Distribution and Conservation Status of Hoolock Gibbon (*Bunopithecus hoolock*) in Tripura

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1. Introduction

Tropical environments are being destroyed due to severe unsustainable biotic disturbances. Those habitats which are not totally destroyed, are broken into fragments, unable to support wild animal/bird species with large home ranges, habitat specialization and long-term viable population of such species. The edges of these habitats may also be the point of entry to humans, introduced species, and exotic diseases that may further reduce and even eliminate many species on local scale. The specialist species are more prone to extinction. Traditionally, the hoolock gibbon (*Bunopithecus hoolock*) (herein after called gibbon) has been regarded as a member of the genus Hylobates and the monotypic representative of the subgenus Bunopithecus (Giessmann 1995, Rowe 1996, Marshal and Sugardjito 1986). Among the 9 known species of lesser apes from Southeast Asia, the gibbon is the second largest after siamang (Grooves 1970; Napier 1967). The gibbon occurs in Bangladesh, Mayanmar, India (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland,Tripura) and South Western China (Tilson 1979, Mukherjee 1986, Alfred and Sati 1986, 1990a, b, 1994; Choudhury 1987, 1988, 1991; Geissmann 1995, Groves 1967). The gibbon is found in tropical evergreen forest, wetter tropical semi-evergreen forests, sub-tropical monsoon evergreen broadleaf forests, and sub-tropical evergreen broadleaf hill or mountain forests. The species appears to be less common in deciduous forest and scrub forest, and absent from mangrove areas (Mukherjee 1982, Alfred and Sati 1986, 1990a, b; Choudhury, 1987, 1990, 1991, 1996a; Gittins and Tilson, 1984). Distribution of the species ranges between 20° and 28° North, and 99° to 98° East. It occurs at an altitude between 80 to 1500 m (Choudhury, 1996a, Mukherjee 1986). The gibbon, a habitat specialist in terms of frugivory and undisturbed dense forest, is an endangered species and at present restricted to very few areas of northeast India. Though the species is found in some disturbed and degraded habitat, it is primarily a habitat specialist and resident of evergreen to semi-evergreen type of forest. In spite of its listing in Schedule -1 of Wildlife (Protection Act) 1972 and endangered status, no detailed survey of the species has been conducted in areas of its distribution.

The history of conservation of forests and wildlife in Tripura is not very old. Although few studies highlighted the distribution of the species in Tripura state, no information has yet been reported on the present status of the gibbon in the state. The only information available on gibbons in Tripura is from Mukherjee (1986), Gupta & Kumar (1994).

2. Methods

2.1 Study area

The Study was carried out in the forested areas of Tripura state. The state is located between 22° 56' and 24° 32' North Latitude and 91° 09' and 92° 20' East Longitude **(Fig. 1)** covering an area of 10,492 km^2 (DESPD 2003). State has Reserved Forest of 3588 km^2, Proposed Reserve Forest of 509 km^2 and Unclassified Government forest land of 2195 km^2 **(Fig. 2).** Total forest cover of the state is 7065 km^2 out of which 3463 km^2 is categorized as dense forest and 3602 km^2 as open forest (SFR 2001). PA coverage of the state is 603.65 km^2 (5.8%)) consisting of four sanctuaries (Fig. 2), namely, Sipahijala WLS (18.53 km^2), Gumti WLS (389.5 km^2), Rowa WLS (0.85 km^2), and Trishna WLS (194.7 km^2).

Forest type of Tripura ranges from East Himalayan lower bhabar sal, Cachar tropical evergreen forests, Moist mixed deciduous forests, Low alluvial savannah woodland, Moist mixed deciduous forest with dry bamboo brakes to Secondary moist bamboo brakes. Forest and hill ranges of Tripura are in close continuity with the Chittagong Hill Tracts (Bangladesh) and the hills of southern Assam and bear a close resemblance to these adjoining areas (Menon 1975). Tripura owes rich biodiversity and copious wealth of biological resources to its unique Bio geographical (8B Assam Hills) and Zoogeographical (Indian sub-

Fig. 1 : Map of Tripura (Source: FSI State Forest Report, 2002)

