



Assessment of Conservation Values of Chunati Wildlife Sanctuary and Identification of Critical Conservation Areas for Inclusion in Nishorgo Support Project





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1. INTRODUCTION

Chunati Wildlife Sanctuary (WS), in the range of tropical evergreen forests of Bangladesh, is situated at about 70 km south of the Chittagong city in the west side of Chittagong – Cox's Bazar highway. The GPS locations for the sanctuary are 21°40' N and 92°07' E. The sanctuary embraces partly 7 Unions (namely, Chunuti, Adhunagar, Herbang, Puichari, Banskali, Borohatia, Toitong) of Banskali and Lohagara Upazila of Chittagong District and Chokoria Upazila of Cox's Bazar District (Fig. 1)

Chunati WS was formally established through a Gazette Notification in 1986 under the provision of Wildlife Preservation Act 1974. . As per the Gazette Notification the Chunati Wildlife Sanctuary covers an area of 7763.94 ha or 19177 acres. The sanctuary area is generally hilly with shallow to deep gullies and gentle to steep slopes. The average elevation is 30 to 90 m. There are numerous creeks, which are clear with gravely, and stony beds, which traverse the area.

Earlier, the sanctuary was under the jurisdiction of Chittagong (south) Forest Division, but in the recent past, it has been transferred to the newly created Wildlife and Nature Conservation Division of the Forest Department. Administratively, the sanctuary is divided into 2 Forest Ranges, Jaldi and Chunati, and 7 Forest Beats (namely, Chunati, Herbang, Aziznagar, Jaldi, Puichari, Chambol and Naporja). The Sanctuary covers 7 forest blocks.

It is one of the initially selected five pilot protected sites under Nishorgo Support Project (NSP). The overall objective of the project is to demonstrate the replicable case for conservation and management of biodiversity of protected areas of Bangladesh with participation of local community. Site-level appraisals for each of the pilot sites have recently been completed (Mollah et al. 2004). The results indicate some issues that pose potential threat to the successful implementation of the project in the site. The major concerns that have come out of the study are as follows:

- Deteriorating local law and order situation and consequently FD's loose control over the WS.

- Strong local opposition to WS
- Extremely degraded and fragmented habitat and highly declined wildlife
- Loss of almost all primary habitats
- Presence of large number of settlements within the WS
- Extensive agricultural activities including betel leaf farms by the local by the local people within the WS
- Highly exposed to public activities and interventions
- Six brick fields in the vicinity of the WS

The above issues have generated some questions whether it is feasible to successfully implement the project in the entire Chunati WS, and whether any parts of it have got any potential conservation values. A draft Action Plan was drafted earlier on the sanctuary under Forestry Sector Project and identified some core areas for conservation (TECSULT 2001). So, the NSP took initiative to critically review these areas as to whether these areas could be considered under NSP.

The present activity is thus designed to assess the conservation value of the Chunati WS as a whole or/and to identify the potential critical areas that could be brought under the project for management.

2. STUDY OBJECTIVES

The overall objective of the study is, therefore, to assess the conservation value of Chunati WS as a whole or in parts. Specific objectives are to:

- Assess the conservation value of the WS from biological, ecological and local socio-economic perspectives.
- Identify core areas, if any which have still got conservation importance and thus has got potential for bringing under the project
- Assess the feasibility for implementations of the project successfully and make specific and feasible recommendations/suggestions for biodiversity conservation for the identified areas.

