SIMPLIFIED MANAGEMENT GUIDELINES : CHUNOTI WILDLIFE SANCTUARY

Task no.:
USAID Contract no.: 388-C-00-03-00050-00

SIMPLIFIED MANAGEMENT GUIDELINES : CHUNOTI WILDLIFE SANCTUARY

Forest Department
Dhaka, September 2006

USAID FROM THE AMERICAN PEOPLE
With Partners : CODEC, NACOM & RDRS
IRG

The simplified management guidelines have been prepared based on the five year management plan developed for Chunoti Wildlife Sanctuary (WS) being managed under the Nishorgo Program of Forest Department (FD). Main aim of Nishorgo Program is to protect and conserve the forests and biodiversity of protected areas (PAs) by building gainful partnerships between FD and key stakeholders based on shared roles and responsibilities for biodiversity conservation and sustainable use. An effective implementation of the Nishorgo Program in the Sanctuary will help conserve biodiversity through facility development, capacity building, and gainful partnerships with relevant stakeholders. In addition to development pressures on forest land, the subsistence dependence of local communities on neighboring forests has been an important aspect of Chunoti forests. As a result, the biodiversity conservation priorities in Chunoti cannot be set in isolation from local forest resource use and development. The Plan has, therefore, adopted a landscape approach comprising:

i) protection and conservation of all remaining ecosystems including natural forests and constituent biodiversity in the Sanctuary,
ii) rehabilitation of degraded forest ecosystem and elephant movement corridors,
iii) identification and restoration of interface landscape and development to reduce ongoing habitat damage by helping them achieve sustainable livelihoods through alternative income generation activities, and
iv) iv) provision of support to better administration and management of the Sanctuary including capacity development, infrastructure, training, and wider extension and communication.

The Plan provides for an overall five year framework for developing and managing the Chunoti WS. Planned management interventions under Nishorgo Support (NSP) are included in the Plan along with other relevant activities necessary for developing the Sanctuary by FD. Main focus of forest management under this Plan is on the protection and conservation of forests, forest land and constituent biodiversity, sustainable use of specified areas where this can help to achieve conservation on a broader scale, and involvement of local people and other key stakeholders in the Sanctuary management, and livelihood opportunities linked with biodiversity conservation in identified landscapes surrounding the Sanctuary.

I. Assessing the Present Situation

Chunoti Wildlife Sanctuary located in the south-eastern region (comprising RF area of 7,763.94 ha, covering 7 forest blocks in Chunoti and Jaldi Forest Ranges) was gazetted in 1986. The Sanctuary falling within Banskhali and Lohagara Upzilas of Chittagong District and Chakoria Upzila of Cox's Bazar District covers 7 union councils (Chunoti, Adhunagar, Herbang, Puichari, Banskhali, Borohatia and Toitong). The Sanctuary is accessible from Chittagong City via the national highway to Cox's Bazar (the Sanctuary lies almost halfway in between Chittagong and Cox's Bazar – nearly 70 km south of Chittagong), which borders the eastern boundary over a distance of nearly 15 km; another metalled road leading south from Chittagong runs parallel to the western boundary (at an average of 3-5 km away).

Chunoti forests, originally supporting mixed tropical evergreen and semi-evergreen forests, have over the period become substantially degraded due to heavy biotic interference. As a result, the habitat has severely fragmented, adversely affecting the wildlife by restricting their movements through a barrier effect. There is hardly any natural forests left presently; the Sanctuary has few scattered patches of garjan trees that were planted earlier by converting high forests. However, at places natural re-growth of grasses and bamboo has come up due to favorable climatic and edaphic conditions, thereby enhancing the Sanctuary's *in-situ* conservation values, especially as elephant movement corridors. Few scattered large trees are mixed with evergreen bamboos (*Melocanna baccifera*, *Schizostachyum dullooa*, *Bambusa burmanica* and *Gigantochloa andamanica*) and grasses. Main tree species include Goda (*Vitex sp*), Bon-chalta (*Dillenia sp*), Menda (*Litsea sp*), Chapalish (*Artocarpus chama*), Amloki (*Phyllanthus emblica*),