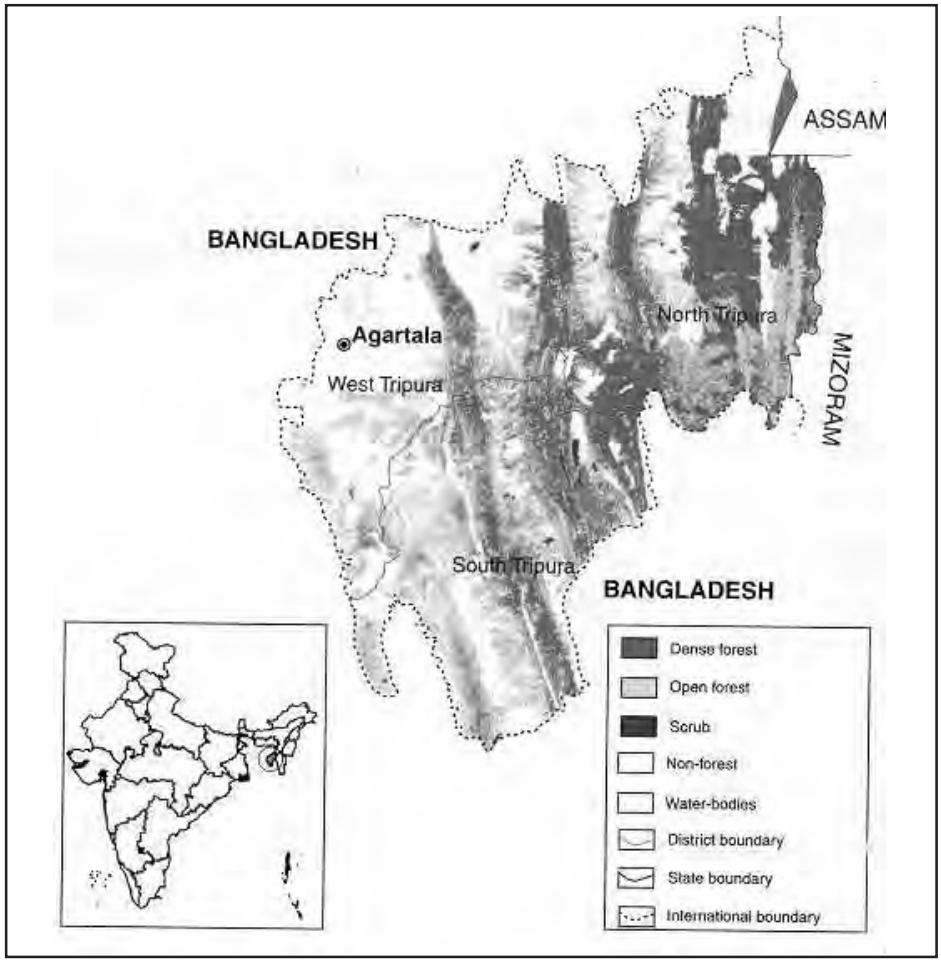
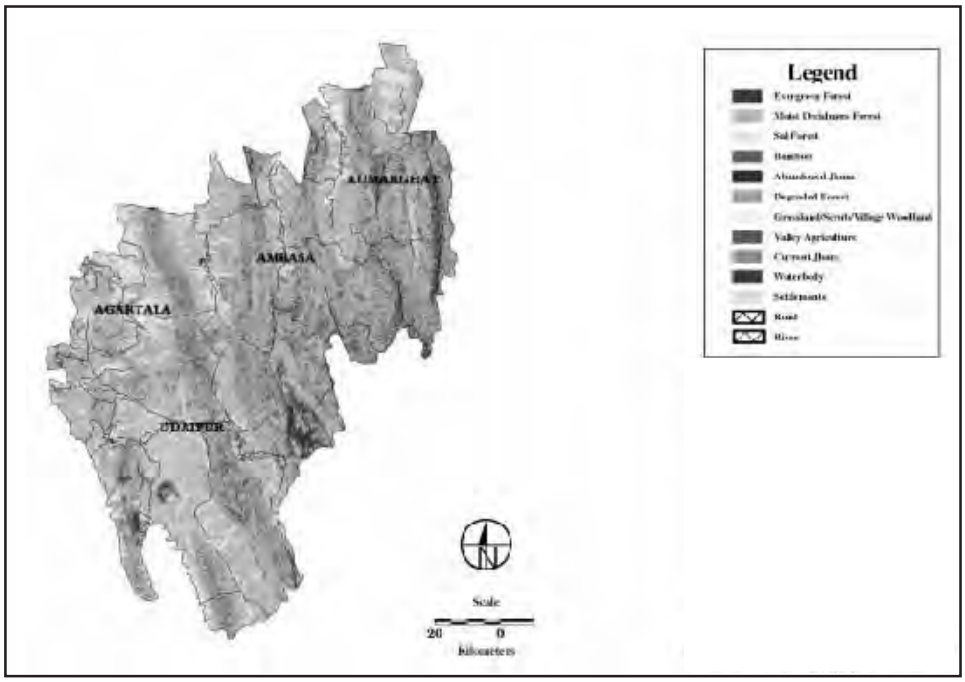
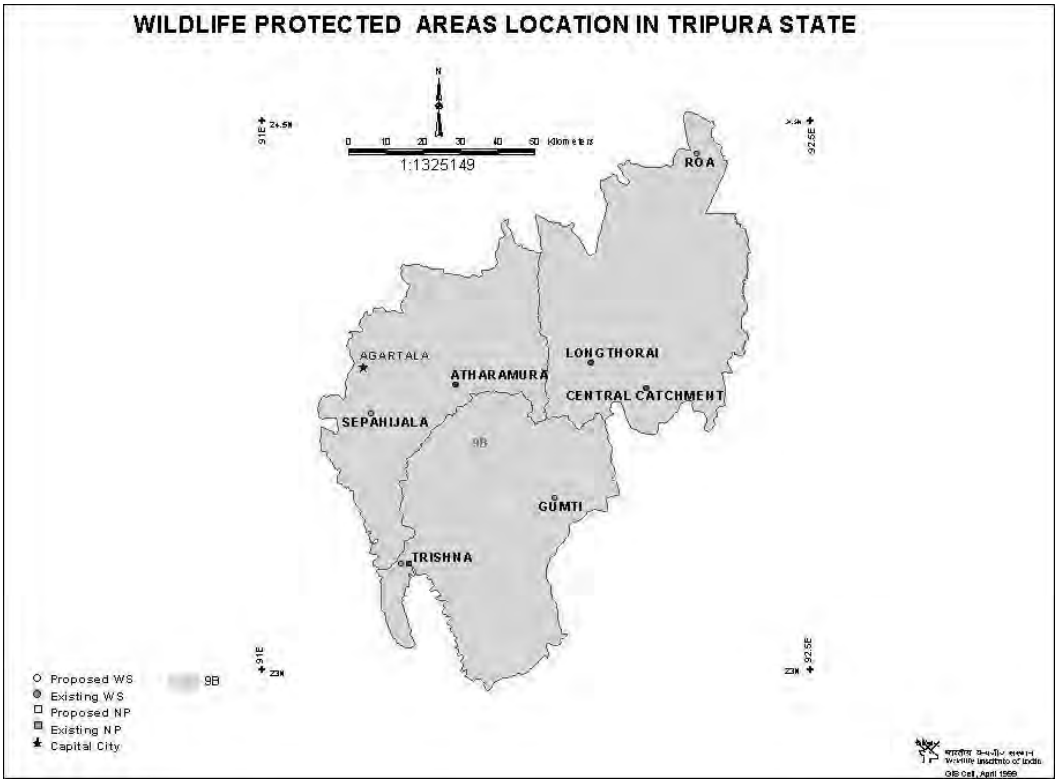


Fig. 2 : Forest and vegetation types of Tripura *(Source : IIRS, 2002)*



region of Oriental Zoogeographical Region) location and position. These areas served as a great faunal gateway. Out of 15 free ranging primate species in India, 7 species are found in Tripura, which is the highest for any one Indian state (Gupta 2001). Almost 30% of the total

Fig. 3 : Location of Protected Areas in Trupura



area of the state is placed under Autonomous District Council (ADC). The ADC areas are also highly rich in forest cover and overall biodiversity. These areas constitute one very important aspect of Wildlife Conservation in the State **(Fig. 4).**

North Tripura District

The North Tripura District comprises of 2,469.90 km² of land and is divided into three sub-divisions, namely, Dharmanagar, Kanchanpur and Kailashahar **(Fig. 5).**

For the present survey we sampled sites in Kanchanpur. This district is again subdivided into eight Blocks namely Kumarghat, Panisagar, Pecharthal, Kadamtala, Damcherra, Dasda, Gournagar and Jampui Hill. Main tribes of the District are Tripuri, Koloi, Halam, Chakma.

There are two hill ranges, namely Jampui and Sakan and they run almost parallel to each other. "Betling ship", the highest point of the state (939m. ht.), is located in the Jampui hill range. Main rivers of the area are Deo, Manu, Longai and Juri.

This district has 1204.59 km² of forested land. With relation to ownership and protection scenario, a total of 628.28 km² is under reserve forest category and 501.57 km² is under private forest. Another 74.76 km² is proposed for the reserve forest.

The area received 3014.5 mm and 2698.6 mm of rainfall during year 2000 and 2001 respectively. Maximum and minimum temperature was 35 °C and 27 °C, respectively in summer and 27 °C and 7 °C, respectively was recorded in winter.