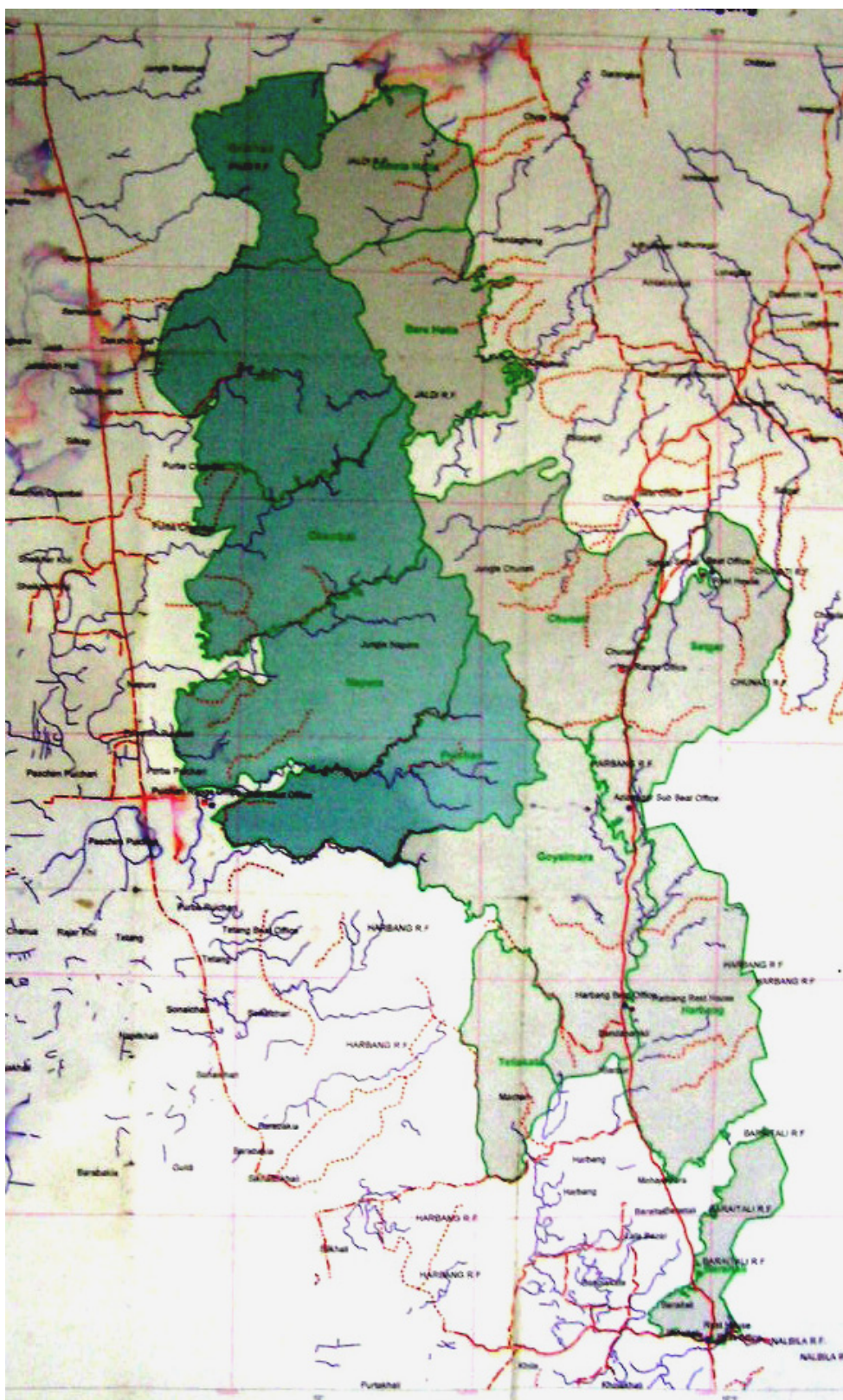


Fig. 1. Map of Chunati Wildlife Sanctuary

3. STATE OF KNOWLEDGE

3.1. Biological

The draft Action Plan by TECSULT and Site-Level Field Appraisal Report by NSP have documented necessary information on Chunati WS required for management planning and management implementation. The biodiversity of Chunati WS is reasonably well known, having been the long –term subject of botanical collections undertaken by Bangladesh Forest Research Institute, and various floral and faunal inventories. A qualitative inventory of flowering plants undertaken during 1988– 1990 has recently been published (Khan and Haq 2001). A survey reports 422 vascular taxa from the sanctuary. Rahman et al. (2000) reports an assessment of the diversity of tree species composition and their distribution in the WS undertaken during February 2000 to April 2001. Rahman and Hossain (2003) listed 36 fodder species from Chunati WS. The FSP draft Action Plan reported extensive areas of the WS covered with scrub forests and degenerating bamboo clumps with scattered trees.

A total of 178 species of wildlife species (amphibia: 6, reptiles: 8, birds:137 and mammals:27) were recorded in 1990 (Husain 1991; Feeroz 1991) while this number reduce to 53 species in 1997 (FRMP, 1997). So it seems fifty percent wildlife of this area is lost within seven years. In 1990, Chunati had the second largest gibbon population of the countries (Feeroz 1991; Feeroz and Islam 1992; Ahsan 1994). Ninety percent of this population disappeared from this area by 2003 (Islam *et al* 2004). No group was recorded during the present field study.

3.2. Socio-economic

The social issues of Chunati WS are very complex, and are compounded by relatively easy access to the WS through all the weathered roads bordering the area on both the east and west. Another major issue is the power structure that is mostly involved with land grabbing, Land encroachment leading to expansion of settlements and agriculture, illicit tree felling, collection of bamboo and fuel wood, harvesting of left over stumps of trees and brush wood for brick fields, grazing, expansion of betel leaf farms, and bamboo for the construction of betel leaf farms have caused heavily degradation of the forest cover. Poor management by the FD, adverse role of the local influential people, operation of brickfields and saw mills have also caused synergistic

effects on forest degradation. Also there is a long history of animosity between the FD staff and people who live in or harvest resources from the WS.

3.3. Management

There is no Management Plan for the WS. However, the Forestry Sector Project proposed a draft Management Plan for the WS but not yet approved. The primary target area FSP Management Plan for conservation management is approximately 8,000 ha of gazetted sanctuary and contiguous areas of vegetation cover (TECSULT 2001). For an effective management the FSP plan suggested an spatially based management zones to be developed (Appendix – 1). The Table in Appendix – 1 shows the expected management subdivisions. The indicative zoning scheme suggested 10 spatial zones assuming the retention of gazetted WS under protected area management, gazettelement of northward and southward extension totaling 5,162 ha, and management of private and FD lands adjacent to the sanctuary as External Buffer Zone, and other related zoning areas. This Plan targeted the area of approximately 8,000 ha of existing conservation area, 5000 ha of new conservation area, and 4000 ha of External Buffer Zone, totaling approximately 17,000 ha.

4. METODOLOGY

The differences between “Present Chunati WS” and “Chunati WS in 1990” are so vivid that no methodology is virtually needed to compare it and ascertain the present status of Chunati WS, specially for those who are working on Chunati since 1990 and before. Apart from paddy field and water stream, rest of the Chunati now have undergrowth composed of bushes, bamboo thickets and sun grass. This monotypic habitat supports a very few wildlife species. After spending three hours in the morning inside forest for transect walk, only 2 black drongo and four chesnutheaded bee eater were record. However, to satisfy general requirements and to compare with the previous study we choose the traditional line transect method to study present status of wildlife diversity of Chunati. This is the only method used by most of the previous studies (Feeroz 1991, 1999, 2001; Ahsan 1994, Hussain 1991).