Bohera (*Terminalia bellirica*), Dumur (*Ficus hispida*), Gotguttya (*Bursera serrata*), Bazna (*Zanthoxylum rhetsa*), etc. The clumps of Fuljharu (*Thysanolaena maxima*) are found along the barren steep slopes. Few cane (*Calamus viminalis* and *Daeomonorops jenkinsiana*) clumps occur sporadically and wild banana regenerate naturally along the moist banks of streams. Forest fires in summer have adversely affected the natural regeneration in the Sanctuary, often giving way to a process of regression to a drier scrubby or savannah type of forests. As a result sungrass (*Imperata cylindrical*) has invaded many dry hills.

Both forest-dwelling and wetland-associated animal species of different genera and families have been reported in the Sanctuary. A diversity of other faunal groups such as reptiles, vertebrates, hanumans, fishes and amphibians is present. Aquatic species including turtles and frogs are found in water bodies. The following faunal species diversity of wild animals was recoded in a recent (2004) transect survey conducted in the Sanctuary:

i) Amphibia (Common Toad and Skipper Frog),
ii) Reptillia (Lizard and Common Skink), and
iii) Aves (Black-rumped Flameback-Kaththokra; Coppersmith Barbet-Chhoto Basanta Bauri; Chestnut-headed Bee-eater; Green Bee-eater-Banspati; Greater Coucal-Kanakua; House Swift-Ababil; Spotted Dove-Tila Ghughu; Black Drongo-Fingey; Jungle Myna-Bhat Shalik; and Asian Pied Starling-Gu Shalik).

Thus only 2 species of reptiles, 2 species of mammals and 11 species of birds were recorded during the transect survey. In the absence of good forests many species of wildlife have disappeared in recent times. Only surviving wildlife with considerable population are thus elephants, who use Chunoti as movement corridor to visit the forests in Bandarban and Lama forest divisions, and CHT. Therefore, main biodiversity conservation value of the Sanctuary stems from the conservation of elephants and their movement corridors.

A number of sandy-bedded streams/*cheras* pass through the Sanctuary and so aquatic habitats associated with forest cover, and riparian (streamside) vegetation and animal species are important part of overall habitat composition. Four main streams and a number of small streams are supported by hill ranges of Chunoti and so the restoration of forest cover of these hills is important for the conservation of water bodies. A number of villages, paddy land, settlements and forest land fall within the zone of influence of Chunoti Wildlife Sanctuary. It is intimately surrounded by a number of villages, towns, and cultivated fields. The Sanctuary is bordered on the north by RFs of Chunoti Range, and in the south-east and south by the RFs of Chunoti and Barabakia Ranges. The plantations raised under different projects including Forestry Sector Project (FSP) exist in Chunoti Range, particularly near the Chittagong – Cox's Bazar Highway that crosses the eastern part of the Sanctuary. However, a number of paddy lands and settlements are found all around the Sanctuary due to encroachments of forest land. Most of the local population, who practice agriculture for their livelihood, depend on nearby forests for meeting their consumption needs for forest produce.

Keeping in view both the relevant human system and biophysical system a 5 km-wide landscape zone (Figure 1) along the boundary of the Sanctuary is taken as interface landscape zone for Chunoti Wildlife Sanctuary. There are 70 settlements (locally called *paras*) in 15 villages (included in 7 mouzas) in and around the Sanctuary, of which 42 *paras* of Chunoti Range have been studied for assessing stakes in the forests. Of the 42 identified villages/paras, 24 are located within the Sanctuary, 13 are located near the boundary whereas 5 are located within 5 km from the boundary. Nearly one-third of the total local population remains unemployed as a result of which biotic pressure on the forests is indeed high. Heavy dependence on forests and forest land resulted in an active opposition by local people to wildlife conservation efforts. Crop damages by elephants have exacerbated this animosity. Nearly three-fourth of the total *paras* were found having major stakes in the WS.