Fig. 4 : Autonomous District Council Areas in Tripura

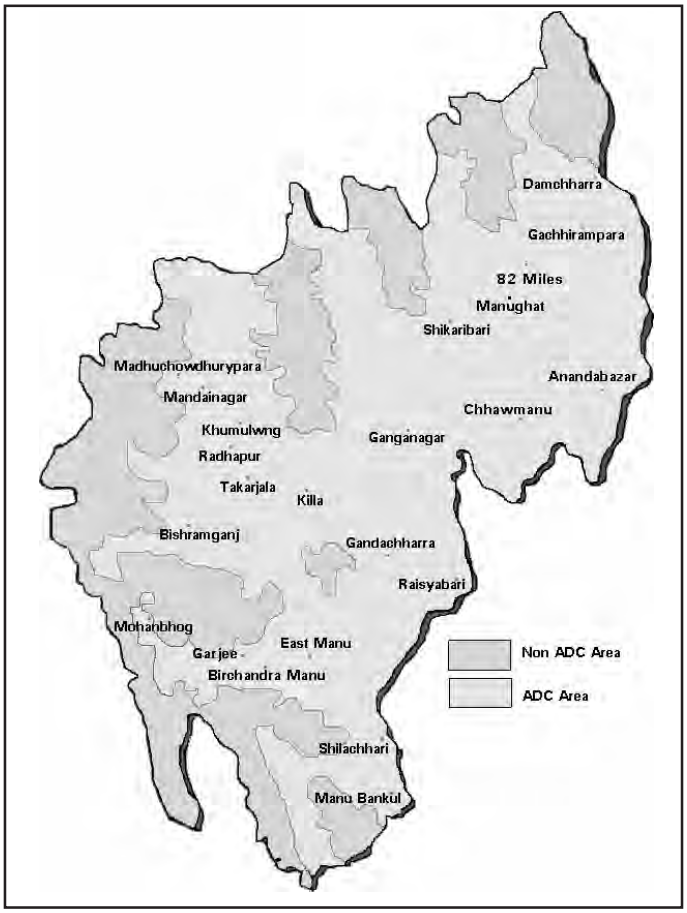


Fig. 5 : North Tripura District

Dhalai District

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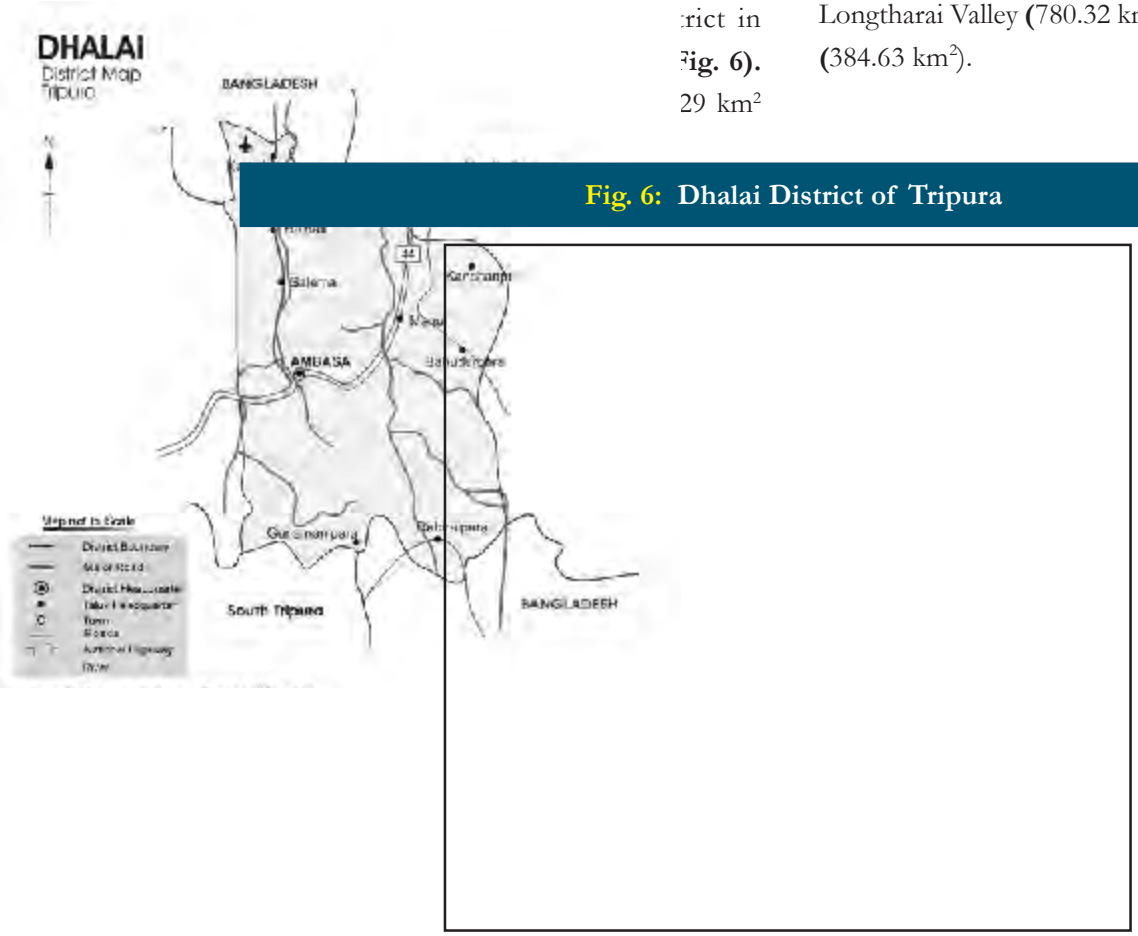
29 km²

and has four sub-divisions, namely, Ambasa (551.12 km²), Gandachera (596.22 km²), Longtharai Valley (780.32 km².) and Kamalpur (384.63 km²).

Fig. 6: Dhalai District of Tripura



The district is rich in natural resources. More than 70% area of this district is hilly and under forest cover. The district headquarter is situated at Ambassa on NH-44 which is around 90 km from the state capital Agartala. The district shares about 169 km of international boundary and with Bangladesh.

Climate: The South -West Monsoon, which normally breaks in the month of May is the source of major rainfall. Hailstorms generally occurs during the month of April and May, occasionally causing damage to the field crops. Autumn and Spring are of very short duration. Average annual rainfall in the district is about 2200 mm. The temperature varies between 36°C and 16.9°C during summer and 28°C and 5.3°C during winter months.

Hill ranges : The district is much more hilly compared to other three districts. Atharamura, Longtharai and Sakhantang are three major hill ranges in the district.

Rivers : The main perennial rivers in the district are, Manu, Dhalai and Khowai .

