



Nishango Support Project

MANAGEMENT PLANS FOR SATCHARI NATIONAL PARK



2006

LIST OF ABBREVIATIONS

ACF - Assistant Conservator of Forests	IUCN - International Union for Conservation of Nature and Natural Resources
ACR - Annual Confidential Report	km - kilometer
ADB - Asian Development Bank	km² - square kilometer
AIG - Alternative Income Generation	LDF - Landscape Development Fund
BDR - Bangladesh Rifles	m - meter
BFRI - Bangladesh Forest Research Institute	m² - square meter
BGD - Bangladesh	MSc - Master of Science
cc - cubic centimeter	NACOM - Nature and Conservation Movement
CCF - Chief Conservator of Forest	NGO - Non-Governmental Organisation
CEGIS - Centre for Environmental and Geographic Information Services	NIC - Nature Interpretation Centre
CF - Conservator of Forest	No. - Number
CIFOR - Centre for International Forestry Research	nos - numbers
cm - centimeter	NP - National Park
dbh - diameter at breast height	NSP - Nishorgo Support Project
DCF - Deputy Conservator of Forest	NTFP - Non-Timber Forest Product
DCCF - Deputy Chief Conservator of Forest	OIC - Officer in Charge
DFID - Department for International Development	PA - Protected Area
DFO - Divisional Forest Officer	PBSA - Participatory Benefit Sharing Agreement
DR - Deputy Ranger	PhD - Doctor of Philosophy
e.g. - for example	PP - Project Proforma
EIA - Environmental Impact Assessment	pp. - pages
et al. - and others	PRA - Participatory Rural Appraisal
etc. - etcetera	RF - Reserved Forest
FAO - Food and Agriculture Organization	RIMS - Resource Information Management System
FD - Forest Department	RoW - Right of Way
FG - Forest Guard	RRA - Rapid Rural Appraisal
Fr - Forester	spp. - species (plural)
FR - Forest Ranger	TA - Technical Assistance
FRMP - Forest Resource Management Project	Tk - Taka
FSP - Forestry Sector Project	TV - Television
GIS - Geographic Information System	UNDP - United Nations Development Programme
GoB - Government of Bangladesh	USAID - United States Agency for International Development
ha - hectare	US\$ - United States dollars
HEED - Health Education and Economic Development	WC - Working Circle
HSI - Habitat Suitability Index	WMNC - Wildlife Management and Nature Conservation
i.e. - that is	WNCC - Wildlife and Nature Conservation Circle
IEC - Information, Education and Communication	WS - Wildlife Sanctuary
IRG - International Resources Group	WTO - World Tourism Organization

EXECUTIVE SUMMARY

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A basic principle of Protected Area (PA) management is that every PA should have a management plan that guides and controls the management of PA resources, the conservation of biodiversity, the uses of area and the development of its facilities. This Management Plan provides five year development programs with framework activities and guidelines for sustainably managing the Satchuri Park (proposed) and its interface landscape. The Plan is based on a sustainable planning approach comprising, i) protection and conservation of all remaining natural forests and constituent biodiversity in the Park, ii) protection and management of plantations, particularly the old plantations that have attained natural structure over the period, iii) conversion of monocultures of exotic tree species into natural and man made regeneration of indigeneous species by gradually opening the canopy, iv) protection and development of constituent biodiversity including wildlife, v) development of co-management agreements (and linking Park conservation with benefit sharing arrangements) with key stakeholders formed into co-management groups and committees in order to reduce ongoing habitat damage by helping them achieve sustainable livelihoods through sustainable forest use and alternative income generation activities for livelihoods, and vi) provision of support to better administration and management of the Park including capacity development, infrastructure, training, and wider extension and communication.

The present situation (description of the Park, biodiversity protection and management, human use and biotic interactions, natural resources use patterns, interface landscape, etc.) with a documentation of main findings and issues is assessed in Part I of the Plan. Based on the findings of Part I, the Part II of the Plan recommends strategic programs and priorities for future development and management of the Park. The stakeholders consultations on the draft Plan were held with public representatives (local MP, chairman and members of Union Parishads and Poursabha), FD field staff, BDR, potential members of user groups and co-management committees, village elites, leaders, journalists, NGOs, tribal leaders and forest villagers, saw mill owners, timber traders and mahaldars (forest contractors).

The NP, proposed by FD in 2003 with a total forest area of 242.83 ha (of Raghunandan Hill RF), has remnants of biologically rich forests located in the high rainfall bio-geographic zone with evergreen and semi-evergreen forests with a multi-tier vegetational assemblage of rich biodiversity. Raghunandan Hill RF originally supported mixed tropical evergreen forests, which over the period have been substantially altered due to heavy biotic interference and plantations established after clear-felling of natural vegetation. The situation got exacerbated with encroachment of forest land as a result of which these forests have become fragmented with much reduced extent of suitable habitats and ensuing adverse effects on the ecological boundaries and wildlife of the Park. However, at places good natural re-growth, particularly of ground flora and middle story, has come up over the period due to favorable climatic and edaphic conditions, thereby enhancing the Park's *in-situ* conservation values.

Five broad ecosystems (of habitats) in the Park and its interface landscape can be identified as i) high forests represented by the remaining patches of natural forests, ii) plantations including the monoculture of exotics, iii) grasslands and bamboos, iv) wetlands, v) Tea Estates, and vi) cultivated fields: the first two being the largest in extent and also important from Park management point of view. Important ecological values of the Park include shelter to biodiversity comprising important flora and fauna, habitat connectivity, presence of threatened and endemic species, and improving degrading habitat. It represents fragile ecosystems with a rich biodiversity, which if not conserved, may be lost for future generations. Its main ecological functions are catchment conservation of several rivers and water bodies (*haors, beels, ponds, etc.*), control of soil erosion, ecological security, irrigation and agricultural production, carbon sink and environmental amelioration. The Park provides significant scope for wildlife education and research, nature interpretation and conservation awareness. Socio-economic values of the Park are important because a number of communities including ethnic minorities reside within and around the forests on which they depend for their livelihood. So the Park also is a potential source of eco-tourism, aesthetic and cultural values, scenic beauty and ethnic diversity. Its comparatively easy accessibility from Dhaka makes it particularly suitable for eco-tourism for urban dwellers. Park's conservation values are regional and national but also with local implications.

The Plan is developed by following a landscape approach of Park management by focusing on an appropriate scale in order to integrate relevant habitat/forests, existing ecosystems and surrounding social/institutional systems. The Plan focuses on protecting and conserving the rich biodiversity of the Park in accordance with sound principles of sustainable environmental and socio-economic development and the Forest Policy of 1994. The interface landscape exercises influence around the boundaries of the Park. In total 15 villages and 6 Tea Estates (Satchuri, Chaklapunji, Chendichera, Nabab Khan, Chandpur and Surma) fall within the zone of influence and an assessment of potential stakeholders has been included in the Plan. It addresses the basic consumption needs of identified villages of interface landscape and co-

management activities in the context of a broader economic, natural resource and socio-institutional environment of Satchuri.

Main long-term management aim is to maintain the maximum possible area under forest cover, and to maintain the forest and conserve its constituent biodiversity in the best possible condition. Main management objectives during the five year plan period are to:

- ➔ develop and implement a co-management approach that will ensure long-term protection and conservation of biodiversity within the Park, while permitting sustainable use in designated zones by local people as key stakeholders.
- ➔ conserve the biodiversity of the Park by following a co-management approach based on building partnerships with all the stakeholders and sharing benefits with local communities and key stakeholders.
- ➔ refine and strengthen the policy, operational, infrastructural and institutional capacity framework for an efficient Park management
- ➔ conserve and maintain viable wildlife population including endangered, threatened, endemic and rare species of plants and animals
- ➔ restore and maintain as far as possible the floral, faunal, physical attributes and productivity of the forest eco-systems
- ➔ encourage eco-tourism in suitable zones and develop visitor amenities
- ➔ implement income generation activities for sustainable livelihood development and enhance skills of local stakeholders

The main framework activities to be undertaken for achieving the above-stated objectives include amongst others:

- ➔ Survey, demarcate and mark the Park boundaries;
- ➔ Develop a co-management model and relevant policy guidelines, and establish co-management agreements linking Park conservation with benefits sharing arrangements with key stakeholders;
- ➔ Survey biodiversity resources;
- ➔ Strengthen FD institutional capacity for Park management;
- ➔ Build conservation awareness, constituencies and extension activities on conservation issues;
- ➔ Train local stakeholders including beneficiaries and FD staff in conservation management and income generation, raise awareness among stakeholders and develop Park facilities;
- ➔ Develop conservation and visitor facilities within the Park;
- ➔ Create tree resources in adjacent agricultural and village areas on participatory conservation and benefits sharing basis and implement alternative income generation activities for sustainable livelihoods;
- ➔ Convert existing short-rotation plantations of exotic species to naturally regenerated areas by gradually opening the canopy, and enrichment plantations of indigenous species in identified gaps, if required; and
- ➔ Provide alternative income generation opportunities for key local stakeholders.

Major challenges expected in achieving the management objectives include encroachment of forest lands and illegal removal of forest produce (mainly timber and fuelwood) are two main challenges facing the Park. Other important challenges include biotic pressure by labor employed by Tea Estates, hunting and poaching, transboundary problems, flood and erosion, grasslands degradation, traffic movement on roads and rail lines, demarcation of PA boundaries, lack of funds, lack of trained professionals, inadequate staffing and infrastructure, monoculture, man-animal conflicts, etc.

The proposed framework activities will be undertaken under the following seven strategic programs developed for a sustainable Park:

1. Habitat Protection Programs: Main objective of this program is to provide adequate protection to the Park for the conservation of its constituent biodiversity. Main activities to be carried out to achieve this objective include preparation of forest cover and interface landscape maps; demarcation of Park boundaries and management zones; control of illegal felling, forest fires and poaching; and stopping encroachment of the Park lands.

Reconnaissance surveys followed by detailed surveys of identified areas will be conducted for verifying actual ground situation. New mapping will be completed during the Plan implementation and will include relevant landscapes within a 5 km-wide interface landscape zone outside of existing/proposed boundaries of the Park in order to provide a spatial context for coordination of regional landscape elements and forests. All the peripheral boundaries of the Park area will be identified, surveyed and marked on the ground. The boundaries of proposed management zones will be defined, mapped and identified on the ground during the Plan implementation period. Posts and/or other markers will be put in place at all important turning points

and will be labeled and maintained regularly. Signboards of appropriate design will be placed at important locations.

Effective protection against illicit felling, poaching, forest fires, forest grazing and forest land encroachment will be provided by FD staff by gainfully associating local stakeholders. In view of limited area of the Park, patrolling on foot by local stakeholders and FD staff will be done regularly. Forest Villagers from Tiprapara will particularly be helpful in forest protection efforts through joint patrol and intelligence sharing. Co-management agreements will be signed with main stakeholders at different levels and all co-management activities in the Park will involve key local stakeholders, FD field staff and NGOs. A conflict resolution mechanism will be established as part of co-management committee because Park level conflicts may arise due to forest extraction, forest land encroachment, forest land disputes, forest offences, forest grazing and local level politics.

In case of organized smuggling an effective checking of tree felling and poaching will require concerted efforts from FD by using modern equipments, arms and ammunition (guns, revolvers, etc.), and transport facilities to combat organized smugglers and poachers. This also may require setting up special protection force by augmenting the presence of FD field staff, if necessary backed by BDR staff. In such cases inter-agency coordination will be necessary for successful efforts and control measures. Communication network will be strengthened by installing a radio communication network and by mobilizing more walky talkies, mobile telephones and vehicles. Adequate rewards will be provided to those FD field staff and local stakeholders, who will perform exemplary biodiversity protection duties.

2. Management Programs: Main objectives of this program are to maintain ecological succession in constituent forests by providing effective protection against biotic interference; to develop natural forests and plantations as good habitat favoring wildlife; to conserve the forest resources including the constituent biodiversity; and to establish appropriate co-management methods and practices through stakeholders' consultation and active participation. The long-term management aim of maintaining the maximum possible area under forest cover along with its constituent biodiversity in the best possible condition will be achieved by zoning the Park area and surrounding landscape such that i) the areas of highest conservation value (forests and/or plantations) are protected, regenerated and managed towards natural forest composition and structure, particularly in the core zone, ii) the areas used to provide benefits to established Forest Villagers through sustainable use of forests are defined. The core zone have the highest conservation value followed by interface landscape zones which of course are important for biotic life; the interface landscape zone is further subdivided into specific zones as discussed below.

The entire proposed Park is designated as core zone and established Forest Village (Tiprapara), where management objective is to protect and maintain remaining vegetation in good stocking and encourage natural regeneration to gradually bring back natural forests. Forest management in this zone will focus on conserving the remaining natural forests and bringing back natural regeneration wherever possible. This will be achieved by providing protection (against illicit removals of forest produce, encroachment, poaching, fires and grazing) through co-management practices and encouraging natural processes for regeneration and rehabilitation of forests. Canopy manipulation (gradual opening of top canopy through selective removals) will be carried out in monoculture of teak and other exotics in order to create more favorable habitat for wildlife by encouraging natural regeneration and enrichment planting of indigeneous trees, shrubs, herbs and palatable grasses. Subsidiary silvicultural operations will be carried out whenever necessary to encourage natural regeneration. Core zone will be subject to management/manipulation of habitat for available wildlife species through selective management interventions. Habitat improvement works including rehabilitation of degraded areas, enrichment planting of fruit bearing species and palatable grasses, replacement of exotics by gradual canopy opening, maintenance of glades and water holes and soil/water conservation in identified micro-watersheds will be taken up. Enrichment plantations of indigenous species will be taken up in those areas where natural regeneration is not coming up due to lack of regenerative rootstock.

The traditional use of assigned forest land by the tribal villagers of Tiprapara Forest Village as habitation/cultivation is included as sustainable use zone within the broad core zone. Such areas existing at the time of Park proposal will be delineated with permanent markers. The existing inhabitants will be registered and further in-migration will be discouraged. As important stakeholders, the Forest Villagers will be engaged in co-management activities with formal co-management agreements signed with FD.

Landscape zone activities will focus on the surrounding landscape helpful in protecting and conserving the core zone and creating congenial habitat for wildlife including protecting and maintaining wildlife corridors. Depending upon the uses to which different areas are used and managed, this zone is further categorized into four specific zones: support zone, intensive use zone, transportation corridor zone and Tea Estate zone.

Support zone comprising plantations in Telmachra Beat can sustainably be used by local people by entering into participatory conservation and benefits sharing agreements. Short and long rotation plantations may be managed under benefit sharing agreements. However, these plantations will not be clearfelled but instead be managed under selection felling (mainly of exotic species) so that the area can be naturally regenerated as mixed forests. Intensive use zones will incorporate the relatively small areas required for administrative buildings and staff quarters, visitor accommodation and other facilities.

The present residents of the villages situated within the interface landscape may be allowed to share harvests from the plantations to be gradually opened for natural regeneration. The livelihoods programs will be implemented by using Landscape Development Fund (LDF) in the identified villages in the interface landscape zone.

Transportation corridors zone will cover an old asphalt-surfaced Dhaka-Sylhet highway, passing through the northern most boundary of the Park. FD will establish and maintain regular contacts with the concerned land owning agency (Roads & Highways Department) in order to get their cooperation in preventing and limiting noise/chemical pollution and damage, and also minimizing the width of vegetation clearing during RoW maintenance. Strip plantations may be raised along this road under FSP/GOB funded schemes by involving local stakeholders under benefits sharing arrangements.

All the six Tea Estates (Satchuri, Chaklapunji, Chendichera, Nabab Khan, Chandpur and Telmachra) surrounding the Park are typically very important part of the Park's interface landscape zone. Some parts of these Tea Estates have so far not been brought under tea cultivation, and have over the period developed as unmanaged secondary vegetation. They provide additional wildlife and plant habitat as a transition zone between mixed forests/plantations and tea plantations. Small areas along Tea Estates have been converted to citrus, pineapple and banana plantations. This trend needs to be reversed back and Tea Estate authorities should be convinced by FD for developing secondary vegetation for providing additional habitat for wildlife. A large number of labor employed by the Tea Estates and their family members depend on Satchuri forests for meeting their livelihoods consumption needs. The unemployed villagers particularly from the adjoining Tea Estates get involved in illicit removals of fuelwood and timber from nearby forests. At times illicit fellers pass through adjoining Tea Estates to fell trees inside the Park and also shade trees inside tea gardens. So joint efforts both from FD and Tea Estate authorities are needed for control of illicit felling. Livelihoods programs will be implemented for identified households of Tea Estate workers, who will be involved in the protection of adjoining forests.

3. Livelihoods Programs for Landscape Development: In the absence of any commercial harvesting inside the Park, additional benefits need to be mobilized through off-PA activities including alternative income generation activities and self-employment opportunities to local stakeholders. Main objective of livelihood programs for landscape development is to establish proper linkages with appropriate livelihoods programs and other projects/initiatives that will reduce biotic pressure on forests. Up-scaling of skills will be taken up for generating value additions through capacity building of local stakeholders. LDF will be used to provide finance for the members of co-management groups and committees, and their federations will be encouraged to set up micro-enterprises, particularly forests-based, to generate value additions locally. The benefits from eco-tourism will also be ploughed back locally for the development of local communities and the Park. Networking with relevant NGOs acting in the landscape zones will be established for rendering rural development services to local stakeholders. The following production technologies were found suitable for their implementation in the interface landscape zones:

- ➔ Agricultural and Horticultural Crops (integrated homestead farming, cultivation of high value crops, village tree nursery, food processing and storage, marketing, etc.)
- ➔ Livestock Rearing (beef fattening, milch cow rearing, broiler/layer rearing, etc.)
- ➔ Fisheries (rice fish farming, fingerling rearing, crop polyculture, fish culture, etc.)
- ➔ Non-Timber Forest Products (NTFPs based technologies and enterprise development)

4. Facilities Development Programs: Main objective of this program is to develop necessary accommodation for FD staff and procure field equipments required for the management of the Park. The development of built facilities will be undertaken to support the Park administration during the Plan implementation period. Built facilities will be developed at Park Hqs. including the existing Satchuri Range and Beat Offices. At each location, the design standards for both renovations and new construction will be based on sound environmental considerations. Existing forest roads and trails will be renovated and maintained regularly. Vehicles, field equipments and office equipments will be procured to support the development and administration programs.

5. Visitor Use and Visitor Management Programs: Regulated eco-tourism in the form of nature education and interpretation tours will be a main objective of visitor use and management programs. The potential of conservation tourism is high in Satchuri mainly due to its easy accessibility and so there is good scope for developing visitors facilities. A tourism region will be identified around the Park by linking with other local

and regional attractions including Guest Houses, tribal villages, rolling landscapes, wetlands and tea gardens through forest roads and trails. Eco-guides to be identified amongst local communities and co-management groups/committees will be trained and employed for the guidance of eco-tourists. Brochurs, pamphlets, guide maps, hand outs, audiovisual aids, display boards will be developed for encouraging eco-tourism.

A network of nature and hiking trails of short, medium and long duration will be identified and developed for visitors movement through key natural and cultural features of interest (patches of high forests, betel leaf gardens, natural streams, cultural remnants, etc.). Priority will be given for developing existing foot paths and vehicle tracks in order to minimize creation of new paths and consequent vegetation clearances and soil erosion. Satchuri Range/Beat Office and Satchuri FRH will be connected with nature trails as far as possible. Sign-posts with adequate information will be provided at main trail heads and printed material will be distributed to interested visitors for their conservation education and awareness.

The publicity of Park management activities will be improved through electronic and print media for propagating biodiversity conservation, environment, and wildlife and the cause of its habitat. Schools and colleges will be targeted (forming Sabuja Vahinis) for conservation education and building an informed wildlife constituency. Nature interpretation will, as educational activity, focus on revealing meaning and relationships of complex ecosystems and landscapes.

A new building will be developed as a Nature Interpretation Centre, which will also act as Environmental Education Centre.

A collaborative conservation strategy will be implemented to provide mechanisms for improving inter-sectoral coordination and information sharing in order to maximize biodiversity conservation efforts. The concept of public-private partnership will be developed and implemented in soliciting the inputs/contributions from private sector for Park facilities development. Nature conservation partnerships will be designed to offer interested businesses a vehicle for contributing to long-term biodiversity conservation in a way that is transparent with low transaction costs, generates beneficial public image for the contributor and makes a long term difference in biodiversity conservation.

6. Conservation Research, Monitoring and Capacity Building: This program will focus on providing tools/mechanisms for a better understanding of the Park and its functions in sustainably managing forests and biodiversity. Keeping in view the funds scarcity for conservation research, appropriate collaboration and networking with relevant Bangladeshi research organizations will be established. Conservation research may include aspects such as diverse types of flora and fauna, status of endangered species, wildlife behavior, socio-economic issues, silvicultural aspects, applied biological research, ecological issues, man-animal conflicts, impact of anthropogenic pressures on natural systems, etc. The results/findings of research studies will be adequately disseminated for their proper utilization by FD field staff. Research dissemination and use methods will be standardized and circulated among FD staff. Useful research outputs will be included in annual development plans of FD for their field implementation.

The following set of core indicators has been designed by following the guidelines contained in the USAID's Performance Monitoring Plan:

- ▶ Indicator 6.2d : Declining incidence in illegal logging in the forests of Lawachara
- ▶ Indicator 6b : Increased production of natural resources in targeted areas
- ▶ Indicator 6c : Increased biodiversity in targeted areas of the PA

Benchmark information base will be developed for measuring and comparing the volume of timber loss (cubic meter/ha), and natural regeneration and biodiversity status for assessing effectiveness of project interventions during the Project period. A critical review of the long-term habitat management strategy based on a detailed inventory of biodiversity will be taken up during the final year of implementation of the Plan. Park management practices will accordingly be adjusted based on the findings of review.