Betel leaf cultivation is widely practiced in and around the WS by local people, who depend on it for their livelihood. Most of the betel leaf cultivation is practiced on forest land encroached by local people for establishing a betel leaf vein. A large number of betel leaf veins have been established, particularly in Chunoti, Aziznagar and Harbang Beats. In view of its popularity, betel leaf cultivation is an important income generation activity of local people, who use a number of inputs (land, sapling vine, bamboo stakes, forest material for fences and roofs, irrigation, fertilizer, etc) in betel leaf cultivation. Family labour is used in growing, harvesting, processing, and marketing the betel leaves (locally in the Bazars of Aziznagar, Chunoti and Deputy). The processed betel leaves also are exported to Chittagong and Dhaka by middlemen, who transport the packaged leaves after purchasing from local markets.

Forest land inside the WS is encroached for agriculture, betel leaf cultivation, brickfields and settlements. Forest land is encroached permanently but also for a temporary period mainly for grazing, fishing and betel leaf cultivation. Some times the village elites are directly or indirectly associated with forest land grabbing for establishing homesteads and cultivation. Institutional encroachment of forest land is common for setting up school, madarasa, graveyard, mosque, nursery, etc. A shelter village (Guccha Gram) has been established for 100 households by the Government inside the WS.

II. Recommending Strategic Programs

Main objectives of the management plan are to:

- develop and implement a co-management approach that will ensure long-term conservation of the Sanctuary's biodiversity while permitting sustainable use in designated zones by local stakeholders
- conserve biodiversity by building and maintaining gainful partnerships with key stakeholders and sharing benefits with local poor communities
- refine and strengthen the policy, operational, infrastructural and institutional capacity framework
- conserve wildlife population including elephants and their habitats/corridors
- restore and maintain as far as possible the floral, faunal, physical attributes and productivity of the forest eco-systems and surrounding landscapes
- encourage eco-tourism and develop visitor facilities in suitable areas, and
- implement income generation activities (including private nursery and tree growing) for sustainable livelihood development for rural poverty alleviation in surrounding landscape

1. HABITAT PROTECTION PROGRAMS

Keeping in view the heavy biotic pressure in and around the Sanctuary, the main objectives of this program are to:

i) Provide adequate protection to the Sanctuary for the conservation of its constituent biodiversity;
ii) Update forest cover and interface landscape maps, ii) demarcating the Sanctuary boundary;
iii) Control illegal removals from the Sanctuary and surrounding landscape; and
iv) Check encroachment of the Sanctuary lands.

The following land-use mapping activities will be taken up:

- Mapping will be carried out during the Plan implementation and will include relevant details within a 5-km wide surrounding landscape zone outside of existing Sanctuary boundaries. Mapping will be extended to include the forest land portions of the landscape and beyond, and will particularly focus on identifying remnant patches of good vegetation and encroachments. Land-use and base maps will be prepared by acquiring latest satellite imageries.

- All the peripheral boundaries of the Sanctuary will be identified, surveyed and marked on the ground. Survey and demarcation of the peripheral boundary of the Sanctuary will be done during the first year of Plan implementation when encroachment areas also will be identified and hopefully evicted after obtaining the voluntary consent of encroachers.
- The boundaries of different management zones will be defined, mapped and also be identified on the ground. The advantage of natural features (i.e. rivers, streams/*cheras*, ridge, roads, etc.) will be taken wherever possible while carrying out demarcation.
- All the locations where primary access routes cross the Sanctuary's outer boundaries will be clearly marked with signs indicating the name and summary of key regulations in written text and symbols.