Before starting wildlife census in a given area, one should determine what kind of information is required. Since wild animals of different classes are found in an area, one might want to make a

checklist of wildlife of that area. He might do it in a very crude (traditional) way by spending a certain length of time for foraging over considerable areas, recording all animals found in that period. So he is able to make a checklist of wild animals of that area. By this way it is not possible to get systematic quantitative data on different species. Since the methodology for systematic census of different wild species varied considerably, a successful census requires careful systematic planning. Technique should be readily standardized, facilitate repeatability, can be applied in most of the habitat conditions and hence, can be compared with one another. Thus results will be with a known level of accuracy and precision and margins of error that can be quantified. Discussion and brainstorming play an important roll in developing a good planning for census.

Line transect sampling can be defined as “in a sampling area, locate a point at random (or systematic random) and walk in a straight line (transect line) of known length (previously decided) from this point, and record target species (individuals or groups) seen on either side of this line”. A transect generally start from a known point, straightway in a direction through one or more vegetation type. Transect may be two types on the basis of the width viz. Fixed-width transect (width of the transect is fixed throughout the transect) and variable-width transect (width varied with the sighting of animals). It is statistically sound and repeatable method. Line transect sampling has been repeatedly tested in the field during the last few decades for a wide variety of species and its theoretical and practical application have undergone substantial improvement.

In the present study, five transects were used; each transect was 1 km long. The GPS locations of some areas visited during the field trips are given in Table 1. Walks were carried out on foot, from 0700h to 1700h with a break of one hour at the mid-day, at a speed of 1km/h or less, depending on the weather condition and habitat type, with stops of one minute to look around for animals. Normally any wildlife species found within the visual distance on either side of the trail were recorded. In some cases, only the movement of the animals was noticed from the trail, because of poor visibility, the group was traced and recorded its size and composition. Whenever any group was noticed, individual age-sex classes of the group were recorded. The status of any species was estimated on the basis of the frequency of sighting during the survey. When any species was sighted more than 75% time in all survey, it was recorded as very common species. The species was also recorded as common (when it was sighted 50-75% time),

few (25-49%) and rare (less than 25%). The habitat type of each transect was recorded separately as (1) forest (evergreen/semi-evergreen, deciduous), (2) bushes (bamboo) and (3) open land (paddy field, valley or roadside).

Table 1. GPS locations of some areas visited during the field trips in Chunati WS

Place	GPS reading
Chunati Beat	21°57.49' N, 92°03.42' E
Ban Pakur	21°57.10' N, 92°04.04' E 21°57.10' N, 92°03.50' E 21°57.01' N, 92°03.46' E 21°56.59' N, 92°03.41' E 21°56.53' N, 92°02.45' E 21°56.02' N, 92°02.45' E
Sufi Nagar	21°57.43' N, 92°03.20' E
Aziz Nagar Beat Office	21°54.43' N, 92°03.20' E 21°54.21' N, 92°03.17' E 21°53.31' N, 92°03.20' E
Harbang Beat Office	21°52.08' N, 92°03.32' E 21°52.46' N, 92°03.06' E 21°53.02' N, 92°02.54' E 21°52.56' N, 92°03.31' E
Jaldi Range Office	21°54.42' N, 91°58.59' E
Chambol Beat Office	21°57.37' N, 91°58.26' E

Major floristic elements of the vegetation were recorded while walking along the transects and their abundance were recorded through visual observations. Decline in floristic composition was noted comparing with the previous literatures and from the team members' experiences for about the area for over last two decades.

Information from the local people, especially from the forest officer, was also collected about the rare and nocturnal wildlife species. Pre-design questionnaires were used for interviewing local people. A pair of binoculars, a digital camera, notes books, data sheet, GPS, distance measuring tape / hip chain, clinometers and a forester tape were used during the survey.

Two M.Sc. students, namely Mr. Masudur Rahman and Mr. Rasheduzzaman, from the Institute of Forestry and Environmental Sciences, University of Chittagong, also accompanied the team

during the field visits. The students performed transect walk along with the consultant team. They helped the team in setting the transect, making observation on biodiversity, taking GPS coordinates and notes on observed flora and fauna.



Chunati WS in 1990 (from Feeroz 1991)



Same area of Chunati in the present day

5. CONSERVATION VALUE OF THE CHUNATI WILDLIFE SANCTUARY

The draft Site- level Field Appraisal Report has given a present situation of the WS. The report states that the forest cover of the WS is seriously degraded and most parts of it are now denuded. Rahman *et al.*(2000) reported 1678 individual of trees having dbh >5 cm of 86 tree species from 20 m X 20 m 50 sample plots. They randomly sampled the whole WS area and the study included the plantations also. In fact there is hardly any natural patch within the WS area. The FSP Management Plan mentioned about the existence of some natural vegetation cover and scattered trees as to be brought under Ecosystem Management Zone. After five years during the present visit to the area the consultants could hardly find any natural patch. The scattered trees are also very scattered (Fig.3). Goda (*Vitex sp*), Bon-chalta (*Dillenia sp.*), Menda (*Litsea sp.*), Chapalish (*Artocarpus chama*), Amloki (*Phyllanthus emblica*), Bohera (*Terminalia bellirica*), Dumur (*Ficus hispida*), Gotguttia (*Bursera serrata*), Bazna (*Zanthoxylum rhetsa*) are some of the common scattered trees. There are also some scattered trees of Garjan (*Dipterocarpus turbinatus*) and along the barren steeps there are clumps of Ful jharu - *Thysanolaena maxima*. Sungrass – *Imperata cylindrica* is an invader of dry hills. Wild banana clumps are found to grow along the moist-shady steep slopes along the streams. Other than some plantations of teak, mixed fodder trees in Goyalmara block, degraded bamboo brakes cover most of the areas under Chunati beat. *Kali bans* (*Gigantochloa andamanica*) is the most common bamboo whereas *Muli* (*Melocanna baccifera*), *dolu* (*Schizostachyum dullooa*) and *mitinga* (*Bambusa burmanica*) also occurs sporadically. Towards the eastern and northern side mostly scrub forest covers the land. Few clumps of rattans (*Calamus viminalis* and *Daeomonorops jenkinsiana*) also occur sporadically.

