 57.8" E 090° 22' 47.0"
Mandalgri	Village, Inside PA (Nokrek BR)	1	5(1AM, 1SAM, 1Juv, 1AF, 1SAF, 1Inf)	PC	N 25° 32' 57.6" E 090° 19' 50.2"
Chandigri	Songacham, Inside PA (Nokrek BR)	1	4 (AM-2,AF-1, Inf-1)	S	N 25° 31' 55.9" E 090° 19' 38.9"
Nokwatgri	Village, Inside PA (Nokrek BR)	1	-	PC	NA
Aagoragri	Village, Outside PA	1	2 (AM-1,AF-1)	Song	N 25° 35' 47.4" E 090° 18' 46.7"
Waribokgri	Village, Outside PA	1	5 (AM-1,AF-1,SAM-1,Juv-1,Inf-1)	S	N 25° 36' 40.8" E 090° 19' 29.0"
Wakrenkhongri	Village, Outside PA	1	-	Song	N 25° 35' 29.5" E 090° 19' 54.7"
Baljek	Songacham, Outside PA	1	3 (AM-1,AF-1, Juv-1)	S	N 25° 40' 03.0" E 090° 20' 54.2"
Jengjalgri	Village, Outside PA	1	2 (AM-1,AF-1)	PC	N 25° 38' 58.3" E 090° 19' 06.6"
Ringigri	Village, Outside PA	1	2 (AM-1,AF-1)	PC	N 25° 38' 23.8" E 090° 18' 44.2"
Megapgri	Songacham, Outside PA	1	-	PC	N 25° 39' 55.5" E 090° 18' 32.5"
Chiksingri	Village,+ Songacham, Outside PA	1	2 (AM-1,AF-1)	PC	N 25° 44' 08.4" E 090° 19' 28.4"

Contd....

Table 12 contd....

Locality	Status and Position	Grp No.	Group Size	Mode	Location
Rangrangkhati	Songacham, Outside PA	1	4(not identified)	PC	N 25° 41' 00.2" E 090° 23' 47.6"
Gindopara	Songacham, Outside PA	1	4 (AM-1,AF-1,SAM-1,Inf-1)	PC	N 25° 47' 36.4" E 090° 23' 40.9"
Manggakgri	Songacham, Outside PA	1	-	PC	N 25° 48' 52.2" E 090° 20' 42.4"
Rongramgri	Village, Outside PA	1	-	PC	NA
Songmarangri	Songacham, Outside PA	1	3 (AM-1,AF-1, Inf-1)	S	N 25° 46' 36.2" E 090° 12' 25.2"
Ribugri	Songacham, Outside PA	1	4 (AM-1,AF-1,SAM-1,Juv-1)	S	N 25° 45' 38.7" E 090° 12' 17.2"
Rongsu	Songacham, Outside PA	1	-	PC	NA
Romsensalgri	Outside PA	1	1 (AM)	S	N 25° 44' 04.8" E 090° 08' 06.0"
Migungri	Songacham, Outside PA	1	-	PC	NA
Rangirabri	Songacham, Outside PA	1	-	PC	NA
Magalpara	Songacham, Outside PA	1	3 (AM-1,AF-1, Inf-1)	S	N 25° 45' 24.3" E 090° 09' 41.9"
Rongkhongri	Songacham, Outside PA	1	1 (AM)	S	N 25° 48' 59.7" E 090° 04' 49.2"
Tura Peak	NP, Inside PA (Nokrek BR)	1	-	Song	N 25° 30' 37.7" E 090° 14' 22.9"
Duragri	Village, Inside PA (Nokrek BR)	1	5 (AM-1,AF-1,SAM-1,Juv-1)	S	N 25° 33' 04.8" E 090° 16' 03.2"
Achugri	Village, Inside PA (Nokrek BR)	1	1 (AM)	S	N 25° 33' 22.7" E 090° 14' 40.6"
Khantragri	Village, Inside PA (Nokrek BR)	1	2 (AM)	S	N 25° 33' 04.8" E 090° 16' 03.2"
R'ngmri	Village, Outside PA	1	-	PC	NA
Aigri	Village, Outside PA	1	-	PC	NA
R'bongri	Village, Outside PA	1	-	PC	NA
Dabongri	Village, Outside PA	1	-	PC	NA

S = Actual sighting; PC = Personal Communication

3. Results

- A total of 39 groups of gibbon were located in the West Garo Hills.
- Of the total groups identified, 16 were sighted, 3 groups were detected based on the songs and the remaining 20 groups were located based on the personal communication with the local staff and local people.
- A total of 67 individuals were identified, of which 23 were adult males, 18 adult females, 7 sub adult males, 2 sub adult females, 9 juveniles and 8 infants.
- A total of 23 gibbons groups were located in the private village forests, while 15 groups were found in the Songacham (abandoned jhum plots). One group was recorded from the Nokrek BR.

- Of the total 39 locations from where 39 groups were located, 28 locations were outside the PA and remaining 11 locations were inside the Nokrek BR.
- There were hardly any patches of evergreen forests left in the West Garo Hills mainly due to presence of very heavy jhuming in this area.
- Most of the sightings of the gibbon groups was from deciduous forest patches only which were the resultant of jhuming and are mostly abandoned jhum patches.
- The West Garo Hills area is heavily degraded. The degraded patches contain two types of jhum lands, one, which have been abandoned for last one decade or so and two, those patches which had been put to jhum practice recently and now lying abandoned for last 5 years or so.

Potential Sites for gibbons in West Garo Hills : The survey revealed that there could be many potential sites where the gibbons can survive once required category of protection is provided. The brief description of these sites is presented below:

Chandigri Songacham: It is situated inside the Nokrek BR and inside the Chandigri village. This songachum, locally called 'somang nakkap' is 8 acre in size and is surrounded in east by jhum fields and cultivated fields in south. There is a good forest patch in the north which also has some connectivity with this songachum.

The songachum is dominated by bamboo with only few big trees. The gibbons prefer to inhabit the songacham compared to the forest patch which has much dense vegetation. One adult male gibbon is located in Nokwatgri which is

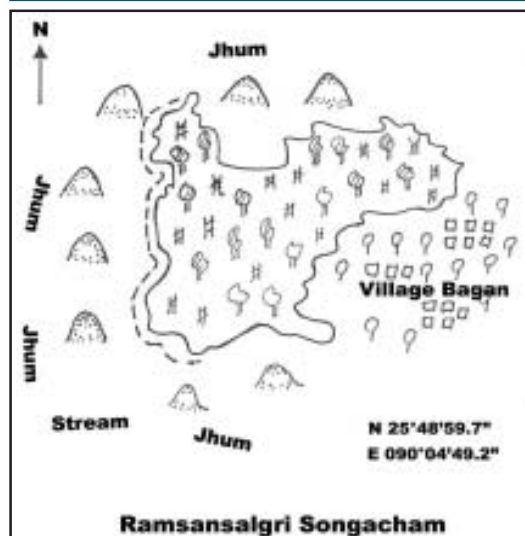
about 2 km from Chandigri moving from songacham and the village.

Duragni Songacham (village): This is also located in the Nokrek BR and is dominated with bamboo and many fruit orchards. The gibbons prefer to feed in the orchards though occasionally venturing into the village bamboo groves for feeding on tender shoots.

Beljak Songacham (village): This 14 acre songacham, located near Jenjal Bagan is near the newly build airport. This area is in a very good condition having vary tall trees and dense canopy cover. It is, however, surrounded, on three sides by jhum fields and on one side is having a cultivated field.

Romsansalgri Songacham : In comparison to other songacham, this 22 acre big songacham is highly disturbed due to severe biotic pressure. There is a small 'saw mill' inside the songacham. This is surrounded on three sides by the jhum fields and by a village on one side (**Fig. 20**).

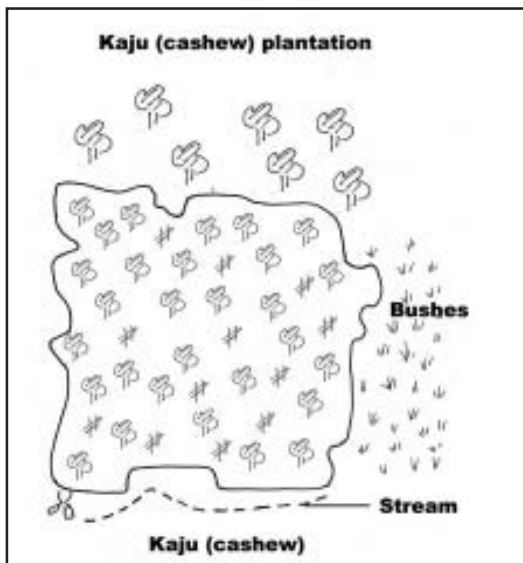
Fig. 20: Hand sketch of Romsansalgri Songacham



Rongkhongri Songacham : This 14 acre songacham is about 80 years old which was jhummed earlier and later used for settlement and subsequently

abandoned (**Fig. 21**). Due to this reason, there are mostly young crops and regenerating seedlings of trees rather than old tree growths. Severe jhumming pressure in the past has reduced the area of songacham as well. It is surrounded on three sides by cashew plantations and by scrub forest on one side.

Fig. 21: Hand sketch of Rongkhongri Songacham

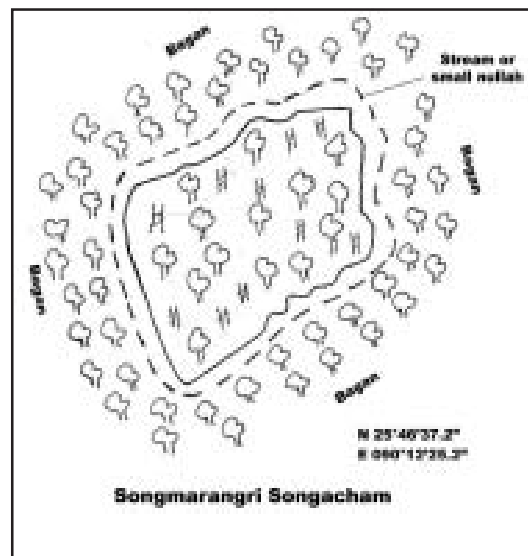


Presently, only one adult male gibbon was noticed. Reportedly, the female was killed by leopard in the year 2000. On enquiry from the villagers revealed that there was one female gibbon earlier, which was later joined by one male. The villagers killed the female and the left over male consorted with another female from Cherangri area located about 2.3 km from this songacham. However, this female was killed by leopard leaving only the lone male.

Songmarangri Songacham : This is 8.3acre in size and is about 15 years old forest patch (**Fig. 22**). This was an abandoned village which has developed into a forest patch as is evident from the presence of many fruit trees and other house hold materials. This songacham is conserved by the villagers and the permission to fell the tree rests with the headman (Nokma).

This is surrounded on all sides by jhum fields. The orchards have no connectivity compelling the gibbons to descend on the ground to cross over from one place to another. It was confirmed from the villagers that the gibbons do not normally call during foggy and rainy days.