As a part of Plan implementation a good coordination with related organizations in Asia and elsewhere will be developed. Cross-country exchange visits and training will be arranged to learn from relevant experiences from similar projects being implemented in different Asian countries. A working group will be supported under NSP for preparing and disseminating co-management best practices and lessons learned. Potential organizations for establishing and maintaining professional contacts may include FAO (Bangkok office), RECOFTC (Bangkok), ICIMOD (Kathmandu), WII (Dehra Dun), CIFOR (Bogor), etc.

There is great necessity of imparting conservation training to the FD field staff responsible for managing Satchuri Park. FD presently does not have any specialized capacity for imparting PA management training, although adequate forestry training infrastructure has developed under different donor funded projects. Of

many forestry subjects only one paper relates to wildlife management being taught to cadre officers at Forest Academy, Chittagong. Other subordinate FD staff do not receive any significant training on PA management, although wildlife management is one of the many taught subjects. There is lack of faculty, particularly on in-situ conservation at ecosystem and landscape levels by involving stakeholders. Some forest officers have undergone overseas training on wildlife and PA management but are presently working outside WNCC, thereby under-utilizing their expertise. An exhaustive conservation training plan, covering both in-country and overseas training, will be developed under NSP and implemented over the project period. A training strategy dealing with both quality and quantity of conservation training including refresher and orientation training will form part of the training plan.

The existing Wildlife (Preservation) (Amendment) Act, 1974 is under revision process by a committee comprising of FD officers. The revision process will be expedited and completed after taking relevant inputs from renowned legal and environmental experts and stakeholders. It will be ensured that the revised Act is compatible with relevant international conventions and agreements signed by the Government of Bangladesh.

7. Administration and Budget: Main objectives under this program are to ensure that technical and administrative staff required to manage the Park effectively are posted and adequate financial organizations systems are in place. It is recommended to implement the approved organogram by operationalizing newly created wildlife division and posting of approved technical and management staff for each PA. Satchuri Park will be an independent operational unit with greater decentralized authority for decision-making with an assigned ACF who will have required administrative and financial powers. The duties and responsibilities of the designated staff have been defined in the Plan.

The existing financial organization systems are adequate and appropriate in most areas but need a detailed review in order to identify specific areas of financial strengthening in future. For example, under the existing budget codes neither there is any specific budget code for PA head (the WNCC is created in 2001 only whereas the budget codes were designed much earlier) nor separate budget allocations are made for operational funds exclusively for the management of wildlife and PAs. This system needs to be implemented as soon as possible in order to ensure a certain required level of annual financial stability for *in-situ* biodiversity conservation in the PAs managed under the WNCC.

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VOLUME 1

MANAGEMENT PLANS

P A R T I

ASSESSING THE PRESENT SITUATION-FINDING AND ISSUES

1. BACKGROUND

With the launch of Asian Development Bank (ADB) supported community forestry project, participatory forestry projects have been implemented in Bangladesh on a large scale since 1981. Sectoral forestry development projects such as Forestry Sector Project (FSP) were implemented with a major policy shift in favor of a participatory management of forests/plantations (Figure 1) and protected areas (Figure 2). Local people and communities participated in developing, protecting and managing plantations *in lieu* of usufructory rights, granted as per participatory benefit sharing agreements (PBSAs) signed between user groups (comprising participants) and land owning agencies (e.g. Forest Department in case of forest land). The Nishorgo Program of Forest Department (FD) aims to protect and conserve the forests and other biodiversity of the country's protected areas (PAs) by building gainful partnerships between the FD and main stakeholders based on mutual trust and shared roles and responsibilities for biodiversity conservation and sustainable use.

The country's protected areas (PAs) have been an intimate interspersion of human habitations and cultivation through them with traditional dependency on neighbouring forests for their livelihood in a largely agrarian economy. In addition to development pressures on forest land, the traditional dependence of local communities on forests has historically been an important aspect of forests management in Bangladesh. As a result, the biodiversity conservation priorities cannot be set in isolation from local forest resource use and development. Anthropogenic pressures including increased commercial extraction of forest produce, and forest land encroachment for habitations and agriculture, brought by manifold increase in human and cattle population, led to widespread shrinkage and degradation of PAs in Bangladesh. Illegal removals from the forests have increased off late, thereby jeopardizing the very existence of biodiversity in some of the PAs. This has adversely affected the local people and communities as well as the conservation status of wildlife habitat. The livelihood of the natural resources dependent people is affected adversely.

A basic principal of Park management is that every Park should have a management plan. A management plan guides and controls the management of Park resources, the uses of the area, and the development of facilities needed to support that management and use; it facilitates all development activities in an area (MacKinnon et al. 1986). Participatory management plans were prepared for two PAs (Lawachara National Park and Rema-Kalenga Wildlife Sanctuary) covered under the conservation area management component of FSP. Although these management plans prescribed an exhaustive list of management activities to be carried out in the two PAs, they required updating in view of a co-management approach being adopted under the Nishorgo Support Project (NSP).

The NSP is a project of the FD, Ministry of Environment & Forest, funded by USAID and implemented by International Resources Group (IRG). The project is supporting a broad Nishorgo Program of FD, which is a comprehensive effort to improve the management of country's protected areas being managed by FD. The Nishorgo Program, which focuses on PAs (Wildlife Sanctuaries, National Parks, Safari Parks and Game Reserves), aims to protect and conserve country's forests and biodiversity for future generations.

This Plan is the first five year management plan for the proposed Satchuri National Park (NP). The plan will be implemented mainly by FD and the project staff but would also be useful to all the stakeholders including local participants, NGOs, planners, policy-makers and researchers.

2. INTRODUCTION

At the heart of Nishorgo Program is a focus on building partnerships between the FD and key local, regional and national stakeholders, who can assist in the conservation efforts for a PA. An effective implementation of the Nishorgo Program will help conserve biodiversity through facility development, capacity building, and gainful partnerships with stakeholders. Under its partnership with the Government of Bangladesh (GOB), USAID is providing targeted technical support to main aspects of the Nishorgo Program. The NSP works closely with the FD and key conservation stakeholders to develop and implement a co-management strategy to help conserve the country's PAs where relevant partnerships for PA conservation are essential. The Project is working at five initial pilot sites (Lawachara National Park, Rema-Kelinga Wildlife Sanctuary, proposed Satchuri National Park, Teknaf Game Reserve and Chunut Wildlife Sanctuary), of which 3 PAs (Figure 3) are in Sylhet Forest Division

The Plan provides for an overall five year framework for developing and managing the the proposed Satchury National Park of Sylhet division under Nishorgo Program. Planned development interventions under FSP, NSP and other GOB schemes are included in the Plan along with other relevant activities, necessary for the development of the Park. The stakeholders consultations on the draft Plan were held with potential members of organized groups, forest villagers, FD field staff, tribal leaders, sawmill owners, timber traders, mahaldars, NGOs, local journalists, BDR and public representatives (UP chairman and members, Poursabha chairman, local MP). Main focus of forest management under this Plan will be on conservation of forests and constituent biodiversity resources, 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 PA management.

Part I of the Plan assesses the present situation (provides a description of the Park, an assessment of biodiversity, resources protection and management, human interactions, forest resources use patterns, interface landscape situation, past management and practices, etc) with main findings and issues. Additional information on the regional/national biophysical and socio-economic scenario can be found in the documents listed under References. Part II of the Plan recommends strategic programs and priorities (comprises prescriptions for future development and management of the Park with detailed guidelines) for a sustainable National Park. The Plan, as a guide to development interventions, will be useful for the Park managers, planners, decision-makers, researchers, donors and other stakeholders including local forests dependent communities.

The scope, timing and relative emphasis on specific activities may be modified by the Park managers on the basis of experience, success and progress as the Plan is implemented. The overall levels of inputs indicated under each activity will be maintained to the extent possible in order to ensure reasonable success in management implementation. However, it is important to have sufficient flexibility needed for making required modifications and adjustments to management activities within the limits set by overall goals and objectives. Hence, although five year schedules of activities and inputs are presented, it is recommended that needed changes in timing, inputs and outputs will be reflected in annual work plans to be prepared by Park managers every year.

The Management Plan is based on a sustainable planning approach comprising, i) protection and conservation of all remaining natural forests and constituent biodiversity in the Park, ii) conversion of monocultures of exotic tree species into natural and man made regeneration of indigeneous species by gradually opening the canopy, iii) development of co-management agreements (and linking Park conservation with benefit sharing arrangements) with key stakeholders to reduce ongoing habitat damage by helping them achieve sustainable livelihoods through participatory forest use and alternative income generation activities, and iv) provision of support to better administration and management of the Park including capacity development, infrastructure, training, and wider extension and communication.

2.1 Location and Constitution

The proposed Satchury National Park, one of the three PAs, (namely Lawachara NP, Rema-Kelinga Wildlife Sanctuary and the proposed Satchuri NP) in Sylhet forest division, is covered under this Plan. The proposed Satchuri NP (in Chunarughat Upzila of Habiganj District) is located nearly 130 km east-northeast of Dhaka and approximately 60 km southwest from Srimongal (between Teliapara and Srimongal) on the erstwhile Dhaka-Sylhet highway (a recently constructed bypass road now serves as the main Dhaka-Sylhet highway). This road forms the northern Park boundary (nearly 1.8 km) starting from near Satchari Beat Office to the border of Chaklapunji Tea Estate. The proposed NP comprises forests of Raghunandan Hill RF, covered under Satchuri Range. A proposal for notifying the NP, with a total forest area of 242.82 ha (600 acre), was submitted by FD to the MOEF on 22 December, 2003 (a copy annexed in Volume 2).

2.2 Approach and Access

Bangladesh Railway serves well as the Park falls very near to the main railway line running through Sylhet forest division. Due to its well connectivity (through road and railways), the Park is very attractive for eco-tourism and biodiversity, particularly for the people of large urban centers such as Dhaka. Satchuri NP, representing the accessible hill forests of Sylhet division, is well connected by the national highway, which also provides easy access to the nearest national/international airport at Sylhet. There is currently no road access to the interior of the Park, except a number of foot trails leading into or across the Park.

3. BIODIVERSITY CONSERVATION ATTRIBUTES

3.1 Statement of Biodiversity Significance

The forests of Satchury NP (Figure 4) are very rich biologically, located as they are on the high rainfall bio-geographic zone with evergreen and semi-evergreen forests. The Park represents several features of the bio-diversity of north-eastern subcontinent, which is one of the mega biodiversity region with many floral endemic species. Many important rivers including Surma and Kushiara flow through Sylhet forest division, forming fertile floodplains with enhanced economic activity and high population density. Sylhet forest division is home to many tribes with their traditional lifestyle dependent on natural resources including forests for their forests-based livelihood. Many forest villages were historically established within the RFs of Sylhet forest division in order to ensure a regular labor supply for forestry activities including harvest of natural forests and raising plantations. The forests of Satchury NP are important in regulating water flows and checking soil erosion. Indeed the conservation of the Park is very important as the forests form important catchments and were so designated historically as head water reserves for many rivers and numerous water bodies. They are part of transnational watersheds with intense forests-water interactions that have regional implications. In addition to providing a sanctuary to wildlife, these forests also may in future form water sanctuaries required for the conservation of water and soil, and in carbon sequestration. The protection and conservation of these forests is particularly important in view of significant loss of natural forests in the country.

3.2 Biodiversity Conservation Values

Socio-economic values of the Park are important because a number of communities including ethnic minorities reside within and around the forests on which they depend for their livelihood opportunities. Tiprapara Forest Village is located within the Park boundaries. Biological values include providing shelter to biodiversity comprising important flora and fauna, habitat connectivity, presence of threatened and endemic species, and improvement of degrading habitat. Main ecological functions are catchment conservation of several rivers and water bodies (haors, beels, ponds, etc.), control of soil erosion, ecological security, irrigation and agricultural production, carbon sink and environmental amelioration. The Park provides significant scope for wildlife education and research, nature interpretation and conservation awareness. It represents a fragile landscape with a very rich biodiversity, which if not conserved, may be lost for future generations. The Park is also a potential source of eco-tourism, aesthetic values, dense high forests, historical and cultural values, scenic beauty and ethnic diversity. Finally many conservation values of the Park are global, regional and national but also with local implications.

3.3 Wildlife Conservation

Special protection measures were contemplated for the preservation of elephants under Bengal Elephant Preservation Act, 1879. The Wildlife Birds & Animal Protection Act, 1912 provided for the preservation of wildlife in Bengal through protection of many species of birds and animals, particularly during breeding season. The promulgation of Bangladesh Wildlife (Preservation) Order in 1973 was followed next year by the enactment of Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. A Wildlife Advisory Board was set up for performing such functions as the Government may assign to it. The Act provided a sound legal basis for the preservation of wildlife in Bangladesh. Both *in-situ* and *ex-situ* conservation of wildlife were to be achieved by designating and managing PAs in representative zones. A new circle (Wildlife and Nature Conservation Circle) was created in 2001, exclusively for looking after the affairs related to wildlife and nature conservation.

3.4 Forest Boundaries

The Park is a part of Raghunandan Hill Reserved Forest (RF), which was reserved (Gazette No. 4238-R dated 22nd October, 1914) in early nineteenth century by following the reservation process per the Forest Act 1878, and Assam Forest Manual 1898. The settlements claims of local communities were settled and legal boundaries identified with names of forest blocks, compartments, etc. Working Plans were prepared with topographical maps (1 inch to 1 mile or 1: 63,360) and specific recommendations for the maintenance of legal boundaries of forest blocks and compartments were given. The boundaries of forests could not, however, be maintained, as a result of which many forests have been brought under encroachment for cultivation and settlements. Although the Park has been proposed to be notified by FD, no efforts have been made to physically demarcate the boundaries in the field. The situation got exacerbated with heavy biotic pressure on forests and large scale encroachment of forest land in Raghunandan Hill RF. As a result, these forests have become fragmented with reduced extent of suitable habitats and ensuing adverse effects on wildlife. This has adversely affected the ecological boundaries of Park with limited wildlife corridors and breeding space.

3.5 Forest Geology, Rock and Soil

The low and rolling hills (of upper tertiary rocks) of the Park are composed of upper tertiary rocks in which soft sandstone predominates. For example, the Park covers an area of low hills formed primarily from soft sandstone, and originally supporting a vegetation cover of mixed tropical evergreen forests (Alam, 1988).

A major portion of Sylhet forest division lies within the Surma-Kushiara floodplains, which are of alluvial origin, composed of clay and sand in varying proportions. This is a low lying area with smooth and broad ridges and basins, which are subject to deep flooding and the shallow basins (*haors*) may remain wet even during dry season. The area has been formed from the sediments brought down by rivers draining from neighbouring hills of India. The soils are heavy, silty loams and clays with strongly acidic in reaction.

A series of isolated low (nearly 150 m) and high (nearly 300 m) hills, derived from sandstones and shales, and extending north from India and interspersed with narrow floodplains of small rivers, are found in the Park. They represent northern and eastern hills, interspersed with northern and eastern piedmont plains. The soils of the Park can be categorized as hill brown sandy loams with slight to strong acidity. They are shallow over sandstone bedrocks on high hills and accumulation of humas on the top of soil is small due mainly to rapid decomposition of debris under moist warm tropical conditions. The Park has well drained sandy loam soil with good humus but near nullahs and streams the soils are sandy. Sandy loam soils are predominant in Raghunandan Hill RF but lack humas on hill tops. In swampy areas forest soils are clayey.

3.6 Biophysical Situation

The Park originally supported mixed tropical evergreen and semi-evergreen forests, which over the period have been substantially altered due to heavy biotic interference and the plantations of exotic species established after clear-felling of natural vegetation. Large scale encroachments of Raghunandan Hill RF has resulted in conversion of many low lying areas into paddy cultivation. As a result, the habitat has fragmented, adversely affecting the wildlife by restricting their movements through a barrier effect. However, at places good natural re-growth, particularly of ground flora and middle storey, has come up due to favorable climatic and edaphic conditions, thereby enhancing the Park's *in-situ* conservation values. Old plantations raised in the Park have grown up in shape of tall multi-storied structure with re-growth of ground flora and a middle storey of naturally occurring species. Consequently the vegetation at many places in the Park has approached towards natural structure and species. The biophysical conditions of the Park are further described in detail in Chapter 4.

3.7 Micro-Climate

The climate of the Park is in general warm and humid but the weather is cool and pleasant during winter. The temperature varies on an average from nearly 27 degrees in February to nearly 36 degrees in June. The humidity is high in the Park throughout the year, with monthly average humidity varying from 74% in March to 89% in July. There is heavy dew during winter when rainfall is low. The water condensation is thus distributed throughout the year in different forms and greatly influences plants and wildlife. The area covered under the Park is one of the wettest in the country and so the rainfall is quite high with an annual average of 4,000 mm approximately, with maximum rainfall falling during June to September from South-West monsoon. Pre-monsoon Nor'westerly and cyclonic storms are accompanied by high speed winds and rains, which do considerable damage to property and trees.

3.8 Water Bodies

Sylhet forest division, characterized by high rainfall and a large amount of water drained from the surrounding hills, comprises a valley fed by two main rivers, Surma and Kushiara. In the absence of adequate steep gradient required to carry huge monsoon rainfall, the water gets collected in depressions, locally known as *haors*. The water recedes during dry season, enabling local people to cultivate the remainder land with winter crops. The level of swamps is, however, being raised gradually due to siltation.

The Surma passes through Sylhet city and joins the Meghna river further south. There are a number of other small rivers such as Khaway, Dholai and Manu (and their tributaries), and shallow depressions (e.g. *haors*), which are wetlands providing marshy sanctuaries to migratory birds and livelihood to local fishermen. They provide good habitat, drainage and drinking water source for the wild animals and local people. The rivers possess main characteristics of a flat alluvial country as the current is sluggish, the course tortuous and the bottom muddy. The waters are surcharged with materials brought from surrounding hills during monsoon rains and a large portion of the silt is deposited in the immediate neighbourhood of the streams.

A number of sandy-bedded streams and nallahs pass through the Park and so aquatic habitats associated with forest cover and riparian (streamside) vegetation and animal species are important part of overall habitat composition. Many of these streams are subjected to intense collection of sand during dry season for commercial sale.

The Park and Raghunandan Hill RF form the catchment areas of a number of small streams, locally known as *cheras*. In most cases the catchment areas of each *chera* constituted a bamboo working coupe (*mahal*) under Working Plan and so named after the name of concerned *chera*. The ridge dividing the *chera* valley was taken usually as the *mahal* boundary. So the watershed line of each *chera* has been taken as the boundary of the mahal. If *cheras* had big valleys, the *chera* itself is taken as mahal boundary by naming it as right or left bank.

4. PARK BIODIVERSITY AND HABITAT

The forests of the Park are composed of mixed tropical evergreen and semi-evergreen plant species, characterized by high rainfall and a multi-tier vegetational assemblage of rich biodiversity. Therefore, the Park is categorized under the tropical evergreen and semi-evergreen biogeographic zone. The Park has also been shown as Sylhet hills biological ecological zone by the IUCN, Bangladesh. The influence of microclimatic and edaphic factors including rainfall, humidity, aspect, sunshine and soil is predominant on the forests of Park.

The conservation of biodiversity in each of the representative biogeographic zone of Bangladesh is a main objective of the establishment and management of PAs. Five broad types of habitats in Satchury Park can be identified as i) high forests represented by the remaining natural forests, ii) plantations including the monoculture of exotics, iii) grasslands and bamboos, iv) wetlands, and v) cultivated fields; the first two being the largest in extent and also important from Park management point of view. The cultivated fields (mainly of paddies) and grasslands, which harbour some mammals, ground birds and reptiles, get inundated during monsoon rains. The water bodies harbour important fish species, water birds and amphibians.

The following main components (flora, fauna and NTFPs) of biodiversity are described in order to have a better understanding of Park habitat.

4.1 Forests

The forests (mainly mixed tropical evergreen and semi-evergreen forests) of Sylhet forest division including the PAs were reserved in early nineteenth century. Raghunandan Hill forests, a part of which is covered under Satchuri NP, was the first to be decalred as RF in 1914 (Notification No. 4238-R, 22nd October 1914 with a forest area of 10,000 acres). Before reservation many forests were cleared for *jhum* (shifting cultivation), after which secondary vegetation developed over the period. Presently the Park has natural forests, and the plantations raised earlier by converting high forests of great biodiversity value. Large deciduous trees are mixed with evergreen smaller trees and bamboos. The top canopy includes *Artocarpus chaplasha*, *Dipterocarpus turbinatus*, *Elaeocarpus floribundaas*, *Dillenia pentagyna*, *Castanopsis tribuloides*, etc. The shrub species comprise of *Adhatoda zeylanica*, *Carea arborea* and others, whereas bamboos species are *Bambusa tulda*, *Bambusa polymorpha*, *Bambusa longispiculata*, etc, and *Saccharum*, *Daemonorops*, *Thysanolaena* as main grass species. A number of fodder and fruit bearing plants occur naturally in the Park. Forest fires in summer have adversely affected the natural forest regeneration in the Park.

Major parts of natural forests of Raghunandan RF were converted by raising long rotation plantations (of teak, mahogany, garjan, karai, sal, gamari, shiso, toon, pynkado, agar, jarul, cham, jam, etc) taken up since 1920s for production forestry. Parts of the original forests have been removed and its conservation value currently stems from the remaining natural forests and the plantations, which have developed a tall, multi-storied structure. The Park area represents the most accessible hill forests in Sylhet Forest Division, and its biodiversity conservation and eco-tourism values need to be recognized. In the oldest of these areas the vegetation cover has taken on the structure of natural forest. On review of the old compartment history files of Raghunandan forest block it came out that the natural regeneration in different compartments was still good (in sixties) with dense undergrowth in mixed irregular top canopy. Therefore, it can be concluded that the conversion of high biodiversity value natural forests was not justified in view of traumatic disturbances to the forest ecosystem, brought by clearfelling of natural forests and followed by plantation activities.