Other than herb and shrub vegetation, natural regeneration found for trees are not encouraging. The saplings that are found to occur are mostly from the stumps or root suckers.

If the vegetation cover and flora are considered, conversation value is not significant. Other than degenerating bamboo clumps, sun grass, clumps of Ful jharu and tree saplings, no mentionable non-timber forest products are extracted from the WS area. Land encroachment for betel-leaf farming seems to be the major land use interest.

A short field visit is obviously not enough to enumerate status of wildlife of an area. But this area has been well studied by two consultants (Dr. Md. Mostafa Feeroz and Dr. M. Khairul Alam) for the last one and half decade. After several transect surveys in three days, both the species diversity and population density of wild animals were recorded to be very low. Only 2 species of amphibians, 2 species of reptiles, 11 species of birds and two species of mammals (indirect sitting by dung) are recorded during the present field study (Appendix III). It seems more than 95% of the wildlife in this area had disappeared during the last one and half decade. No natural forest is left in Chunati WS to support the wildlife of this area. It is now only a bushy jungle dominated by bamboo. Natural fruit yielding trees present are not sufficient to support any forest birds or frugivorous mammals.

Elephant is the only large mammals surviving in this area with a considerable population size. There is an elephant corridor 500m south of the Chunati range office running from east to west. The elephants regularly use this corridor and some herds use it to visit Bandarban through Satgar forest patch. Without this corridor elephants will be trapped in this area. This corridor crisscrosses the sanctuary and linked Chamble with Chunati through Napura.

The only interest or conservation value of the Protected Area lies with the conservation of elephants and its corridor in Chunati. Secondarily, this hill range supports four main streams and a number of streamlets within the WS. Restoration of the habitat through conservation activities will help in keeping the streams with perennial flow of water.

Habitat requirement for elephants is given in the following section.



Panaromic view of Chunati WS (proposed target area)

6. ELEPHANT HABITAT REQUIREMENTS

The first step in developing the elephant habitat suitability assessment was a review of relevant field studies and other literature (primarily Seidensticker (1984), Sukumar (1989), Dudley (1993), Salter and Alam (2003) and included references) to identify what environmental features are the best descriptors of habitats used by this species. This focused on: 1) the life requisites of food, cover and special habitat requirements such as space (minimum area) and juxtaposition of habitat components; and, 2) the effects of habitat change.

In summary, high quality elephant habitat is characterized by:

- close proximity of seasonal foraging areas, waterholes (for drinking and bathing) and mineral resources (salt licks);
- availability of a mosaic of habitat types, including forests, forest clearings, forest scrub, savanna, grasslands and alluvial floodplains;
- availability of preferred food plants (primarily grasses, but also fruits, bananas and succulents);
- low levels of habitat alienation and fragmentation (*e.g.*, as resulting from permanent agriculture; plantation forestry; clear-felling; over harvesting of plant resources for fodder, fuel and timber; competition from domestic livestock; human settlement; road construction);
- Contiguous areas of habitat sufficiently large to support a genetically viable population (probably several hundred km² over the short-term); and,
- retention of seasonal movement corridors.

With regard to habitat change, key considerations are:

- changing evergreen forest from climax to seral stages can result in an increase in browse and forage production and hence increased carrying capacity for elephants, but carrying capacity may subsequently decrease if secondary forest is further degraded to the scrub stage;
- selective logging in closed canopy forest can result in positive habitat changes, to the extent that light-demanding plants that also are elephant food species (*e.g.*, bamboos and other grasses) become established in disturbed areas;
- occasional ground fires in forested areas can increase forage availability, but regular fires may reduce carrying capacity by degrading tree cover and species composition;
- clear-felling for plantations causes adverse habitat changes, although elephants may also forage to some extent on plantation species such as teak,
- heavy removal of fuel-wood ultimately degrades natural vegetation cover, reduces standing biomass, and reduces food availability for elephants; and,
- elephants that lose parts of their home range to agricultural production, or that otherwise are confined to highly fragmented habitats, are likely to become crop raiders.

7. JUSTIFICATIONS AND SUITABILITY OF THE IDENTIFIED TARGET AREA AS A POTENTIAL ELEPHANT CONSERVATION SITE FOR INCLUSION IN NSP

In the light of the above discussion, the present habitat scenario, Chunati WS does not really represent a good habitat for elephants other than the:

- availability of a mosaic of habitat types, including forests, forest clearings, forest scrub, savanna, grasslands and alluvial floodplains;

- Availability of preferred food plants (primarily grasses, but including browse, fruits, bananas and succulents).