Effective protection against illicit felling, forest fires, poaching, forest grazing and forest land encroachment will be taken as described below:

- Recently formed co-management councils/committees will be responsible for community patrolling for which community patrol parties of local people will be formed at strategic places. They will also review annual work plans as prepared by implementing agencies.
- Illicit felling will be checked through extensive joint patrolling (FD staff and local stakeholders) inside the forests, particularly the core areas.
- The villagers from nearby *paras*/villages will particularly be helpful in forest protection efforts through patrol and intelligence sharing.
- An effective checking of organized smuggling of timber and poaching will require concerted efforts from FD by using modern equipments and transport facilities.
- Communication network particularly needs strengthening by installing a radio communication network and by mobilizing more walkies talkies, mobile telephones and vehicles.
- At least one four wheel jeep along with sufficient nos. of motor cycles will be provided for the use of the Sanctuary field staff; each Beat would have at least one motor cycle.
- Existing motorable roads will be maintained for easy movement of patrolling duties. But construction of new roads is not proposed as patrolling on foot will be more effective.
- Redeployment of FD field staff may be necessary depending upon the intensity of illicit felling in certain areas.
- A public awareness program will be mounted through TV, Radio, Video film, newspaper, magazines, brochures, etc. for generating awareness among local people for propagating the cause of wildlife and its habitat, and control of forest fires and illicit felling.
- Handy fire extinguishers and other fire fighting tools (e.g. fire beater, fire rake, fire shovel, brush hook) can also be kept at Beat/Camp HQs and other convenient places.
- A register of forest fire occurrences will be maintained for monitoring of fire incidences and assessing their adverse impacts.

2. MANAGEMENT PROGRAMS

Main objectives of the management programs are to:

i) maintain ecological succession in constituent forests by providing effective protection against biotic interference,
ii) develop and maintain natural forests as good habitat that favors biodiversity including wildlife,
iii) conserve the forest resources including the constituent biodiversity, and
iv) establish co-management practices through key stakeholders' consultations and active participation.

The long-term management aim of maintaining the maximum possible area under vegetation cover along with its constituent biodiversity in the best possible condition will be achieved by zoning the Sanctuary area and surrounding landscape such that:

i) The areas of conservation value (forests and/or plantations) are protected, regenerated and managed towards natural forest composition and structure, particularly in the core zone, and
ii) The areas used to provide benefits to local people through sustainable use of forests are defined, and high impact activity areas, mainly as interface landscape zone.

Landscape management zoning (Figure 2) is useful in implementing relevant management practices in different areas of the Sanctuary based on management objectives to be achieved spatially. The total notified area (7,764 ha) of Chunoti WS having conservation value is designated as the core zone, where management objective is to protect, rehabilitate/restore and maintain remaining vegetation in good stocking and encourage natural regeneration to gradually bring back natural forests through effective protection (as discussed under habitat protection programs). The proposed extension (5,162 ha) towards north and south of the Sanctuary (presently categorized under interface landscape zone) will also be managed as core zone after its gazettement.

Core Zone Management:
Forests management in core zone will focus mainly on:

- conserving the remaining vegetation and bringing back natural forests by providing effective protection and encouraging natural processes for regeneration and rehabilitation of degraded habitat.
- main factors responsible for habitat degradation will be identified by holding stakeholders' consultations.
- protection against the identified causal factors including illicit felling, forest fires and grazing, encroachment and poaching will be provided by involving key stakeholders.
- salvage of dead, dying and diseased trees will be done after leaving some dead trees suitable for bird nesting.
- wherever required, enrichment planting of indigenous species will be taken to supplement natural regeneration, particularly in those areas, where regenerative rootstock and mother trees have depleted.
- effective protection against biotic pressure (as discussed above) will be provided to allow natural processes of regeneration and rehabilitating degraded forests ecosystem.
- co-management practices will be implemented (by associating members of user groups, other key stakeholders, co-management councils/committees) in strengthening protection efforts against biotic pressure.
- *in lieu* of reduced removals by the local communities from the core zone, they will be provided alternative means from interface landscape zone and other alternative income generation activities to be implemented for sustainable livelihoods.
- protection efforts will be facilitated through communication/outreach activities, public awareness, stakeholders' access to interface landscape zones in meeting their subsistence requirements but also enhanced enforcement by FD, particularly for combating organized smuggling.
- subsidiary silvicultural operations will be carried out for encouraging natural regeneration mainly of indigenous species.
- selected dead and hollow trees will be retained as they provide shelter/nest to wildlife including birds.
- in order to improve forest habitat for key wildlife species – elephant, some selective management interventions will be taken up while preserving and increasing the diversity and interspersion of habitat. For example, food and shelter will be needed for the elephants, who use parts of Chunoti