Mixed and irregular forests of semi-evergreen and evergreen species are found in Raghunandan RF (a part of which is proposed as Satchury NP), which was initially subdivided into 12 compartments. Main tree species include udal, banborai, kurcha, cham, rata, awal, jam, amalaki, kumbi, ekush, jawa, bohera. Asamlota, katalota, dudlota, bamboo and sungrass form understorey. Forest fires have been common during summer. Plantations of many species (e.g., teak, gamar, sal, sissoo, cham, jam, jarul, agar, bamboo, cane, pynkado, etc.) have been raised in Raghunandan RF since 1922 as documented in Working Plans. Some parts of Raghunandan Hill RF still have comparatively better stocked forests that are mainly mixed tropical evergreen forests. Although plantations occupy substantial part, a significant portion of the Park still has natural forests, where the under-storey of shrubs, herbs and bamboo is good. The enrichment plantations of indigeneous tree species and under-planting of bamboo and cane has been taken up in some areas.

Initially these forests were managed, and rightly so, under selection-cum-improvement silvicultural system as the natural regeneration of main species was good and the terrain was generally hilly. Unfortunately they were subsequently opened for clearfelling followed by artificial regeneration by planting species such as garjan, champ, bonak, karai, jam, gamar, sal, teak, jam, kumbi, haritiki, bohera, dhakijam, hargoza, jarul, kadam, malakana, gamar, rata and gondrai (the first plantations were taken up in 1922 as documented in

Working Plans). Teak plantations of Raghunandan Hill RF have been particularly subject to illicit felling by local people but also by outsiders due to high value teak timber. Similarly NTFPs such as cane and creepers are illegally harvested and some wildlife damage also done by hunting.

Total forest area of Satchury Range is 1518.80 ha, divided into Satchari Beat (836.50 ha including 242.82 ha covered under the proposed Satchury Park) and Telmachra Beat (682.30 ha). The remaining forests/plantations (593.68 ha) of Satchury Beat (not covered under the proposed Park) lie mainly (except some teak plantations located to the southern most boundary of the Park) on the north to Park boundary (along Dhaka-Sylhet highway). This remainder forest/plantation area of 593.68 ha is proposed to be included in the Park as discussed in Part II of this Plan. The remainder forest areas of Raghunandan Hill RF, located on north-east of Satchury Range forests, are covered under Raghunandan Range of Sylhet Forest Division.

Natural forests still exist on the western and central parts of the Park whereas the plantations of both long and short rotation species have long since been established on other sides of the Park. For example, teak plantations have been raised since 1948 on southern boundary of the Park whereas short rotation plantations have recently (since 1988) on northern and eastern boundaries. The enrichment plantations of indigeneous tree species and under-planting of bamboo have been taken up since 1996 in north-western part of the Park. Oil palm plantations, taken up on pilot scale outside the northern boundary, have been discontinued but short rotation plantations of fast growing species have continued.

4.2 Fauna

A number of animal species (mammals, birds, reptiles and amphibians), both forest-dwelling and wetland-associated species, of different genera and families are found in the Park. Satchury NP and adjoining Raghunandan Hill RF are home to avifauna of many species (representing a substantial portion of the country's known bird species) dependent on good undergrowth and forest cover. Some of the forest-dwelling and wetland-associated species are at high risk of extinction. The Park supports herpetofauna, including frogs, toads, turtles, lizards, snakes and a rich diversity of other faunal groups such as invertebrates and fishes. A viable populations of many small and medium-sized mammal *species* that can survive in limited forest areas and/or disturbed or secondary habitats (e.g., jackals, small cats, barking deer, wild pigs, etc.) are found in the remaining disturbed and fragmented habitat. A rich diversity of other faunal groups such as reptiles, vertebrates, fishes and amphibians is present.

A number of bird species are found in Satchuri; important bird species include Greater Racket-tailed Drongo (*Dicrurus paradiseus*), Hill Myna (*Gracula religiosa*), Oriental Pied Hornbill (*Anthraceros albirostris*), Red Headed Trogon (*Harpactes erythrocephalus*), Red Jungle Fowl (*Gallus gallus*), White-crested Laughing Thrush (*Garrulax leucolophus*), Puff-throated (Spotted) Babbler (*Pellorneum ruficeps*) and White-rumped Shama (*Copsychus malabaricus*).

4.3 Non-Timber Forest Products (NTFPs)

The role of NTFPs in providing livelihoods, employment and income to forest dependent communities has been recognized, particularly with international surge on rural poverty alleviation, biodiversity conservation and co-management of forests and PAs by empowering local communities. Traditionally NTFPs have played an important role in sustaining livelihoods of rural poor and forest dwellers in forest areas of Sylhet. Rural communities in past collected from the forests foods such as honey, mushrooms, fruits, nuts, tubers, leaves and numerous other forest products. They collected a variety of NTFPs (e.g. honey, creepers, grass, fruits, nuts, tubers, leaves, bark, bamboo, canes, medicinal plants, resin, gums, oil seeds, essential oils, tannin materials, wild animals, etc.).

Medicinal plants collected from natural forests formed the main resource base for traditional medicine and health practices characterized by folk stream (village based local knowledge) and codified stream (Ayurved and Unani systems of medicine). The traditions of folk stream were purely empirical, decentralized, local resource-based, community rooted and location specific. A majority of rural population in the country depends on traditional medicines as allopathic medicines are expensive and not easily available in the countryside. Local biodiversity, trees, shrubs, herbs, grasses, animal products and minerals formed a major resource base of these traditions. Local people depend on Kabirajs who prescribe traditional medicines based on their experiences. There is increasing demand for herbal medicines in urban areas as well due to their curative properties and no harmful side effects.

Various NTFPs being currently obtained from the forests of the Park include medicinal plants, bamboo, canes, sungrass, honey, wax, fish, prawn and shells, lac, leaves and seeds, wild animals, etc. Rural population depends on medicinal plants as traditional medicine, oftenly prescribed by indigeneous medical doctors (*Kabiraj*). Usufructury rights in terms of both timber and non-timber products are granted to local communities through PBSAs under FSP. A regular flow of benefits from NTFPs can be a good source of

livelihood, employment and income to local people. However, sustainable management of forests and the Park are necessary for managing NTFPs sustainably.

As commercial harvesting is not practiced in the Park, one of the multiple objectives of forest management should be the production of NTFPs and consequent employment and income generation to rural surplus labour through the collection stage to processing and sale. Many NTFPs such as roots, seeds, leaves and barks of medicinal trees can be harvested sustainably without adversely affecting forest regeneration (as cutting down a tree is not required). *In-situ* and *ex-situ* conservation of biodiversity of medicinal value is appropriate within the Park in view of heavy dependence of rural poor on medicinal plants for their primary health care. Some NTFPs collected by local people (e.g. sungrass) offer opportunities for self-employment if NTFPs based cottage and small-scale industries are promoted locally through co-management committees and their federations. They may be assisted (e.g. micro-level finance from LDF and skill development training through partner NGOs) in establishing value addition units locally.

4.4 Biodiversity Utilization

Sylhet is densely populated and a majority of population depend on agriculture for earning their livelihood. The forests of Sylhet division are not adequate in meeting a huge demand of a predominantly agrarian population. Isolated forests of Raghunandan Hill RF in general and the Park in particular are surrounded by large population.

4.4.1 Biodiversity Produce for Human Use

Although no commercial harvesting is being done presently by FD in the Park, the forests are under tremendous biotic pressure for forest produce and forest land for cultivation mainly by local people but also from the people from neighbouring towns and Tea Estate labourers. In addition to timber and fuelwood collected by local people for meeting agricultural demands and boat construction, a number of NTFPs are collected by them, mainly for subsistence consumption. Bamboo, cane and sungrass are important furniture and house building material (used as thatch for roof construction). Although the hunting of wildlife is prohibited, local tribes depend on hunting for meeting their consumption demands for meat. Even surrounding urban population use the Park for earning their livelihood through commercial sale of illicitly felled timber and fuelwood. Although the relatively easy accessibility of the Park is a source of easy access to visitors to the Park, it also provides a scope for illicit removal of forest produce from the forests and encroachment of forest land. Therefore, the protection of forests and wildlife against smuggling, and encroachment of forest land pose a big challenge both for the FD staff and other stakeholders.

In addition to 15 surrounding villages, two Tea Estates (Satchuri and Chaklapunji on western and eastern sides respectively) are located around the Park and the labourers, many of them migrants from other densely populated districts, depend on the neighbouring forests for forest produce.

4.4.2 Marketable Forest Products

Important local markets for forest produce include Sylhet, Sunamganj, Maulvibazar, Chunarughat, Madhabpur, Habiganj and Srimangal. The demand for forest produce far exceeds their supply from the forests of Raghunandan Hill RF due to heavy population density. The predominantly agrarian economy of local people puts a heavy demand on forest produce including timber for agricultural implements. A large part of the demand for forest produce is met by homesteads, which in addition to meeting the subsistence needs of local farmers are an important source of meeting demand-supply gap.

Sylhet forest division is a main source of supply of bamboo, cane and murta from the government forests. However, the supply of forest produce from the government forests is declining due mainly to deforestation and shrinking forest lands. Other NTFPs that are harvested include vines, medicinal plants, grasses, fodder and mulch. Illicitly harvested timber and fuelwood are also marketed in nearby towns and markets.

5. ASSESSMENT OF BIODIVERSITY MANAGEMENT PRACTICES

5.1 Forest Management Systems

The forests of Raghunandan Hill RF (a part now covered under the proposed Satchari National Park) were the first to be declared as RFs during early nineteenth century. By and large the catchment area of each existing stream (*chera*) was designated as a forest block. This illustrates that the concept of watershed management was adopted at an early stage of managing the hill forests of Sylhet Forest Division. Raghunandan Hill RF was divided into 12 compartments. These forests were subjected to unrestricted biotic interference; shifting cultivation, grazing and forest fires being the most prominent.

Initially individual trees used to be sold based on permits issued by FD. The purchase contract system based on a minimum guaranteed royalty was introduced during 1924-25 under which the purchaser was allowed to fell any tree over and above 6 feet girth. The system of marking trees (by a responsible officer of FD) before felling was introduced in 1930-31. As the traders objected, the marking system had to be replaced next year by coupe (*maha*) system of timber harvesting based on fee-cum-royalty. Bamboo working in the the RF was regulated in order to avoid excessive extraction of immature bamboo clumps/culms in designated areas and compartments (that were opened for bamboo harvesting over a four year felling cycle).

The first Working Scheme, prepared for Sylhet forest division for the period 1935-38, prescribed plantations of teak, jarul, gamar, cham, toon and garjan in Raghunandan Hill RF. The first Working Plan (Das, 1938-47) recommended three Working Circles (Timber A & B, Firewood A & B, and Bamboo) and the RF was included under Timber Working Circle (WC) to be managed under the selection-cum-improvement silvicultural system in view of the hilly terrain. Raghunandan Hill RF was divided into 12 compartments under the two Working Schemes (prepared for the periods 1950-54 and 1959-65) for their silvicultural management under selection-cum-improvement (harvesting of selected trees for timber based on exploitable girth) and clear-felling-cum-artificial (conversion of existing forests by clearfelling followed by raising plantations) regeneration methods. As a result, natural forest in this RF were clear-felled and planted with teak, jarul, garjan and other tree species.

A revised Working Plan was prepared by Chowdhury (for the period 1963 – 1983) recommending five Working Circles for managing the forests of Sylhet division. Unfortunately the selection-cum-improvement WC, which was a very appropriate system of silvicultural management for the hill forests of Raghunandan RF, was abolished in this plan. Given good rainfall and forest soils, the natural regeneration in the hill forests would have been encouraged by checking biotic pressure. The clearfelling-cum-artificial regeneration WC was split up in two WCs in order to accommodate the plantations of long and short rotation plantations. The hill forests covered under the present day Lawachera NP were allocated under long rotation WC wherein annual coupes were marked for clearfelling followed by the plantations of long rotation trees species such as teak, sal, chapalish, garjan and jarul. The hill forests covered under the present day Satchuri NP were divided under the long and short rotation WCs.

The plantations of malakana (*Paraserianthes falcataria*) were introduced in 1974 in many RFs of Sylhet Forest Division in order to ensure a regular supply of short rotation (10-15 years) pulpwood material for Sylhet Pulp and Paper Mill. The plantations continued to be raised in Raghunandan Hill RF and with increased focus on plantation forestry, the recommendations for conversion of natural forests and raising of plantations continued under the Management Plans of Balmforth and Howlader (1988-97) and Choudhury (1991-2001) till the proposal submitted for the proposed Satchuri NP in 2003.

5.2 Wildlife Management Practices

The management plans of Balmforth and Howlader (1988-97) and Chowdhury (1991/92-2000/01) provided for preservation working circle for the management of the PAs of Sylhet Forest Division. Although the main prescriptions of stopping commercial fellings in notified PAs were implemented, wildlife management could not be improved due mainly to paucity of funds required for field activities. The plans also recommended to prepare separate schemes/plans for the management of PAs. Accordingly separate Management Plans were prepared for Lawachara and Rema-Kalenga by Rosario (1997), and by Salter and Alam (2001) but these could neither be approved nor implemented.

5.3 Habitat Protection

The forests of Raghunandan Hill RF were subject to indiscriminate felling prior to their reservation in early nineteenth century. The forests were brought under scientific management during British rule when in 1865 FD was established and Forest Acts of 1865, 1878 and 1927 were implemented. Raghunandan forests were the first to be declared as RF in 1914 by following due reservation procedures. As a result, the legal status of these forests got enhanced and the protection of habitat against illicit felling, encroachment, forest fires and grazing was organized by FD staff. The provisions of Wildlife (Amendment) (Preservation) Act, 1974 will further strengthen protection after gazetting the proposed Satchari NP.

Participatory forestry is being implemented in Sylhet Forest Division under FSP. The buffer plantations (raised in the interface landscape zones of Lawachara and Rema-Kalenga) are protected by the participants (organized into user groups), who get usufructury benefits from the harvests as per the benefits sharing guidelines of FSP. The Park is approachable by jeep, bicycles and foot, and this easy accessibility available to huge local population density (combined with fertile soil and suitable topography) have contributed to encroachment of forests lands, over-exploitation of forest produce and degradation of habitat in Raghunandan RF. A large labour force working in surrounding Tea Estates not only derive forest produce from nearby forests resulting in vegetation degradation. A close proximity of forests of Satchari Park to international borders gives rise to transnational protection problems, which require international coordination between the Forest Departments of Bangladesh and the neighbouring Indian states.

5.4 Eco-Tourism

The easy accessibility of Satchari from Sylhet and Dhaka through rail and road networks make the Park very attractive for eco-tourism, particularly to urban dwellers. After the development of minimum visitor facilities a large number of tourists are expected to visit, particularly easily accessible Satchari to have a feel of luxuriant vegetation of evergreen forests and good landscape with rolling hills and interspersed valleys. However, chartered eco-tours on the pattern of Sundarbans have not been yet popular in Sylhet Forest Division. But with increased facilities for visitors it can be anticipated that the number of eco-tourists will increase manifold in future.

5.5 Management Practices for Non-Timber Forest Products

Forest management practices in Sylhet have in past focused mainly on timber management due mainly to its commercial value. The approach of forest management laid more emphasis on the development of major forest products such as timber whereas NTFPs received relatively low priority by treating them as by-products. This is evident from the terminology, minor forest produce (MFP) given to all the forest products other than timber and fuelwood (termed as major forest products). As a result, the management of NTFPs did not receive its due importance. NTFPs cover a broad spectrum of biomass obtained from leaves, flowers, fruits, seeds, stems, roots and barks from different tree species, shrubs, herbs and wild animals for meeting human needs for food shelter, clothing and other items for local use and income generation. Many of these NTFPs are collected locally by primary collectors for their subsistence consumption but also for cash sale. Food and medicinal value of the products for which they are used as raw material largely determined the degree of commercialization of NTFPs. The extent and use-patterns of many NTFPs have remained inadequately known in the absence of any scientific survey.

Destructive harvesting practices have been adopted by private traders in the collection of many NTFPs, whose collection and trade were taken up as an un-organized sector. The adverse impact of unscientific and destructive exploitation practices adopted by some private collectors inside easily accessible forests has not been investigated. With dwindling forests many NTFPs have become extinct and the symbiotic relationship that existed in past between forest dwellers including tribals is disturbed, leading to further deforestation and loss of NTFPs. Clearfelling, jhum, encroachment and forest degradation without adequate replenishment through natural and artificial regeneration, has reduced the availability of NTFPs considerably in many forests including Raghunandan RF.

Some NTFPs in past used to be leased out to private sector based on fixed royalty payment to Government. Although primary collectors including forest dwellers and tribals did the collection of NTFPs from forests, the lessees got the rights for their procurement and marketing. The disposal of some NTFPs (e.g. sungrass), based on auctions of forest coupes (locally known as *mahals*), was done to private sector on payment of fixed royalty. In such cases the primary collectors sold the collected NTFPs to the designated agents of lessee (locally known as *mahaldar*). Both of these systems of disposing NTFPs favor of over-exploitation of forests and NTFPs without adequate consideration for the sustainability of forest resources or the livelihoods of the local forest dependent communities. The royalty and revenue generated from the sale of NTFPs have not been ploughed back for their sustainable management and development. Except a scheme on the

plantations of bamboo, cane and murta funded by the GOB, no significant efforts have been taken up in past for the regeneration of NTFPs yielding species. There are some other NTFPs, which do not fall under the above category, and their trade is free from FD restrictions. Local collectors including tribals sell such NTFPs in local weekly markets (*hats*), sometimes on barter basis.

There is a lack of appropriate policies, harvesting rules and regulations to the management, harvesting and development of many NTFPs. Whatever harvesting rules are existing for some NTFPs such as bamboo and canes do not get implemented in the absence of adequate funds and field supervision. There are no organized marketing institutions, which can support the primary collectors of NTFPs. Adequate research has not been taken up for the promotion, management and development, harvesting and utilization of NTFPs. Hill forests managed under clearfelling system have reduced biodiversity and inadequate regeneration of NTFPs bearing species. Although many NTFPs yielding species can be well integrated in the FD plantation program through inter-planting and under-planting, no efforts have been made in past while undertaking plantation programs, which focused mainly on few commercially important species such as teak (*Tectona grandis*) and gamar (*Gmelina arborea*).

The role of NTFPs in rural livelihoods, biodiversity conservation, poverty alleviation, household food security, nutrition and local employment generation is being increasingly recognized. However, in Bangladesh inadequate attention has been given to NTFPs, particularly with respect to their sustainable management, regeneration, collection, storage, processing, value addition and marketing.

5.6 Conservation Research, Monitoring and Training

There is neither any wildlife research staff nor research facility (e.g. laboratory) for the Park. Similarly there is no established monitoring mechanism presently for assessing the health status of wildlife and biodiversity. The assessment of regeneration or degeneration of forests is necessary for which a suitable monitoring mechanism need to be put in place for better management.

Although no special wildlife in-country training of FD staff has been organized, some officers have been trained overseas in wildlife and PA management. Wildlife management is one of the several subjects being taught during the regular forestry training imparted to cadre officers at Forest Academy, Chittagong. There is a need for organizing special training (in-country and overseas) courses on protected area management, conservation of biology, habitat restoration, co-management of PAs, legal aspects of PA management, capture of wildlife, census operations, captive breeding, etc.

5.7 Administrative Set Up

Under the overall charge of the CCF, a wildlife and nature conservation circle (with CF as head and assisted by a staff officer of DCF rank) operates with six field level DFOs. Of the six DFOs, four are incharge of Wildlife Management & Nature Conservation (WMNC) Divisions with HQs at Chittagong, Sylhet, Khulna and Dhaka. However, of the four designated DFOs, only three (at Chittagong, Sylhet and Khulna) are in position presently. There is a need of immediately posting a DFO for the WMNC Division at Dhaka as per the approved organogram. They should be well assisted with adequate staff including trained ACFs posted at each PA level within a Wildlife Division.

6. INTERFACE LANDSCAPE SITUATION

The present situation of the surrounding landscape (both biophysical and stakeholders landscape) of the proposed Satchari NP is described as below.

6.1 Landscape Approach

The Plan has adopted a landscape approach of Park management by focusing on an appropriate spatial scale to integrate relevant habitat/forest system, ecosystem and social/institutional system (Figure 5). It is an holistic approach that takes into account relevant factors impinging on the management of Satchari NP in the context of a broader spatial scale. So surrounding landscape is taken as a planning and development unit for integrated Park management. It addresses the needs of households and co-management activities in the context of a broader economic, natural resource and socio-institutional environment of the Park. It provides a framework to manage a PA for multiple uses by addressing interactions between local economy, stakeholders and natural resource base of a Park.

Landscape management of a PA entails biodiversity conservation by linking surrounding ecosystems and human systems. It helps restore ecological processes both within a Park and in surrounding landscapes by accounting presence and needs of local inhabitants. It promotes active involvement of main stakeholders in Park management and biodiversity conservation. However, the boundaries of an identified integrated system (the spatial scale) need to be kept within manageable limits after assessing field specific situation. The structure and conditions of surrounding landscape must be accounted for in the management of a Park.

6.2 Interface Landscape of Satchari National Park

An interface landscape exercises influence around the boundaries of the Park. A number of villages and tea estates fall within the zone of influence of Satchari NP. The Park is intimately surrounded by a number of villages, towns, cultivated fields, Tea Estates and the remainder forests of Raghunandan Hill RF. The Park is situated in Paikpara Union of Chunarughat Upzila (of Habiganj). The Park is bordered on the north by Dhaka-Sylhet Highway (a major part of the remainder Raghunandan Hill RF lies north of Dhaka-Sylhet Highway), on the west and west-east by Satchari Tea Estate, on the east by Chaklapunji Tea Estate, and on the south-east by Raghunandan RF lands under plantations of teak (raised during 1962-66) and the plantations of short rotation tree species (raised in 1988).