Fig. 22: Hand sketch of Songmarangri Songacham

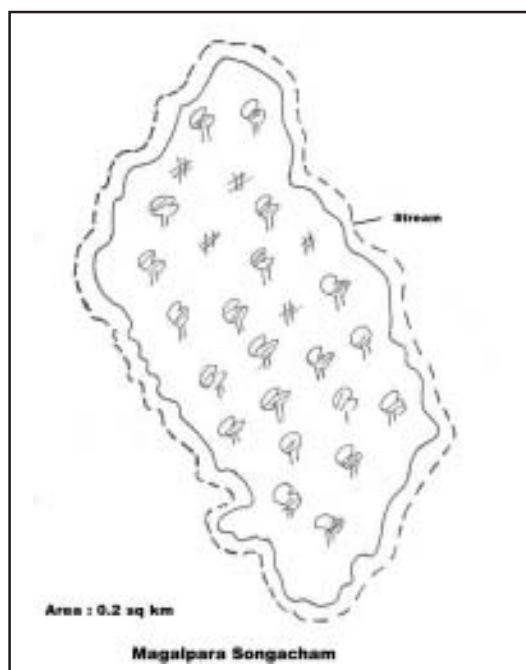


Megalpara Songacham : This is located about 1 km away from the Megapagri village and was abandoned by the villagers about 40 years ago.

This is a fragmented patch which is dominated by bamboo and weeds. It is lacking in big trees and has lots of banana trees (**Fig. 23**). This is a potential gibbon site.

Rombagri Songacham : It is located near Simsang river and opposite to the Willaim Nagar road. This is not a typical shifting cultivation site because of the typical soil characteristics which is not conducive to this type of cultivation. The area is full of boulders. The habitat is dominated by bamboo and some fruit bearing trees.

Fig. 23: Hand sketch of Magalpara Songacham



The villagers confirmed presence of 2 gibbons (1 each of adult male and female) and one of these was also sighted on 28th January 2003.

Khantragri songacham : Two adult males were seen. Another group is also reported from here but could not be sighted.

Bibrage village: It is located inside the NBR. There is another village adjacent to this one called Tusigri. A total of 37 families have a population of about 60 people in both the villages. In Alfred and Sati(1990) report, 4 gibbon from here. Enquiries from the villagers revealed that their number had increased to 6. However, 4 individuals were reportedly killed by the people from other villages and only 2 individuals (1 AM and 1AF) are left. The whole village is dominated by bamboo (locally called 'wah'), kathal and orange.

Ribugri (Rimandowari) songacham : This large (16 ha) songacham is about 100 years old and is located on the bank of Ringgi river

(Fig. 24). It is surrounded by jhum fields on remaining three sides. The villagers confirmed presence of gibbons in this area. A group of Assamese macaque and capped langur was sighted from this area. One fisherman also confirmed presence of gibbons in this songacham.

Misimagri village : In this village one group of gibbon with 4 individuals (1 each of AM, AF, SAM and SAF) was reported. The forest patch in this village is in very good condition. It is a small evergreen moist forest having numerous vines and evergreen species. Bamboo patches are also seen. This forest was never under pressure from human population. However, it is very small in dimensions (3-4 km²). The village, which was earlier situated inside this forest patch has now shifted to the top of adjacent hillock.

Silbalgri Sacred Grove : The sacred grove is inside the village which acts as a good habitat for the gibbons.

Waribok Village : One group of gibbon with 5 individuals was reported from this village which has a lush green forest. The forest patch has teak, bamboo, jack fruit, and huge number of mango trees. It also has one sacred grove.

Fig. 24: Hand sketch of Ribugri Songacham



About 4 km south of Waribok is Aungalri and at the southeast is Wakrenkhongri from where also the calls of gibbons were heard.

Jengalgri Village : Unlike other locations, this village comprises of good patches of forests. The patches are continuous with abundance of jack fruit and mango trees and bamboo patches. Simul and ficus trees are also found sporadically. A reserved forest of teak and sal species is also present. Shifting cultivation is practically absent from here. Overall this is a very good potential habitat for gibbons.

4. Siju Wildlife Sanctuary and Adjacent Areas

The Sanctuary is located in the Garo Hills district of Meghalaya between 25°19'-25°21'N and 90°41'-90°42' E. Siju (Fig. 25) was declared a sanctuary in the year 1979 and occupies an area of 5.18 km². The Sanctuary corresponds with the IUCN Management Category IV. It is a rolling plateau surrounded by steep to precipitous slopes, especially on the side of the Simsang River that forms its western boundary. The river is very deep and wide near the Siju village. The altitude varies from 40 to 260 m above sea level.

The vegetation consists of mixed hardwood species ranging to moist evergreen type. The Sanctuary is rich in wild fauna. Some of the representative faunal species include Indian elephant, gaur, barking deer, sambar, wild pig, common langur, hoolock gibbon, capped langur, rhesus macaque, Assamese macaque,

pig tailed macaque, stump tailed macaque, slow loris, tiger, leopard, etc. The fish diversity and abundance in the river Simsang is considered significant and attracts large scale fishing. In winters, especially during December and January, traditional fishing in many deep pools is popular, which also attracts the traders from the nearby states as well.

The biotic disturbance in the area is mainly in the form of jhuming and mining. Siju is surface-mined for its rich deposits of coal and limestones. The Siju area includes a deep limestone cave locally known as 'Do' bak kol [the cave (kol) of bats (Do'bak)] (Fig. 26). It provides habitat for thousands of bats belonging to different species including Kelaart's leaf-nosed bat (*Hipposidervus lankadiva*). However, because of the inaccessible terrain, other kinds of biotic pressures are practically absent in the sanctuary.

Fig. 25: Map of West Khasi Hills district showing location of Siju WLS



Survey of Gibbons in Siju WLS : A total of 4.01 km² area under Siju WLS (SWLS) was surveyed to record the population density and distribution pattern of gibbons (Table 13).

- A total of 4 groups were located in SWLS after traversing through 15 km long transects covering an area of about 4 km², which is roughly 83% of the total area of the SWLS.
- Of the total 4 groups, 3 were located based on their songs, while one group was sighted and also the song heard.
- Only 1 solitary adult female could be counted in the group which was sighted.
- Of the 4 groups, 2 each were located inside the SWLS and one each in songacham and adjacent to the Sanctuary.

Table 13: Areas surveyed in and around Siju WLS

Name of the Transect	Transect Length (in Kms.)	Area surveyed (in Sq. Kms.)
From Siju Cave to Inside WLS	7	1.25
Along the Simsang River	4	1.23
Durama Abri & Adjacent Areas.	Using formula πr^2	1.53
Total Area Surveyed		4.01 Sq. Kms

roughly make up for about 82% of the total sanctuary area. Almost 12-13% of the total sanctuary area is with tropical moist deciduous forests. The degraded area is limited to a very small patch located in the extreme north of the sanctuary. The bamboo density is also very less in this sanctuary (Fig. 27).

The biotic disturbance is not very prominent across the sanctuary mainly because of the tough terrain. This is evident from the fact that the degraded area is limited to flat areas where people can reach to collect the forest resources from the sanctuary.

As such the sanctuary appears to be an ideal hide out for gibbons given the types of vegetation and low level of biotic disturbance. In this study, only 4 groups were recorded, of which 3 were based on the songs heard and only one group was sighted with a solitary adult female. The main object was to collect information on the potential of the given area to act as suitable habitat for gibbons. To this effect, the Siju WLS happens to be scoring high and it is recommended to conduct detailed survey covering even the comparatively inaccessible areas. A definite

Fig. 26: Siju Cave



The distribution and group size of gibbons in SWLS is presented in Table 14.

The vegetation types in SWLS clearly reveal that it is rich in semi-evergreen forests, which

Table 14: Distribution, Group size and Group composition of Hoolock gibbons in the Siju WLS and adjacent areas in South Garo Hills

monitoring plan also needs to be drawn up to periodically undertake population estimation to ascertain the trend in population.

Fig. 27: Vegetation types of Siju WLS

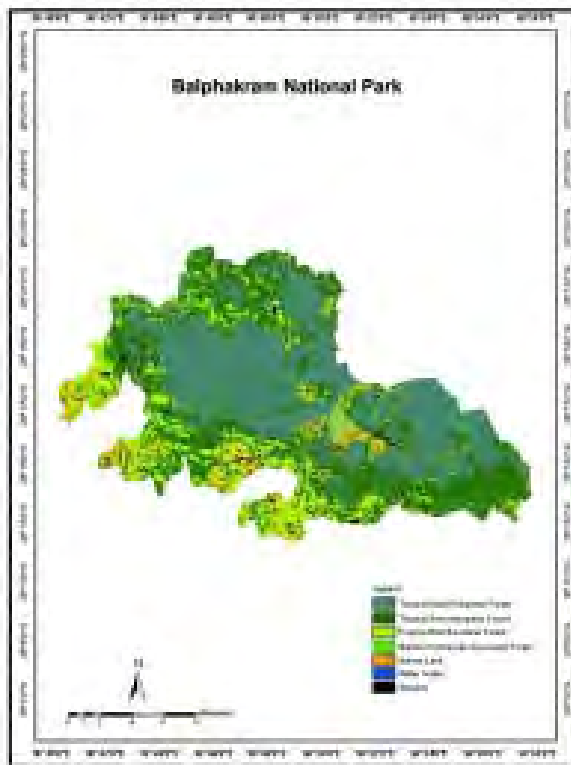


The presence of solitary adult female is a cause of concern. The reason for this has to be carefully analyzed to undertake suitable management action to ensure that such populations are either translocated to a place where other groups are present or to create corridors for effective out breeding opportunities to these solitary individuals.

4.1 *Balphakram National Park*

The Balphakram National Park (BNP, 200 km²) lies in the West Garo Hills and West Khasi Hills districts of southern Meghalaya about 200 km by road south-west of Shillong, the state capital. It approximately corresponds with 25^o19' N longitude and 90^o 58' E latitude. This falls under the IUCN Management Category II (National Park). The BNP, which was declared a NP in February 1996 falls within the Burma Monsoon Forest Biogeographic unit. The altitude varies from 50m to 1,026m (Kailash or Chutmang Peak). Balphakram, literally

Fig. 28: Balphakram National Park



meaning ‘wind blows continuously’ is believed by the Garo tribals to be the land of the departed soul.

There is a vast tableland of dense forests, which is known as the Land of Perpetual winds, is of great mythological importance to both the Garos and the Hindus. According to the Garos, this is a sacred area where the spirits of the dead sojourn. This land is teeming with wild life and is undoubtedly one of the richest spots of biodiversity in the country. Many rare and exotic species of flora and fauna including some endemics and many almost extinct flora and fauna are found in the area. This area has always evoked a lot of interest among the naturalists, botanists and zoologists.