The savannah type of expanding bamboo brakes, presence of succulent wild banana clumps along the slopes of steep gullies, perennial streams as water source and still regenerating saplings of good number fodder plants support the delineation of some areas as Habitat Management Zone for elephant conservation. Recent studies by IUCN (2003) shows that a total of 143 plant species were found, out of which 17 species are elephant fodder species that represents only 12% of the total plant species (Appendix IV). The elephant fodder species are: bamboo, bamboo (*moli bash*), black berry, chapalish, jack fruit, mango, teak, coconut, banana, *chon*, fig, *fuljharu*, yams (*pahari alu*), *mete alu*, *chupri alu*), *jambura*, *dheua*. Among the 17 fodder species, bamboo and *chon* dominates the area. Further, there is scope for improving the habitat in support of the elephant conservation.

Chunati WS is The MIKE site of the country and still support an elephant population of about 20 individuals. Elephant is considered to be a flagship and conspicuous specie in the country. Further, Bangladesh Government has tremendous interest in conserving the elephants of the country. Considering the MIKE site and the presence of elephant population, Chunati WS still demands some attention for conservation. So, the only interest or conservation value of Chunati WS as the Protected Area lies with the conservation of elephants and its corridor.

8. ISSUES AND THREATS IN RELATION TO ESTABLISHMENT OF A TARGET AREA FOR CONSERVATION

i. Human-elephant conflict and local opposition to wildlife sanctuary: This is one of the major issues in Chunati. As mentioned in the preceding sections, agriculture, including paddy and betel leaf cultivation, has invaded deep into the forest, the elephant often damages the crops. It is one of the major causes for the local opposition to the WS. In addition, since considerable area of the WS has been grabbed, people are worried about losing their encroached land, in the apprehension that they would loose their land if sanctuary becomes functional.

ii. Fuel wood and bamboo collection and poor forest regeneration: As stated above, the proposed area is almost devoid of trees and mainly characterized by growth of shrubs, bamboo and grasses. Even these are also extensively harvested leading to further denudation. Saplings and coppice are also being collected which contributes to poor forest regeneration..

iii. Deteriorating local law and order situation and weak law enforcement for forest protection: The local law and order is so deteriorated that the local FD has little control over the WS and, particularly at the western side of the sanctuary, as a result the local FD staff fails to protect the forest. For implementation of any management plan for the sanctuary, establishing stringent control over forest is necessary.

iv. Poor sanctuary management by the Forest Department: So far the sanctuary had been managed by general FD staff and no designated WS management personnel were posted. Recently, that has happened, but WS management personnel lack the sanctuary management skills. Furthermore, there is no management plans to be implemented in the sanctuary except for the draft Action Plan developed under FSP for the Chunati WS.

v. Land grabbing and expansion of settlements: Many people claimed that they possess land even within the proposed target area and could be an issue of conflict while implementing the management plans for the conservation of elephants. Settlements have extended in to the sanctuary at many places and contributed most to degradation of the WS. There are some villages located adjacent to the proposed target area. The settlers impose adverse impact on the forest resources and its environment.

vi. Agricultural activities within the proposed target area: Paddy and betel leaf are cultivated extensively in and around the target area. Betel leaf cultivation involves clearing of land area, use of bamboo and saplings for providing shade and support, furthering the degradation of the forest.

vii. **Local poverty:** The local people are poor, particularly the villagers (legal and illegal) located inside the WS. They depend on the forest resources in many ways for supporting/supplementing livelihood.

vii. Lack of consultation of the local people and other stakeholders

viii. **Disturbances to elephant:** In order to avoid the damage caused by the elephants the local people sometimes, collectively, try to drive away the elephants from the vicinity of their crop fields.

9. SUGGESTIONS AND RECOMMENDATIONS

9.1. Establishment of a target area for the conservation of elephant

As stated above, the conservation value of Chunati WS lies largely with the conservation of elephant and its corridor. Considering the current situation, a target area is identified and it will be the focus area for all conservation activities. If the proposed target area is protected and the habitat is restored through enrichment planting with indigenous species then it is hoped that the target area could be developed into an elephant habitat. **We, therefore, recommend a part of the sanctuary , hence called the target area, instead of the entire WS, for inclusion as a PA site under NSP.** It is strongly suggested that further visit to the site should be made to delineate the target area boundary, and describe its physiographic.

The location, boundary, size and characteristics of the target area are given below:

The Target Area: On the basis of this field visit, previous studies and our experiences we are recommending the area around the elephant corridor and pathway from Chunati to Chamble through Napura as the Target Area for management of Chunati WS (Fig.3). Initially the elephant corridor and some of the areas of Chunati, Napura and Chamble can be considered for elephant protection. This corridor is very important for the elephants to forage in and around the sanctuary and also to visit Bandarban forest areas.

1. **Location/ Boundary:** The proposed target area is located in Jaldi and Chunati Ranges, covering parts of Chamble and Chunati Beats.
2. **Topography:** The target area is composed of hills, 50 – 100 m high in the north –south direction facing the area into two faces, western and eastern with narrow strip of valleys and streamlets. The hill slopes are gentle to steep. From the main range of hillocks several small ridges forming spurs between them have gradually sloped down into broken gullies. There are foot trails across the hills. A wide footway crosses the highest hill from east to the west. There are also some water bodies bounded by the hills. Separated by the valleys some hills are situated also in isolation. The widths of the valleys vary from 15 – 100 m.
3. **Vegetation:** Most of the target area is covered with scrub vegetation with scattered trees. The vegetation is very similar to the other areas described under Section– 5 of this report.
4. **Land use:** The land use system of the target area is heterogonous. Most of the hills are covered with scrubs and scattered trees. Broadly the land use of the target area can be categorized into following categories:
 - **Scrub vegetation:** Covered with phol jharu, sungrass, degenerating bamboo clumps and scattered trees. Saplings from the root suckers of Ficus hispida, goda, menda, bohera, amloki and gutgutiya are also common.
 - **Forest plantations:** There are some plantations of teak, akashmoni and other mixed plantations within the target area.
 - **Betel leaf farms:** There are some betel leaf farms in the gentle hill slopes within the target area.
 - **Crop fields:** All the valleys between the hills are arable and rain fed transplant Aman paddy are being cultivated.
 - **Water bodies:** Other than streams and streamlets there are some small artificial water bodies that are mainly used to irrigate the paddy fields.
 - **Foot trails and walk ways:** Foot trails and walkways along the contours of the hills and across the hills also cover the land use system of the target area.