Old teak plantations raised during 1953-63, 1948-52 and 1959-65 are located beyond the southern boundary of the Park up to the international border of the Indian state of Tripura. The remaining plantations/forests of Satchuri Range are situated to the northern side of the Park's boundary along the Dhaka-Sylhet highway. Most of the local population including ethnic minorities, who depend on agriculture for their livelihood, depend on nearby forests for meeting their consumption needs for forest produce.

The total forest area (1518.80 ha) of Satchuri Range is divided into Satchuri Beat (836.50 ha including 242.82 ha of the proposed Satchuri Park) and Telmachra Beat (682.30 ha). The forests of Telmachra Beat lie towards north-western boundary of the Park. The remainder forest area of Satchuri Range (1275.98 ha) is covered under the proposed interface landscape zone. Further north to this landscape zone lie, i) the remainder forests of Raghunandan Hill RF (forests covered under Shaltila Beat of Raghunandan Range are adjoining to the forests covered under Satchuri Range), ii) Kapaichara Tea Estate, and iii) Laskarpur Tea Estate (TE). Chandpur TE, Nabab Khan TE and Chandichera TE lie towards north-western side of the Park.

Considering the forest habitat and existing socio-economic system a 8 km wide interface landscape zone around the Park's boundary is adopted for effective management of the Park. The relevant elements of this socio-economic system are described in Sections 6.4 and 6.5.

6.3 Tea Estates

Satchari Tea Estate borders the Park entirely on the western side while on the eastern side Chaklapunji Tea Estate runs parallel to the Park boundary. Other Tea Estates located close to the Park and the neighbouring forests of Raghunandan Hill RF covered under Satchuri Beat of Satchuri Range are Amo, Surma, Nababkhan, Chandpur, Teliapara, Kapaichora and Laskarpur. Satchari and Chaklapunji Tea Estates have major stakes in the Park as a large number of tea labourers and their families have significant dependency on the forests. A large labor force required for managing the Tea Estates gives rise to tremendous pressure on nearby forests for fuelwood, fodder, timber and NTFPs. The unemployed villagers (on an average a quarter of the male labour force remains unemployed) get involved in fuelwood collection and illicit felling of trees.

A PRA was carried out in Satchuri and Chaklapunji Tea Estates with following estimates : total households Satchuri-350, Chaklapunji-450 nearly; total population Satchuri-1350, Chaklapunji-1200 approximately; permanently employed person Satchuri-350, Chaklapunji-450 approx; partially employed persons Satchuri-200, Chaklapunji-200 approx; persons involved in fuelwood collection Satchuri-200, Chaklapunji-200 approx; literacy rate Satchuri-30%, Chaklapunji-25% nearly. The daily labourers employed by the Tea Estates earn Tk. 28/day and provided flour @ 3.5 Kg/week/person. In addition an amount of flour of 1.5 Kg/child is provided for children up to 12 years old, and medical facilities are free for household members. Three NGOs (ASA, BRAC and Grameen Bank), one Bank (Krishi Bank) and two insurance companies (Sandhani and Delta Life) are working in the area mainly for livelihood improvements of local people. Adibashi Samaj Unnayan Sanstha is working as a community based organization for educational and cultural aspects.

Tea Estate lands were leased out by the government on long term basis for developing tea gardens with a specific portion of the total land being devoted for tree plantations. Although many Tea Estates plant trees regularly (for example, Finlays take up 5 ha of commercial plantations annually in each Tea Estates), some parts of the Tea Estates have not yet been brought under tea/tree cultivation. The vacant areas have over the period developed as unmanaged secondary vegetation, which provides additional wildlife habitat as transition zone between mixed forests/plantations and tea gardens. Such areas should not be converted into monoculture of cash crops (citrus, banana, pineapple, etc.) by individual families residing within Tea Estates.

The shade trees such as *Albizia lebbec* and *Deris robusta*, planted inside tea plantations for providing shade to tea bushes, are also selectively stolen by illicit fellers. Sometimes they use Tea Estates as transport routes after felling trees illicitly inside the forests covered under the Park. This means that joint efforts are required both from FD and Tea Estate authorities for controlling illicit felling of trees. Poor families can be organized into groups for implementing income generation activities by using LDF and helping FD and Tea Estate management in tree protection. Bangladesh Tea Labour Association looks after the welfare of tea workers of all member Tea Estates, each of which has a Panchayat of tea workers. But this will require a policy decision from Bangladesh Tea Association (Agrabad, Chittagong) to issue suitable instructions to the concerned Tea Estate management. Forest Department may approach the Chairman, Tea Association (it comprises 161 Tea Estates as members) to issue such instructions to the authorities of Satchari and Chaklapunji Tea Estates and also form a coordination committee of FD and Tea Estates. Some organizations (e.g. International Labour Organization) and NGOs (e.g. BRAC) are already working in the Tea Estates of Finlays for providing services such as primary education, health and women empowerment.

Some parts of adjoining Tea Estates have not so far been brought under tea cultivation and have over the period developed unmanaged secondary vegetation, which provide additional wildlife and plant habitat as a transition zone between mixed forests/plantations and tea gardens. Small areas along Tea Estates have been converted to citrus, pineapple and banana plantations by individual families. The current trend of converting secondary vegetation areas into monocultures is not good for wildlife as it adversely affects their additional habitat comprising secondary vegetation. Huge amount of labor required for managing Tea Estates give rise to tremendous pressure on nearby forests for fuelwood, fodder, timber and other forest products. Sometimes illicit fellers pass through adjoining Tea Estates to fell trees inside the Park but also shade trees inside the Tea Estates. This means joint efforts are required from FD staff and Tea Estate managers for controlling illicit felling.

6.4 Forest Village

Only one recognized Forest Village, Tiprapara inhabited by 24 households of Tripura tribe (Muktachand Devburman is village Headman), is located inside the Park (near to the old Dhaka-Sylhet highway). The village was established by FD inside the RF to provide labor for raising plantations after clear-felling natural forests. Jhum cultivation practiced by them since their settlement has now been stopped. As primary occupation nearly two-third of the villagers practice paddy, banana and lemon cultivation on the forest land assigned to them by FD. Nearly one-third of Tripuras are day laborers as their primary occupation. All the Forest Villagers have major stakes in the nearby forests due to their livelihood dependence on forest resources. They join FD field staff in patrolling the nearby forests.

6.5 Interface Villages

Except the Tiprapara Forest Village no other village is located in the immediate vicinity of the Park due mainly it being surrounded by Tea Estates on east and west side and the portions of Raghunandan Hill RF on north and south sides. However, four villages (Bagharu, Enatabad, Kalishiri and Ghanashyampur), located on the eastern side of the Park, have minor to medium level stakes in the Park. These four villages along with Tea Estate workers are potential beneficiaries of income generation activities to be carried out by forming organized groups. Other villages located away from the Park but near to north-eastern and north-western parts of Raghunandan Hill RF covered under Satchari Beat are Gazipur, Halholia, Deogach,

Promanandapur, Rasulpur, Ratanpur, Baghbari, Sahajahanpur, Teliapara and Goachnagar. Almost all these villages fall under the identified 5-km wide interface landscape zone.

6.6 Stakeholders Assessment

The primary, secondary and institutional stakeholders have been identified by NACOM (2004) through RRA/PRA carried out in the Park. Thirteen identified primary stakeholders derive various resources from the forests whereas five secondary stakeholders exert influence on the Park forests indirectly. Three primary stakeholders (moholdar, fuelwood collector, illegal timber feller) have major stakes, being responsible for forest degradation. Other three primary stakeholders (bamboo collectors, house building material collectors and lemon cultivators) have minor stakes whereas the remainder seven (honey collectors, sun grass collectors, fruit collectors, hunters, vegetables collectors, medicinal plants collectors and sand collectors) have only minor stakes in the forests. Most of the primary stakeholders are poor, who earn their livelihoods by carrying out forest-based activities.

The five identified stakeholders are timber traders, sawmill owners, furniture shop owners, fuelwood traders and brickfield owners. They are linked with forest-based activities through utilization and trade. There are 15-20 timber traders and 18 saw mills located at Deogach, Teliapara and Chunarughat Bazar. Sometimes there are allegations of illicit felling and illegal timber trade against timber traders and sawmill owners. Nearly 20 furniture shops are located in Chunarughat but locally made furniture is transported as far as Sylhet and Dhaka. Nearly 15 fuelwood traders, located at Teliapara, Chunarughat and Deogach, engage in procurement of fuelwood from individual collectors. In addition to local sale, the collected fuelwood is stacked and transported by trucks and train to Habigonj, Brahamanbaria, Comilla, etc. Three brick kilns, all located in Deogach Union use fuelwood and coal for their operations.

Main institutional stakeholders involved with the development and administration activities around the Park are identified as Forest Department, NGOs, CBOs, Police, BDR, banks, Union Parshads and Gram Sarkar. Main NGOs operating around the Park are BRAC, ASA, BRDB, HEED, BASA and PASA. Main Banks involved in credit programs are Krishi Bank and Grameen Bank. The CBO currently operating at Deogach and Gazipur is Youth Development Club.

P A R T I I

**RECOMMENDING STRATEGIC PROGRAMS FOR A
SUSTAINABLE PROTECTED AREA SYSTEM**

1. PLAN OBJECTIVES AND CHALLENGES

1.1 Objectives of Management

The Plan focuses on protecting and conserving the rich biodiversity of the Park in accordance with sound principles of sustainable environmental and socio-economic development and the Forest Policy of 1994. Main long-term management aim is to maintain the maximum possible area under forest cover, and to maintain this forest and its constituent biodiversity in the best possible condition. Main objectives of the Plan are as follows:

- ➔ To develop and implement a co-management approach that will ensure long-term protection and conservation of biodiversity within the Park, while permitting sustainable use in designated zones by local people as key stakeholders.
- ➔ To conserve the biodiversity of the Park by following a co-management approach based on building partnerships with all the stakeholders and sharing benefits with local communities and key stakeholders.
- ➔ To refine and strengthen the policy, operational, infrastructural and institutional capacity framework for PA management
- ➔ To conserve and maintain viable wildlife population including endangered, threatened, endemic and rare species of plants and animals
- ➔ To implement income generation activities for sustainable livelihood development
- ➔ To enhance skills of local stakeholders
- ➔ To restore and maintain as far as possible the floral, faunal, physical attributes and productivity of the forest eco-systems
- ➔ To encourage eco-tourism in suitable zones and develop visitor amenities

1.2 Framework Activities

Main framework activities to be undertaken for achieving the above-stated objectives include amongst others:

- ➔ Survey, demarcate and mark the Park boundaries;
- ➔ Develop a co-management model and relevant policy guidelines, and establish co-management agreements linking Park conservation with benefits sharing arrangements with key stakeholders;
- ➔ Survey biodiversity resources;
- ➔ Strengthen FD institutional capacity for Park management;
- ➔ Build conservation awareness, constituencies and extension activities on conservation issues;
- ➔ Train local stakeholders including participants and FD field staff in conservation management, raise awareness among stakeholders and develop Park facilities;
- ➔ Develop conservation and visitor facilities within the Park;
- ➔ Create tree resources in adjacent agricultural and village areas on participatory conservation and benefits sharing basis and implement alternative income generation activities for sustainable livelihoods;
- ➔ Convert existing short-rotation plantations of exotic species to naturally regenerated areas by gradually opening the canopy, and enrichment plantations of indigenous species in identified gaps, if required; and
- ➔ Provide alternative income generation opportunities for key stakeholders.

1.3 Challenges in Achieving Management Objectives

Encroachment of forest lands and illegal removal of forest produce (mainly timber and fuelwood) are two main challenges facing the Park. Other important challenges include biotic pressure by labor employed by Tea Estates, hunting and poaching, transboundary problems, flood and erosion, grasslands degradation, traffic movement on roads and rail lines, demarcation of PA boundaries, lack of funds, lack of trained professionals, inadequate staffing and infrastructure, monoculture, man-animal conflicts, etc.

2. SUSTAINABLE PROTECTED AREA MANAGEMENT SYSTEM

2.1 Protected Area Management : Emerging Priorities

In earlier stages of forests management in the country its main objective was production of wood, mainly timber. The value of other forest functions and services such as regulation of stream flow, source of biological diversity and sink for carbon content was neither adequately appreciated nor accounted for in forest management decisions. Consequently the management of forests was based on partial valuation of forest functions and services. With the promulgation of Forest Policy of 1994, the emphasis shifted from timber production to ecological requirements, conservation of biological diversity, meeting bonafide consumption needs of local people and other services from forests.

A forest ecosystem creates its own micro-climate that is an integrated result of meteorological processes and the conditions within the space occupied by the forest ecosystem. Success of natural forest management depends upon adequate site information, understanding of plant communities and local people, nutrient availability, regeneration, etc. Management of natural forests for generating products and services while maintaining their environmental roles and multiple functions is possible, but silviculturally complex. An important process responsible for the sustainability of forest ecosystems is the biogeochemical cycling of nutrients. The leaves, twigs, small branches and fruits make the litter falling on forest floor. The litter is decomposed by micro-organisms (bacteria, fungi), adding nutrients to forest soils for plant growth. Forest management should thus be part of biodiversity and land management strategy so that perennial vegetative cover is maintained. The management system should be perceived as husbandry of renewable forest resource with attention to the protection of conservation, recreational and other values.

2.2 Management Strategies

Consistent with the definition of a National Park under the Wildlife (Preservation) (Amendment) Act, 1974 and the need to establish gainful partnerships with key stakeholders based on sustainable use, the following management strategies have guided the development of this Management Plan, and of the management and development programs outlined in Part-II. The overall focus of management planning in the Park is to manage the Park in as natural and undisturbed condition as possible, and to provide protection to their constituent biodiversity including wildlife population. However, such a management of Satchari Park would by necessity require gainful partnerships with key stakeholders in view of their intimate interspersions with human habitations and cultivation in a largely agrarian economy with traditional dependency on neighbouring forests for livelihoods. Co-management approach within the parameters set by the NSP has, therefore, been adopted as described in detail in next section.

The maintenance and development of good quality forest cover with natural structure and composition, and the conservation of its constituent plant and animal biodiversity will guide the management of the Park. The management of Satchari Park will focus on maintaining, and wherever necessary developing, natural forests with its constituent biodiversity. Hunting of wildlife and commercial felling from forests will not be allowed in keeping with the provisions of the Wildlife (Preservation) (Amendment) Act, 1974, applicable for National Parks. However, subsidiary silvicultural operations required for natural forests regeneration will be carried out keeping in view of specific requirements of habitat management. Similarly sustainable use practices will be allowed by local people/stakeholders particularly in buffer areas based on co-management agreements, specifying roles and responsibilities for stakeholders partnerships. As far as possible subsistence use will be gradually shifted to interface landscape zones and no new settlement or in-migration will be permitted within the core area. Visitor use for outdoor recreation, research and educational purposes will be encouraged in designated areas.

Boundaries of the Park will be surveyed, demarcated and maintained regularly. Specific zones will be designated for achieving different management objectives. Within the Park a management zone is an area of specific management category, distinguishable on account of its management objectives. Zonation will help achieve different management objectives by applying suitable management strategies and operations in each identified zone. Zone programs, prepared for each identified zone with specific management objectives and strategies, will be implemented over the plan period of five years. Some management strategies may be common to two or more zones and so will be detailed in the relevant zones. Such strategies may be related to habitat improvement, restoration and protection. Detailed strategies along with management practices are described in detail in each zone plans in subsequent chapters.

2.3. Co-management Approach

Rural development efforts have so far either been inadequate or failed to take into account relevant linkages between conservation of PAs and welfare of local people. Not only they are getting less production and

employment opportunities due to decreasing land fertility and reduced underground water tables but also degraded forests are not able to meet their bonafide consumption needs for forest produce. The consequent degradation of both public and private land-based resources has resulted in widespread deprivation and rural poverty among local people. A gainful association of such rural mass, achieved by establishing partnership mechanisms, is essential for sustainable management of the country's PAs. Co-management agreements are formal mechanisms for soliciting community interventions for the protection and conservation of PAs in lieu of identified benefits.

Collaborative management – or co-management - is defined as a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources. An equitable sharing of benefits and costs of PAs' protection and management among the stakeholders is, therefore, an important part of co-management approach. An effective linking of socio-economic and ecological incentives and biodiversity conservation will be instrumental in eliciting stakeholders' participation in this approach. For Bangladesh's PAs, relevant co-management actors will include the FD, as legal custodian of PAs, and the stakeholders that play important role in the conservation management. Co-management agreements are important for linking participatory benefit sharing arrangements to PA conservation and will help formalize symbiotic linkages.

The NSP is designed to assist in achievement of the primary objective of conservation of biodiversity within the PAs of Bangladesh. This overall objective is to be achieved through support to the FD and key stakeholders in protecting, rehabilitating, conserving and sustainably managing biodiversity of the PAs by building partnerships based on shared rights and responsibilities.

Nishorgo Support Project will work to achieve the following six separate but closely related objectives in support of the above-stated co-management objective:

- ➔ Develop a functional model for formalized co-management of PAs;
- ➔ Create alternative income generation opportunities for key local stakeholders associated with pilot co-managed PAs;
- ➔ Develop policies conducive to improved PA management and build constituencies to further these policy goals;
- ➔ Strengthen the institutional system and capacity of the FD and key stakeholders so that improvements co-management under the Project can be made permanent;
- ➔ Build or reinforce the infrastructure within PAs that enable better management and provision of visitor services at co-managed sites; and Design and implement a program of habitat management and restoration of pilot PAs.

Local communities are generally put to hardships after notification of a forest area as PA due mainly to curtailment of the flow of forest usufructs through strict regulation, and threats from wildlife to their life and property. Fragmentation of wildlife habitat due to loss of forest land has given rise to man-wildlife conflicts and a tenuous interface situation. Conservation-oriented management of PAs with strict restrictions on forest harvesting and enhanced patrolling have further exacerbated their problems. Local people incur high opportunity costs in terms of foregone benefits, which they were deriving from the forests before the implementation of strict enforcement practices.

The local people, who were hitherto using forests for meeting their livelihood consumption needs, get deprived from forest-based benefits and so need to be compensated adequately for the loss of economic opportunities and wildlife damage to their life and property. This can be achieved by launching co-management projects such as Nishorgo Support Project and sharing the benefits with local people. So there is a strong case for compensating them by sharing benefit streams flowing through PAs and/or off-PAs alternative income generating (AIG) activities.

A sustainable partnership will require an equitable sharing of both benefits and costs. Due to widespread impoverishment of local people it is not expected that they will come forward in investing cash money in the conservation efforts of PAs. However, due to widespread unemployment and under-employment it is plausible to solicit their voluntary labour contribution in an effective protection and management of the PAs and also create self-employment opportunities through alternative income generation activities. This will not only help in instilling ownership feeling among the partners but will also help utilize surplus labour productively for efficient allocation of human and land resources for effective wildlife and habitat conservation.

The stakeholders' rights (e.g. sharing of usufructs and revenue) and responsibilities (e.g. protection and conservation of biodiversity) need to be defined in co-management agreements. Easy access of stakeholders to PAs and protection measures against anthropogenic factors including illegal removals,

encroachment, poaching and man-made fires should also be clarified. These agreements will play an important role in the protection and conservation of PAs as discussed in the next chapter.

Main focus of co-management is on equitably sharing roles and responsibilities by main stakeholders for biodiversity conservation in the Park. Benefits sharing from the harvests of plantations is a main mechanism for eliciting peoples' participation in participatory forestry and so the focus is on plantations as a part of production forestry. For instance, the harvests from plantations raised under FSP form seed money for Tree Farming Fund (10% of total proceeds from the harvests of plantations are earmarked as seed money for TFF). So with focus on biodiversity conservation the flow of benefits to local people is much less in co-management of PAs when compared to participatory forestry. This means that benefit stream need to be strengthened for which LDF is being designed for funding alternative income generating activities. An initial amount of USD 300,000/- is earmarked to be used as seed money.

A two-tier co-management institutional structure (co-management councils and committees) will be developed; the co-management council will have a broad-based structure based on people (nearly 50) from different strata of the community from an identified landscape whereas the committee (responsible for overall management functions including the oversight on Plan implementation) will have nearly 15 persons elected from the council. The precise form and constitution of councils/committees will be specified by the Government.

2.4. Elements of a Sustainable Protected Area Management System

A study on assessment of the FD's institutional organization and capacity to manage the PA system of Bangladesh was completed under NSP with main objectives as i) identifying main elements of a sustainable PA system, ii) assessment of current status of PA management elements and finally iii) making recommendations along with delivery mechanisms. Two broad elements identified were on institutional organization (management support systems), and training and capacity building. These two broad elements were further sub-divided into specific elements as below:

Institutional Organization: Management Support Systems:

- Organizational management
- Information management technology
- Spatial data management
- Financial organizational systems
- Institutional orientation to co-management
- Legal support
- Law enforcement
- Wildlife insurance
- Information, education and communication
- Research
- Monitoring and Evaluation
- Inter-sectoral conservation planning
- Public-private partnerships
- Sustainable financing

Training and Capacity Building:

- Staffing pattern
- Training facilities and capacity
- Training for professional specialist skills
- Integrated training for on-site PA field staff
- Integrated training for local community and other stakeholders

Some of the relevant aspects from the above-mentioned list are covered in this Plan.

3. HABITAT PROTECTION PROGRAMS

3.1 Objectives

Heavy biotic pressure brought by manifold increase in population, and agricultural demands have resulted in habitat degradation and loss of wildlife in the Park. Main objective of this program is to provide adequate protection to the Park for the conservation of its constituent biodiversity.

Main activities to be carried out to achieve this objective will include i) updating forest cover and interface landscape maps, ii) demarcating the Park boundary, iii) controlling illegal removals from the Park, and iv) checking encroachment of Park lands.