Physical features and Climate: It comprises a plateau at 797 m of about 700 ha from which originate a number of rivers that have cut deep gorges (up to 800m) and valleys in

various directions Mahadeo, lor etc. are spectacular canyon geological formations dating back to the Archaen group, represented by a gneissic complex of granite, magnetite, pyroxene, granulite and amphibolite. The area is rich in minerals, notably coal (with a possible reserve of 107 million tones), limestone, mica, etc. Soils vary from sandy to clayey and pH varies from 5.6 to 6.5. Forest soils have about 10% organic content (Kumar and Rao, 1985). Climate conditions are hot for most of the year (February to October) due to the relatively low altitude of southern Meghalaya. Mean maximum temperature ranges from 25° C in winter (November to January) to 32° C in June. Mean minimum temperature in winter is about 10°C. The south-east monsoon lasts from May to October, (the wettest months being June, July and August). Rainfall is negligible from November to February. Mean annual rainfall is 8136mm (Kumar and Rao, 1985)

Vegetation: The vegetation is mainly undisturbed due to the area’s relative inaccessibility. Eight types of tropical moist forests are distinguished. Tropical moist evergreen forest (almost virgin), which is confined to gorges and moderately sloping limestone areas and dominated by members of the Ebenaceae, Fagaceae, Lauraceae and Clusiaceae; tropical semi-evergreen (mixed evergreen) forest, occupying depressions in the plateau and surrounded by grassland or secondary forest; riverine forest in areas subject to periodic inundation, grassland and tree-savanna, which are confined to the Rongcheng and Lumsorjong areas and maintained through browsing and burning; tropical deciduous forest, which is a successional type, man-made and tends to be heavily disturbed; bamboo forest, dominated by *Bambusa* spp and *Melocanna bambuoides*, and secondary formations in areas of shifting agriculture.

Fauna: The area supports a diverse fauna and is an important refuge for elephant *Elephas maximus* (E) and tiger *Panthera tigris* (E). Four species of primates are present, namely, Assamese macaque *Macaca assamensis*, rhesus macaque *M. mulatta*, capped langur *Trachypithecus pileatus* and hoolock gibbon *Bunopithecus hoolock* (V), and also slow loris *Nycticebus coucang* (Ghosh and Biswas, 1977). Carnivores include wild dog *Cuon alpinus* (V), Himalayan black bear *Selenarctos thibetanus*, leopard *Panthera pardus* (V), clouded leopard *Panthera nebulosa* (V), Asiatic golden cat *Felis temminckii* (I) and a number of other small felids. Ungulates include wild ??? *Sus scrofa*, sambar *Cervus unicolor*. Indian muntjac *Muntiacus muntjak*, water buffalo *Bubalus bubalis* (E), gaur *Bos gaurus* (V), goral *Nemorhaedus goral* and serow *Capricornis sumatraensis*. Water buffalo and gaur are confined largely to the grasslands, savannas and adjacent evergreen forests of the plateau. Good numbers of red jungle fowl *Gallus gallus* and grey peacock-pheasant *Polyplecton birinlitrntum* are also reported.

Biotic Pressure: There are about 500 inhabitants (mostly Garos) distributed among 6 villages within the area.

Wildlife studies, including an elephant census, were undertaken by the Zoological Survey of India (Ghosh and Biswas, 1977) as part of a multi-disciplinary project to survey the vegetation, flora, fungal and insect pathogens, and mammals of Balphakram Forest (Kumar and Rao, 1965). Elephants visit nearby villages and cause considerable damage to crops, particularly during the dry season (Kumar and Rao, 1985).

There are more than 45 interesting sites that reflect the uniqueness of this area, both as mythological and biodiversity rich table land. Some of these sites are also potential sites for

wildlife in general and gibbons in particular and deserve brief description:

Memang boldak matchu karam: On the way side there is a big *Schima wallichii* tree that has mysteriously acquired a depression on its trunk as if weathered and worn out by constant tethering of animals on its trunk. The belief is that the spirit on their way to their abode of the dead take rest here and tether the animals killed on their funeral. Surprisingly a few years ago, when one tree fell due to strong winds, another tree close to it started getting the same symptoms.

Chidimak-Chianggal (Black Water): It is a pool of water charcoal black in colour. It is believed that spirits wash and take bath in this pool before entering the realm of the dead, and hence the water turned charcoal black from the sins and the soot of cremations.

Matchru anti (Animal market) : In the heart of the plateau there is a vast flat rock that bears the footprints of all kinds of wild animals - big and small, each one of them very easily distinguishable. Mythologically it says, this place used to be the market place of animals. Interestingly, this is the only portion in the whole vast plateau that has the foot-prints embedded in the rock whereas other rocks surrounding it are completely bereft of any such imprints.

Bandini Jalang (Stone bridge): A stone bridge over a stream is said to have been constructed by a legendary hero Bandi.

Dikkini ring (Fossilized boat): There is a huge flat rock resembling an upturned boat to the south of Balphakram near Makadeo village. According to the lore of the Garos, Dikki - a legendary person - was carving a boat but

unfortunately before he could complete the task the cock began to crow and he had to abandon the work. It is believed that the spirits work only at night and any incomplete work at cock's crow had to be abandoned.

Areng patal (Magnetic stone): This massive rock with a hollow space on its surface has a property of a very strong magnetic force. Animals or birds that inadvertently wander close to the rock get magnetically drawn towards the hollow. Once drawn, these are not able to come out and eventually die. This magnetic force however has no effect on humans. In Chimitap village, located close to this site, there is a Chimitap stream meaning underground that may perhaps be the shortest stream in the world. The stream comes out and flows for a mere 500 yards and disappears underground.

Goncho-dare (Steep rock cliffs of the canyon): These are believed to be the natural habitats of the *gonchos* or evil spirits. The *gonchos* are believed to carry away people and lead them over steep precipices and inaccessible rock cliffs. They however do not cause any harm to their victims.

Rongsobok-Rongkol (Beautiful cave): There is a beautiful cave to the north east on Khasi hills border, wherein shining pieces of rock in the shape of banana flowers are found. The Hindus believe that it was the house of a Shiva Thakur.

Rongsaljong-Agal: On the Khasi hills border there is a natural water tank of rock measuring about 120 x 90ft. The water in this tank is perpetually clear and transparent and remains at the same level throughout the year. The Garos believe that it is the bathing ghat of Bandis wife.

Gitingni Suunte: There are 3 stones close to each other set in a triangle that resemble the crude hearth. Over these 3 big stones there sat another rock, which looked like a huge pot or

cauldron. However the top pot like rock was damaged during road construction in 1987. The entire structure resemble as if something is cooking in a big pot over the tripped chullah.

Menggo Kol (Cave of cat): It is a spectacular cave with magnificent rock formations around it. Even now some rock fossils that resemble hairs of the cat can be seen. This cave is believed to be inhabited by a white cat, hence the name cave of the cat.

Wakso-Chiring: One stream in the northern side of Balphakram resembles the intestines of the pig and has a very bad rotten smell. The legend says that when Bandi defeated the monster Wakmanganchi Aragondi - he pulled out its intestine and washed here. Hence the horrible stink of the rotten intestine.

Mebit mebang: It is a small hillock from where tiny pebbles resembling the seeds of rice, millet and other cereals appear mysteriously. The Garos believed that the side and direction of the hillock from which the seed like pebbles come out predict good in that direction. In 1927 it is said that Shri G. D. Walker the thence Deputy Commissioner of Garo still swept the pebbles away and ordered the rock to be guarded. Next morning he was so astonished to find the pebbles mysteriously re-appeared.

Bandini nagil: A deep pool believed to be the fishing pond of Bandi - a legendary hero. The long dam like stone barrier is believed to have been constructed by Bandi.

Not only the Garos, but Hindus also consider Balphakram a sacred place. It is believed by the Hindus that Laxman when critically injured during a fight with Ravana, the Hanuman found the life saving herbs on top of the Balphakram. Not knowing which herb to choose, he broke the top of the hill and carried it away to save

Laxman's life. The Balphakram remains a topless vast tableland since then and the deep canyon was created from where he is believed to have removed the hills. Even the 5 rivers that originate from this tableland have been given Hindi names like such as Mahadeo, Maheshkola, Goneswari, Kanai and Chimite. The nearby Chitmang hill is known as Kailash to the Hindus and is considered to be the Abode of Lord Shiva.

During autumn the tableland looks bleak and dreary. Even the lone tree atop of hill looks eerie and spooky. At night the spine chilling eerie sounds indicate presence of spirits in this area. Some believe that there are mat-meinang (animal spirits) and domemang (bird spirits) that have lured many unsuspecting hunters only to mysteriously disappear when shot-at. However during spring, the Balphakram tableland is covered with ground orchids, herbs and bushes in multi-colour blooms. The best time for bird watching and wild life study is from mid- April to mid-June.

The Balphakram National Park (BNP) is spread over 220 km² of rich and dense forests with unique biodiversity components.

Survey of Gibbons in Balphakram National Park : A total of about 6 km² was surveyed across the BNP through 2 main transects (**Table 15**).

- A total of 3 groups of gibbons were located in BNP traversing through 6 km² area through 2 distinct transects.
- One group each was located through sighting, call and personal communication.
- One group each was sighted inside the NP, in a songacham inside BNP, and outside BNP.
- The lone group sighted consisted of 3

Table 15: Area surveyed in Balphakram National Park

Name of the transect	Status of the Transact	Area surveyed (in Sq. Kms.)
Mahadeo-Deoban (Along the river)	River Bank	4.8
Mahadeo to Range Office	National Park	1.2
Total Area Surveyed		6.00 Sq.Kms.

individuals (1 AM, 1 AF, and 1 sub adult male) (**Table 16**).

5. Baghmara Pitcher Plant Sanctuary and Reserve Forests

Baghmara Pitcher Plant Sanctuary (BPPS) is a small sanctuary spread over only 0.02 km². The BPPS and its adjacent reserve forest areas were surveyed for gibbon populations (**Table 17**). The results of the survey are tabulated below:

- A total of 5 km² area was surveyed in and around the BPPS through two distinct transects.
- A total of 5 groups were located.
- While 1 group was sighted, 3 groups were located by their songs and 1 group was located based on personal communication of the researcher with the local people and local forest staffs.
- The sighted group consisted of 4 individuals (1 adult male, 1 adult female, 1 sub adult female, and 1 infant).
- All the 5 groups were found located inside the Baghmara Reserve Forests. (**Table 18**).

Table 16: Distribution, Group size and Group composition of Hoolock gibbons in the Balphakram National Park

Table 17: Area surveyed in Baghmara Pitcher Plant Sanctuary and Reserve Forest

Locality	Name of the transect			Status of the Transact		Area surveyed (in Sq. Kms.)
	Status	Group No.	Group Size	Mode	Location	
Near V.I.P. IB	National Park Baghmara to Project	1 Amphangri Pilot	3 (AM- 1/AF- 1/SAM-1)	Sighting Motorable Road	N 25°11'51.0" E 090°51'45.2"	3.0
Do-Gap	Baghmara to Songacham (inside BNP)	Makra-Sinap 1		Village Road Call	N 25°12'59.9" E 090°53'40.5"	2.0
	Total Area Surveyed					5.00 Sq.Kms
Rang-tang Sora	Outside BNP	1		Personal communi- cation	N 25°12'27.5" E 090°55'46.7"	

Table 18: Distribution, Group size and Group composition of Hoolock gibbons in the Baghmara Pitcher Plant Sanctuary and Reserve Forest

Locality	Status	Group No.	Group Size	Mode	Location
Baghmara RF	RF	1	4 (AM-1,AF-1,SAF-1,Inf-1)	Sighting	N 25°12'21.9" E 090°40'22.3"
Baghmara RF	RF	1	-	Call	N 25°11'59.1" E 090°40'00.2"
Baghmara RF	RF	1	-	Call	N 25°12'55.8" E 090°40'40.6"
Baghmara RF	RF	1	-	Call	N 25°13'40.5" E 090°41'11.7"
Baghmara RF (Makra-Sinap)	RF	1	-	PC	N 25°13'01.4" E 090°39'37.3"

6. Vegetation Survey in West Garo Hills

6.1 Nokrek National Park

A total of 12 plots of 10 m radius were surveyed across 5 different transects covering the following 5 areas in NNP:

Name of the Area	Number of plots
Salbagri-Nokrek	03
Duragui-Nokrek	02
Bibnagri-Nokrek	04
Chandgri Songchen-Nokrek	02
TP-Nokrek	01
Total	12

The number of plant species in these plots ranged from 2 to 11. In most plots (9, 75%), the number of species was 6 or less (minimum being 2) and only in 3 plots (25%) the number of tree species was 8 to 11. Only 5 species were dominating all the plots. Of these 7 (58%) plots were with bamboo growth. Other dominant species were *Mangifera indica*, *Arecanut*, *Sagung*, *Khambal*, and *Dina Aagong*.