9.2 Preparation and implementation of a Management/ Action Plan for the conservation of the target area

In the changing scenario, the draft Action Plan developed for Chunati WS under FSP needs to be reconsidered and modified to the specific requirement of target area and eventually implemented with participation of local people. The Action Plan, among others, should have the following provisions:

- A plan of action for habitat restoration and rehabilitation
- A plan of action for protection and sustainable use of forest biodiversity
- A plan of action for ensuring the participation of local people and other stakeholders in the process
- A plan of action for reducing the local poverty

A number of interventions need to be planned in accordance with the above provisions. The following are suggested to include:

Enhancement of forest regeneration

- i. Fuel wood and bamboo collection should be stopped, but may not be a success as long as there is scarcity of its supplies in the area. Therefore the project should establish a buffer sustainable resource use zone around the proposed target area with provision for fuelwood plot, woodlot and other plantations required for house building purposes. This will help in the forest regeneration.
- ii. Resource substitution for fuel wood and house building materials should be promoted
- iii. Agricultural activities, including paddy and betel leaf cultivation within the target area should be stopped. An alternate source of income generation to the local people, and rehabilitating them to some other areas would be useful.

iii. **Enhancement plantation:** Provision for habitat restoration through forest regeneration for a degraded forest like Chunati may not be adequate. Extensive plantation program with multi-species fruit bearing indigenous tree like kathal etc. should be considered.

iv. **Alternative Income Generation program:** Poor resource users should be identified around the proposed target area and brought under AIG program within provision that they give up the unsustainable use of forest resources. Skill development training may also be provided to them.

v. **Human-elephant conflict** should be resolved / minimized. Erection of electric fencing at strategic places could be useful. This technique has brought success in many parts of the world. Paddy cultivation within and around the target area should be discouraged/stopped in order to avoid the conflict.

vi. Massive **awareness program** should be conducted in the area on priority basis in favor of the elephant and biodiversity conservation. The activity may include, posting of billboard, holding of community meetings, organizing folklore and folk drama, nature walk and nature camp etc.

Local level negotiation

vii. Approach should be taken to bring the local elite and public representatives on board with concept of forest protection.

viii. The project should initiate a dialogue with brickfield owners to comply with forest laws. In unsuccessful cases, tougher actions should be taken against them with strong support from FD's higher authority.

viii. Steps should be taken to recover FD's lost land and to this end some pragmatic and feasible trade off policy should be taken.

9.3 Other Issues

1. A strong dialogue should be made at higher level with other law enforcement authority to ensure the effective involvement of law enforcement agencies at local level.

2. There is an urgent need to strengthening the local FD at the sanctuary with adequate and skilled manpower and to capacitate them in dealing with co-management of Protected Area. Logistical support, like vehicle and modern arms and ammunitions should be provided. A strong administrative support from the higher authority needs to be ensured. A mechanism for providing incentives to local managers should be made to make their job lucrative. Staff posted in PA should be transferred only between PAs. Step should be taken to make them dedicated to the cause of biodiversity conservation.
3. The Management Plan should incorporate a strong element for **monitoring** the elephants and other biodiversity of the forest.
4. The management plan should have provision for **conducting scientific studies**, like elephant census, identification of foraging area and pattern of elephant, human-elephant conflict, determination of elephant corridor
5. Local people from different stakeholders must be involved in any conservation activities in this target area. Recommendation cited in TECSULT (2001) and Site-Level Field Appraisal Report by Mollh *et al.* (2004) should be considered in developing the Management/ Action Plan for the co-management the target area.
6. Once the Management Plan is developed it needs to be implemented. Implementation requires the **institutional development**. IRG Report on Institutional Development for Protected Areas under NSP should be the guideline in implementation of the Management Plan. Once the implementation starts working then the Management Plan can be further revised and elaborated with further zoning, in view of the conservation needs and needs of the local people.
7. **Time frame:** Initially the Management Plan can be taken for implementation for a period of **five years**. Based on the experiences, the working Management Plan should be revised

for further management activities. But this should also be developed in a participatory manner.