3.2 Updating of Existing Forest Cover and Landscape Maps

Detailed forest cover/landscape mapping for Raghunandan Hill RF is available with FD based on 1996 satellite imagery and relevant FD records. This mapping will be updated and used in management zoning by identifying core zones and interface landscape zones. It is recommended to complete this zoning during the Management Plan implementation based on field visits and stakeholders assessments. A map (Figure 4) prepared by FD is used in identifying the core area covering the entire proposed area of 242.83 ha (600 acres).

Reconnaissance surveys followed by detailed surveys of identified areas will be helpful in verifying actual ground situation. New mapping will be carried out during the Plan implementation and will include relevant landscapes within a 5 km-wide interface landscape zones outside of existing/proposed Park boundaries in order to provide a spatial context for coordination of regional landscape elements and neighbouring forests. Mapping will be extended to include the Tea Estate and khas land portions of the landscape and will particularly focus on identifying remnant patches of natural vegetation. Land-use and base maps will be prepared by acquiring latest satellite imageries (e.g. high resolution IKONOS or aerial images) for the Park. These maps may be standardized after comparing with the previous RIMS maps. Actual maps may be produced based on groundtruthing by making use of differential GPS.

3.3 Boundary Demarcation

All the peripheral boundaries of the NP will be identified, surveyed and marked on the ground. The boundaries of core and interface landscape zones will be defined, mapped and also be identified on the ground during the Plan implementation. The advantage of natural features (i.e. rivers, streams/*cheras*, ridge, roads, etc.) will be taken wherever possible while carrying out demarcation. Posts or other markers (wooden or iron pillars, trenches, mounds, etc.) will be put in place at all important and/or turning points and will be labeled. Sometimes boundary and markers are vulnerable to alteration due to human-interference or natural calamities such as floods. So a regular annual maintenance program will be necessary for boundary and pillar renovation and maintenance.

All the locations where primary access routes cross the Park's outer boundaries will be clearly marked with signs indicating the Park's name and summarizing key regulations in written text and symbols. Signboards will be of the following types: i) attractively designed, large wooden signboards where the Dhaka-Sylhet Highway crosses the northern boundaries of the Park; and ii) concrete slab signboards (of the type currently used to mark plantations) at all other locations. Signboards will be placed at other important locations as decided by FD field staff

The traditional traversing method is generally used for boundary demarcation based on Gazette Notification. This method does not employ Aerial Photographs for re-validation. The boundaries of the Park have not been delineated keeping in view permanent natural features such as streams/rivers, roads and ridges. As a result, some inconsistencies may creep in particularly with respect to boundaries and areas of the Park. Some human errors during plotting the traverses and mapping are also not ruled out. The field maps have been used by RIMS to generate GIS databases (administrative boundary layers) through digitization. These problems can be solved either through traditional survey and mapping or else through DGPS guided survey using satellite technology. However, the traditional survey method may not produce desired accuracy and will indeed be costly in terms of time and man power. So the DGPS survey, which may be accurate to sub-meter and would require limited manpower, may be employed for field work.

3.4 Control of Illicit Felling, Fires and Grazing

Effective protection against illicit felling, forest fires and grazing are necessary for the conservation of biodiversity and management of the Park.

3.4.1 Control of Illicit Felling

Illicit felling inside the Park will be checked through extensive joint patrolling (FD staff and local stakeholders) inside the forests, particularly the core areas. The tribal villagers from Tiprapara Forest Village will particularly be helpful in forest protection. Similarly local people from surrounding villages (e.g. Bagharu, Enatabad, Kalishri, Ghanashyampur, etc.) will be involved to help provide protection along with FD field staff. The present practice of appointing helpers (for protection of forests) from villages is not working well and so be stopped herewith. User groups and co-management committees comprising local stakeholders may instead be entrusted with patrolling forests along with FD field staff. Stakeholders' participation in controlling petty theft will be very helpful as being local people they are better informed about biotic pressure points and routes. In view of limited area of the Park, patrolling on foot by participants and FD field staff will regularly be done. In addition to controlling illicit felling they will also check the boundaries of Park and encroachment within Park. It will be essential to regulate illegal running of sawmills and furniture shops located nearby the Park. Guidelines may include that no sawmill should function, say within 10 km boundary of the Park. Wood-based industries without proper license should be stopped. Issuing transit permits by FD staff will also be checked and regulated keeping in view of biodiversity conservation in the Park.

An effective checking of organized smuggling of timber and poaching will require concerted efforts from FD by using modern equipments and transport facilities. In case of organized smuggling by outsiders there may be need for sophisticated fire arms and ammunition and training to combat organized poachers and smugglers. In such cases it may be necessary to give one Revolver and/or Rifle to each ACF/RO and DBBL guns to Beat Officer and FGs. This also may require setting up special protection force by augmenting the presence of FD field staff, if necessary backed up by local police and BDR officials. In such cases inter-agency coordination will be necessary for successful protection efforts and control measures. Similarly international coordination with north-eastern Indian states may be sought. 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 Park 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 due to limited areas under the Park. Redeployment of FD field staff may be necessary depending upon the intensity of illicit felling in certain areas. Special incentives and amenities may be provided to the FD field staff posted in difficult areas (e.g. international border points). Adequate rewards will be provided to those field staff who perform exemplary protection duties. Similarly a group of local informers may be engaged based on payment of rewards to those local people whose information may lead to catching of smugglers. This may prove most effective against poaching of wild animals and theft of forest produce.

3.4.2 Control of Poaching

Poaching of wildlife inside the Park will be checked by FD field staff. Local stakeholders' participation in controlling poaching will be very helpful; patrolling on foot by participants (particularly from the villagers of Tiprapara and surrounding villagers on the Park's periphery) and FD field staff will regularly be done. Special care will be taken during moon nights when incidences of poaching may increase due to better visibility. However, an effective checking of poaching by organized gangs will require concerted efforts from FD by using modern equipments and transport facilities. This also may require setting up special protection force, if necessary by involving local police and BDR officials. 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.

3.4.3 Regulations of Non-Timber Forest Products (NTFPs)

NTFPs such as bamboo, cane and sungrass are presently collected from the Park by whosoever gets access. This collection process should be streamlined and entrusted to co-management committees (to be formed at different levels) who will be responsible for the collection of NTFPs under overall guidance of FD field staff. An assessment of availability of NTFPs will be done before allowing NTFPs collection by the members of co-management committees). This assessment will cover the regeneration status of NTFPs, time and methods of collection and limits of sustainable harvest. The collection of bark and roots will not be allowed. Similarly felling and lopping of trees will also not be allowed. Fruits, seeds, leaves used by wildlife will not be collected. If possible, the processing of NTFPs will be done locally in order to get value addition and generate employment opportunities.

3.4.4 Control of Forest Fire

Control of forest fires will be done by involving local stakeholders. Existing paths/tracks will be used as fire lines as well and will be maintained so by cutting and control burning of grasses and debris twice a year (say in December and March/April). Existing patrolling paths will be cleaned every year before fire season. Additional fire lines will be created at strategic places including regeneration areas. Local people engaged in grazing and NTFPs collection will particularly be targeted for making them aware about forest fire control. Publicity and awareness material will be developed and put up at convenient places for making local people aware about the necessity of forest fire control. The watch towers, to be developed for tourists, will be used as fire watch tower as well. Similarly patrolling squads in association with local stakeholders will guard against forest fire as well. Communication network including walkie talkies will be used in forest fire control. 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 may be maintained for monitoring of fire incidences and assessing their adverse impacts.

3.4.5 Control of Forest Grazing

Villagers (including Forest Villagers and Tea Estate labourers) in and around the Park maintain cattle who invariably graze in forests. No grazing will be allowed in the Park except allowed by the concerned DFOs, particularly rotational grazing in plantation areas. Stakeholders will be convinced not let loose their cattle in forests and also control the cattle of other villagers while patrolling for illicit felling and poaching. However, cutting and carrying of grasses from some specified areas such as plantations may be allowed for stall feeding of cattle of local stakeholders. In buffer areas silvi-pastoral models may be implemented and villagers may be provided such technologies (including seeds/slips) so that they can raise their fodder plantations on their private lands and other unutilized khas lands. Improved cultivation practices carried out with mechanical appliances including power tillers will reduce the need for draught animals. Similarly the breed of livestock may be improved in collaboration of Department of Livestock. A public campaign should be undertaken by holding public meetings and distributing leaflets to make the local people aware about adverse effects of grazing.

3.4.6 Control of Forest Land Encroachment

Survey and demarcation of the peripheral boundary of the Park will be done during the first year of Plan implementation when encroachment areas will also be identified and evicted, if possible after obtaining their voluntary consent.

3.4.7 Resolution of Man-Animal Conflicts

Wild animal depredation (e.g. monkeys, langur) may be a problem in fringe villages including the Forest Village and surrounding Tea Estates. Local stakeholders will be responsible for checking wildlife damage. They will be trained by FD staff and NGOs and the equipments will be provided under the project for driving away wild animals. An awareness campaign be launched for villagers and Tea Estate labourers. A provision will be made in the revised Wildlife Act for making compensation in case of wildlife depredation.

Currently no Wildlife Insurance Schemes for human-animal conflict (e.g. injury, death, property damage, crop damage, etc.) and no provision for damage compensation exist in FD. In some south Asian countries compensation schemes through wildlife insurance have developed as a mechanism to compensate the loss caused by wildlife. Similarly the budget provisions are made for FD compensating the damage to private property and life by wildlife. The Wildlife Insurance and compensation for damage should be implemented in Bangladesh and be incorporated in the draft Wildlife Act.

3.5 Co-Management Agreements

The existing traditional use of forests for bonafide consumption inside the Park needs to be formalized through co-management agreements to be signed with groups of users. For example, there is one Forest Village established inside Park (Tiprapara) by allotting forest lands and have villagers' established rights for betel leaf cultivation and their responsibility in forest protection and labour supply for forestry works. Detailed discussions will be held with the users about their roles and responsibilities, and the type and quantity of benefits to be accrued to them on long-term basis in lieu of their current exploitative forest use to be foregone.

Under FSP the plantations (woodlots, strip plantations and agroforestry) are being raised in buffer areas of 7 PAs (including the 4 pilot PAs of NSP). Participants formed into user groups take responsibility for protecting and managing the plantations in lieu of usufructury benefits ensured through participatory benefit sharing agreements (PBSAs) signed between them and FD. These PBSAs will be valid (and so renamed as co-management agreements) under NSP as well. The participants will have responsibility for the protection of neighbouring forests of core zone in addition to the plantations assigned to them under FSP.

As per the Wildlife (Preservation) (Amendment) Act, 1974 no commercial harvesting is allowed inside the core zone and hence other relevant mechanisms of benefits flows to local communities need to be explored. Moreover, in future no regular plantations are planned to be established in the core areas. This means that no benefits will flow from the harvests of either plantations or naturally occurring trees. Some enrichment plantations of indigenous tree species, shrubs, herbs and grass species will be taken up by gradually opening the top canopy through selectively felling of exotic trees that are not suitable for wildlife. It is envisaged that the enrichment plantations of indigenous species will over a period of time develop similar to natural stands of forests to be retained in future as a part of suitable habitat for wildlife.

An important source of benefits to local people could be from the sustainable harvesting of NTFPs from the forests of Park. The forests of Satchari Park are particularly rich in NTFPs, which may supply raw materials for NTFP-based village and cottage industries. Similarly some forest produce will be available as a by-product of subsidiary silvicultural operations (SSOs) to be carried out for the improvement of wildlife habitat. Water yield as a result of habitat conservation can be an additional incentive to local people for agricultural purposes. A draft co-management agreement format applicable for the benefits sharing from natural forests (particularly from core areas of the Park) is developed.

The above-enumerated benefits may not be sufficient to motivate local people and so additional benefits need to be mobilized through off-PA activities including alternative income generating (AIGs) activities. The upscaling of skills by RDRS and CODEC will be helpful in generating value additions through capacity building of local people. Landscape Development Fund (LDF) will help provide finance for organized groups of local stakeholders to set up micro-enterprises, offering self-employment opportunities to the skilled members. Benefits from eco-tourism can also be ploughed back for the development of local communities and Park. The FD may countersign the benefit sharing agreement.

A new co-management agreement format to be signed between organized groups and the implementing NGOs is developed for the AIG activities to be carried out through LDF. Existing traditional users from the established Forest Village (Tiprapara) will in groups formalize their existing bonafide consumption use practices by signing a co-management agreement to be signed between them and FD with the assistance of implementing NGO. The existing use areas will be marked and shown on maps of FD.

3.6 Park Conflict Resolution and Management

Co-management activities in the Park will involve local stakeholders, NGO staff and FD field staff. Park conflicts may arise due to misunderstanding or a disagreement between two or more parties engaged in Park management activities. As elsewhere in many south Asian countries, natural forests are not only scarce and limited in Bangladesh but also with manifold increase in population the biotic pressure on forests within the Park is indeed high, thereby giving rise to possibilities of PA conflicts. Unlike the traditional forestry practiced in RFs, the chances of Park conflicts are more in co-management approach due to a number of actors involved.

Identification of Park conflicts and the underlying reasons for such conflicts in co-management need to be done through field visits and close interactions with disputing parties by adopting participatory methods such as RRA/PRA, focus group discussions, diagnostic visits and stakeholders analyses. Face to face interactions between disputing parties and use of communication tools such as audio-visuals will help establish a participatory process of Park conflict resolution based on dialogue and mutual trust. Building appropriate local institutions (e.g. regular meetings of co-management committees, and forming federations or umbrella groups and networks) as a platform for airing dissent and creating situations where local stakeholders can learn together are necessary for resolving Park conflicts.

Some of the following steps may help prevent and resolve Park conflicts:

- ➔ Self-sensitization of FD and NGO staff is important
- ➔ Learn from Park dependent communities instead of telling them as to what to do
- ➔ Using co-management tools to involve local stakeholders in the process of learning about Park use and management
- ➔ Appreciating and nurturing grounds of common interest on Park issues
- ➔ Generating recognition between individuals/user groups and underlining similarities of their aims and objectives on Park issues
- ➔ Establishing reliable information base on Park resources on which conflicts may be based
- ➔ Organizing short workshops and developing manuals on training on Park conflict resolution
- ➔ Conducting focus group discussions with co-management committees to build consensus on collective goals of co-management committees as against individual goals
- ➔ Raising questions on real Park issues, seeking options/suggestions from local stakeholders for co-management of the Park
- ➔ Developing, implementing and monitoring a plan of co-management action for the PA, and

- ➔ Follow up, networking and process documentation for future learning

Park conflicts that cannot be resolved over a short period, need to be managed and transformed so as to enable their ultimate resolution in long-term. Park scenario planning may be adopted as a dialogue tool, and flexibility in responding to local stakeholders' needs and unfolding events is desirable. Dialogue between the disputing parties is necessary to build an on-going relationship. Influencers such as village leaders and elites on both sides of a Park conflict may help sustain such a dialogue.

A negotiated management of a Park conflict may involve i) acting as catalyst in making understanding among disputing parties, ii) focusing on a particular situation being faced by disputing parties, iii) informal efforts (Track II) by local leaders/elders that may complement/supplement formal efforts (Track I) of co-management committees, FD staff and NGOs, iv) collaborative approach to negotiations, v) taking adequate preparations before starting of formal negotiations, and vi) adopting appropriate negotiation skills/tools. In some cases the disputing parties locked in an endless tit-for-tat retribution cycle may need a third party to push or pull them into a Park conflict management process. Intervention efforts through a third party may in such cases involve negotiation, facilitation, mediation or arbitration.

In summary a typical Park conflict resolution/management process may involve:

- ➔ Develop and institutionalize a mechanism for interactions and discussions at a common platform (e.g. co-management committee meetings)
- ➔ Allow disputing parties to present their versions of facts at a forum conducted by a neutral third person
- ➔ Build trust and confidence among the members of local stakeholders through informal interactions, discussions and social gatherings
- ➔ Explore with each party main areas of common concern/understanding where a consensus could be reached and issues resolved through dialogue among disputing parties
- ➔ Leave out contentious Park issues initially. Flag areas of severe dissent where bridges need to be built
- ➔ Hold meetings with the representatives of both disputing parties to explore PA issues and bring about agreements among them
- ➔ Create a win-win situation for disputing parties by establishing a regular dialogue, patience listening, consulting with co-management committees to deflate potential PA conflicts and crises as they emerge. Seek solutions to the identified PA issues with tangible benefits to be shared equitably among disputing parties
- ➔ Develop and install confidence building measures before solving contentious issues and provide sufficient time for their implementation
- ➔ Attempt to resolve contentious Park issues by making use of local leadership. If needed outside help may be taken in the form of mediation, etc.
- ➔ Establishing a forum for maintaining a regular dialogue among disputing parties to review performance and discuss relevant issues of co-management of the Park
- ➔ Maintain a list of selected persons (e.g. villager leaders/elders), who can be available as facilitators/mediators.

3.7 Summary of Main Prescriptions

Main prescriptions outlined under the above-developed protection programs are summarized (Table 3.1) with respect to indicative timing of each proposed activity and responsibility assigned.

Table 3.1 Summary of Main Prescriptions

Year	Main Activities	Main Outputs/Success Criteria	Responsibility
1	<ul style="list-style-type: none"> ➤ Procuring modern equipments, vehicles, tools, imageries, etc. ➤ Reviewing the existing forest cover and land-use maps and updating them by using latest imageries/aerial photos and ground truthing ➤ Establishing co-management committees and forming user groups ➤ Signing co-management and benefit sharing agreements ➤ Controlling poaching, forest land encroachment and illicit removals from the Park and checking forest grazing and fires by associating local stakeholders ➤ Providing incentives for good protection efforts and disincentives for poor protection ➤ Establish conflict resolution mechanisms through co-management committees 	<ul style="list-style-type: none"> Equipments, vehicles & remote sensing products procured Updated maps prepared by RIMS Co-management committees and user groups are in place Co-management & benefit sharing agreements signed Reduced level of biotic interference Capable FD field staff and stakeholders rewarded Conflict resolution mechanism in place 	<ul style="list-style-type: none"> FD/NSP RIMS/FD NSP/FD/ Stakeholders FD/NSP/ Stakholders Stakeholders/ FD/NSP FD/NSP Stakeholders/ FD/NSP
2	<ul style="list-style-type: none"> ➤ Delineating the Park's boundaries and management zones and putting pillars and markers ➤ Maintaining a register of the Park's boundaries and pillars, and conducting annual inspections by supervisory FD field staff ➤ Conducting regular meetings of co-management committees and user groups for providing effective protection against illicit felling, encroachment, forest grazing and fires ➤ Controlling poaching, forest land encroachment and illicit removals from the Sanctuary and checking forest grazing and fires by associating local stakeholders ➤ Providing incentives for good protection efforts and disincentives for poor protection ➤ Resolving forest conflicts 	<ul style="list-style-type: none"> Park's boundaries delineated in field Register updated and inspections done Reduced level of biotic interference Reduced level of biotic interference Good FD field staff and stakeholders rewarded Certain no. of conflicts resolved 	<ul style="list-style-type: none"> FD/NSP FD Stakeholders/ FD/NSP Stakeholders/ FD/NSP FD/NSP Stakeholders/ FD/NSP
3	<ul style="list-style-type: none"> ➤ Maintaining a register of the Park's boundaries and pillars, and conducting annual inspections by supervisory FD field staff ➤ Conducting regular meetings of co-management committees and user groups for providing effective protection against illicit felling, encroachment, forest grazing and fires ➤ Controlling poaching, forest land encroachment and illicit removals from the Park and checking forest grazing and fires by associating local stakeholders ➤ Providing incentives for good protection efforts 	<ul style="list-style-type: none"> Register updated and inspections done Reduced level of biotic interference Reduced level of biotic interference Good FD field staff and 	<ul style="list-style-type: none"> FD Stakeholders/ FD/NSP Stakeholders/ FD/NSP FD/NSP

	and disincentives for poor protection ➤ Resolving forest conflicts	stakeholders rewarded Certain no. of conflicts resolved	Stakeholders/ FD/NSP
4	<ul style="list-style-type: none"> ➤ Maintaining a register of the Park's boundaries and pillars, and conducting annual inspections by supervisory FD field staff ➤ Conducting regular meetings of co-management committees and user groups for providing effective protection against illicit felling, encroachment, forest grazing and fires ➤ Controlling poaching, forest land encroachment and illicit removals from the Sanctuary and checking forest grazing and fires by associating local stakeholders ➤ Providing incentives for good protection efforts and disincentives for poor protection ➤ Resolving forest conflicts 	<ul style="list-style-type: none"> Register updated and inspections done Reduced level of biotic interference Reduced level of biotic interference Good FD field staff and stakeholders rewarded Certain no. of conflicts resolved 	<ul style="list-style-type: none"> FD Stakeholders/ FD/NSP Stakeholders/ FD/NSP FD/NSP Stakeholders/ FD/NSP
5	<ul style="list-style-type: none"> ➤ Maintaining a register of the Sanctuary boundaries and pillars, and conducting annual inspections by supervisory FD field staff ➤ Conducting regular meetings of co-management committees and user groups for providing effective protection against illicit felling, encroachment, forest grazing and fires ➤ Controlling poaching, forest land encroachment and illicit removals from the Park and checking forest grazing and fires by associating local stakeholders ➤ Providing incentives for good protection efforts and disincentives for poor protection ➤ Resolving forest conflicts 	<ul style="list-style-type: none"> Register updated and inspections done Reduced level of biotic interference Reduced level of biotic interference Good FD field staff and stakeholders rewarded Certain no. of conflicts resolved 	<ul style="list-style-type: none"> FD Stakeholders/ FD/NSP Stakeholders/ FD/NSP FD/NSP Stakeholders/ FD/NSP

4. MANAGEMENT PROGRAMS

4.1 Objectives

Main objectives of the Park management program 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, favouring wildlife, iii) conserve the forest resources including the constituent biodiversity, and iv) establish co-management practices through stakeholders' consultations and active participation.