All the plots were very dense in tree growth and a total of 109 trees were counted in all the

12 plots. Except in 2 (17%) plots the number of trees was less than 5 and in rest of the plots (10, 83%), the number of trees was more than 5 and up to 22 in a given plot.

Most of the plots (10, 83%) were with dense (50-75%) to very dense (75-100%) canopy cover. Only 2 plots (17%) were with light canopy cover. There was no plot without the canopy cover. Similarly, the canopy continuity in 7 plots (58%) was also between dense (50-75%) to very dense (75-100%), however, 5 (42%) were with very poor (1-25%) canopy continuity. The plots were very poor in herb concentration as only 2 (18%) plots were with medium (25-50%) to dense (50-75%) herb growth and majority (10, 82%) were either with no herb growth or very poor herb growth (less than 25%). Shrubs were even poorer in their growth and were having medium (25-50%) shrub concentration.

Most plots (7, 58%) were having a mixture of plantations and natural forest cover followed by 4 (33%) plots having plantation as vegetation cover. Only 1 plot was having exclusively natural forest vegetation.

Except the signs of illicit felling in form of cut stumps noted in 6 plots, the remaining plots

were free from human disturbances such as illicit timber felling, grazing, collection of minor forest products, shifting cultivation and fragmentation. By and large, this area was free from human disturbances.

No other animal was detected in any of the surveyed plots either by direct sighting or indirect signs.

6.2 West Garo Hills

A total of 35 plots of 10 m radius were surveyed across 29 different transects covering the following areas:

Name of the Area	Number of plots
Baljek Songcham	04
Romsensalgri Songcham	04
Megapri Songcham	01
Chandgiri Songcham	01
Tura Peak	12
Siju WLS	13
TOTAL	35

The number of plant species in these plots ranged from 2 to 11. In most plots (26, 74%), the number of species was 5 or more (up to 11) and in remaining 9 plots (36%) the number of tree species was less than 5. A total of 15 species were found dominantly present in the surveyed plots. *Khamdi*, *Bolgisum*, *Jack Fruit*, and *Sidai* were the most dominant species and were present in 21 (60%) plots. Other dominant species were *Kilkara*, *Chambo*, *Bordek*, *Jungle Tamul*, etc. (2 plots each).

All the plots were very dense in tree growth and a total of 149 trees were counted in all the 35 plots. In all the plots the number of trees

was more than 5 and only in 2 plots there were less than 10 trees. The number of trees ranged between 7 and 21.

Most of the plots (29, 83%) were with medium (25-50%) to very dense (75-100%) canopy cover. Only 6 plots (17%) were with light canopy cover (1-25%). A total of 11 plots (31%) were with very dense (75-100%) canopy cover. The canopy continuity was even better with 34 plots (97%) having medium (25-50%) to very dense (75-100%) canopy continuity. Only 1 plot (3%) was with light canopy cover (1-25%). A total of 22 (63%) plots were with very dense (75-100%) canopy contiguity. Most plots (25, 71%) were having nil (0%) to very poor (1-25%) herb concentration and only 10 (29%) plots were with medium (25-50%) to very dense (75-50%) herb growth. Similar status of shrubs was noted in the plots. Most plots (34, 97%) were having nil (0%) to very poor (1-25%) shrub concentration and only 1 (3%) plot was with dense (50-75%) shrub growth. There was no plot with very dense shrub growth.

The area was having mostly natural forests (31, 89% plots) and few plots (3, 9% plots) were having a mixture of natural forests and plantations. Only one plot was with plantations of mixed timber species. No plot was noted with secondary growth following jhuming in the past in these areas.

A total of 36 cut stumps were counted from only 9 (26%) plots across the survey areas, although majority of the plots (26, 74%) were without any sign of cut stumps. Other types of biotic pressures included grazing (15, 43% plots) and collection of firewood and other forest products (16, 46% plots). However, no plot with current shifting cultivation signs was noted during the survey. The fragmentation

of the habitat was noted from 8 (23%) plots. Overall, medium biotic disturbance was recorded from all the surveyed plots.

Among other animals, capped langurs were sighted in two plots. Indirect signs such as pellets, dung, and fallen trees in 3 plots confirmed presence of barking deer, wild boar, and elephants.

The above results indicate that the areas under the West Garo Hills are still very good in terms of supporting biodiversity and gibbons in general. Based on the canopy cover, canopy continuity, natural forests, and biotic disturbance, it is evident that of the total sample plots (35) surveyed in this study, almost 83% (29) are potential sites and can support gibbon populations. This is well reflected during the survey where out of a total of 83 gibbon groups, as many as 51 groups alone are recorded from the Garo Hills areas including most of the PAs and reserved forests. However, most of the gibbon groups are recorded from both the village forests and songacham. This is also reflected from the vegetation study that there are more potential sites outside the protected area and reserved forests network which could support viable gibbon populations.

However, due to lack of control of the forest department over these areas, there is hardly anything that can be done to ensure maintenance of these potential sites for gibbons and overall biodiversity. The provisions of Conservation and Community Reserves can be used in these potential sites to make them serve twin purpose of imparting protection to the impending wildlife therein and to meet the economic, social and cultural needs as well, in a sustainable manner though.

7. Discussion

A total of 83 gibbon groups were located from 10 different populations (including separate populations of Tura peak and Nokrek National Park inside West Garo Hills) in Meghalaya covering an area of about 260 km² in all the districts of Meghalaya. The survey locations included all the existing and proposed PAs and reserved forests.

The total survey area was visited in 8 study sites consisting of 76 intensive survey sites. The vegetation survey was also conducted in 160 plots of 10 m radius over 56 different transects covering the intensive study sites (Table 19).

Table 19: Gibbon survey sites in Meghalaya

Study Sites	Intensive Survey Sites	Transects	Vegetation Plots
Narpuh Block – I	5	3	21
Narpuh Block II	5	5	11
Corridor Area	7	-	-
Nongkhyllum WLS	11	5	81
West Garo Hills	36	36	47
Siju WLS	4	3	-
Balpakram National Park	3	2	-
Baghmara Pitcher Plant WLS	5	2	-
TOTAL (8)	76	56	160

The survey was also extended into the private forests, village forests wherever secondary information indicated past or present distribution of gibbons in those areas. However, the total area covered during the surveys in and around the villages, private forests, songacham and areas adjacent to the PAs is not reflected here.

Of the total 83 groups, 22 (26.5%) groups were actually sighted. Of the remaining groups, 32 groups (38.5%) groups were located based on the songs heard during the surveys and the presence of 29 groups (35%) was based on the secondary information (**Table 20**).

A total of 88 individuals counted from 22 groups of gibbons that were sighted during the

surveys. The adult male to female ratio is almost 1:1 and one of the most redeeming features is the presence of good populations of infants and juveniles in practically all the groups. However, in Siju WLS, the isolated adult female was detected, which is a matter of concern and calls for some corrective measures to facilitate conversion of this solitary group into a family group for its long term viability. In the entire Jaintia Hills, not a single direct sighting could be made though a total of 17 groups were recorded based on the songs and secondary information. It definitely calls for undertaking more concerted efforts on the part of the local forest staff to monitor the secondary information to convert those into direct sightings.

Table 20: Population Estimates of Gibbons in Meghalaya

Sl. No.	Location	Number of Groups				Number of Individuals							Area (km ²)
		PC	S	ST	T	AM	AF	SAM	SAF	INF	JUV	TL	
1.	Narpuh – I	5	-	-	5	-	-	-	-	-	-	-	9.2
2.	Narpuh – II	2	3	-	5	-	-	-	-	-	-	-	9.1
3.	Corridor	-	7	-	7	-	-	-	-	-	-	-	18.2
4.	Siju WLS	-	3	1	4	-	1	-	-	-	-	1	4.1
5.	Balphakram NP, BR	1	1	1	3	1	1	1	-	-	-	3	6.0
6.	Baghmara	1	3	1	5	1	1	-	1	1	1	5	5.0
7.	Nongkhyllum WLS	-	12	3	15	3	3	2	-	3	1	12	28.1
8.	West Garo Hills	20	3	16	39	23	18	7	2	9	8	67	179.5
	TOTAL	29	32	22	83	28	24	10	3	13	10	88	259.2

PC = Personal Communication; S = Songs; ST = Sighting; T-Total Groups; AM-Adult Male; AF-Adult Female; SAM-Sun-adult Male; SAF-Sub-adult Female, INF-Infant; JUV-Juvenile

The study by Alfred and Sati (1990) in the West Garo Hills identified 130 individuals from 42 gibbon groups spread over 32 localities out of 200 localities surveyed. The gibbons were reported in all the remaining 168 localities by the villagers over the last decade or so. However, because of the fragmentation and large gaps between these localities, the gibbons failed to colonize new territories and got locally extinct (Alfred and Sati 1990). This highlights fragmentation of habitat as the main threat for the viable survival of gibbons in this terrain.

In the current study, the principal investigator and his team has recorded gibbon populations from 20 localities even after a gap of almost fifteen years out of a total of 32 localities surveyed by Alfred and Sati (1990). The remaining 12 localities could not be surveyed due to time constraint and other logistic problems. However, few additional sites were also surveyed and gibbon groups were recorded from the West Garo Hills district. This indicates that the habitat condition has not yet worsened to the extent of making gibbons locally extinct. However, presence of isolated individuals and skewed group size and presence of fragmented patches (songacham and village forests) surrounded on all sides by barren habitat is a cause of serious concern and need be addressed on priority basis.