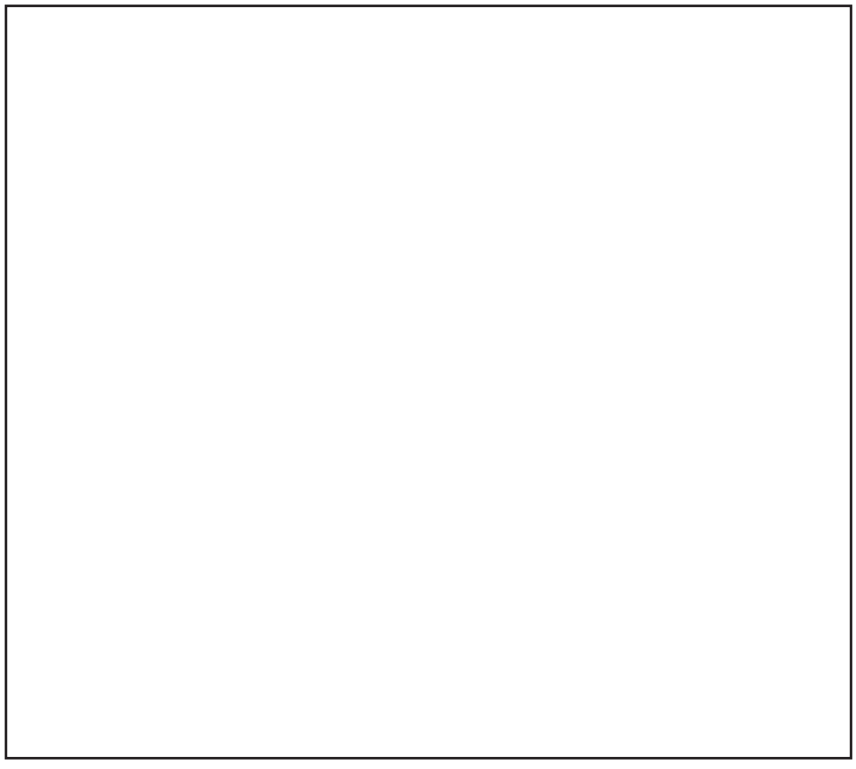
South Tripura District

South Tripura District is situated approximately between longitude 91^0 18' and $91^0$59' E and between latitude 22^0 56' and 23^0 45' N **(Fig. 7).** Udaipur is the headquarter of South Tripura District.

Udaipur is popularly known as the city of lakes and was the capital of Tripura till 1760 A.D. The city is famous for temples. The total geographical area of South Tripura District is 2624 km^2, which is about 25% of the total state area. The South Tripura District is bounded on the the North by Dhalai and West Tripura districts and in east, west and south by the International border with Bangladesh.

Climate : Climate of the district is characterized by a humid summer and a dry cool winter with

Fig. 7 : South Tripura District



high rainfall during July to October. Rainfall is received from the South -West Monsoon, which normally breaks in the month of May. Hailstorms generally occurs during the month of April and May, occasionally causing damage to the field crops. Autumn and Spring are of very short duration. Average annual rainfall in the district is about 2000 mm and the temperature varies between a maximum of 35°C and a minimum of 7°C.

Hill ranges : Three (3) hill ranges namely; Baramura, Deotamura and Atharamura (part) hill range are present in the district. Deotamura is the principal hill range of South Tripura district having a length of 85 km. and forms the boundary between Amarpur and Udaipur subdivisions.

Rivers : Main rivers of the district are, Gumti, Muhuri and Feni. The river Gumti originates from the range connecting the Longtharai and Atharamura. At its source, two rivulets, namely, Kalyansing and Malyansing meet, thereafter it takes the name of Raimacherra till it meets the Sharmacherra and assumes the name Gumti. The river Gumti is about 135 km. long and flows across the sub-divisions Gandacherra, Amarpur, Udaipur and Sonamura. The river Muhuri has its source in the Deotamura range and is more than 64 km. long and has a catchment area of 1014 km^2. Muhuri flows westwards through hillocks and plains of Belonia sub-division till it enters Bangladesh.

At the source of river Feni, there are three streams known as the Asslang, the Rangafeni and Taindung, of which the Asslang is the principal channel. The river Feni forms the natural boundary between the South Tripura District and Bangladesh.

Socio-cultural setup: About 37.5% of the population in South Tripura disrtrict is scheduled tribe and 17.16% of the population is scheduled caste. Major tribes in the district are: Tripuri, Jamatia, Reang, Chakma and Halam. The tribals as well as the non-tribals residing in the district have a socio-cultural similarity with the tribals and non-tribals of Bangladesh. The main language of the majority of the population is Bengali while the tribals mainly speak Kakborak dilect.

Economic activities : Agriculture is the main occupation. However, only 31.61% of the land in the district is cultivable. The holdings are small, and agriculture is mainly rainfed and at subsistence level. A large population however is daily labourer, which depends on the employment generation schemes of the Government. An analysis of occupational structure in the district shows that about 12.6% are cultivators, 8-9% are agricultural labourers and 1.61% are dependent on trade and commerce. The non-working population is about 68% which is an indication of the weak economic base and under-development. About 72% of the rural population is living below poverty line. Paddy (rice) is the main food crop grown. Potato, sugarcane, mesta, jute, mustard, etc. are some other crops grown in the district. Tea, coffee, rubber, jackfruit, banana, mango, pineapple, etc. are the major plantation crops.

2.2 Study design

Based on previous and current information from forest department, detailed survey was conducted in the North Tripura District, Dhalai District and South Tripura District. For a number of reasons the placement of transects was not entirely random and they varied from 2-3.5 km. Most transects were placed in densely forested area to cover maximum potential areas of gibbon presence. Existing trails were used to approach in the core of surveyed areas and then transects were placed on both side of the existing trail.

Except for very small forest patch transects were laid at least 500m inside the edges of the patch.

Length of transects were determined by using pedometer and the area covered was calculated by determining visibility on transects obtained at regular interval of 100m by Range Finder. Survey was assisted by staff from the Tripura forest department and one local villager from each surveyed place. Survey in the North Tripura district and Dhalai district was conducted during November - December 2002, where as South Tripura was covered during January - February 2004. Each transects was walked twice, once in the morning and then in the afternoon. Incase presence of gibbon is confirmed in the first visit, afternoon visit in the same transect was cancelled and adjoining areas were surveyed walking on the existing trails. Transect walk usually began at first daylight, if not prevented by high wind, fog or rainfall. Typical starting time was 6:30 am in the morning and 1:00 pm in the afternoon. We moved at a slow speed and as quietly as possible. We stopped at every 100m to take the reading on visibility and spend 2-3 min to listen to any sound of movement or song. In most of the cases confirmation was made after crossing the animal or while returning after finishing transect walk. All these confirmations were included in the present analysis. Some cases where presence were confirmed from songs and the animal remained far away from the transect, we tried to follow the direction of the song and locate the group in order to collect information on population structure.

For each confirmation the following data were noted; Name of the place/locality, Status of the forest, Transect ID, species, mode of confirmation, mode of detection, GPS location, Group number, Population structure - if available, broad vegetation category. Entire observation was made by at least one observer in common for entire survey, thereby data consistency was enhanced providing additional opportunities for comparison of the species distribution in different parts of the state.

Information on threats to the species was obtained from local human population representing different age group. Preference was given to those who are regularly going to the forest for their day to day livelihood. Historical information about the presence and extinction of the gibbon in surveyed areas was collected from village head or elderly person who was living in that area for quite a long time. Condition of forests during survey was also assessed visually in terms of habitat disturbance and suitability for gibbon.

Status is described based on descriptive analysis of present distribution, decline in number of population in course of time, abundance and quality of natural habitats.

3. Results

Intensive search was conducted in 19 sites out of which 8 were in reserve forest, 6 included private forest as well as reserve forest, 2 were in purely Private Forest, 2 were in WLS and the land status could not be confirmed for the remaining two sites.