4.2 Landscape Management Zoning

Land-use within the Park and surrounding landscape will be managed based on sound co-management principles and practices. The general approach is to permit existing levels of land-use where these are manageable by means of zoning, and/or where they do not result in major adverse or irreversible environmental impacts. This includes the majority of existing and expected land-uses with some controls on location and use intensity.

Management zoning is useful in implementing relevant management practices in different areas of the Park based on management objectives to be achieved spatially. The Park and surrounding land-use is, therefore, divided into two zones (core zone and interface landscape zone) based on existing forests, land-use, landscape elements and management objectives. The proposed management follows internationally accepted management zoning principles (MacKinnon and MacKinnon, 1986) applied to a Park. It provides the basic spatial framework for protecting the areas of highest conservation value (plantations and natural vegetation), for limiting the spatial extent of high impact activities (administrative and services and transportation facilities), and for designating areas used to provide benefits to local people. Illegal removals and commercial harvests will be checked and stopped in order to achieve the objectives of Park management.

The long-term management aim of maintaining the maximum possible area under forest cover along with its constituent biodiversity in the best possible condition will be achieved by zoning the Park area and surrounding landscape such that i) the areas of highest conservation value (forests and/or plantations) are protected, regenerated and managed towards natural forest composition and structure, particularly in core zone, 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 zones. The core zone will have the highest conservation value followed by interface landscape zones which of course are important for biotic life; the latter is further subdivided into specific zones as discussed below.

4.3 Core Zone

The total forest area (242.83 ha for notification as Satchari NP: Figure 4) is designated as core zone. The entire forest area covered under the core zone has the highest conservation value as all the well stocked forest areas with good wildlife of Raghunandan RF are covered under the core zone. It is recommended to bring the remaining forest area of Satchuri Beat (593.68 ha). Main management objectives in the core zone are, i) to protect and maintain remaining vegetation in good stocking and encourage natural regeneration to gradually bring back natural forests, and ii) to improve forest habitat for wildlife species through selective management interventions while preserving and increasing the diversity and interspersion of habitat.

The core zone is constituted to preserve constituent forests in as near natural conditions as possible by providing an effective protection against all forms of biotic interference (illicit felling, forest land encroachment, forest fires and cattle grazing) and maintaining natural course of ecological succession. So main management aim in core zone is long-term protection of existing vegetation including remaining natural forests and mixed plantations, and rehabilitation toward natural forest habitat. Forest management in this zone will focus on conserving remaining natural forests and bringing back natural vegetation (composition and structure) wherever possible. This will be achieved by providing protection (against illicit removals of forest produce, encroachment, grazing and fire) and encouraging natural processes for regeneration and rehabilitation of forests. Monoculture of teak and other exotic species need canopy manipulation in order to create more favorable habitat for wildlife by encouraging natural regeneration and enrichment planting of indigenous trees, shrubs, herbs and palatable grasses. Subsidiary silvicultural operations will be carried out whenever necessary to encourage natural vegetation. Effective protection against biotic pressure (illicit felling, forest fire and grazing) will allow natural processes of regeneration in degraded forest areas of the core zone.

Co-management practices will be implemented (through associated user groups and co-management committees to be formed at different levels) in strengthening protection efforts against illicit felling, forest

fires and grazing. In lieu of reduced removals (due to control of illicit felling) by the local communities from the core zone, they will be provided alternative means from interface landscape zones and other alternative income generation activities for sustainable livelihoods. The visitor use of the core zone will be regulated and only low impact tourist activities will be allowed in terms of hiking and wildlife watching. High impact visitor activities such as motorized transport and group pick nicks will not be allowed.

The 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 in combating organized smuggling by outsiders. Local people will be convinced not to send their cattle for forest grazing by associated user groups. For example, the villagers from Tiprapara Forest Village will be engaged in alternative income generation activities for sustainable livelihoods in order to wean them away from illegal harvesting from the nearby forests. Only sustainable use of selected NTFPs (garsses, bamboo, canes, medicinal plants, etc.) for bonafide consumption will be allowed in lieu of their increased protection efforts for the core zone. Control of forest fires will be through community efforts but forest fire lines will be established in order to check spread of forest fires. Controlled burning will be used as a management tool particularly in moist forest areas. Fire lines will be created and maintained in forest fire prone areas.

Subsidiary silvicultural operations will be carried out for encouraging natural regeneration of indigenous species. Gradual opening of top canopy through selective removal (leaving any indigenous tree) may be taken up in the areas having exotic plantations in order to create favorable conditions for natural regeneration to be established over a period. However, dead and hollow trees will not be removed as they provide shelter/nest to wildlife. Reduced impact logging methods (e.g. vine-cutting prior to felling, directional felling, non-mechanized skidding and hauling) will be employed during harvesting in order to minimize damage to natural growth and wildlife. Similarly the area under-planted with canes will gradually be reduced through harvesting followed by planting by local herbs, shrubs and indigenous tree species.

Consumptive use of forests by the resident villagers of Tiprapara Forest Village within the Park will be limited to the recognized households situated within the Park. Consumptive use by non-residents will be shifted to a 5 km-wide interface landscape zone bordering the Park boundary and comprises FD lands (remainder Raghunanadan Hill RF in Satchuri Beat), Tea Estate lands and other land-uses. The traditional forest use by the tribal community of Tiprapara Forest Village will be allowed to continue by formalizing co-management agreements. Their assigned areas will be delineated with permanent markers and shown on updated maps. The existing tribal inhabitants will be registered and further in-migration will be discouraged.

The remaining forest area (593.68 ha) of Satchari Beat, now covered under Support Zone (see Section 4.5 as below), will be added to the existing Park area (as Core Zone) and will naturally be regenerated over a period of time.

4.3.1 Habitat Improvement Works in Core Zone

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, replacement of exotics by gradual canopy opening in plantation areas, eradication of weeds from glades and wetlands, soil and water conservation, watershed development, etc. will be taken up. Gradual opening of top canopy in exotic plantations will be taken up mainly to replace exotic species and encourage natural regeneration to come up and get established. 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 given by involving all the stakeholders. The collection of NTFPs from this zone will be regulated in consultation with stakeholders. Salvage of dead, dying and diseased trees will be done only after leaving some dead trees suitable for wildlife nesting, etc. Different habitat improvement activities to be carried out in this zone are explained further as below.

4.3.1.1. Canopy Opening in Monoculture

This operation will be done on a limited scale in the plantation patches of core zone where monoculture of exotics occurs. There are patches of pure teak and other short rotation tree species such as eucalyptus, mulacana and acacia. These plantations are not favoured by wildlife as they inhibit bushy undergrowth and middle storey to provide food and shelter for wild animals. Suitable areas of monoculture will be identified for gradual (say 10 ha each year) canopy opening in teak and other exotic plantations based on the following guidelines:

1. Dense teak and exotic plantations will be taken up for marking the trees, whose removal will open the canopy for natural regeneration to come up.
2. Canopy opening will be done in small but irregular plots of say 2-4 ha, staggered to minimize disturbance to wildlife and its habitat. Mosaic pattern of opening provides better ground light penetration for getting good natural regeneration.
3. No canopy opening will be undertaken near waterbodies including *cheras* in order to avoid erosion.
4. At least 150-200 trees/ha will be retained along with all the natural regeneration and advance growth.
5. Marking of trees will be done after monsoon rains are over and felling operations completed by February.
6. Teak and eucalyptus (being strong coppicer) stumps will be battered after felling in order to discourage coppicing. Any upcoming coppices of exotics will be removed subsequently.
7. The first year after the felling will be devoted for obtaining natural regeneration. Suitable gaps will be identified for raising enrichment plantations (see below) of indigeneous fruit bearing shrubs and trees (suitable for wildlife), and palatable grasses during the second year.

4.3.1.2. Enrichment Plantations of Indigeneous Species

Enrichment plantations of indigeneous species will be taken in those areas where natural regeneration is not coming up due to lack of existing rootstock. Fruit bearing species for wildlife and palatable grasses will be planted up in those forest areas where adequate regenerative rootstock may not exist. A list of framework species (defined as native species that grow rapidly, shade out weeds and attract seed-dispersing wildlife) suitable for plantations is given in Volume 2. Enrichment plantations will also be done after canopy is opened in monoculture of exotics. Planting (spacing 2.5m x 2.5m) of indigeneous shrub and tree species may be taken up in alternate rows whereas fruit tree species (not more than 10% of total stock) may be planted sporadically. Maintenance operations including weeding and casualty replacement will be taken up in subsequent years. The plantations will be protected against fire and grazing at least for initial three years. Some suitable species for plantations include siris, sisoo, simul, chikrasi, jarul, chalta, amla, bahera, ficus species, jackfruit, bamboo. Palatable grasses for fodder plantations will 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*.

A plantation journal will be maintained for each of the enrichment plantation. Nurseries will be raised well in advance. Maintenance operations including weeding and cleaning will be taken for three years after raising enrichment plantations. Beating up operations will be taken only during the first year. Plantations of species attractive to butterflies, bees and other pollinator insects will be included in the planting species mix. The cleafelling of understorey vegetation will not be done. The present practice of underplanting cane will be stopped as cane hinders the free movement of wildlife.

4.3.1.3. Canopy Manipulation for Congenial Wildlife Habitat

Removal of congestion is required for easy movement of wildlife. So canopy of plantations will be manipulated properly to create congenial habitat for wildlife. Two canopy manipulations say at 5th and 10th year of plantations can be taken up.

4.3.1.4. Development of Grasslands

Existing grasslands will be maintained. Grasslands will be further developed by taking up grass plantations along with other tree species as a part of enrichment plantations. Plantations of palatable grasses will be taken up in blank patches. They will be protected against grazing and forest fires by involving all stakeholders. Suitable grass species for planting 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*.

4.3.1.5. Maintenance of Waterbodies

This operation is applicable to the entire core zone. A number of natural waterbodies are present in the Park and they will be maintained for use of wildlife and also local people. An inventory of existing water bodies and a list of wildlife using different water bodies will be developed. Desiltation, cleaning and repairing may be necessary in those waterbodies where soil erosion has taken place. Biomass removed during cleaning may be handed over to local people. Stakeholders' participation may be ensured in maintenance of waterbodies by developing fisheries on sharing basis. Plantation of shrubs and vegetables may be taken up

around water bodies by involving local stakeholders. Unauthorized fishing, hunting, cattle grazing and contamination of water should be checked by involving local people as a part of co-management activities.

4.3.1.6. Maintenance of Special Habitats

Areas rich in NTFPs including medicinal plants, orchids and other threatened species will be given special attention. Breeding sites of any animal and any other site (e.g. burrow) harboured by nocturnal animal will be protected and maintained. Over-storey trees with twisted boles, furrowed bark or natural cavities will be retained (say 3-5 nos./ha) to provide shelter to snakes, etc. Snags (hollow, dry, partially/fully dead standing trees, at least 1.5m in height and with a minimum of 20cm diameter at breast height) will be retained (say 3-5 nos./ha) for use by birds, small mammals and other life forms such as bacteria and fungi. Fruit and NTFPs bearing trees will also be retained.

4.3.2 Habitat Restoration Works in Core Zone

Degraded habitats within the habitat management zone will be restored naturally by carrying out low capital but labour intensive land-based restoration activities in identified micro-watersheds.

4.3.2.1. Watershed Management

Micro-watersheds will be identified for carrying out habitat management practices within the natural boundaries of a drainage area by developing biophysical and human resources for the socio-economic welfare of local people. The micro-watershed will provide a context for a gainful participation of local people by taking on board the diversity of forests and human resources. Appropriate land husbandary practices in such watersheds will focus on in-situ moisture conservation based on the percolation of water under-ground. This will enable the natural regeneration of indigenous vegetation, soil conservation and enhancement of moisture regime. Low input land husbandary technologies (e.g. half moon trenches, contour furrows, staggered trenches, mulching, hedgerows, small check dams, impounding pits, small tanks, soil barriers and traps, diversions ditches, etc.) which can be implemented by local stakeholders will be more sustainable when compared to large water harvesting structures and engineering works requiring high capital inputs.

4.3.2.2. Eco-restoration

Good rainfall, incident radiation and soil are some of the favourable factors that are present in Sylhet forests for natural regeneration. Therefore natural regeneration comes up rather well in the forests but do not get established due mainly to biotic pressure. The protection against biotic factors will be taken up before low-input oriented land husbandary practices can be implemented for facilitating eco-restoration process, necessary for the rehabilitation of forests and local people. Degraded forests with recoverable rootstock will be restored through community protection by establishing suitable mechanisms under co-management approach. Degraded forests with inadequate rootstock shall be taken for assisted natural regeneration for recovering remaining rootstock and enrichment planting.

Natural regeneration and succession in this zone will be encouraged by carrying out eco-restoration activities in identified micro-watersheds. Soil and water conservation measures including stabilization of land slips 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 husbandary practices. Over the period the woody vegetation cover will extent 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 degraded and barren areas that do not have rootstock.

4.4 Forest Village Sub-Zone

The habitation and gardens/cultivation in Tiprapara Forest Village (24 households of Tipra tribal community) that are included in the proposed Park area are included in this Zone. Such areas will be delineated in the field with permanent markers, and a register of the existing inhabitants will be maintained and no further immigration will be allowed. The villagers from Tiprapara are main stakeholders and so will actively be involved in co-management activities. Their existing use of forest and help in forest protection will be formalized by signing co-management agreements.

4.5 Interface Landscape Zones

Interface landscape zones will focus on the surrounding landscape helpful in protecting and conserving the core zone and creating congenial habitat for wildlife including protecting and maintaining wildlife corridors. As opportunities for receiving tangible benefits from the conservation-oriented management of core zone are very less, off-forest livelihood opportunities will be provided to the local stakeholders in the surrounding landscape. Subsistence consumption needs of local people for fuelwood, NTFPs and timber will be met by entering into co-management agreements before carrying out co-management activities. Though interface landscape zones will have comparatively less conservation value, they will play an important role in supporting the biodiversity conservation in the core zone. Interface landscape zone is further categorized into four zones (support zone, intensive use zone, transport corridor zone and Tea Estate zone) depending upon the uses to which different areas are managed. Interface landscape zones support the protection of biodiversity in core zone and so can also be termed as support zone or buffer zone. However, the word buffer has a negative connotation of buffering something good by something bad and so has not been used in this Plan.

4.5.1 Support Sub-Zone

This sub-zone comprises the remainder forests/plantations (of Raghunandan Hill RF covered under Satchari Range – 682.30 ha in Telmachra Beat) around the Park which can be managed by FD on a sustainable basis by associating local stakeholders. As explained in Section 4.3 the remainder plantations/forests (593.68 ha) of Satchari Beat will over a period of time be included in core zone as an extension of the present Park area. In lieu of their protection efforts the short-rotation and recent long-rotation plantations adjoining the Park may be assigned to local communities for meeting their bonafide consumption needs for fuelwood, timber, NTFPs and other products. Short and long rotation plantations will be brought under PBSAs as applicable under FSP. The guidelines as applicable for FSP will be applicable for the existing plantations raised earlier. However, the participants will, in addition to the protection of plantations, be responsible for providing biodiversity protection in the Park areas. These plantations will not be clearfelled but instead be managed under selection felling (mainly of exotic species) so that the area can be naturally regenerated to be ultimately included in core zone as a mixed forest over a longer period of time. In such a case the existing participants will be well compensated through off-PA alternative income generation activities to be carried out for sustainable livelihoods.

Management of FD lands will focus on sustainable use of the remaining natural patches, bringing selected plantations under co-management agreements, checking conversion of forest land into agriculture and maintaining biodiversity conservation values. Local stakeholders will be identified and co-management agreements signed for providing livelihood opportunities and protecting habitat. Co-management forestry consistent with biodiversity conservation may be implemented after preparing a site-specific plan. For example, enrichment planting and subsidiary silvicultural operations will be defined in this site specific plan. Reduced impact logging techniques will be followed in case selective harvesting is prescribed in the site specific plan.

4.5.2 Intensive Use Sub-Zone

Intensive Use Sub-Zone incorporates the relatively small areas required for administrative buildings and staff quarters, visitor accommodations and other facilities. The Park HQ will be developed at Satchari with administrative buildings (Park Hqs, Satchari Beat Office, etc.), Park staff quarters, visitor facilities (e.g. Environmental Education Centre) and other infrastructure facilities. Future facility development will be based on environmentally friendly guidelines and green management principles. Adverse environmental impacts of infrastructure development will be minimized by carrying out Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) before taking up design, construction and operation building works. Green management will ensure that designs, materials and construction works are compatible with the natural background; that water, air and solid waste pollution is checked; and that other adverse environmental impacts are avoided or minimized during construction and operation. Detailed guidelines for facilities development including the existing Satchari Beat Office facilities; Park Headquarters, comprising of a Park Office, Park Staff Quarters; and an Environmental Education Centre are discussed in the next Chapter.

4.5.3 Transportation Corridor Sub-Zone

The northern most Park boundary is a linear corridor of nearly 1.8 km of old Dhaka-Sylhet highway, traversing the Park in a generally east-west direction, is covered under interface landscape zones as transportation corridors: an asphalt-surfaced highway, constructed and maintained by the Roads and Highways Department. The Park management will take proper initiatives in developing the necessary communication channels and agreements with the operators of the facilities (Roads and Highway Department) in order to get their cooperation in preventing and limiting noise and chemical pollution and by minimizing the width of vegetation clearing during RoW maintenance. For example, the Roads and

Highways Department will not only provide to FD staff free access to Park but also help regulate traffic in order to avoid damage to wildlife and vegetation.

4.5.4 Tea Estate Land Sub-Zone

The Tea Estate lands of Satchari and Chaklapunji, bordering the Park along western and eastern boundaries respectively (and also Surma Tea Estate on north-western side, and Chandichera and Nabab Khan Tea Estates on north-eastern side), are a good source of bamboo, sungrass and fodder to Tea Estate labourers. However, the area under vegetation is reducing, as a result of which the Tea Estate labourers and their families put pressure on nearby forests of Satchari including the Park's core zone for meeting their needs for fuelwood, timber and other NTFPs. The vacant areas developed as unmanaged secondary vegetation provide additional wildlife habitat as transition zone between mixed forests/plantations and tea gardens. These areas will not be converted into monoculture of cash crops (citrus, banana, pineapple, etc.). Tea Estates authorities will, therefore, be encouraged to retain secondary vegetation in order to meet the demands of the labourers and their families, and also to provide additional wildlife habitat. In addition, they will also be pursued for raising enrichment plantations of indigeneous tree species particularly on Satchari and Chaklapunji Tea Estates lands included in the 5 km-wide interface landscape zone of the Park.

The labourers and their families residing in the neighbouring Tea Estate lands in proximity to the Park use sungrass, bamboo, fuelwood, small timber and fodder from the unused Tea Estate lands. The availability of these forest products from the Tea Estate lands is gradually reducing in view of the government policy (which requires that more than 50% of leased estate lands be planted under tea) and the Estate management programs (which emphasize planting cash crops such as rubber and pineapples on unused lands), which result in reduction of area under secondary vegetation and consequent biotic pressure on neighbouring forests. Shade trees (e.g. *Albizia lebbec*, *Deris robusta*) planted inside tea plantations for providing shade to tea bushes, are selectively stolen by illicit fellers. The illicit fellers use Satchari and Chaklapunji Tea Estates as transport routes after felling trees illicitly inside the forests covered under the Park. So joint efforts are required both from FD and Tea Estate authorities for controlling illicit felling of trees.

Biotic pressure on the Park's forests may be reduced by encouraging the growth of vegetation (through assisted natural regeneration and enrichment planting techniques) on vacant Tea Estate lands and for meeting the needs of local people living on Tea Estates, and also of wildlife. The establishment of cash crops such as pineapple, lemon and rubber plantations will be discouraged in favour of suitable tree and horticultural crops. This will require a regular dialogue with Tea Estate management during the implementation period of the Plan in order to coordinate sound land-use management along the Park/Tea Estate boundaries including enrichment plantations to be taken up by FD staff based on co-management agreements to be signed with local labourers. Poor households will be organized into groups for implementing income generation activities by using LDF and helping FD and Tea Estate management in tree protection.

Bangladesh Tea Labour Association and Bangladesh Tea Association (based at Chittagong) will be approached to issue suitable instructions to the concerned Tea Estate authorities for extending necessary help in biodiversity protection efforts. Forest Department will approach the Chairman, Tea Association (it comprises 161 Tea Estates as members) to issue such instructions to the authorities of Satchari and Chaklapunji Tea Estates and also form a coordination committee of FD and Tea Estates.

4.6 Zonal Boundaries

Boundaries of intensive use zone and transportation corridor zone will be identified by permanent physical features such as streams, roads, settlements/villages, concrete pillars, etc. The boundaries of core zone will be marked with posts having legible inscriptions in Bangla for easy differentiation. One corner of each use area will be marked by a concrete signboard indicating the management regime and the identification of user group responsible for co-management of the forest area. The Park staff will explain the system to local stakeholders for their wide acceptance and publicity.

4.7 Summary of Main Prescriptions

Main prescriptions outlined under the above-developed management programs in Core and Landscape Zones are summarized in Tables 4.2 and 4.3 with respect to timing of each proposed activity and responsibility assigned.

4.7.1 Summary of Main Prescriptions in Core Zone

Main prescriptions outlined under the above-developed management programs in Core Zones are summarized in Table 4.2 with respect to timing of each proposed activity and responsibility assigned.