as movement corridor. Good growth of palatable grasses and bamboo are required as food for elephant.

- habitat improvement works including rehabilitation of degraded forest areas, enrichment planting of fruit bearing shrubs and trees and palatable grasses, thinning of plantations, maintenance of glades and waterholes, retention of snags, eradication of weeds from glades and wetlands, soil and water conservation, and watershed development will be taken up.
- enrichment plantations will be taken up in those areas where natural regeneration is not coming up due to lack of rootstock.
- fodder species suitable for elephant and so to be included in plantation program are bamboo, jam, chapalish, kathal, am, segun, narikel, kola, chon, dumur, fuljharu, pahari alu, met alu, jambura, dheua and chupri alu.

Chunoti Wildlife Sanctuary supports about 20 elephants that are considered to be flagship and conspicuous species. They are important ecological part of forests ecosystem and are indeed indicator of good forest health. Elephants as large hervibore mammal require huge amount of forage and water for drinking and bathing. They prefer a mosaic of habitat types including patches of forests, scrub forests, bananas, forest clearings and intermittent open spaces, succulent grasslands and savanna. Chunoti forests meet these requirements in terms of good amount of palatable grasses, scrub forests with open spaces, bamboo and herbs/shrubs, and a number of streams flowing through the Sanctuary. Controlled forest fires may be helpful in the development of fresh grasses but intense fires may ultimately degrade the forests ecosystem.

A substantial contiguous area is required as a suitable habitat for elephants, mainly for their seasonal movement but also to support a genetically viable population. However, the continuing fragmentation of the forest land in and around the Sanctuary is posing a great challenge for elephants and their habitat. The control of illegal felling, forest land encroachment, poaching of wild animals, forest fires and grazing is not possible without active involvement of local people. It is, therefore, necessary to involve local people in biodiversity conservation through co-management efforts including sustained motivation and alternative income generation activities. Main objectives in such areas will be to:

i) ensure a continuous elephant movement corridor by checking any further fragmentation of habitat,
ii) provide community protection to both habitats and wildlife including elephants, and
iii) provide diversified food and adequate shelter to elephants by restoring forests and the habitat.

Micro-Watershed Management:

As a result of good rainfall, incident radiation and soil, the natural regeneration comes up rather well in Chunoti but do not get established due mainly to heavy biotic pressure. Therefore, protection against biotic factors will be taken up before low-input oriented land husbandry practices can be implemented for facilitating eco-restoration process in identified micro-watersheds. Degraded forests with recoverable rootstock will be restored through community protection. But degraded forests with inadequate rootstock shall be taken for assisted natural regeneration for recovering remaining rootstock, and enrichment planting. Natural regeneration and succession will be encouraged by carrying out eco-restoration activities in identified micro-watersheds. Soil and water conservation measures, and control of erosion of stream/*chera* banks will be taken up in identified areas. This will allow the existing rootstock to be recovered by enlisting active participation of local stakeholders in the protection of forests and implementation of low-input forests management and land husbandry practices.

Over the period the woody vegetation cover will extend and gradually thin out the primary succession vegetation such as weeds and grasses. Given protection against illicit felling and burning, the plant succession will progress over a period towards semi-evergreen forests. The enrichment plantations of indigeneous shrub and tree species (e.g. chapalish, chikrassi, toon, karoi, garjan, dhakijam, pynkado, gamar, albizzia, kadam, etc.) can be taken up in the identified degraded and barren areas that do not have

rootstock. All the habitations and cultivations including encroachment areas will be identified and delineated with permanent markers. The existing inhabitants will be registered and further in-migration and encroachment will be discouraged. As important stakeholders, the villagers from the surrounding villages will be engaged in co-management activities.