10. CHALLENGES FOR THE PROJECT

1. Establishing FD control over the forest vis-à-vis on the target area.
2. Reduction / minimization of human-elephant conflict
3. Building good relationship and trust with local people and other stakeholders, including government entities at the local level
4. Reduction of local poverty
5. Addressing the local opposition to the WS
6. Stopping collection of fuel wood and bamboo
7. Bringing visible achievement within stipulated time frame

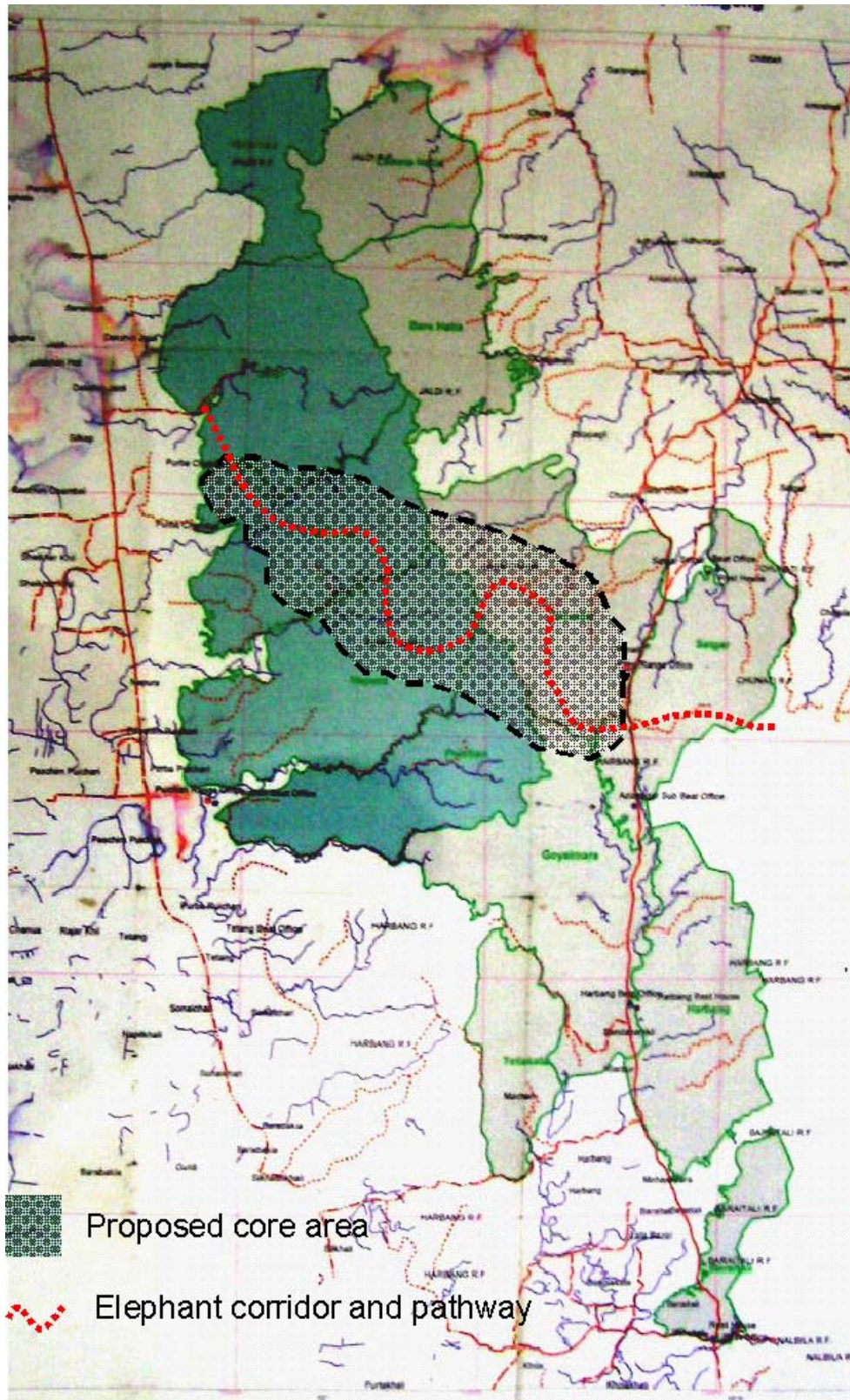


Fig. 3. Map of Chunati WS showing elephant corridor, path way and proposed target area
(areas shown are indicative and not exactly to scale).

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Appendix 1. Indicative management zoning for Chunati Wildlife Sanctuary (after TECSULT 2001)

Zone	Main Management Objective	Indicative Area
Ecosystem Management Zone	-long-term rehabilitation and protection of remaining natural vegetation cover (all existing scattered trees and brush); restoration of habitat for key wildlife species (elephant, serow, capped langur); protection from extractive use.	-all of currently gazetted Sanctuary area except existing plantations, recoverable agricultural lands adjacent to existing plantations, and agricultural lands under private ownership. Total area ~5,500ha.
Habitat Management Zone	-restoration and or manipulation of habitat for key wildlife species (elephant, serow, capped langur); compatible sustainable use of forest resources.	-proposed northward and southward extensions. Total areas ~5, 000ha.
Sustainable Use Zone	-participatory management and sustainable use of plantations maintenance of habitat structure that facilitates elephant movement to other natural habitat areas (east side of Sanctuary only)	-all existing FD plantations within the Sanctuary and extension areas, and recoverable (encroached) agricultural lands adjacent to existing plantations. Total areas~ 2,000 ha.
Village Use Zone	-intensification of wood production, limited and strictly controlled sustainable use of forest resources within narrow strips along zone edges.	-private agricultural lands within the Sanctuary boundaries Location and area to be determined during further management planning Total area probably ~ 500 ha
Special Visitor Use Zone	-visitors management (e.g. access control, fencing, footpaths, signs, litter collection) around areas such as viewpoints and other specific natural features that may be particularly attractive to visitors, and where special management measures are required to maintain safety and or to prevent damage to the resource.	-location and area to be determined during further management planning.
Intensive Use Zone	-site management around administrative buildings and built visitor facilities.	-Chunati, Jaldi and Barabakia Range Offices. Total area<10 ha
Transportation Corridor	-right-of-way management of major roads, power transmission lines, other linear facilities.	-location and area to be determined during further management planning
External Buffer Zone	-sustainable use of forest resources compatible with elephant habitat conservation.	-FD lands north, and east of the Sanctuary and proposed extensions. Total area ~4,000 ha