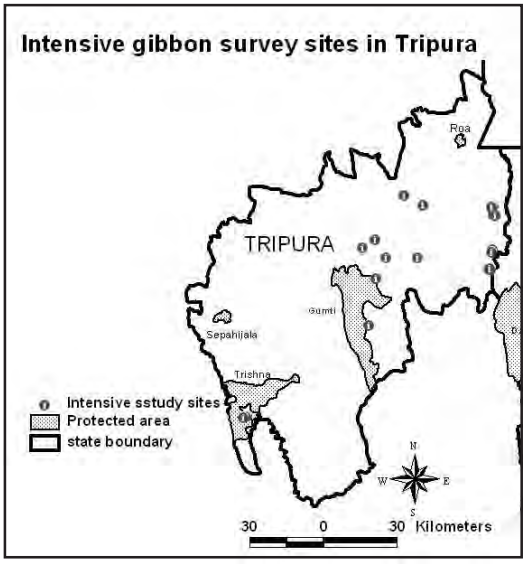
- Reserve forest sites: Phuldangsai, Kanchal chera, Harinchera, Ganganagar, Khowi chera, Noona chera, gandachera and Jiyal chera
- Reserve as well as private forests sites: Betlinship, Vangmung water point,

Manu Nepal tilla, Laxmanjoy para, Dewa chhera and Thal chhera.

- Private forests: Sabual and Conzai.

Trishna and Gumti Sanctuaries were the PA in Tripura where gibbons were reported. Status of lands surveyed in Chamanu and Ambassa localities of Dhalai district could not be conclusively ascertained due to lack of landmarks distinguishing between private and reserved forest. A Total of 41 trails/transects were surveyed in these 19 sites (**Fig. 8**).

Fig. 8 : Intensive Gibbon Survey Sites in Tripura



Out of the total surveyed sites, 33 % of the sites did not record presence of gibbon though these sites were earlier reported having gibbon populations. Over 31% of the sites surveyed, presence of gibbons was confirmed based on personal communications with villagers and hunters. About 24% sites recorded presence of gibbon during the surveys conducted in the year 2001. Only in 7 % of the sites we could confirm gibbon presence by direct sighting whereas in 5% of the sites presence were confirmed by songs during survey (**Fig. 9 & Table 1**)

Distribution of gibbon within Tripura is restricted to very few forested patches. Almost all the patches where presence of gibbons was confirmed, most of those sites were either in isolated fragmented patches or in secondary forest type. Hoolock gibbon is a highly specialized forest dweller. Their arboreal nature, brachiating locomotion and frugivory feeding habits make them specialized and indicate on its specific habitat requirements. Usually these

Fig. 9 : Presence and absence status of Gibbon in Tripura based on different sources of information

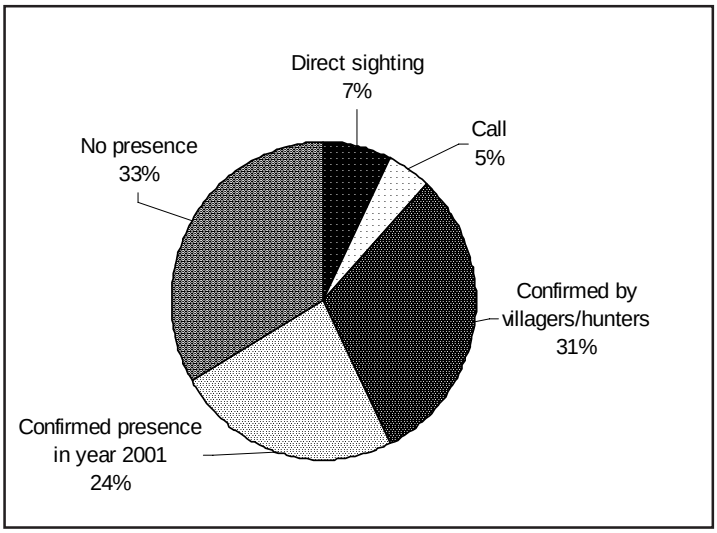


Table 1: Location of gibbon groups in Tripura

Place	Status	Latitude	Longitude	Source of Informaton	Group structure	Patch (sq. km)
Phuldangsai	Rf	23.812083	92.258806	local people	1Am +1Af	4
	Rf	23.811556	92.257722	local people	1Am +1Af	
	Rf	23.810111	92.258389	song	-	
Betlinship	Rf+Pf	23.814278	92.259444	local peoples	-	3
	Rf+Pf	23.813472	92.260667	local people	-	
	Rf+Pf	23.812139	92.261556	local people	-	
	Rf+Pf	23.809722	92.261444	local people	-	
	Rf+Pf	23.811861	92.260667	local people	-	
Sabual	Pf	23.878528	92.268639	song	-	5
	Pf	23.882222	92.269222	local hunters	1AM + 1AF	
	Pf	23.883111	92.269722	song	-	
Conzai	Pf	23.873028	92.266889	sighting	1AM +1AF +1INF	3
Vangmung	Pf	24.008222	92.278139	song (may, 2001)	-	3.5
	Pf	24.010444	92.277917	song (may, 2001)	-	
	Pf	24.011556	92.276389	song(may, 2001)	-	
	Pf	24.011833	92.273972	song (may, 2001)	-	
Vangmung	Rf	24.006833	92.275139	Song (july, 2001)	-	3
	Rf	24.006667	92.277861	Sighting (july, 2001)	1AM	
	Rf	24.006611	92.278694	song (july, 2001)	-	
Vangmung	Rf	24.006833	92.275139	Song (jun-july, 2001)	-	3
	Rf	24.006667	92.277861	song (jun-july, 2001)	-	
	Rf	24.006611	92.278694	song (jun-july, 2001)	-	
Vangmung	Rf	24.038556	92.271806	personal communication	-	4.5
	Rf	24.038389	92.269250	- personal communication	-	
	Rf	24.037222	92.269194	personal communication		
	Rf	24.036639	92.267639	personal communication	-	
	Rf	24.036750	92.265972	personal communication		
Manu Nepal tilla)	Rf+Pf	24.078417	91.946028	personal communication	- (last sight- 92-93)	
Kanchan chera	Rf	-	-	sighting	2 AM +1 AF	9
Lakxman joy para	Pf+Rf	24.044528	92.016722	song	–-	
Chamanu		23.851675	91.995556	-	-	
Dewachera	Pf+Rf	-	-	sight	1 AM +2AF	
Thalchera	Pf+Rf			song	-	
Ambasha		23.918806	91.842222	-	-	
Harinchera	Rf	23.851778	91.882083	sighting	2AM	
Ganganagar	Rf	23.776944	91.847250	song	-	
Khowi chera	Rf			song	-	
Noona chera	Rf			-	-	
Gandachera	Rf	23.605667	91.818472	pesonal communication	-	4
Jiyal chera	Rf	23.889556	91.795444	sighting	2M	
Trishna	WLS			Sighting	1 AM + 1AF	7
				Sighting	1AM + 1AF+ 1JUV	

requirements are met by diverse, evergreen and semi evergreen forests. The hoolock gibbon is not always exclusively restricted to these types of habitat and can also be found in deciduous and secondary forests though its distribution essentially coincides with the occurrence of evergreen and semi-evergreen forest types.