Enrichment Plantations Guidelines:
Enrichment plantations will be taken up in identified areas of the core zone as discussed below :

- Identify areas suitable for enrichment planting and take necessary steps for advance closure for protection against illicit removal, grazing and fires
- Cutting back of old, high and malformed stumps
- Stump dressing and stool thinning (singling of coppice shoots leaving 2-3 shoots per stool) in coppice species
- On an average 360 seedlings per ha mainly of indigenous species (multi-species plantations to optimize species and habitat heterogeneity) will be planted.
- Pits of size 45m x 45m x 45m will be dug in the month of Feb. – March (1 kg of cowdung/fertilizer will be applied – 50 gms per seedling: 2o gms TSP, 20 gms MP and 10 gms Urea) in identified gaps (of more than 0.5 ha).
- No burning and clear cutting of existing vegetation will be taken up. In case of weeds a circular area around the pit can be cleared before taking up planting on the onset of monsoon rains (in the month of June-July). The dead and hollow trees will not be salvaged.
- Subsidiary silvicultural operations such as cleaning, bamboo clumps decongestion, climber cutting and freeing of natural regeneration from suppression will be taken up as a part of encouraging natural regeneration. Priority will be given to clean those saplings and seedlings firstly that have shown manifestations of diseased/dead/crooked growth, damage, and infestation. In coppice species, stump dressing, stool thinning and cleaning will be taken up.
- Half-moon trenches around the planted seedlings are suggested in the slopes as an integral part to conserve and trap soil and retain soil moisture.
- Weeding, beating up and cleaning will be taken up as and when required. Normally 3 weeding are taken up in the 2nd financial year and 2 weeding in the 3rd financial year. Vacancy filling will be done along with weeding.
- Suitable species for enrichment plantations are mainly indigenous species that may include a mixture of siris, sisoo, simul, chikrasi, jarul, gamar, garjan, telsur, koroi, champa, mahogany, kadam, arjun, haritoki, pitali, chapalish, boilam, agar, hargoja, padauk, jam, dhakijam, toon, bazna, jalpai, chalta, amla, bahera, ficus species, jackfruit, bamboo, etc. Canes will not be planted and monoculture, particularly of exotics will not be taken up.
- Exotic species such as acacia, eucalyptus and mangium will not be plated inside the core zone.
- Palatable grasses for fodder plantations may include *Typha angustifolia, Alpimia nigra, Themeda arundinacea, Saccharum arundinaceum, Sacharum longisetosum, Sacharum narenga, Sacharum hookeri, Phragmites karka, Arundo donax, Impreta cylinder, Sacharum spontaneum, Cymbopogan flexuosus* and *Setaria palmafolia*. These grasses may also be used for gully plugging in case soil erosion takes place due to gradient and run off.
- Plantation of shrubs and vegetables may be taken up around waterbodies by involving local stakeholders.
- Forest fire control measures will be taken up in fire prone areas.

In areas having large blank patches buffer plantations can be taken by following the guidelines as described in the next section.

Landscape Zone Management

Keeping in view the surrounding villages exercising influence on the Sanctuary and the adjoining forests under the management of FD, a 5-km wide landscape zone surrounding the core zone has been found suitable. Interface landscape zone is further categorized into four specific sub-zones (proposed core area sub-zone as extension of existing core zone, buffer reserve sub-zone, assisted production sub-zone and elephant movement corridor sub-zone) depending upon the uses to which different areas are used and managed. The proposed core sub-zone (around 5,000 ha), comprising northward and southward forest extensions, is currently categorized under landscape zone. But after re-gazetment these northward and southward extensions will be part of core zone. It will also provide effective protection as buffer between the present core zone and nearby habitations/cultivation. The management of this sub-zone will be as recommended in the core zone (as discussed above).