In another report, a total of 236 gibbons from 10 populations were reported from Meghalaya (Source: PHVA Workshop on Western Hoolock Gibbon. Dhaka, Bangladesh, 14-18 February 2005) with the following details:

One of the most interesting findings in this study relates with the location of gibbon groups with respect to the limits of the PAs and reserved forests. Out of a total of 83 gibbon groups recorded in this study, as many as 51 groups (61.4%) were outside the boundary of either PAs or reserved forests. Of the remaining 32 groups, almost equal numbers

Locality	No. of Gibbons
Nokrek NP	25
Songsek RF	18
Nongkhyllum WLS	3
Baghmara RF	7
Balphakram NP	15
Rewak RF	2
Siju WLS	12
West Garo Hills	130
Jaintia Hills	10
Siaphang RF	14
TOTAL	236

were either inside the reserved forest (18, 21.7%) or within the PA [NP-2 (2.4%) and WLS-12 (14.5%)]. Of the total groups reported from outside the reserved forests and PAs, 23 (27.7%) groups each were recorded from songacham and village forests. Only 3 (3.6%) groups were recorded from the private forests and 2 (2.4%) groups were found adjacent to the boundary of PA (Table 21).

The information contained in above table clearly indicates that more gibbon groups were recorded from outside the PAs and reserved forests. In fact, in Meghalaya, only about 8% of the total forest cover is under the control of the forest department, which constitutes PA and reserved forests in the State. Most of the forested areas are under the control of the communities as Autonomous District Council (ADC) forests. This peculiar situation and the fact that most of the gibbon groups and for that matter other wildlife species too are not under the direct control of the forests authorities, do call for much for efforts to make the participatory conservation approach more effective. The importance of conservation education to this effect will be immense and has to be adopted with focused approach keeping in mind the target communities.

Table 21: Locations of the Gibbon Groups in the different Survey areas of Meghalaya

Sl. No.	Location	Outside				RF	Protected Area		Total
		PF	SCH	VIL	ADJ		NP	WLS	
1.	Narpuh – I	2	-	-	-	3	-	-	05
2.	Narpuh – II	2	-	-	-	3	-	-	05
3.	Corridor	1	6	-	-	-	-	-	07
4.	Siju WLS	-	1	-	1	-	-	2	04
5.	Balphakram NP, BR	-	1	-	1	-	1	-	03
6.	Baghmara	-	-	-	-	5	-	-	05
7.	Nongkhyllum WLS	1	-	-	-	4	-	10	15
8.	West Garo Hills	-	15	23	-	-	1	-	39
	TOTAL	6	23	23	2	15	2	12	83

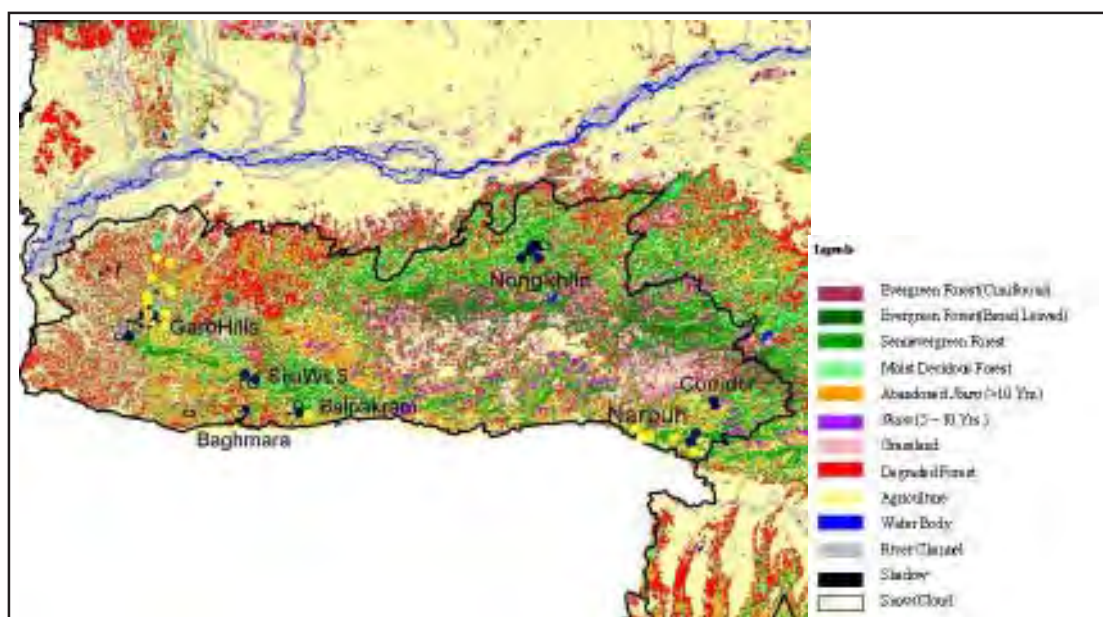
PF- Private Forests; SCH-Songacham; VIL-Village Forests; ADJ-Adjacent to Protected Areas; RF-Reserved Forests; NP-National Park; WLS-Wildlife Sanctuary.

Most gibbon groups in West Garo Hills district are found in degraded and abandoned jhum areas. In Nongkhyllum and Siju WLS only, the gibbon groups were recorded from the evergreen and semi-evergreen forests. In Jaintia Hills (Narpuh and Corridor areas), gibbons were recorded from jhum and degraded forests. Similar is the case with Baghmara and Balphakram protected areas. Here too, most of the forest areas outside the protected

coverage is either degraded or jhumed (having abandoned jhum patches of less than or more than 10 years old). Degradation of potential and existing habitat is very clear across the state (**Fig. 29**).

The Rongregiri Reserved Forest, Songsak RF, Dambu RF, and Darugiri RF are also reported to have gibbon populations (P.H.S.Boney, IFS, Personal communication).

Fig. 29: Distribution of gibbon groups with respect to vegetation types in Meghalaya



7.1 Jaintia Hills

Threats

- Habitat loss due to the encroachment, jhuming and logging in and around the Reserved Forests are the main attributes for fast declining populations of gibbons in these areas.
- Apart from these direct causes, hunting of gibbons for meat, skin and other parts by the locals in these areas partly due to superstitions, is also equally contributing in rendering the endangered status to the gibbons in this region.

Recommendations

- This study suggests that main emphasis should be given in identifying the entire range of gibbon distribution in this belt.
- Thus identified belt of gibbon populations should be included within the perimeters of the proposed Wildlife Sanctuary.
- The existing populations of gibbons within the reserve forests and surrounding fringe areas should be provided a protected coverage and further suitably stringent measures should also be taken to stop illicit felling of trees within and outside the reserve areas.
- Equally important would be to launch mass awareness programmes to educate the public about the importance and need for conservation of the gibbons and its habitat. The awareness programmes should have young generation as their main target to free them from the clutches of

superstitions. As described elsewhere in this document, lots of hunting and killing of the gibbons is associated with many superstitions of the communities in Meghalaya for ages. Therefore, it would be comparatively easier to convince the young generation than the older generation who have been following and perpetuating these superstitions for past many years.

The majority of the human populations sharing habitat in and around the gibbon distribution ranges are generally poor and below poverty line. In addition, the poor migrants from the neighbouring states (e.g., the Bru community in Moulien) inhabit the potential and existing corridor areas between different reserved forests. The abject poverty and traditional meat eating habit force them to hunt the animals, especially gibbons. Moreover, total apathy by the local people towards the rules and regulations and the paucity of forest protection staff coupled with bad law and order situation keep these areas literally free from the presence of the forest department personnel and other law enforcing agencies. The need is strongly felt to undertake some kind of people oriented development programmes under the existing Joint Forest Management and Eco-development Schemes. These programmes will help the people earn their livelihood based on non-forestry options and would thus lead to reductions in the hunting pressure on gibbons and other animals. These programmes may also convince people to assist the forest department in imparting much needed protection cover to these areas to check all kinds of illegal activities that are causing destruction and degradation of habitat and reductions in the gibbon populations. Specific efforts are needed by way of special schemes to wean the shifting cultivators away from this practice. There are

various models available wherein the shifting cultivators have been successfully settled on certain non-jhumming options. These models can be applied here according to their feasibility and acceptability by the shifting cultivators. All these development activities will definitely take off lots of pressure on the gibbon populations both by way of reduction in the hunting instances and an appreciable check on the habitat destruction (mainly through jhumming, encroachment, and removal of key habitat components).

These potential gibbon habitats are currently having the status as Reserved Forests. It has been realized that to have a focused attention on the conservation of certain endangered animal species it is must to upgrade the conservation status of these areas to the level of PAs (either as a NP or a WLS). A mere Reserved Forest status is insufficient to impart desired protection to this area. Therefore, it is strongly recommended to bring these gibbon rich reserved forests within the boundary of either a National Park or a Wildlife Sanctuary. This will also facilitate getting special funds from the Central Government for the overall development and conservation of this unique habitat for gibbons and other primate and animal species, besides a huge repository of representative unique flora of this region.

7.2 Nongkhyluum Wildlife Sanctuary

Threats and Recommendations

Similar to the general trend found amongst almost all the people of northeastern India, including Meghalaya, the people residing in and around this Sanctuary are also noted for heavy exploitation of wildlife for satiating various superstitious beliefs, fancies and actual subsistence needs. Not only are all forms of wildlife hunted for their products like fur, scales,

skins, etc. but the meat of wild animals (and most of them incidentally are highly endangered) is also fancied and preferred over meat from domestic cattle and other livestock. This has put almost all species of wildlife into the endangered list. One may argue that this habit of wildlife hunting for meat had been in vogue in these regions for last many years so it should not be singled out as a potential threat for the endangered status of wildlife now. The consumption of wild animals by the humans possibly formed a part of natural ecosystem through which excessive numbers of animals were kept in check from growing beyond the carrying capacity. Conversely, now the human to wildlife ratio has just reversed in favour of humans and extraction of available wildlife in any amount is causing severe depletion of resources. On top of this lopsided ratio, there is a problem of the availability of limited habitats for the remaining wildlife species. This has led to a very peculiar situation where even if the wildlife is allowed to grow to attain the status of a viable population, it invariably leads to man-animal conflict when the growing wildlife population spill over beyond the small limits of PAs into the human-occupied areas.

Following are the major threats faced by the gibbons and other wildlife species in general in this sanctuary:

Community Hunting: As a part of traditional and religious beliefs, the practice of community hunting whereby large groups of people charged with religious fervour storm an area and kill everything in sight has been by far the most destructive form of hunting. The NWLS, being a well known wildlife habitat, has been a prime target for community hunters from all over the state for the last many years.

Community hunting is one of the major threats for the primate species including hoolock

gibbon because of their arboreal mode of living. The songs of gibbons act as definite guide to the hunters to locate them as soft targets.

Besides the religious and traditional dogmas driving people to resort to this practice, other reasons for this community hunting could be listed as follows:

1) *Local consumption:* The people in this area tend to consume the meat of almost all the species of wildlife. This trend is very similar to the practice being followed all over the state of Meghalaya and other northeastern states. The gibbon is no exception to this practice. This has resulted in a sharp decline of otherwise rich gibbon populations. However, the forest habitat is still very rich and possesses enough potential to allow resurgence of depleted populations provided concerted efforts are taken in this direction.

Hunting of primates including the gibbons is quite rampant in this area despite the constant efforts of the forest department. This has put the survival of entire primate communities at stake. In absence of other animals of food consumption value which are difficult to hunt, the primates become soft targets due to their easy visibility and accessibility.