Of the total 39 groups recorded over an area of 53 km^2, 16 groups were confirmed through personal communications with the local people and forest staff, songs were heard for 15 groups and only 8 groups were actually sighted. A total of 25 individuals were counted from 8 gibbon groups consisting of 14 adult males, 9 adult females and only 2 infants. Absence of large number of infants, juveniles and sub-adults was quite conspicuous. A total of 5 adult males were sighted from 3 solitary groups. All these 3 groups were in reserved forests (Vangmung, Harinchhera, and Jiyalchhera). These forests were more like fragmented patches without any connectivity with other nearby forest patches. No gibbon group could be recorded from Ambassa, Chhamanu, and Noonchhera reserved forests, although old records suggested presence of gibbon populations in these areas **(Table 2).**

Out of the total 41 locations where the gibbon survey was undertaken, as many as 40 sites were outside the PA network. Only 1 site was inside the sanctuary (Trishna WLS). This suggests the importance of forests outside the PA network for conservation of gibbons. Most of the sightings were from reserved forests (N = 23). A total of 8 sightings were made in the private forests and 9 from a mix of reserved and private forests. Unlike, large number of gibbon groups recorded from the villages and village forests, no such recording was made from the villages in Tripura. The survey in sanctuaries was done only in Trishna, while among other three sanctuaries, gibbons are not found in Rowa and Sepahijala WLS. Gumti WLS has good gibbon populations, but due to logistic reasons survey could not be conducted during this study. An earlier study, recorded 7 groups of gibbon with 15 individuals consisting of 6 adult males, 5 adult females, 1 sub-adult and 3 juvenile from the Gumti WLS (Gupta and Kumar, 1993). Most of the sightings were from secondary forests of the jhum origin **(Table 3).**

Satellite photographs, classified by Indian Institute of Remote Sensing (IIRS) for North East India were used to determine the areas in Tripura that are likely to be potential gibbon habitat. The gibbon location plotted over classified imagery revealed that, owing to fragmentation in the primary forest types and increasing disturbance regimes like habitation and shifting agriculture, the original vegetation of Tripura has been largely destroyed. Primary forests are now confined to very few isolated patches in North Tripura and Dhalai districts. These fragmented primary forest patches are of varying shape and size and spread over the entire landscape. Most of the forest patches where presence of gibbons was confirmed are located in relatively undisturbed patches and in areas where hunting of gibbon is almost absent and does not form a limiting factor. The view that habitat degradation is one main factor responsible for local extermination and extinction of gibbons from most of the primary forests in North Tripura district may not be absolutely correct. This study has revealed that as a result of severe hunting pressure in the dense primary forests, the gibbons are almost absent.

In the Dhalai district, especially around Dumbur lake, natural vegetation is restricted almost exclusively around the reservoir. Most of the areas in the north Tripura district and especially adjacent to Mizoram are still covered

Table 2: Population Estimates of Gibbons in Tripura

Sl. No.	Location	Number of Groups				Number of Individuals							Area (km^2)
		PC	S	ST	T	AM	AF	SAM	SAF	INF	JUV	TL	
1.	Phuldansai	2	1	-	3	2	2	-	-	-	-	4	4
2.	Betlingship	5	-	-	5	-	-	-	-	-	-	-	3
3.	Sabul	-	2	1	3	1	1	-	-	-	-	2	5
4.	Conzai	-	-	1	1	1	1	-	-	1	-	3	3
5.	Vangmung	5	9*	1	15	1	-	-	-	-	-	1	14
6.	Manu (N Tilla)	1	-	-	1	-	-	-	-	-	-	-	4
7.	Kanchanchera	-	-	1	1	2	1	-	-	-	-	3	9
8.	Laxmanpara	-	1	-	1	-	-	-	-	-	-	-	-
9.	Chamanu	-	-	-	-	-	-	-	-	-	-	-	-
10.	Dewachera	1	-	-	1	1	2	-	-	-	-	3	-
11.	Thalchera	1	-	-	1	-	-	-	-	-	-	-	-
12.	Ambasa	-	-	-	-	-	-	-	-	-	-	-	-
13.	Harinchera	-	-	1	1	2	-	-	-	-	-	2	-
14.	Ganganagar	-	1	-	1	-	-	-	-	-	-	-	-
15.	Khowaichera	-	1	-	1	-	-	-	-	-	-	-	-
16.	Noonchera	-	-	-	-	-	-	-	-	-	-	-	-
17.	Gandachhera	1	-	-	1	-	-	-	-	-	-	-	4
18.	Jiyalchhera	-	-	1	1	2	-	-	-	-	-	2	-
19.	Trishna	-	-	2	2	2	2	-	-	1	-	5	7
	TOTAL	**16**	**15**	**08**	39	**14**	**09**	**-**	**-**	**02**	**-**	**25**	**53**

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

* = These were last seen in summer 2001. These could not be located during November-December 2002 survey

with original primary forests. However, gibbon presence was noted only in two such dense forest areas. The areas where gibbons were located are either present as closely located from each other separate forest patches. Nearly all the isolated patches of primary forests having past distribution of gibbons in these areas were surveyed at least once in most of the cases during the current study. The hoolock gibbon has been found to occur from 200 ft above MSL up to an altitude of approximately 3200 ft. The absence of gibbons higher up is likely to be a result of traditional hunting practice and shifting agriculture. Differences between different forest formations in terms of structure and physiognomy, floristic composition etc. are other factors affecting gibbon distribution in the area.

Table 3: Locations of the Gibbon Groups in the different Survey areas of Tripura

Sl. No.	Location	Outside				RF	Protected Area		Total
		PF	SCH	VIL	PF+ RF		NP	WLS	
1.	Phuldansai	-	-	-	-	3	-	-	03
2.	Betlingship		-	-	5	-	-	-	05
3	Sabul	3	-	-	-	-	-	-	03
4.	Conzai	1	-	-	-	-	-	-	01
5.	Vangmung	4	-	-	-	11	-	-	15
6.	Manu (N Tilla)	-	-	-	1	-	-	-	01
7.	Kanchanchera	-	-	-	-	1	-	-	01
8.	Laxmanpara	-	-	-	1	-	-	-	01
9.	Chamanu	-	-	-	-	1	-	-	01
10.	Dewachera	-	-	-	1	-	-	-	01
11.	Thalchera	-	-	-	1	-	-	-	01
12.	Ambasa	-	-	-	-	1	-	-	01
13.	Harinchera	-	-	-	-	1	-	-	01
14.	Ganganagar	-	-	-	-	1	-	-	01
15.	Khowaichera	-	-	-	-	1	-	-	01
16.	Noonchera	-	-	-	-	1	-	-	01
17.	Gandachhera	-	-	-	-	1	-	-	01
18.	Jiyalchhera	-	-	-	-	1	-	-	01
19.	Trishna	-	-	-	-	-	-	1	02
	TOTAL	**08**	**-**	**-**	**09**	**23**	**-**	**01**	**41**

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

3.1 Population

Surveyed patch size varied between 3 km² to 9 km² with mean(SE) patch size of 4.45 (±0.58) km². It is difficult to count all the individuals of hoolock gibbon population and come up with exact population size. As the area was highly heterogeneous, extrapolating information for predicting population numbers could lead to either under or over estimation and could be misleading. The estimation of the population numbers of the hoolock gibbon is preceded by the determination of the forest area inhabited by the species and by the estimation of its population density.