Table 4.7.1 Summary of Main Prescriptions in Core Zones

Year	Zones	Main Activities	Main Outputs/ Success Criteria	Responsibility
1	Core Zone Forest Village Sub-Zone	<ul style="list-style-type: none"> ➤ Protecting forests and other biodiversity against biotic interference (illicit removals, poaching, land encroachment, forest grazing, fires, etc.) ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without rootstock) ➤ Carrying out silvicultural operations for improving habitat for wildlife ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without existing rootstock) ➤ Implementing habitat improvement works (canopy manipulation, grassland development, special habitats maintainance, waterbodies maintainance, etc.) ➤ Implementing habitat restoration works (identification of micro-watersheds, watershed management, eco-restoration activities including soil/water conservation and other low input land husbandry practices) ➤ Delineating the habitation and forest land assigned to Tiprapara Forest Village ➤ Involving Forest Villagers in forest protection, and in income generation activities by using LDF ➤ Motivating Forest Villagers to adopt biodiversity friendly betel leaves growing practices ➤ Signing benefit sharing agreements with the villagers of Tiprapara for protecting nearby plantations and associating them in LDF funded activities 	<p>Reduced level of biotic interference including illicit felling</p> <p>Natural regeneration established</p> <p>Enhanced wildlife</p> <p>Natural regeneration established</p> <p>Improved habitat</p> <p>Rehabilitated habitat</p> <p>Forest use areas delineated on ground and maps</p> <p>Forests regenerated & Villagers' income enhanced</p> <p>Cleaning of forest floor stopped</p> <p>Income of villagers enhanced and forests protected</p>	<p>Stakeholders/ FD/NSP</p> <p>FD</p> <p>FD</p> <p>FD</p> <p>FD</p> <p>FD</p> <p>FD/Forest Villagers</p> <p>FD/Forest Villagers/ NSP</p> <p>FD/Forest Villagers/NSP</p> <p>FD/Forest Villagers/NSP</p>
2	Core Zone	<ul style="list-style-type: none"> ➤ Protecting forests and other biodiversity against biotic interference (illicit removals, poaching, land encroachment, forest grazing, fires, etc.) ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without rootstock) ➤ Carrying out silvicultural operations for improving habitat for wildlife ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without rootstock) 	<p>Reduced level of biotic interference including illicit felling</p> <p>Natural regeneration established</p> <p>Enhanced wildlife</p> <p>Natural regeneration established</p>	<p>Stakeholders/ FD/NSP</p> <p>FD</p> <p>FD</p> <p>FD</p>

	<p>Forest Village Sub-Zone</p>	<p>opening in exotic monoculture and enrichment planting in identified gaps without existing rootstock)</p> <ul style="list-style-type: none"> ➤ Implementing habitat improvement works (canopy manipulation, grassland development, special habitats maintainance, waterbodies maintainance, etc.) ➤ Implementing habitat restoration works (identification f micro-watersheds, watershed management, eco-restoration activities including soil/water conservation and other low input land husbandry practices) ➤ Forest Villagers continue to involved in forest protection, and in income generation activities by using LDF ➤ Encourage Forest Villagers to adopt biodiversity friendly betel leaves growing practices ➤ With the villagers of peripheral villages continue protecting nearby plantations and core areas by associating them in LDF funded activities ➤ No new habitations by Forest Villagers of Tiprapara are allowed 	<p>Improved habitat</p> <p>Rehabilitated habitat</p> <p>Forest Villagers' income enhanced</p> <p>Cleaning of forest floor stopped</p> <p>Income of villagers enhanced and plantations and core protected</p> <p>New habitations stopped</p>	<p>FD</p> <p>FD</p> <p>FD/Forest Villagers</p> <p>FD/Forest Villagers</p> <p>FD/Villagers/NSP</p> <p>FD/Forest Villagers/NSP</p>
<p>3</p>	<p>Core Zone</p>	<ul style="list-style-type: none"> ➤ Protecting forests and other biodiversity against biotic interference (illicit removals, poaching, land encroachment, forest grazing, fires, etc.) 	<p>Reduced level of biotic interference including illicit felling</p>	<p>Stakeholders/ FD/NSP</p>

	Forest Village Sub-Zone	<ul style="list-style-type: none"> ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without rootstock) ➤ Carrying out silvicultural operations for improving habitat for wildlife ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without existing rootstock) ➤ Implementing habitat improvement works (canopy manipulation, grassland development, special habitats maintainance, waterbodies maintainance, etc.) ➤ Implementing habitat restoration works (identification f micro-watersheds, watershed management, eco-restoration activities including soil/water conservation and other low input land husbandry practices) ➤ Continue involving Forest Villagers in forest protection, and in income generation activities by using LDF ➤ Continue motivating Forest Villagers to adopt biodiversity friendly betel leaves growing practices ➤ Villagers of peripheral villages continue protecting nearby plantations ➤ Keeping a vigil that the Forest Villagers of Tiprapara do not add more habitations 	<p>Natural regeneration established</p> <p>Enhanced wildlife</p> <p>Natural regeneration established</p> <p>Improved habitat</p> <p>Rehabilitated habitat</p> <p>Forest Villagers' income enhanced</p> <p>Cleaning of forest floor stopped</p> <p>Plantations protected</p> <p>Convinced Forest Villagers</p>	<p>FD</p> <p>FD</p> <p>FD</p> <p>FD</p> <p>FD</p> <p>FD/Forest Villagers</p> <p>FD/Forest Villagers/NSP</p> <p>FD/Villagers/NSP</p> <p>FD/NSP/Forest Villagers</p>
4	Core Zone	<ul style="list-style-type: none"> ➤ Protecting forests and other biodiversity against biotic interference (illicit removals, poaching, land encroachment, forest grazing, fires, etc.) ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without rootstock) ➤ Carrying out silvicultural operations for improving habitat for wildlife ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without existing rootstock) ➤ Implementing habitat improvement works (canopy manipulation, grassland development, special habitats maintainance, waterbodies maintainance, etc.) 	<p>Reduced level of biotic interference including illicit felling</p> <p>Natural regeneration established</p> <p>Enhanced wildlife</p> <p>Natural regeneration established</p> <p>Improved habitat</p>	<p>Stakeholders/ FD/NSP</p> <p>FD</p> <p>FD</p> <p>FD</p> <p>FD</p>

	Forest Village Sub-Zone	<ul style="list-style-type: none"> ➤ Implementing habitat restoration works (identification of micro-watersheds, watershed management, eco-restoration activities including soil/water conservation and other low input land husbandry practices) ➤ Continue involving Forest Villagers in forest protection, and in income generation activities by using LDF ➤ Continue motivating Forest Villagers to adopt biodiversity friendly betel leaves growing practices ➤ Villagers of peripheral villages continue protecting nearby plantations ➤ Keeping a vigil that the Forest Villagers of Tiprapara do not add more habitations 	Rehabilitated habitat	FD
			Forest Villagers' income enhanced	FD/Forest Villagers
			Cleaning of forest floor stopped	FD/Forest Villagers/NSP
			Plantations protected	FD/Villagers/NSP
			Convinced Forest Villagers	FD/NSP/Forest Villagers
5	Core Zone	<ul style="list-style-type: none"> ➤ Protecting forests and other biodiversity against biotic interference (illicit removals, poaching, land encroachment, forest grazing, fires, etc.) ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without rootstock) ➤ Carrying out silvicultural operations for improving habitat for wildlife ➤ Carrying out subsidiary silvicultural operations required for encouraging natural regeneration (including gradual canopy opening in exotic monoculture and enrichment planting in identified gaps without existing rootstock) ➤ Implementing habitat improvement works (canopy manipulation, grassland development, special habitats maintenance, waterbodies maintenance, etc.) 	Reduced level of biotic interference including illicit felling	Stakeholders/ FD/NSP
			Natural regeneration established	FD
			Enhanced wildlife	FD
			Natural regeneration established	FD
			Improved habitat	FD
	Forest Village Sub-Zone	<ul style="list-style-type: none"> ➤ Implementing habitat restoration works (identification of micro-watersheds, watershed management, eco-restoration activities including soil/water conservation and other low input land husbandry practices) ➤ Continue involving Forest Villagers in forest protection, and in income generation activities by using LDF ➤ Continue motivating Forest Villagers to adopt biodiversity friendly betel leaves growing practices ➤ Villagers of peripheral villages continue protecting nearby plantations ➤ Keeping a vigil that the Forest Villagers of Tiprapara do not add more habitations 	Rehabilitated habitat	FD
			Forest Villagers' income enhanced	FD/Forest Villagers
			Cleaning of forest floor stopped	FD/Forest Villagers/NSP
			Plantations protected	FD/Villagers/NSP
			Convinced Forest Villagers	FD/NSP/Forest Villagers

4.7.2 Summary of Main Prescriptions in Landscape Zone

Main prescriptions outlined under the above-developed management programs in various sub-zones of the Landscape Zone are summarized in Table 4.7.2 with respect to timing of each proposed activity and responsibility assigned.

Table 4.7.2 Summary of Main Prescriptions in Landscape Zone

Year	Sub-Zones	Main Activities	Main Outputs/ Success Criteria	Responsibility
1	Support Sub-Zone	➤ Short rotation plantations brought under co-management in Telmachra Beat	Agreements signed	FD/ Stakeholders
		➤ 15 identified villages are grouped for LDF activities in lieu of their forest protection efforts	Groups formed	FD/NSP/ Stakeholders
		➤ Vacant FD lands brought under plantations	Woodlots established	FD
		➤ Establishing communication channels with the land owning agencies (R&H)	Land Owning Agencies contacted	FD/Land Owning Agencies FD
	Transportation Corridor Sub-Zone	➤ Planting strip plantations along roads	-do-	FD./R&H
		➤ Maintain communication channels with the land owning agency (Roads & Highways Department)	R & H Department contacted	FD/NSP
		➤ Establishing strip plantations along the road	Nurseries and plantations established	Tea Estates/ FD/NSP
	Tea Estate Land Sub-Zone	➤ Establishing contacts with Tea Employers Association, Chittagong and the Management Authorities of 6 identified Tea Estates	Instructions issued by the Association to	Tea Estates/ FD/NSP
		➤ Encouraging the Management Authorities of Tea Estates to bring vacant land under plantations for the benefits of local people and also wildlife	Tea Estate management	FD/NSP
	Intensive Use Sub-Zone	➤ Motivate Tea Estate workers and if possible involve them in income generation activities	Groups of workers formed	FD
➤ Existing FD buildings maintained by following environmental friendly guidelines		FD buildings maintained	FD	
2	Support Sub-Zone	➤ Short rotation plantations protected under co-management	Plantations protected	FD/ Stakeholders
		➤ Remaining vacant FD lands brought under plantations	Plantations established	FD
		➤ Villagers from the 15 identified villages start LDF funded activities in lieu of their forest protection efforts	Income of the villagers enhanced	NSP/FD/ Stakeholders
		➤ Maintaining communication channels with the land owning agencies (R&H)	Regular contacts established	FD/Land Owning Agencies FD
		➤ Planting and managing strip plantations along roads	Strip plantations protected	FD
		➤ Maintain communication channels with the land owning agency (Roads & Highways Department)	R & H Department contacted	FD/R&H
		➤ Establishing strip plantations along the road	Nurseries and plantations established	FD/R&H

	Transportation Corridor Sub-Zone	<ul style="list-style-type: none"> ➤ Maintaining regular contacts with Tea Employers Association, Chittagong and the Management Authorities of 6 identified Tea Estates 	Better coordination established between FD and Tea Estate	FD/Tea Estate Management
	Tea Estate Land Sub-Zone	<ul style="list-style-type: none"> ➤ Pursue the Management Authorities of Tea Estates to bring vacant land under plantations for the benefits of local people and also wildlife ➤ Involve Tea Estate workers in income generation activities 	Management Vacant land brought under plantations Groups of workers formed and motivated	FD/NSP/Tea Estate Management NSP/FD/Workers/Tea Estate Management
	Intensive Use Sub-Zone	<ul style="list-style-type: none"> ➤ Proposed FD buildings are developed by following environmental friendly guidelines 	Buildings constructed	FD
3, 4 and 5	Support Sub-Zone	<ul style="list-style-type: none"> ➤ Continue protecting short rotation plantations ➤ 15 identified villages continue to be covered under LDF in lieu of their forest protection efforts ➤ Plantations raised on vacant FD lands continue to be protected ➤ Continuing good communication with the land owning agencies (LGED, Railways) 	Plantations protected Villagers' income enhanced and forests protected Protected plantations	FD/Stakeholders NSP/FD/Stakeholders FD/FSP
	Transportation Corridor Sub-Zone	<ul style="list-style-type: none"> ➤ Protecting strip plantations along roads and railway lines ➤ Maintain communication channels with the land owning agency (Roads & Highways Department) 	Strip plantations protected R & H Department contacted	FD/FSP FD/R&H
	Tea Estate Land Sub-Zone	<ul style="list-style-type: none"> ➤ Establishing strip plantations along the road ➤ Continuing regular contacts with Tea Employers Association, Chittagong and the Management Authorities of 6 identified Tea Estates ➤ Management Authorities of Tea Estates continue to bring vacant land under plantations for the benefits of local people and also wildlife 	Nurseries and plantations established Better coordination established Vacant land planted	FD/R&H FD/NSP/Tea Estate Management Tea Estate Management
	Intensive Use Sub-Zone	<ul style="list-style-type: none"> ➤ Tea Estate workers continue to be involved in income generation and protection activities ➤ FD buildings are maintained by following environmental friendly guidelines 	Groups of workers with enhanced income Better maintained FD buildings	NSP/FD/Workers/Tea Estate Management FD

5. LIVELIHOOD PROGRAMS

5.1 Objectives

As per the Wildlife (Preservation) (Amendment) Act, 1974 no commercial harvesting is allowed inside the Park. So other relevant mechanisms of benefits flows to local communities need to be explored as minimum benefits (mainly from NTFPs, which may currently not be sufficient to motivate local people) will flow from the core areas in absence of any timber harvests. Additional benefits can be mobilized through off-PA activities including alternative income generation activities and self-employment opportunities.

Main objective of livelihood program is to develop appropriate linkages with relevant livelihood opportunities and other projects/initiatives that will reduce biotic pressure on forests by providing alternative livelihood opportunities to poor stakeholders living both within and outside of the Park. Up-scaling of skills will be taken up for generating value additions through capacity building of local people. Landscape Development Fund (LDF) will be used to provide finance for the members of user groups and co-management committees, and their federations will be encouraged to set up micro-enterprises to generate value additions locally. The benefits from eco-tourism may also be ploughed back for the development of local communities and the Park. This program will be implemented in the interface landscape zones as identified in Chapter 6 of Part I and Chapter 4 of Part II of the Management Plan. Networking with relevant NGOs active in the area will be established for rendering other rural development services to local stakeholders.

5.2 Production Technologies

Appropriate production technologies, which may be implemented as a part of off-PA development interventions, were identified based on field investigations done by the partner NGO (RDRS). The following production technologies are proposed by RDRS to be implemented mainly in the interface landscape zone of the Park:

5.2.1 Agricultural and Horticultural Crops

The following production technologies are proposed:

- ➔ Integrated homestead farming
- ➔ Cultivation of high value crops
- ➔ Village tree nursery
- ➔ Food processing and marketing

Integrated Homestead Farming

Many villagers on fringes of the Park (in interface landscape zone) practice subsistence farming (low input and low output) on their homesteads (small yard, backyard ditch, etc.). Inter-dependency among the various components of the production technology package can be designed to maximize output, which can be used for household consumption and surplus being sold for buying non-agricultural daily necessities. This will provide livelihood security and enhance their income by creating livelihood assets and self-employment opportunities. Diversification of production possibilities will help avert production risks and reduce vulnerability of livelihood during natural calamities. Possible components of such an integrated production technology package may include vegetables (on open fields, machans, dykes and other unutilized places around houses), cash crops, horticultural and tree nursery, poultry rearing, cow rearing (local improved breed with crossing for fattening), fish culture (in micro-ponds), duck-cum-fish culture (in family ponds), pigeon farming (six pairs of pigeon reared as scavengers) and apiculture (domesticated wild bees). Complementary off-farm activities may include food processing (threshing, winnowing, drying, grading, husking, etc.) food preservation, and other cottage and small scale value addition activities.

Cultivation of High Value Crops

High value crops have more nutritive value, high price and demand. But this production technology is suitable to those farmers, who have cultivable land and can make a minimum investment. Suitable high value crops for the Park landscape include tomato, potato, fine rice, papaya, ginger, turmeric, yard long bean, leafy vegetables, aroids, chilly, beetle leaf, maize. Guava, banana, jackfruit, pineapple, etc. Some vegetables can now be grown all year round and so fetch more prices during off-season.

Village Nursery

Many private nurseries have grown up in cities and towns for meeting the demand for quality seedlings and seeds of horticultural, vegetables and tree species. Village nurseries to be developed by local people having some land will be encouraged to meet the local demand for quality seedlings and seeds. Technical

and logistic support will be arranged to prospective farmers. Seedlings to be raised in village nursery will be as per local preferred species that may include timber, fruit, vegetable, flower, fuelwood, fodder, medicinal and other NTFPs bearing species.

Nursery planning activities will be started at least one year in advance with proper attention on i) collection, processing and storage of seeds, ii) testing, certification and distribution of quality seeds, iii) training and awareness on improved nursery techniques and inputs, iv) seed orchards, v) water source and watering regime, vi) nursery management intensity and technical supervision, vii) culling, root coiling and fibrous root development, viii) standardization of nursery techniques, ix) improved transportation of seedlings from nursery to planting sites.

Food Storage and Processing

Simple food storage, processing and preservation techniques will be explained to local people for creating value addition locally and providing self-employment opportunities. For example, pickles of mango, lemon and jackfruit can be made locally for households nutrition and cash sale.

5.2.2 Livestock Rearing

Livestock-poultry sub-sector is an important part of agriculture sector and cattle rearing with focus on milch cow rearing is particularly suitable for poor people residing within and outside the Park. The following livestock rearing technologies are found suitable for their implementation in and around the Park:

- ➔ Beef fattening
- ➔ Milch cow rearing
- ➔ Broiler/Layer rearing

Beef fattening can be achieved within a short period (3-12 months) by using a local improved breed cow with crossing hybrid. Milk provides a balanced diet by meeting the required demands of nutrition. So at least one milch cow of a locally improved bred or crossbred cow with average milk production of liters/day can be targeted for the identified households. The poultry industry has developed near cities and towns for meeting huge demand within a short time as a supplement of animal protein. Females are particularly suitable for carrying out broiler/layer rearing activities carried out in households.

5.2.3 Fisheries

The following production technologies were identified for the fishery sector:

- ➔ Rice fish farming
- ➔ Fingerling rearing
- ➔ Carp polyculture
- ➔ Fish culture

Broadly three main methods of fishery would involve capture fishery, culture fishery and dry fishery activities.

5.3 Non-Timber Forest Products (NTFPs)

Short-term production objectives of NTFPs management will be linked with long-term biodiversity conservation objectives in order to create personal stakes among the members of co-management committees. The flow of NTFPs from the natural forests of Satchuri will start from the first year of co-management activities; their volume and composition increasing gradually as the Park is provided an effective protection against biotic interference. The importance of NTFPs depends on a number of factors including use value, barter (exchange) value, market demand, accessibility to markets, storage and perishability. An important objective of NSP is to create stakes among local stakeholders for biodiversity conservation by ensuring adequate benefits to them from the Park and off-PA based income generation activities. In the forests being managed for biodiversity conservation in the Park, this objective can be achieved by facilitating close linkages with the livelihoods of local stakeholders and NTFPs development.

A long-term NTFPs management policy focusing on the access of co-management committees, liberalization of government restrictions on storage and transport (e.g. transit permit), dissemination of relevant information about marketing is necessary. The development of such a policy will be based on an exhaustive survey of NTFPs (extent, distribution, threatened species, regeneration and enrichment, collection and use-patterns, illicit removals, present and sustainable level of extraction, local needs and community dependence, processing and value addition opportunities, ethnobotany, indigenous knowledge base, local stakeholders, markets and marketing channels, forward and backward linkages, export and trade).

Appropriate management practices can be locally adopted in order to provide year-round employment and income to local unemployed villagers. For example, the agriculture lean season could best be made use by the members of co-management committees for the collection, harvesting, processing and marketing of NTFPs. In addition to the benefits from NTFPs, forest management interventions such as pruning and cleaning would enhance the flow of intermittent benefits. The NTFPs based activities are more suitable for the rural poor including tribal women and children due to specific characteristics of NTFPs management such as labor-intensive (for instance, the collection and primary processing of bamboo and canes requires substantial labor), simple technologies (many times the collection techniques are inherited and handicrafts made by employing family skills), easy accessibility and benefits to poor, seasonal collection, supplementary income to forest dwellers and household activities with low volume.

NTFPs based forest management within the Park is ecologically and economically sustainable provided extraction levels are maintained below the maximum sustainable yield by adopting appropriate silvicultural systems and management practices. Indeed sustainable management of NTFPs demands a sustainable management of forests as mother resource. Enrichment planting of NTFPs bearing shrub and tree species (e.g. bamboo, cane, medicinal plants, etc.) will be taken up in identified gaps within the Park by associating members of co-management committees. Bamboo, canes and many medicinal shrubs and herbs can be planted and managed as an understory without adversely affecting forests with trees in top canopy.

Mature bamboo clumps need to be intensively managed, failing which they may hamper the growth of both natural and artificial regeneration. A regular working of bamboo will allow local people to get intermittent yield and alternative income generation. Depending on site conditions, the first harvest of clumps is available from year 5 to 7 based on usual cutting rules to be followed meticulously. Based on a usual cutting cycle of 3 years the harvested clumps will be ready for subsequent harvests every 3 years until the clump flowers.

A number of cane based industries are located at Sylhet. Canes are harvested manually and permits are issued by the FD staff for the collection of canes from the government forests. Canes are pulled down, trimmed and bundled for transporting for transporting to local collection centers as headloads or through bamboo rafts in waterways. These are subsequently transported to markets through boats and trucks. Royalties are collected at forest check gates as length of collected canes. Sun dried canes are bent by using blowtorch after they are split manually. Can grows well in areas having well drained, deep, moist and alluvial soil. Ripe fruits are collected, crushed and soaked in water for a week before they are sown in mother beds. Seedlings with 2-3 leaves are pricked out to polybags after 4-5 months. One year seedlings are planted at a spacing of either 4m x 4m or 5m x 5m. Under planting of canes is particularly suitable in homesteads having multiple stories of vegetation.