2) *Sport hunting:* Hunting is also considered as a recreational sport in Meghalaya and Nongkhyllum WLS is no exception to this rather bygone (from other parts of the country) and strictly prohibited activity. This area is favoured by the hunters due to easy accessibility through a well laid and linked network of motorable roads. The hunters vary from a simple and unsophisticated villagers from the

neighbouring villages to the urbanized more sophisticated vehicle bound fully equipped hunters having National and possibly International trade linkages. A total apathy towards the importance of wildlife and its habitat is leading to this destructive activity.

3) *Retaliation to crop depredation:* The Reserved Forests and NWLS is surrounded by many paddy fields and fruit orchards. The wildlife do frequent these areas to supplement the shortfall in their food requirements from inside the reserves and sanctuary. These forays by wildlife and subsequent perpetration of economic losses by them are naturally not taken very kindly by the owners of those properties. It triggers man-animal conflict. This invariably results in the killing of wildlife by the people to partly quench their anger and frustration and partly meet the economic losses through trading in saleable parts of the concerned species.

4) *Commercial Trade:* There are few cases where people hunt regularly for a living, i.e., for trade. Such people make forays into the forests even during the monsoon to hunt and trap animals for commercial sale as wildlife products or live pets.

Mounting jhuming pressure: Although, there appears to be no immediate threat to the Sanctuary from jhuming because the Sanctuary and larger portions of the Reserve Forests are still rich in vegetation, yet, the incessant jhuming pressure from the adjacent villages is sure to degrade the habitat rendering it unsuitable for wildlife. As a specialist species, gibbons are going to be the first ones to suffer the most.

Illegal tree felling: The Sanctuary is comparatively safe from this activity. However, the permission granted to the people to fell selective trees from

the District Council forests affecting even the forests under the control of the forest department which form an integral part of the PA.

The NWLS is an excellent habitat for gibbons. At present, the gibbon populations inhabiting the PA and reserved forests are not facing immediate severe threats of any kind. However gibbon groups present outside the PA and reserve forests are not so safe and they are being subjected to all sorts of threats.

Recommendations

Certain conservation measures which need to be implemented are common to those which are undertaken for other wild life species. However, given the uniqueness in the ecology of the gibbons a few special and specific measures are also required for their viable survival.

1. Strengthening protection measures to check both subsistence and commercial hunting of gibbons should be the very first priority. Special efforts are needed for those areas that lie outside the perimeters of protected areas and reserve forests. Since the control over such areas generally rests with the local communities, it becomes all the more important to ensure that exploitation of natural resources by the communities for their sustenance needs do not exceed the carrying capacity limits.
2. Second most important aspect to this effect would be to remove age old superstitions associated with respect to the utility of gibbon and its body parts for curing some illness etc. The fact that outside trade for this use is very less and it is only restricted to the local beliefs,

the task can be effectively addressed through proper and targeted education and awareness programmes. For this, special awareness package need to be developed in the local language for its dissemination in a way it is understood by the people.

3. To meet the above needs, it would be of great utility to strengthen the local institutions which are already in existence within the communities. This would also facilitate taking exemplary penal actions against the culprits engaged in commercial trade in wildlife including the gibbons. It is experienced elsewhere that unless the communities are themselves convinced and make it a part of their functioning, meeting out any kind of punishment to anyone from within the community may become quite unfeasible. The Committees formed under either the joint forest management or eco-development may be used for this purpose as well. In fact the main philosophy behind undertaking these participatory approaches is to also seek full cooperation of the local communities in imparting required protection to those very natural resources on which they are so much dependent. Their needs are to be met by providing them non-forestry and non-wildlife based alternatives.
4. One major concern is the presence of non-viable meta-populations of gibbons in small habitat remnants outside the PAs or reserved forests. These patches are mostly surrounded by hostile matrices consisting mainly of human habitations and/or agricultural or other land-use categories, which are not conducive for gibbons or even other animals to migrate to the main groups present inside the

forests. These animals are also much more vulnerable to poaching and are exposed to all other kinds of disrupting factors. Besides this, these meta-populations lead to improper sex-ratio in the population. There are instances where in these meta-populations either there are only males or females or where both the sexes are present, their ratio is skewed.

There could only be two options to handle such situations. One, to include these areas inside the protected areas or reserved forests for imparting equal amount of protection cover, and two, to capture and translocate these isolate gibbon groups to the PAs or reserved forests to make them the part of other residential groups. The case in point could be the Umla gibbon group, which can be trapped and translocated to the Sanctuary.

Apart from above two alternatives, no other way to address this problem of meta-populations is available. This is also true in case of Bangladesh where at many places the gibbon groups are present as meta-populations that are awaiting their natural extermination over a period of time, either through poaching or complete loss of food and cover in absence of any proactive approach. According to an estimate almost 60% of the total gibbon population in Bangladesh is fragmented and isolated (personal communication with Dr. Farid Ahsan).

5. Associated closely with the above issue is another very pertinent issue which relates to the ineffective management of the good forest areas by the local

communities under their control. The concept of sustainable utilization of the natural resources from within the community forests under their control is probably no more in vogue mainly due to exponential growth in the human population vis-à-vis natural forestry and wildlife resources. There is an urgent need to address this issue. Although, it may not be advisable and feasible to completely stop exploitation of such resources by the local communities even for their sustenance, yet, a limit needs to be imposed based on workable carrying capacity for key stakeholders (wildlife and human populations). May be, the new concept of Community Reserves and Conservation Reserves can be introduced depending upon the title of the land in question. Being a part of the Wildlife (Protection) Act, these Reserves would enjoy the legal status and it would therefore be easy to implement. Even the local communities will feel strengthened as they would also have the backing of various legal provisions associated with the Wildlife Protection Act.

6. The area around NWLS has high potential for broomstick making. The local people can be encouraged to create permanent cultivation fields. Besides broomstick, the area adjacent to the Sanctuary and reserved forests is excellent for betel nut, betel leaves, banana, rubber, coffee and tea plantations. All these options would prove highly remunerative and viable alternatives to the collection of meager natural resources from the forests, which incidentally are not enough to meet even the subsistence needs of the people. This surely would help

minimize the dependence of local people on the forestry resources.

7. Although, there is not much difference in the legal status of a Sanctuary as against a NP, yet, there are added advantages in upgrading the Sanctuary to the NP status. In case of NWLS, this can be thought of and there are enough justifications to accept this proposition. Another refurbishing in terms of imparting more protective cover to the Sanctuary could be to declare entire surrounding area enveloping the existing Sanctuary as reserved forests. This will bring in some of the meta-populations of gibbons within the purview of PA coverage that will then automatically start drawing enabling benefits.

7.3 West Garo Hills

Threats and Recommendations

The survey reveals that more gibbon groups are present outside than inside the PA. And, this very fact is one major reason for their sharp decline in numbers over the last few years. Barring the areas inside the PA, there is absolutely no planning and viable management options over all those areas (community forests) which are under the control of the local communities. Community forests are managed by the people for the sole purpose of meeting their subsistence needs for food, fuel and cover. These 3 needs are common with the gibbons too. Incidentally, due to paucity of additional areas, the gibbons are also forced to meet their three basic needs from the same areas as the local human populations do. Hence the conflict of interest ensues. In this tug-of-war the humans are the obvious winners.

Shifting Cultivation

As mentioned in case of Nongkhyllum Wildlife Sanctuary, here too, the wanton destruction of community forests for jhuming or for such other ecologically (even economically too) unviable land uses, lead to complete degradation of the habitat for wildlife, and more so for this habitat specialist species, the gibbon. Jhuming is more of a social need rather than purely a economic need, therefore, even the alternatives to this have to have a component that could also satisfy their social needs besides meeting their economic demands. The example of jhumia rehabilitation schemes based on the Rubber Plantations in Tripura can be cited as an example fitting well to describe the above situation. While raising rubber plantations, the jhumias identified themselves in the same social set up mode and thus stamped this option as an accepted alternative to jhuming. Although, this example may not fit well for all the different tribal clans and groups, yet, this example proves a point beyond doubt that certain strategies need to be evolved on similar lines in the Garo Hills to address this issue. The interactions with most jhumias revealed that although they do realize that the jhuming is no more an economically and ecologically viable livelihood option, yet, they perforce fall back on it.

Hunting

Hunting is yet another concern worth finding a place for discussion to devise viable strategies to deal with it. Both, commercial and subsistence hunting prevails in this entire belt. A taste of easy money among few inhabitants by way of unrestrained poaching and smuggling has further aggravated the already grave situation. Two ways by which this problem can be effectively addressed are: 1), by providing alternatives to the local people to meet their

needs for animal protein, and 2), by resorting to hardcore protection measures with an element of imparting severe punishment to the guilty taking recourse to the existing rules and regulations. As mentioned in case of NWLS, the help of local institutions in this matter would be of much relevance here too in these community dominated areas where local rather than national rules and regulations take precedence.

Songacham

The hunting and excessive jhuming is forcing the gibbons to take refuge in the villages and one type of extremely fragile habitat especially for habitat specialist gibbons, called *songacham*. A *songacham* is nothing but isolated forest patches or island forest surrounded by jhum fields. In Garo language, *songacham* means an abandoned village. A given *songacham* comes into existence when the Jhumia abandon the current year's jhum plot in favour of more fertile forested land. Since the newly formed jhum fields happen to be located at a considerable distance from the old jhum plots, the jhumias shift their house close to new jhum fields to save time and energy. The deserted jhum fields in due course of time transform into a forest patch with characteristic orchards (fruit tree groves). It is not always the case that a particular place is abandoned only in favour of a new jhum plot, but at times the villagers do abandon a particular area in favour of those areas which are equipped with better living conditions such as good facilities of drinking water and other basic facilities. The *Nokma* (the headman) have the full authority over the *songacham*. No one is allowed to fell a single tree without the consent of the *Nokma*. The *songacham* acts as a store house for timber and during construction of house the villagers after getting the permission from the *Nokma* cut down the required number of trees. Most of the *songacham* are good in

forest cover including the dense and close canopy consisting of many fruit trees. The ground cover (forest floor) is also very thick with lots of regenerating seedlings and saplings of diverse floral species. All together some of them provide very good habitat for gibbon (such as Magalpara *Songacham*). However, the small size of most *songacham* may not support large number of gibbon groups. Moreover, as an island surrounded by jhum plots and other non-forest lands, the gibbon groups present in those *songacham* are meta-populations without any scope of their migration to other gibbon groups present in the nearby forested areas. Moreover the area of *songacham* is decreasing gradually to accommodate the enhanced needs of the people to occupy more and more areas under jhuming. In some of the cases, it was found that even illegal cutting of trees was quite rampant without the permission or even knowledge of the *Nokma*. This is an indication of a situation where the people not only flout the government rules and regulations to meet their needs, but even the age old traditional norms are flouted in favour of meeting their sustenance needs. It is also a reflection of the pressure that the local people have to undergo in order to meet their daily subsistence needs.