The present subsistence harvest of wood and NTFPs (grazing, fodder, bamboo, canes, etc.) by non-residents is expected to continue, particularly in peripheral areas. However, consumptive use by non-residents will gradually be shifted, to the extent possible, to buffer reserve sub-zone comprising FD lands outside of but adjacent to the Sanctuary boundary. Two such buffer reserve sub-zones, one on the north and one on the east of the Sanctuary have been identified, where management interventions are required to lessen biotic pressure on the core zone. These forest areas may be used by elephants, and so also will act as elephant movement corridors. The plantations of palatable grasses and indigenous herbs, shrubs and tree species may be taken in these reserves. These plantations will be brought under co-management agreements in order to alleviate harvest pressures from adjacent settled areas as evident by heavy, commercial harvest of fuelwood and bamboo currently. Co-management activities in this Sub-zone will focus on providing a reliable and legitimate source of wood and non-wood products for local poor.

In addition to movement corridors as identified in the forests of core zone, elephants use some areas (RF/USF/private lands) of Bandarban and Lama forest divisions for their migration. It is important to maintain and indeed develop these movement corridors in order to provide good connectivity (including food and shelter) between the Sanctuary and other adjoining habitats of elephants.

Suitable private lands bordering the Sanctuary on the west and east are suitable for developing wood-based energy resources. Vacant lands will be planted with suitable fast growing tree species and agroforestry systems will be established on the lands being used for cultivation. Agroforestry (alley model or trees on farm boundary) may be suitable in those lands where farmers are raising agricultural crops and may need wood either for self-consumption or for cash sale. However, detailed consultations will be held with local people before finalizing any land-based management intervention for which technical support may be provided by local FD staff.

Buffer Plantations Guidelines:

The following guidelines will be adopted while raising buffer plantations in buffer reserves (but also in comparatively big blank areas in core zone where villages exist):

- Block plantations of both indigenous (list as in case of enrichment plantations) and fast growing species such as acacia will be taken in mixture at 2m x 2m (2500 seedlings/ha) by associating local stakeholders (e.g. members of community patrolling groups and user groups).
- The rotation age for the fast growing species would be 10 years (two thinning at 4^{th} and 7^{th} year) and 30 years (two thinning at 10^{th} and 20^{th} year) for long rotation species. The fruit bearing trees suitable for wildlife will be retained at the time of felling.
- The usufructury benefits from 2^{nd} thinning and final felling will be shared by following the FSP guidelines (45% of the total proceeds to FD, 45% to participants and 10% to co-management committee - as in case of Tree Farming Fund under FSP).
- Other guidelines will be as described above for enrichment plantations.

3. LIVELIHOOD PROGRAMS

As per the Wildlife (Preservation) (Amendment) Act, 1974 no harvesting is allowed inside the Sanctuary. Other benefits flows to local communities will, therefore, be explored through off-Sanctuary activities including alternative income generation activities. Up-scaling of skills for alternative income will be taken up for generating value additions through capacity building of local people. Landscape Development Fund will be used to provide finance for the members of user groups and co-management councils/committees to set up micro-enterprises and alternative income generation opportunities. The benefits from eco-tourism will be ploughed back for the development of local communities and the Sanctuary. The program will be focused mainly in the identified interface landscape zone but also in the core zone where local communities are living. Networking with relevant NGOs acting in the area will be established for rendering rural development services to user groups and co-management councils/committees. Appropriate production technologies, which may be implemented as a part of off-PA development interventions include:

i) agricultural and horticultural crops, nursery and homestead planting,
ii) livestock rearing such as poultry,
iii) fisheries, and
iv) small enterprise development.