Potential habitat for viable gibbon populations

During the terminal workshop conducted in Agartala, Tripura (8-9 September 2005), many forest officers of Tripura forest department shared their experience of knowledge on potential gibbon sites within jurisdiction of their respective forest divisions **(Table 4).**

4. Discussion

The survey conducted in this project has revealed some very vital information on the distribution of gibbons in the state. Contrary to earlier belief that the gibbons are only distributed inside the PA, this survey has established that gibbon populations are more distributed outside the PA jurisdiction than inside. This has also clearly established that the PA coverage in the state is far short than what is needed to provide proper protection cover to this highly endangered species. Some of the key areas inhabited by gibbons especially in north and Dhalai districts are under tremendous biotic pressure and need immediate attention to save this species. There is no base line information for gibbons based on surveys conducted in the past. The degradation of the habitat follows severe jhuming pressure mainly in the interior areas where the dense forest patches still exist. It can be concluded that for people sustenance and by poachers engaged in local commercial trade to meet the requirements of local people and superstition are major factors

Table 4: Potential sites for gibbons in Tripura *(Terminal Workshop, Agartala, 8-9 September 2005)*

District	Forest Division	Potential areas (number of individuals)
North	Kailashahr	Churaibari (19-20 migratory), Unakoti
	Kanchanpur	Ujan Machmara RF, Laljuri, North Laljuri, Bangshul, Machmara
Dhalai	Ambassa	Gabdachhera, Dhalajhari (10), Taruchhera (15), Teturja, Chakmapur (10), Saikarbari, Kaitharaicherra, Northern Baramura Hills
West	Teliamura	Kakrachhera, Noonachhera, Foot Hills of Atharamura Hill Range, eastern side of Salema
West & South	Gumti	Amarpur, Deotamura
South	Bagafa	Betaga, Ludhua

responsible for fast disappearance of this species from its usual distribution range.

4.1 Threats

The species is threatened by habitat loss and by hunting for food (Ahsan 1995b, Choudhury 1990, 1991, 1996a, Mukherjee *et al.* 1992). Jhum cultivation is the main factor leading to the destruction and fragmentation of gibbon habitat. Conversion of tropical forest to teak plantations, betel-leaf {*Piper betel)* plantation, and encroachment of forestland for settlement (Choudhury 1996a, Mukherjee *el al.* 1992) are the few other cause of habitat destruction of gibbon. In Bangladesh, North East India and South West China, much of their habitat is extremely fragmented (Alfred and Sati 1990, Choudhury 1996b, Lan 1994). This makes gibbon particularly vulnerable to hunting and predation. Most populations are very small and declining (Choudhury 1996b, Mukherjee *et al.* 1992), and many local populations will probably go extinct in the near future (Alfred and Sati 1990). Simlar trend is noticed in the present survey too where at least three adult male groups were recorded as solitary individuals without any connectivity with other patches of forest and thus without the facilities of inter-mixing with other gibbon groups. The solitary individuals present as meta-populations in the Central Cathment Areas in North Tripura district are to be immediately looked at for their translocation to a safer and viable habitat. Many isolated individuals have been recorded by the forests staff in and around jhoom fields in South and Dhalai districts (personal communication with staff during workshop at Agartala, 8-9 September 2005). These isolated populations suffer from food and nutritional stress, besides being susceptible to disease, new and unnatural predators. Absence of suitable mate leads to low reproductive success, almost a dead end to contributing to the formation of new generation.

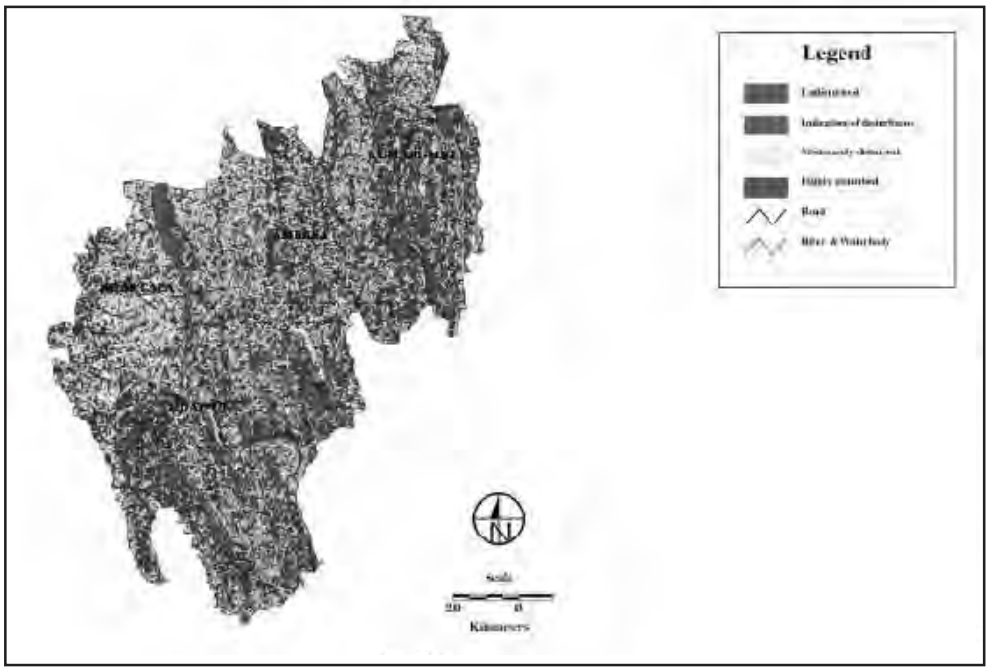
Isolated individual gibbons are reported from Betaga Reserved Forest, Ludhua Reserved Forest, Joychandpur Reserved Forest, and Rishyamukh Reserved Forests in South Tripura district and under Bagafa territorial forest division (Shri Angshuman Dey, DFO, Bagafa, Personal communication).

In one of the instances, it is reported that the gibbon group consisting of 5 individuals often visit the urban areas in Unakoti from their original dense primary forest habitat in Choraibari (North Tripura district) due to food stress in their habitat. This exposes the group to unnatural dangers. One case of electrocuting of adult male gibbon was seen in Dharamnagar town (Shri Nirodh Debnath, ACF, Personal communication).