Name of the Songacham	Village	Area (acres)	Age (in Years)
Songmarangri	Songmarangri	8.3	15
Ribugri	Ribugri	16.2	100
Rongkhongri	Rongkhongri	13.9	80
Romsensalgri	Romsensalgri	22.0	60
Baljak	Near Jengjalgri Air Drome	14.0	55
Somang Nokkap	Chandigri	7.41	50
Magalpara	Magalpara	57.0	80

The name, area, and age (years since formed) of some of the *Songacham* that were surveyed

during this study are as follows:

In fact the presence of gibbons in the *songacham* is an indication of the facts that these were part of the main forests in the past. As mentioned earlier, practically all the *songacham* have attained the form of islands due to extensive jhuming in their surrounds. It has resulted into complete loss of the intervening forest patches serving as corridors between the *songachams*. Even the dense forest patches are also lost in favour of more and more jhum lands. Therefore, the gibbons inhabiting *songacham* have no place to go since all the connectivity is lost. At the most, the gibbons can occupy areas in and around the villages which are in close proximity of the *songacham* and share the boundaries with them. Presence of some of the gibbons in these villages is a testimony to this point of view. Therefore, in their present conditions, the *songacham* are not suitable habitats for gibbons even though they are beset with good forest cover with diverse floral elements. Due to isolation of habitat, the gibbons present in the *Songacham* are facing the danger of inbreeding depression. The colonization or formation of a new family is not taking place resulting in the decreasing a population trend. During lean periods, when there is no sufficient food available, hoolock gibbon are forced to forage out of the *songacham* exposing themselves as soft targets to hunters or dogs when they descend down from the trees. There are cases reported to substantiate this situation.

May be, here too, it is a fit case to apply the provisions of Community and Conservation Reserves to at least connect some of the *songacham* with nearby dense forest areas. This will facilitate to and fro migration of populations of gibbons and other animals too. Another step that can be advocated is to urgently and effectively check further deterioration of habitat around *songacham* by

clamping complete prohibition to the practice of jhuming. Besides, jhumed areas around *songacham* may be reclaimed by afforestation using suitable plant species and completely protecting them from other kinds of biotic pressures (grazing and firewood cutting). With these measures, most of the *songacham* can be connected with each other to facilitate migration of gibbon groups across different *songacham*.

Currently, the management of a *songacham* solely hinges on the understanding, preferences, whims and fancies of the all pervading *Nokma*. Since the forest department does not have authority over the *songacham* it is difficult on the part of forest personnel to prevent illegal felling therein. Due to increasing demands for timber, firewood and other forest (timber and non-timber) products, the villagers visit *songacham* for uncontrolled collection of such products.

Due to ever increasing demand for fertile land for settled cultivation, the forest patches are encroached for their use as agricultural lands. The *songachams* are no exception to this practice. The jhumias, located adjacent to any given *songacham* keep making inroads into the *songacham* and clear some part for jhum cultivation.

Gibbons in the villages

Many gibbon groups were located inside the villages during the current survey in Garo Hills District. This was true especially for areas surrounding the Nokrek Biosphere Reserve. The gibbons were found using the village orchards as their potential habitats. The orchards consist mainly of fruit bearing trees like jack fruit, orange, mango, tamarind, guava, papaya, banana, etc. The gibbons are found engrossed in unhindered feeding forays in these

orchards for devouring varieties of fruits during the major fruiting season. Second most important food item, besides fruits, is tender bamboo leaves, which are present in plenty all over the village premises. It is reported that the villagers do not normally have a dig at gibbons because of their (gibbon's) undistruptive behaviour while using the natural resources unlike macaques and langurs. The macaques and langurs resort to crop depredation and are therefore looked down upon by the villagers. This is not the case with gibbons. Gibbons are considered by the villagers almost as a part of their family. That is why the people may not hurt the gibbons. It is a common belief among the villagers that the gibbons refrain from singing when someone in the village dies. Conversely, as believed by the villagers, the gibbons make loud noises and sing loudly during festive occasions in the village. The attachment of the villagers with the gibbons is evident everywhere. However, in spite of so much of caring by the villagers, the danger to their survival still lurks larger due to certain groups of people who tend to kill them for leisure, profit and self consumption as meat.

Threats

In spite of the fact that the gibbons are more or less safe both in *songacham* and many villages, various threats remain. A brief description on those potential threats is presented below:

1. *Inbreeding Depression:* Due to small fragmented and patchy habitats in form of *songacham* and village forests, there is a huge problem of dispersal of potential adult males or females across different groups. This arrest in mixing of gene pools among different gibbon groups might lead to the inbreeding depression in the long run. The population may face the risk of going locally extinct following stochastic factors. Moreover, because of the fact that this is the only ape species with 38 pairs of chromosome and having few individuals in the sub-populations, the gibbons are even more threatened genetically following problems in mingling of the different populations. Late attainment of maturity, long inter-birth interval and less reproductive turn over (about 5-6 individuals in entire life span might further compound the problems leading to enhanced inbreeding depression.
2. *Degraded Habitat:* *Songacham* and villages cannot be termed as true gibbon habitats. In fact, the gibbons occupy these areas by perforce as the only available habitats in the surrounds. These are also highly degraded habitats and have severe limitations of both space and resources. At most times, these degraded habitats fall far short in meeting even the optimum requirements of food, cover and water for gibbons. This renders gibbons weak and vulnerable to diseases, infections, and other destructive forces. Together with these threats, the inbred populations run the risk of getting totally wiped out in the near future.

The seasonality of fruit production further leads to the paucity of food resources in these already fragmented habitats. This scarcity in food resources may lead to the severe nutritional stress. Fragmentation also causes unavailability of food resources in required quantity and density leading to the nutritional gaps. Especially for the lactating and breeding females this may sometimes prove fatal.

Selective removal of fruit trees and

especially the citrus food trees has led to the decimation of the gibbon population across its habitat. Another innocuous looking feature could be the removal of climbers and liana species from its habitat, which is supposed to have a severe adverse impact on the conservation of gibbons. The regeneration of fruit plant species inside dense canopied reserved forests and PAs is almost negligible, thus affecting the growth in the food resources.

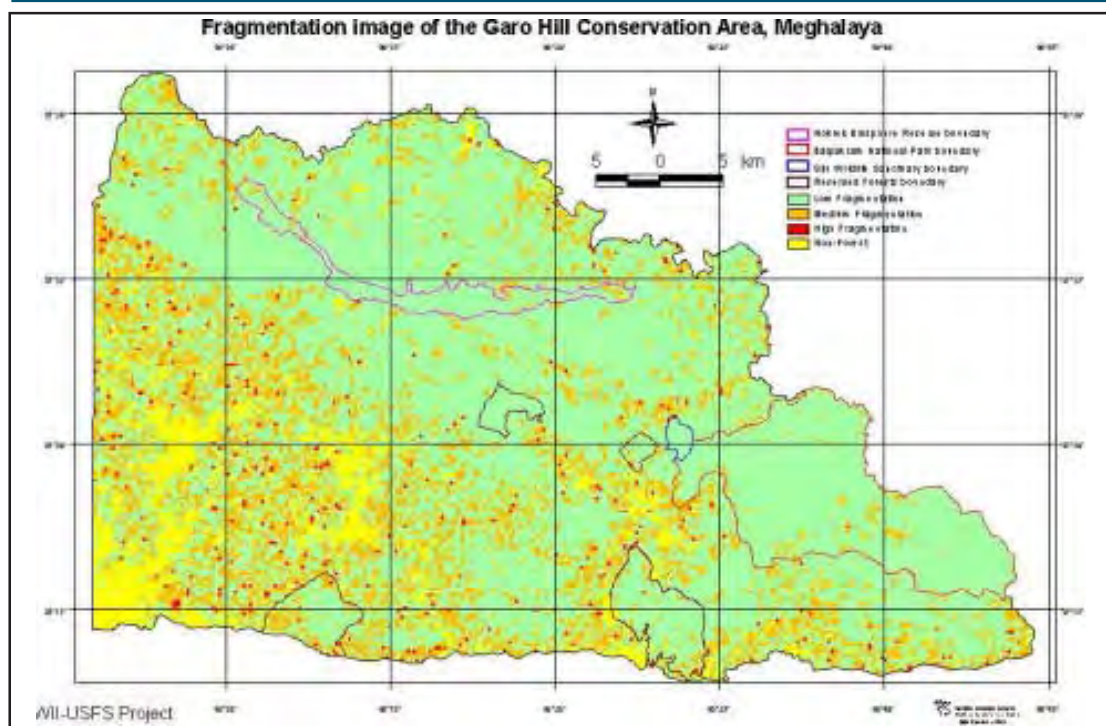
3. *Threatened Habitat: Songacham* and villages are threatened habitats particularly the *songacham* which are exclusively under the control of the *Nokmas*, whose preference of governance to these areas is based on everything but conservation of biodiversity therein. Therefore, the survival of gibbons in this kind of habitat is a big question. In these habitats the predator threats to the gibbon is also unusual due to presence of dogs and other unnatural predators. Also, exposure of these habitats to more man-leopard

conflicts may add to pressures on the gibbons.

Another reason for habitat destruction is associated with the presence of open cast mining fields, tea and coffee estates,

4. *Mounting Jhum Pressure:* Non-traditional jhum cultivation is the root cause of all evil. The decreasing number of wildlife is solely attributed to this type of jhum cultivation. Due to lack of other alternative livelihood options, the people have nothing but to fall back to the practice of shifting cultivation. The jhumming pressure is also seen in Nokrek NP. In one such case, a *songacham* was having very dense forest along with few endangered fauna such as gibbons, rhesus macaques, and capped langur. However, within a span of one month, the same *songacham* area was reported to have lost entire vegetation and wildlife. This exemplifies the mounting biotic pressure

Fig. 30: Fragmentation in the Garo Hills District (Ashish et. al.)



practically over all these remaining forest islands present as *songacham*.

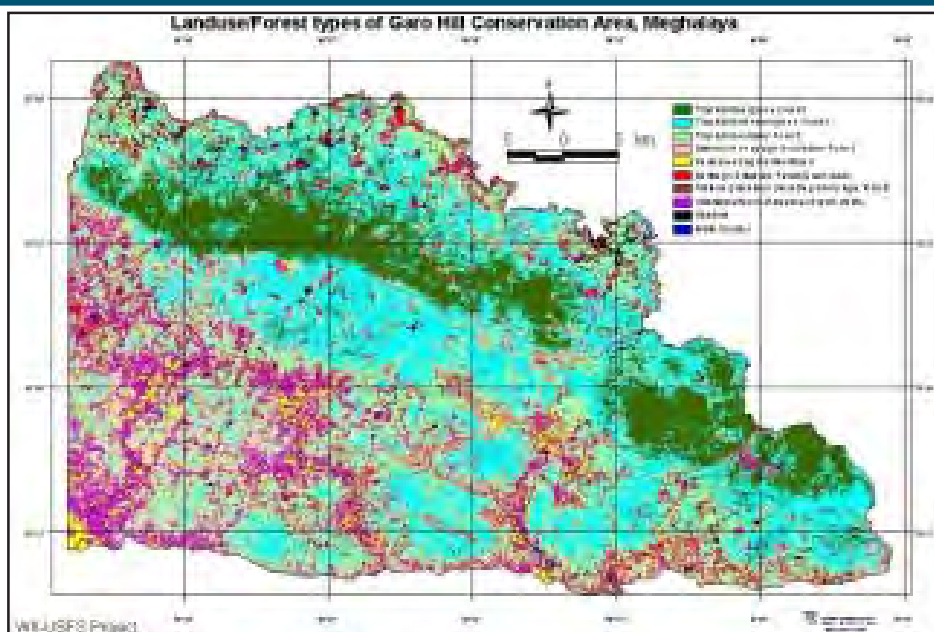
The land use pattern in the Garo Hill district suggests that the virgin and dense tropical evergreen forests have remained only on the ridges, while elsewhere these are replaced by other less dense forest types. This has been so because of the faulty land use pattern of the local human populations. On the slopes and plain areas, the forests types are mainly the semi-evergreen or deciduous. Still heavy to very heavy biotic pressure in form of jhum cultivation has led to the creation of bamboo patches, jhum fields and permanent agriculture fields. In fact the south-west portion of the district is heavily degraded following severe biotic pressures (Ashish *et al.* 2004; **Fig. 31**).