4. FACILITIES DEVELOPMENT AND MAINTENANCE PROGRAMS

The development of various facilities as below will be undertaken based on sound environmental principles to support the long-term administration of the Sanctuary :

- procurement of transport and other equipments required for the implementation of proposed management programs.
- development of built facilities should not negatively impact the area's natural resources or eco-tourism potential.
- existing FD facilities will be fully utilised and incorporated in the Sanctuary management where these can be renovated on a cost-effective basis.
- all built facility requirements at Sanctuary Headquarters, except for senior staff and Forest Guard's quarters, will be satisfied through the use of existing buildings.
- renovations, and a regular schedule of maintenance, will be initiated during the first year of the Plan.
- new constructions will be initiated during the second year of the Management Plan implementation.
- existing visitor facilities including two existing Watch Towers will be renovated to provide two covered visitor shelters and adjacent toilets.
- access roads between sites at Sanctuary Headquarters (*i.e.*, between the main office/accommodation complex and proposed Environmental Education Centre) and the two existing Watch Towers will require periodic manual maintenance, but are currently built to sufficient standards for anticipated traffic loads.
- all the roads within the Sanctuary will be permanently closed to 4-wheeled vehicles.
- unsurfaced forest trails (former logging tracks) linking Sanctaury Headquarters/Chunoti Range Office complex and Jaldi Range Office with the interior areas need to be maintained and several culverts would need to be replaced to restore easy access.

5. VISITOR USE AND VISITOR MANAGEMENT PROGRAMS

Eco-tourism in the form of nature education and interpretation tours will be a main objective of visitor use and management programs. This will help promote biodiversity conservation and educate the visitors as enlightened eco-tourists and also help improve socio-economic conditions of local people. The potential of conservation tourism is good in Chunoti due to its easy accessibility, undulating terrain and scenic

beauty. But it will require developing a number of conservation facilities as listed below before it can attract visitors:

- existing roads and trails will be renovated for easy movement in the identified eco-tourism zone (e.g. Bon Pukur in Chunoti Beat where an elephant ride may be considered by FD as many tourists may be interested to have a close look of nature on elephant back).
- initially the Guest House maintained by a local NGO at Chunoti will be able to provide accommodation to tourists. But when the number of tourists increase, the local enterprenuers including user groups (in interface landscape zone) of the Sanctuary may be encouraged to set up nature camps, eco-lodges, dormitories, huts and cottages for use of eco-tourists.
- eco-guides as identified under NSP amongst local communities will be helpful for the guidance of eco-tourists.
- awareness campaign for visitors on their expected behavior (e.g. litter disposal, sound) while visiting the Sanctuary
- relevant brochures, pamphlets, guide maps, hand outs, audiovisual aids and display boards will be developed at convenient points.
- a network of nature trails will be developed/renovated for visitors movement on foot and bicycle in traversing key natural and cultural features of interest (e.g. patches of high forests, watch towers, cultural remnants, natural streams/cheras, religious places).
- priority will be given to develop existing foot paths and vehicle tracks as far as possible in order to minimize creation of new paths and consequent vegetation clearances and soil erosion.
- Environmental Education Centre will be connected by trails for visitor access.

6. PARTICIPATORY MONITORING PROGRAMS

A detailed methodology for establishing benchmark data and measuring the volume of timber loss (cubic meter/ha) has been developed for assessing effectiveness of project interventions in controlling unauthorized logging in the sampled forest patches (e.g. Bon Pukur garjan forests). A survey of natural regeneration (density of seedlings and saplings per ha) in the identified forests will be taken regularly. This will be complemented by photo monitoring technique, focusing on changes in plant height as a visual evidence of success of plan interventions. Forest dwelling bird species are being used for assessing biodiversity status. A simple procedure of sighting and counting (either population or nests) the indicator bird species using the forests as their habitat has been employed by associating local stakeholders in identified transect walks. Benchmark measurements will be taken to establish initial set of values which will act as reference for future comparison with subsequent measurements taken periodically for assessing socio-economic impacts of project interventions. Management score cards will be employed in making management assessments.