Elephant Movement Corridors	-intensification of wood production; management of land use to maintain elephant seasonal movement corridors.	RF, USF and private lands between extended Sanctuary and FD lands/elephant habitat to the east and south. Area to be determined during further management planning Total area probably ~ 3,000 ha.
Assisted Production Areas	-intensification of wood production; management of land use to discourage utilization by elephants	-private lands west and east of Sanctuary. Activities to be scattered within a total area of ~ 2,000 ha

Appendix II. Photos of present Chunati Wildlife Sanctuary



A partial view of the proposed target area



Paddy cultivation within the target area



A partial view of the proposed target area (dominated by bamboo)



Proposed target area-showing betel vine yard



Target area –showing plantations



A trail through paddy field within the target area



A partial view of the proposed target area



Collection of fuelwood from the proposed target area

Appendix III. List of wildlife recorded during present study

Class: Amphibia

Order	Family	Scientific Name	English Name	Local Name
Anura	Bufonidae	<i>Bufo melanostictus</i> Schneider, 1799	Common Toad/ Common Asian Toad	Kuno Bang
	Ranidae	<i>Euphlyctis cyanophlyctis</i> (Schneider, 1799) [<i>Rana cyanophlyctis</i> Schneider, 1799]	Skipper Frog/ Indian Skipper Frog	Kotkoti Bang

Class: Reptilia

Order	Family	Scientific Name	English Name	Local Name
Lacertilia [Squamata]	Gekkonidae	<i>Gekko gekko</i> (Linnaeus, 1758)	Wall Lizard/Tucktoo/ Gecko	Tokkhak/Shanda
	Scincidae	<i>Mabuya carinata</i> (Schneider, 1801)	Common Skink	Anjoni/Anjon

Class: Aves

Order	Family	Scientific Name	English Name	Local Name
Piciformes	Picidae	<i>Dinopium benghalense</i> (Linnaeus, 1758)	Black-rumped Flameback [Lasser Goldenbacked Woodpecker]	Kaththokra
	Megalaimidae [Capitonidae]	<i>Megaliama haemacephala</i> (P.L.S. Muller)	Coppersmith Barbet [Coppersmith/ Crimsonbreasted Barbet]	Chhoto Basanta Bauri
	Meropidae	<i>Merops leschenaulti</i> (Vieillot, 1817)	Chestnut-headed Bee-eater	--
		<i>Merops orientalis</i> (Latham, 1801)	Green Bee-eater	Suichora/ Banspati
	Centropodidae [Cuculidae]	<i>Centropus sinensis</i> (Stephens, 1815)	Greater Coucal [Crow-pheasant/ Coucal]	Kanakua/ Coucal
Apodiformes	Apodidae	<i>Apus affinis</i> (J.E. Gray, 1830)	House Swift	Ababil
Columbiformes	Columbidae	<i>Streptopelia chinensis</i>	Spotted Dove	Tila Ghughu

		(Scopoli)		
Passeriformes	[Dicruridae]	<i>Dicrurus macrocercus</i> [<i>Dicrurus adsimilis</i> (Bechstein)]	Black Drongo	Fingey
	Sturnidae	<i>Acridotheres fuscus</i> (Wagler, 1827)	Jungle Myna	Jhuti Shalik
		<i>Acridotheres tristis</i> (Linnaeus, 1766)	Common Myna	Bhat Shalik
		<i>Sturnus contra</i> (Linnaeus, 1758)	Asian Pied Starling [Pied Myna]	Gobrey Shalik/ Gu Shalik

Appendix IV. List of elephant fodder species found in Chunati WS (After IUCN 2003).

English Name	Local Name	Scientific Name	Portions taken by elephant as food
Bamboo	Bash	<i>Bambusa sp.</i>	Node, leaf, newly branch, matured branch, if immature, then the entire bamboo
Bamboo	Moli bash	<i>Melocanna baccifera</i>	Node, leaf, newly branch, matured branch, if immature, then the entire bamboo
Black berry	Jam	<i>Syzygium sp.</i>	Bark
-	Chapalish	<i>Artocarpus chaplasha</i>	Fruit
Jack fruit	Kathal	<i>Artocarpus heterophyllus</i>	Fruit
Mango	Am	<i>Mangifera indica</i>	Fruit (if accessible)
Teak	Segun	<i>Tectona grandis</i>	Bark
Coconut	Narikel	<i>Cocos nucifera</i>	Leaf
Banana	Kola	<i>Musa sp.</i>	Whole plant, leaf, fruit, but not the root
-	Chon	<i>Imperata cylindrica</i>	Whole plant
Fig	Dumur	<i>Ficus sp.</i>	Fruit
-	Fuljharu	<i>Thysanolaena mascima</i>	Whole plant
:Yam	Pahari alu	<i>Dioscorea alata</i>	Occasionally (if accessible)
Yam	Met alu	<i>Dioscorea sp.</i>	Fruit, leaf, but Occasionally (if accessible)
-	Jambura	<i>Citrus grandis</i>	Fruit
-	Dheua	<i>Artocarpus lakoocha</i>	Fruit
Yam	Chupri alu	<i>Dioscorea sp.</i>	Fruit, leaf