5. *Hunting and Poaching Pressure:* Comparatively easy accessibility and the availability render gibbons vulnerable to hunting and poaching. Traditionally Garo people are hunters and on occasions most

of them live up to the expectations of their traditional customs and belief. The presence of catapult in the hands of Garo youths is a common sight and this innocuous looking instrument has the potential of harming and even killing the gibbons. There are also the cases of gibbons being kept as pets by the local people, which may cause lopsided changes in the overall genetic makeup of the given gibbon population.

6. *Infections:* The frequent interface of gibbons with domestic cattle especially in village populations may lead to transmission of infections or infectious diseases. This could prove detrimental to the entire gibbon population.
7. *Loss of Natural Instinct:* It is noted that the gibbons inhabiting areas in close proximity to the villagers for many years have lost the natural instincts as a wild species. This often makes them soft targets for poachers. It is urgently required that the gibbon populations

Fig. 31: Land use pattern and Forest Types in Garo Hills district (part)



occupying villages and *songacham* areas are translocated within the main forested habitats. These habitats being more suitable would allow the gibbons to have viable populations in the long run.

Recommendations

Following measures are proposed to protect the dwindling populations of gibbons in the West Garo Hills:

1. *Awareness*: Since the gibbons are present in villages and *songacham*, the villagers should be made aware about the threats that may lead to the extermination of gibbons. They should also be provided with all the options for their conservation. The existing local level institutions in the villages can be used for this purpose. This will not only help the gibbon groups present in the villages and *songacham*, but also in the PAs and reserved forests. Education and awareness should also help the villagers to dispel the superstitions that they may harbour in their mind and daily activities with respect to gibbons. It is to be kept in mind that any conservation programme can not be made successful without the action support and participation of the local communities. On discussions with many people, it was realized that they are open to new suggestions and measures so long as those are in line with their social and cultural norms.
2. *Corridors between the isolated habitats*: The fragmented and discontinuous habitats need to be linked or bridged so as to facilitate the mixing of groups which in turn would lead to the establishment of new colonies or groups. This can be done

by acquiring the land and afforesting the areas with plantations of suitable species. The provisions of Conservation and Community Reserves now available as per the amended Wildlife (Protection) Act, 2002 can be used for this purpose. These provisions are specifically made to ensure continuity between isolated or fragmented PAs without jeopardizing the interests of the communities residing therein. The legal backing available to these Reserves will make these more effective in their implementation.

In an another project in which the first author was also involved as one of the principal investigators (Ashish *et.al.* 2004), 7 corridors have been identified in the Garo Hills mostly connecting the existing NPs, WLS and reserve forests (**Fig. 32**). These corridors are going to play a very crucial role in the dissemination of the gibbon populations across their distribution range in Garo Hills district. As described earlier, all these corridors have to be either in the form of Conservation or Community Reserves because the area of all these proposed corridors is either government land (not under the forest department) or the community land.

3. *Relocation or introduction*: As described in the case of Nongkhyllum Wildlife Sanctuary, the problem meta-populations of gibbons located in small and isolated fragments without having any chance of migration can be addressed in two ways. One, by resorting to creation of corridors as described in the preceding paragraph. Where this is not possible, the only alternative could be to capture and translocate those populations to a place

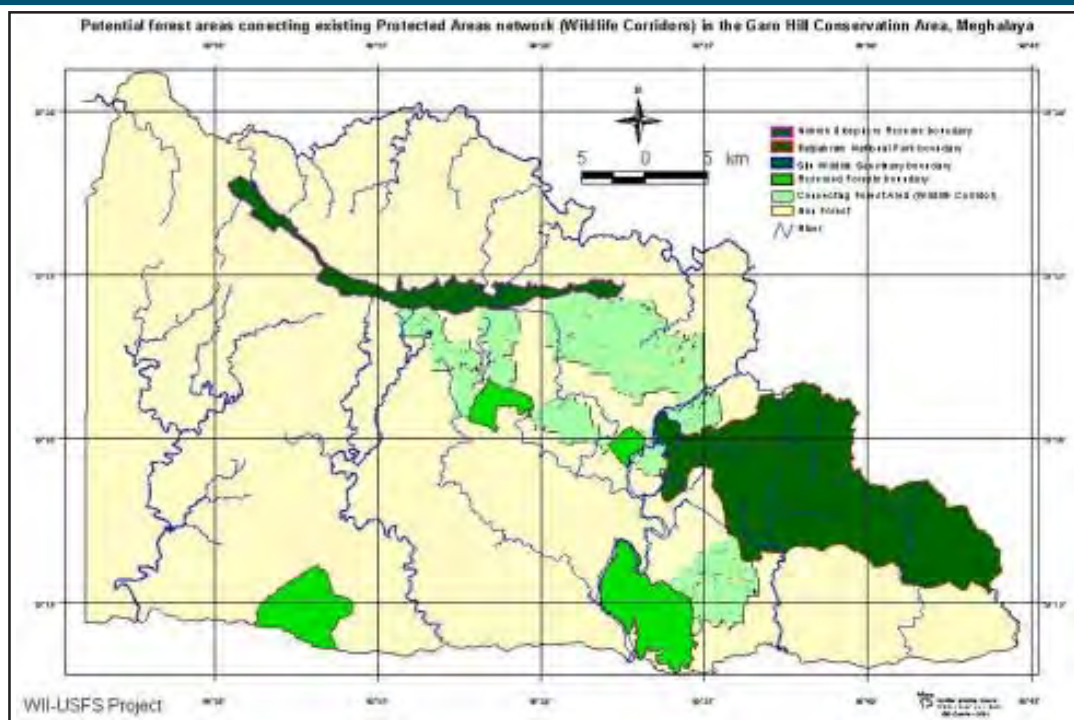
where there is a possibility of inter-mixing of different populations. In this survey, one solitary adult female has been found from one locality inside Siju WLS. There is not a single gibbon group in the close proximity of this solitary adult female to facilitate exchange of individuals for the purpose of out-breeding. The only option is to translocate this isolated female to suitable habitat where she would have an opportunity to establish her family with adult males belonging to other groups. Although this survey did not report on many such (isolated male or female gibbons) cases, but there are many incidences of either solitary males or females reported in Assam, Tripura, Mizoram and at many gibbon sites in Bangladesh. This is one grave problem and needs to be handled deftly with active collaboration with the experts in this field. The IUCN Guidelines available to this effect can be used to address this issue. Besides, there are case studies on the

successful translocation and establishment of other species of primates. These examples may be implemented for gibbons after their suitable modifications from the perspective of gibbons as focal species.

One most urgent need is to properly document all such cases with all relevant details so that a comprehensive project can be developed to address all such cases suitably. As mentioned elsewhere in this report, similar problem of isolated gibbon populations exists in a big way in Bangladesh too as a result to severe erosion of habitat following fragmentation and degradation.

4. *Expansion of the Songacham: Songachams*, which are very small in size, should be expanded after acquiring the land and planting the vegetation therein. To begin with, at least further encroachment of these *songacham* by jhuming practices in

Fig. 32: Identification of corridors in Garo Hills (Ashish et al. 2004)



their surrounds should be completely checked. The *songachams* can be immediately declared as Community Reserves. This will help forest department to save these areas from exploitation by the *Nokmas*. More effective protection measures can be introduced as a part of Conservation Reserves mainly against grazing, encroachment, etc. This small step alone will lead to the upgradation of the status of *songacham* to a relatively well connected vibrant and biotic pressure free (comparatively) forest to meet the needs of both wildlife and people.

Another option to address the problem of degradation of *songachams* could be to facilitate creation of a forest belt all around the jhum plots. The people should be encouraged to not to cut the jhum right up to the edge of the *songacham*. These narrow belts of forests all around the *songachams* will add to the biodiversity of the *songacham*, besides providing a refuge for food and cover to the gibbons.

5. *Alternative Source of Livelihood:* By and large the people residing inside in and around the Nokrek BR are very poor and a number of families are living below the poverty line. There is no other option except jhuming that the local people can look forward at to earn their livelihood. However, a sharp decrease in the economic returns from jhuming is forcing the people to believe that it is no more an economically viable livelihood option. Therefore, the people are gradually getting inclined towards planting commercial or the cash crops such as cashew nut, betel nut, pepper, and betel leaves as economically viable options to

jhuming. The tea and coffee plantations are also gaining momentum in these areas as substitutes to jhuming. However, as could be realized, what is required is to prepare an integrated plan of action involving many other concerned line departments to come up with a holistic approach. This has to be seen in terms of an enterprise at a village level wherein all components right from the creation of resources to the sale in the market have to be addressed to ensure that these options sustain in the long run. The local institutions have to be involved and necessary capacity building of the people in these aspects is also to be ensured. These measures will definitely help the people earn their livelihood based on non-forestry options and then the much desired protection to the flora and fauna of this region will be ensured. Wherever jhum has to continue, it is to be made economically and ecologically viable by introducing enabling scientific components.

6. *Priority to the Target Villages:* After identifying the villages where gibbons and other wildlife species are found, forest department should target those villages for different eco-developmental schemes to ensure active participation and cooperation for achieving a larger conservation goal.
7. *Massive Afforestation Programme:* A massive afforestation programme should be initiated to fulfill the loss to the vegetation due to shifting cultivation. While undertaking afforestation, emphasis should be given to poly-culture rather than mono-culture. Also, indigenous species should be used for this purpose rather than introducing exotics in this

region. The choice of species should also fit well with the Wildlife Habitat Relationship (WHR) matrix. If followed properly, this option will help in reducing man-animal conflicts issue as well.

8. *Constant Monitoring:* A time bound definite plan is a must for periodic monitoring of the gibbon habitats and their populations. Necessary training should be imparted to the field level staff to be able to carry out this exercise without the aid of outside agencies. The information so collected should be analyzed at the higher level and decisions taken to undo any unwanted trend if so reflected in the collected information. The monitoring must be made an integral part of the day to day activities of the field level staffs.
9. *Protection to Other Wildlife:* Being a habitat specialist, the gibbons also serve as one major flagship species. Therefore, protection imparted to the gibbons and their habitat would automatically ensure conservation of other equally important many an endangered species.

8. Reference

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Other references are listed in the ‘References and Selected Bibliography on Hoolock Gibbon’ chapter in this volume.