4.2 Conservation Need

Hoolock gibbon is an endangered primate as per the Schedule-1 of Wildlife Protection Act (1972) and falls under IUCN Category of Endangered species (Hilton 2000). Recently, it has been noted that increasing biotic influences, including socio-economic development and unrestrained commercial exploitation of forest wealth have threatened the survival of this primarily forest dwelling species. The alarming changes that have taken place in recent years, in the ecology and landscape, have brought about a number of changes in the distribution and population structure of hoolock gibbon. Tripura has witnessed heavy depletion mainly due to the large-scale

Fig. 10: Disturbance Index of Tripura *(Source : IIRS, 2002)*

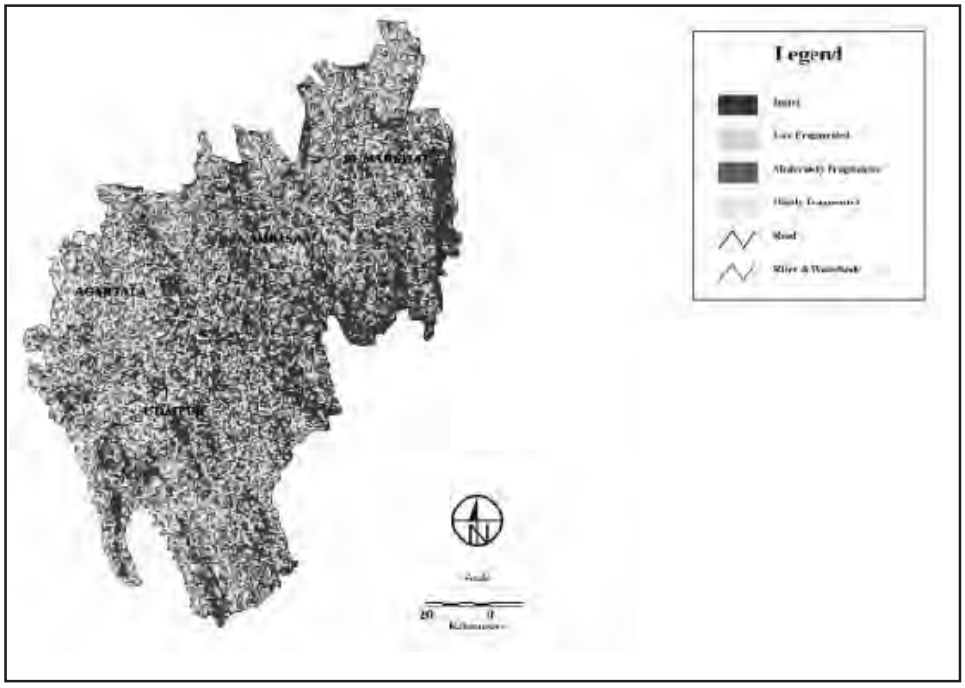


practice of shifting agriculture and forest fragmentation.

Both direct and indirect conservation threats are hovering over this highly endangered species. Among the direct threats, the most severe is the decimation of the effective gibbon habitat across the state due to encroachments for shifting cultivation and other development activities and degradation of habitat quality due to selective removal of key plant species which are vital for the survival of the species **(Fig. 10 and 11)**. The case in point is the selective removal of *Ficus* species trees from the Trishna WLS by local people for their value as firewood for brick kilns. This has led to deprivation of the gibbons present in the given habitat leading to their local extinction. Presence of liana species in the habitat is considered as one very important habitat element for gibbons (Shri Chaitanya Murti, DFO, Sadar Forest Division, Tripura, Personal communication).

Similar trend is noticed elsewhere also though exact documentation of the same has not been done systematically. Although, hunting has reduced to a considerable extent in the state following effective protection measures by the forest department, yet, sporadic incidences can not be ruled out. Given the low fecundity rate and high maturity time in case of gibbons, poaching of even a small number of individuals could lead to severe damage to their population status. There are incidences where the gibbons are caught and kept as pet or given for captive management. This unscientific capture without any considerations to the maintenance of the sex ratio is also one of the reasons for lopsided sex-ration of this species in the state. Absence of proportionate number of juveniles and infants in the groups recorded in this study is a cause grave of concern. This poor representation of young ones in the group speaks of low recruitment, which could be the collective effect of various factors leading to still lower fecundity rate. This needs to be

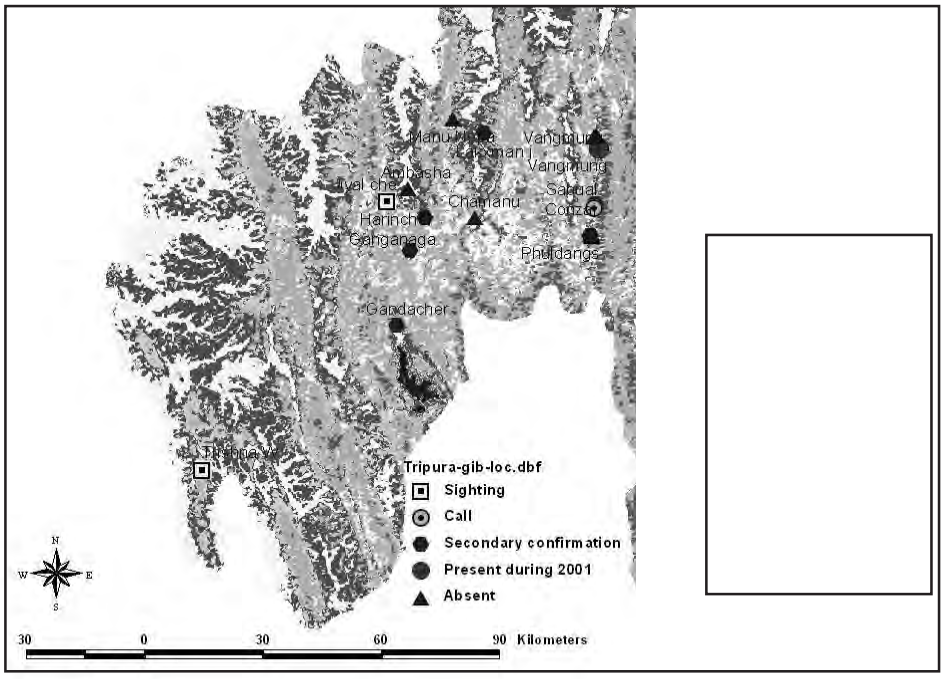
Fig. 11 : Fragmentation of gibbon Habitat in Tripura *(Source :IRS, 2002)*



addressed and for which a proper assessment of all the reasons leading to this scenario has to be charted out.

Role of ex-situ conservation needs to be closely analyzed to supplement the thin populations of gibbon in the wild. There is no such attempt

Fig. 12 : Distribution of gibbons in Tripura



made anywhere in the country so far for gibbons, though, ex-situ conservation is being attempted for few other endangered primate species elsewhere. The results of such studies and experimentations can be assessed with reference to gibbons for implementation at the experimental level first before extending the same at a larger scale.

Conservation education has a very important role to play in making people aware of the importance of the conservation of this species. It has to be very clearly understood by the managers, policy makers and local people that this speices, being a specialist in its ecology and behaviour, serves as appropriate indicator species for the health of evergreen forests throughout its distribution range. Similar to large carnivore species (e.g. tiger), gibbons also serve as flagship species and their presence in viable population can be equated with the rich biodiversity in that given area.

The fact that majority of gibbon groups were recorded from the forests outside the PA networks, calls for taking suitable measure to provide good protective coverage to all those areas. This can be effected either bringing those key areas within the ambit of the PA network or incorporating reserved forest areas with good gibbon populations inside the Wildlife Working Circle of the concerned territorial forest division. The new National Working Plan Code of Government of India provides for this mandatory working circle to be vetted by the Chief Wildlife Warden.

The areas of rich gibbon habitat in the private forests can be included in the Community Reserves as per the provisions of the amended Wildlife (Protection) Act, 1972. The concept of Community Reserves will fit very well in addressing the concerns of both gibbons and the local people in meeting their sustenance needs without adversely affecting each other's survival.

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