A variety of medicinal plants occur naturally in Sylhet due mainly to fertile land resources and favorable climate conditions. Primary collectors collect medicinal plants as per the requirements of local traders who are the main suppliers to big dealers and drug manufacturers. Drug manufacturing processes have been indigenously developed for a number of species such as *Rauwolfia serpentina*, *Datura fastosa*, *Allium sativum*, *Tinospora cordifolia*, *Occimum gratissimu*, *Vinca rosea*, *Berberis aristata*, lemon grass, *Andrographis paniculata*, *Centella asiatica* and *Cinchona succirubra*. There is a need for developing similar processes for other medicinal plants. Extensive training on the management of medicinal plants will be imparted to FD field staff and NGOs. Members of co-management committees will be encouraged to take up homestead plantations of medicinal species.

Table 5.1 Candidate Management Practices for Non-Timber Forest Products

Sl.No.	Functions	Potential Management Practices
1	Production/Regeneration	Manage the PA's forests for sustainable development of NTFPs. Protect forests by associating local stakeholders. Take enrichment planting of NTFPs yielding species in identified blanks.
2	Collection/Harvesting	Harvest/collect NTFPs sustainably by employing members of beneficiary groups. Use better harvesting tools and equipments. Impart training and skill development to beneficiary groups in improved harvesting/collection techniques.
3	Pre-processing	Train the groups in primary processing activities including storing, sorting, cleaning and drying. Help establish primary collection centres for storage after primary processing. Provide better pre-processing tools and equipments to group members.
4	Self-consumption	Awareness training. Basic storage facilities.
5	Marketing of unprocessed NTFPs	Provide useful information on use patterns, market channels, prices, demand, etc.
6	Storage and Processing	Provide relevant technology, training, finance, quality control, etc.
7	Marketing of processed NTFPs	Conduct a market assessment and develop a marketing strategy. Linkages with centres of production and marketing. Financing for storage, transport and marketing.

The collection, processing and marketing practices for NTFPs to be adopted by user groups need to be such as to enable them earn their subsistence living regularly. Development of NTFPs through user groups can be taken up by using LDF and rural credits. Poor harvesting practices for NTFPs will lead to waste and unsustainable practices. Raw materials (e.g. medicinal plants), which are to be kept after harvesting need to be dried and stored properly in order to prevent any quality deterioration. Some NTFPs including honey, grasses and bamboo can be processed at local level (i.e. user groups). Federations of user groups may establish processing-cum-marketing units (e.g. handicrafts, mats, broom, honey, etc.) locally by pooling their resources. These will not only help in accessing better harvesting tools and equipments but will also help in marketing of processed NTFPs at remunerative prices. The FD may not NTFPs into auctions and leases. Instead, the responsibility for primary collection, storage, processing and marketing can be given to user groups and co-management committees. This will help in biodiversity conservation through consumers of NTFPs becoming their primary producers with livelihood opportunities in terms of NTFPs based products, employment and income generation.

5.4 Enterprise Development

A study of pre-assessment of enterprise development around the Park completed under another USAID supported project (JOBS) suggested both the primary and secondary sectors. Primary sectors for potential development around the Park include handicrafts (cane, bamboo and murta), nursery development, food processing (pickle, jam, jelly), waaving and natural dye processing, and bee keeping. Secondary sectors include herbal tea (basak, chamomile, shefali) cultivation and processing, medicinal plantations and processing, essential oil processing, buffer plantations, orchid cultivation and floriculture, eco-tourism and nature-based healing homes development. Priority sectors such as bamboo and canes, nursery and natural dye processing may initially be taken up for enterprise development.

Bamboo and canes occur naturally in the forests of Sylhet and used widely by local people in a variety of ways (making household articles, furniture, domestic utensils, house constructions, rafters, batons, binding material and handicrafts) and provide employment and livelihood to a large number of rural poor. In addition, bamboo is a major source of raw material for pulp and paper industry. Nevertheless the supply of bamboo and canes from natural forests has declined due mainly to clearfelling of natural forests and monoculture of commercial species.

Cane (rattan) is a climbing plant that produces flexible stems used for making handicrafts, furniture, domestic utensils, house constructions and binding material. Its products have export markets as fine quality finished products can be made with a variety of designs. The skills and artisanship for making handicrafts are learnt by local people from one generation to another. Bamboo and cane based cottage industries and enterprises will a good source of wage and self-employment in Sylhet areas. Unlike bamboo, no formal rules have been developed for cane harvesting for which permits by FD are issued after collecting royalty. Canes of adequate length are harvested manually by local people for their own use but also sold in

bundles to local traders. Villagers sell sometimes standing crop of bamboo and canes from their homesteads based on stumpage prices. Selection-cum-Improvement silvicultural system is more suitable for the management of natural forests having bamboo and canes as middle story vegetation.

A well planned marketing of NTFPs can be a means for employment and income generation by optimizing the values of NTFPs and ensuring the distribution of enhanced benefits among the participants. The role of marketing is in creating better linkages between the NTFPs management, processing and end-use. Proper marketing can reinforce sustainable management of NTFPs by indicating the kind of products and raw materials required. The NTFPs markets, which are essentially local, exhibit seasonal behavioral patterns because NTFPs production is seasonal in character. The local merchants and intermediaries many times deprive tribals and poor a fair price for their collected NTFPs. There is a wide gap between the NTFPs prices received by the primary collectors and that of final products. So there is a need for rationalizing the marketing system in order to narrow down the wide price differences. The quality of NTFPs as raw material is influenced by post harvesting handling, processing and storage conditions.

The development of NTFPs based enterprises may be hampered due to a number of factors. Lack of adequate facilities for processing and storage will result in losses, especially for perishable NTFPs. Other constraints include limited availability of finance and uncertain markets. Government restrictions on the transit and movement of some of the collected NTFPs (in terms of transit permits to be issued by FD) discourage the collectors for their collection and sale. If the collected NTFPs are processed at local level then the value added (e.g. broom making, cane processing, leaf collection for puffed and parched rice, basket making, handicrafts making, etc.) can be retained locally thereby generating forward and backward linkages for socio-economic development. However, poor infrastructure, natural calamities, poor skills, poverty and illiteracy among local people may be hindrance in setting up small enterprises for making finished products in the absence of adequate government support. The processing of some NTFPs may require an access to secondary processing industries and regular markets. Therefore, there is a need for establishing proper linkages between the primary collectors, processing units and markets.

Traditional knowledge about medicinal plants and animals should be documented in view of their contemporary relevance. Revitalization of folk traditions on medicinal plants holds a real potential for self-reliance of rural people on primary health care. *In-situ* conservation of biodiversity of use in traditional medicine should be encouraged by delineating medicinal plants conservation areas to conserve cross-sections of diverse eco-systems having potential for medicinal plants and animal species, and their genetic diversity.

5.5 Forest User Groups Formation

Socio-economic and cultural settings of a locality determine sustainable use of available biodiversity by local communities. Forest user groups will be organized by participating NGOs and local FD staff from neighbouring para or village located in and around the Park. The composition of a user group will not be too large, although the number of members (say, 15-25 persons) in a group will obviously depend upon the availability of forests and local population. The formation of user groups will be process-oriented by giving due emphasis to target communities such as ultra poor, poor, landless and marginal households, ethnic minorities, widow, destitute, etc.

5.6 Summary of Main Prescriptions

Main prescriptions outlined under the above-developed protection programs are summarized in Table 5.2 as below:

Table 5.2 Summary of Main Prescriptions

Year	Main Activities	Main Outputs/Success Criteria	Responsibility
1	<ul style="list-style-type: none"> ➤ Conducting reconnaissance surveys and demand-supply assessment ➤ Identifying a list of feasible production technologies ➤ Holding discussions with local stakeholders on feasible production technologies ➤ Finalizing a short list of candidate production technologies ➤ Identifying and selecting master trainers ➤ Preparing training material on the finalized production technologies ➤ Designing demonstration centres for proven technologies ➤ Identifying farmers training schools ➤ Finalizing preparations for imparting training to local stakeholders ➤ Finalizing operational guidelines for LDF 	<ul style="list-style-type: none"> Demand-supply situation assessed Feasible production technologies identified Stakeholders' consultations held Short list of production technologies finalized Master trainers identified Training materials prepared Design of demonstration centres completed Farmers training schools identified Preparations for training completed LDF operational guidelines finalized 	<ul style="list-style-type: none"> NSP NSP/ Stakeholders NSP/FD/ Stakeholders NSP/FD/ Stakeholders NSP NSP NSP NSP NSP/FD/ Stakeholders NSP/FD/ Stakeholders
2	<ul style="list-style-type: none"> ➤ List of feasible production technologies refined based on the first year experiences ➤ Continue holding discussions with local stakeholders on feasible production technologies ➤ Short list of candidate production technologies refined based on the first year experiences ➤ Finalizing training material on the finalized production technologies ➤ Establishing demonstration centres for proven technologies and arranging for stakeholders visits ➤ Establishing farmers training schools and arranging for stakeholders visits ➤ Imparting training to local stakeholders ➤ Training in simple storing and processing technologies ➤ Encouraging low-input small scale and 	<ul style="list-style-type: none"> List of production technologies refined Stakeholders' consultations continued Short list of production technologies refined Training materials finalized Demonstration centres established Farmers training schools established Training to groups imparted Stakeholders trained Stakeholders encouraged 	<ul style="list-style-type: none"> NSP/ Stakeholders NSP/FD/ Stakeholders NSP/FD/ Stakeholders NSP NSP NSP NSP/FD/ Stakeholders NSP/ Stakeholders

	<p>cottage industries</p> <ul style="list-style-type: none"> ➤ Conducting enterprise development assessment 	Enterprise development studied	NSP/ Stakeholders NSP
3	<ul style="list-style-type: none"> ➤ Continue holding discussions with local stakeholders on selected production technologies ➤ Training material on the finalized production technologies reviewed based on the project experiences ➤ Demonstration centres for proven technologies improved based on the project experiences ➤ Upgrading farmers training schools based on the project experiences ➤ Continue imparting training to local stakeholders ➤ Helping in developing market linkages ➤ Training on small enterprise development 	<p>Stakeholders' consultations continued</p> <p>Training materials reviewed</p> <p>Demonstration centres improved</p> <p>Farmers training schools upgraded</p> <p>Training to groups continued</p> <p>Market linkages established</p> <p>Stakeholders trained</p>	<p>NSP/FD/ Stakeholders</p> <p>NSP</p> <p>NSP</p> <p>NSP</p> <p>NSP/FD/ Stakeholders</p> <p>NSP/Federations</p> <p>NSP/Federations</p>
4	<ul style="list-style-type: none"> ➤ Continue holding discussions with local stakeholders on selected production technologies ➤ Continue arranging visits to demonstration centres ➤ Continue arranging training in farmers training schools ➤ Continue imparting training to local stakeholders ➤ Helping in enterprise development 	<p>Stakeholders' consultations continued</p> <p>Demonstration centres visited</p> <p>Training in Farmers training schools continued</p> <p>Training to groups continued</p> <p>Small enterprises established</p>	<p>NSP/FD/ Stakeholders</p> <p>NSP</p> <p>NSP</p> <p>NSP/FD/ Stakeholders</p> <p>NSP/Federations</p>
5	<ul style="list-style-type: none"> ➤ Continue holding discussions with local stakeholders on selected production technologies ➤ Continue arranging visits to demonstration centres ➤ Continue arranging training in farmers training schools ➤ Continuing with enterprise development and market assistance activities 	<p>Stakeholders' consultations continued</p> <p>Demonstration centres visited</p> <p>Training in Farmers training schools continued</p> <p>Enterprise development continued</p>	<p>NSP/FD/ Stakeholders</p> <p>NSP</p> <p>NSP</p> <p>NSP/Federations</p>

6. FACILITIES DEVELOPMENT PROGRAMS

During the implementation of the Management Plan the development of Park facilities will be undertaken to support the long-term administration. In addition to built facilities, the Facilities Development Program will focus on the procurement of transport and other equipments required for the implementation of proposed management programs.

6.1 Objective

Main objective of this program is to develop necessary facilities including accommodation and field equipments for FD field staff responsible for the management of Park.

6.2 Built Facilities

The development of built facilities will proceed in a well-planned and phased manner, that is appropriate to a Park setting, in order to ensure that they do not negatively impact the area's natural resources or ecotourism potential. Existing FD facilities will be fully utilized and incorporated in Park management where these can be renovated on a cost-effective basis. Built facilities will be concentrated in four areas : i) Park Headquarters (incorporating the existing Satchari Beat Office); ii) a rest stop/picnic area located at the Park HQ, on the old Dhaka-Sylhet road; and iii) a Guard Camp located on the old Dhaka-Sylhet road, near the eastern Park border.

Built facilities requirements during the Management Plan period are summarised in Tables 6.1 and 6.2.

Table 6.1 Built facilities development in Satchari National Park: use of existing facilities

Location	Facility (current use)	Use during Plan Period	Action Required
Park Headquarters (Satchari)	Satchari Forest Rest House (2 bedrooms, 2 bathrooms, 1 storeroom, 1 dining room, 1 sitting room)	Forest Rest House	➤ regular maintenance
	Range Officer's Quarter	OIC Quarter	➤ septic tanks, doors & windows ➤ repainting and regular maintenance
	Beat Officer's office-cum-residence	Beat Officer/Ranger's Quarters	➤ renovations to improve rainwater drainage, grill repairing, etc. ➤ repainting and regular maintenance
	Range Office	Park Office (office space for OIC, Ranger and Forester)	➤ general renovation/repairs ➤ installation of water supply, electricity hookup and telephone ➤ repainting and regular maintenance
	Clerk Quarter	Clerk Quarter	➤ repainting and regular maintenance
	Guard Quarters (6 buildings including old buildings)	Gaurds' Quarters	➤ general renovation/repairs ➤ septic tanks, doors & windows ➤ repainting and regular maintenance
	Nursery and Seed Storage	Nursery for enrichment planting	➤ regular maintenance
	Picnic Spot	Nature Interpretation Centre	➤ remove and replace with appropriate structure as NIC

Table 6.2 Built facilities development in Satchari National Park: new facilities

Location	Facility and use during Plan period	Action Required
Park Headquarters (Satchari Rabge Office Complex)	ACF's Quarters (1, area ~120 m ²)	<ul style="list-style-type: none"> ➤ site selection ➤ design and construction ➤ installation of water supply and electricity hookup ➤ regular maintenance
	Guard's Quarters (2, each ~60 m ²)	<ul style="list-style-type: none"> ➤ as above
Camp at Park's eastern boundary	Forester's Quarters (1, area ~80 m ²)	<ul style="list-style-type: none"> ➤ site selection ➤ design and construction ➤ installation of water supply and electricity hookup ➤ regular maintenance
	Guard's Quarters (2, each ~60 m ²)	<ul style="list-style-type: none"> ➤ as above
	Public Toilet	<ul style="list-style-type: none"> ➤ as above

All built facility requirements at Park Headquarters, except for senior staff and Forest Guard's quarters, should 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. At the Park HQ area, existing visitor facilities will be renovated to provide two covered picnic shelters and an adjacent outside picnic area. The existing toilets will be removed and replaced with a new facility. The nursery at Satchari will be retained for production of seedlings required for habitat management. New quarters will be constructed for the Park staff and nursery workers stationed at this location. Guard quarters at Satchari will be renovated to provide electricity and piped water, and will be repainted and maintained on a regular basis.

At each location, design standards for both renovations and new construction will be based on the "Guidelines for Conservation Area Facilities Development" (Tecsult 2001). A regular schedule of maintenance and upkeep will be maintained and all irreparable or unused buildings will be removed. Renovation and construction work will be completed at Park Headquarters as a matter of priority.

6.3 Forest Roads and Trails

Access to the Park Headquarters is currently provided by all-weather access road which does not require upgrading. Access roads between sites at Park Headquarters (*i.e.*, between the main office/accommodation complex, the Resthouse and proposed Environmental Education Centre) will require periodic manual maintenance, but are currently built to sufficient standards for anticipated traffic loads. All other roads within the Park will be permanently closed to 4-wheeled vehicles. Unsurfaced forest trails (former logging tracks) link Park Headquarters/Satchari Beat Office with the interior areas of Park. But these trails have not been maintained and some culverts would need to be placed to restore easy access.

Restoration of these trails would provide quick and easy access to the Park for management staff. But these would also provide unimpeded public access, thereby potentially increasing the severity and spatial extent of management problems. Due to the nature of the terrain, techniques commonly used to block public use of access roads (*e.g.*, barriers, locked gates) could easily be circumvented, and do not provide an effective solution to the potential problems of improved public access. Additionally most access by Park staff is currently and will continue to be by foot and motorcycle, and the distances involved are short. Foot patrols are much more effective than vehicle patrols and so the trails linking will be maintained for foot and motorcycle access, but not for access by vehicles with four wheels. These trails will be incrementally narrowed to an average width of approximately 2 m, through replanting bypass areas and permitting ingress of undergrowth.

Numerous other foot trails have been developed throughout the Park mainly at the time of plantation establishment, and linking settled areas within and on the periphery of the Park with subsistence use areas. Some of these, particularly those that tie in with the main road and trail access system described above, could also be used as nature trails (described in detail in Chapter 7). However, only existing trails will be renovated and maintained as nature walks and trails during the first five years and new trails will be laid out only during the subsequent years after assessing their potential and use. Reconnaissance surveys will be taken up to select trails that pass through diverse habitats and landscapes of interest. The trail selection and development will be taken up with specific objectives: i) to demonstrate the importance of biodiversity conservation to visitors and policy makers, ii) to make outing and hiking for observing the beauty of a PA, iii)

to learn interesting things about the local environment, ecology, culture and wildlife, iv) to raise public awareness for biodiversity conservation and wildlife management. Each trail will be marked on the ground and base map and adequate information will be provided in shape of sign boards (at entry/start point) and also through printed materials including brochures. Some minimum visitor amenities such as resting places, rest rooms, waste disposal bins and hides may in future be provided along the identified trails. Adequate provisions should be made for the renovation and maintenance of these public utilities.

6.4 Field Equipments

Vehicles, field equipments and office equipments will be needed to support the management and administration programs. Double-cab pickups will be provided for the ACF/OIC. In addition, two 100 cc motorcycles will be provided for use at Park Headquarters, and one at Gaurd Camp at the park's eastern boundary. Two walkie-talkies will be provided for use at Park Headquarters, and one at Guard's Camp at Parks' eastern boundary. These will be suitable for communication among these sites. Compasses, binoculars, GPS and other field equipment will be provided as required for support of the Park management programs.

6.5 Office Equipments

Office equipments (telephone, computer, etc.), furniture (desks, filing cabinets *etc.*) and supplies will be provided as required for use at Park Headquarters and the Guard Camp Office. Similarly all necessary equipment and supplies for development and operation of the Environmental Education Centre will be provided. Specific requirements will be detailed in conjunction with the development of environmental education and other visitor use programmes.

6.6 Summary of Main Prescriptions

Main prescriptions outlines under the above-developed facilities development programs are already summarized in Tables 6.1 and 6.2.

7. VISITOR USE AND VISITOR MANAGEMENT PROGRAMS

7.1 Objectives

Regulated eco-tourism in the form of nature education and interpretation tours (as against commercial tourism) will be a main objective of visitor use and management programs. This will help promote biodiversity conservation and educate the visitors as enlightened nature tourists. Socio-economic benefits of eco-tourism will be accrued to local people through forward and backward linkages.

7.2 Conservation Tourism

The potential of conservation tourism is high in Satchury due to Park's easy accessibility. So a number of facilities can be developed for future visitor use. Basic information about the Park will be made available to visitors in the form of information handouts and brochures.

7.2.1 Identification of Tourism Areas

A tourism region will be identified around the Park by linking with other local and regional attractions including Guest Houses, tribal villages, rolling landscapes, wetlands and tea gardens through forest roads and trails. Adequate care will be taken to preserve the local traditions and culture of tribals by avoiding intrusive, exploitative and commercial behavior while implementing visitor program. Existing roads and trails will be renovated for easy movement in tourism zone. Initially tourists will use their own transport but a regular vehicular arrangement by FD on payment basis may be considered subsequently. Elephant ride may also be considered by FD as many tourists may be interested to have a close look of nature from elephant back. Initially Satchuri Forest Rest House (FRH) will provide accommodation to tourists. But when the number of tourists increase local enterpreneurs on the Park's fringes (in interface landscape zone) will be encouraged to set up nature camps, lodges, dormitories, huts and cottages for tourists. Eco-guides to be identified amongst local communities will be employed for the guidance of eco-tourists.

Brochurs, pamphlets, guide maps, hand outs, audiovisual aids, display boards will be developed at convenient points. Mass Communication Officer of FD will provide help in launching publicity program. Local youths/naturalists preferably from the co-management communities will be encouraged to act as eco-guides and nature interpreters. They will be trained as eco-guides by organizing a series of training workshops on communication and interpretation skills (including on what to speak, how to speak, presentation skills, body language assessment, team building exercises, etc.). Main message in these workshop will be on spreading conservation awareness among the visitors. Binoculars and suitable books on ornithology may be provided to tourists on rent. They may also provide catering facilities at tourist accommodation places.

Nature camps (of 1-2 days duration) may be organized at places of interest within the Park for students and youths for learning by experience and discussions on biodiversity conservation issues. Camp accommodation will be provided in temporary tents to be established near sites of interest. Local NGOs and naturalists may help in establishing nature camps.

7.2.2 Facility Development

7.2.2.1 Use Types and Facilities

Only Satchari FRH (under the control of DFO, Sylhet) is available for night halts near the Park and so its use of this FRH for general visitors will be allowed on payment. However, longer-term visitors can get accommodation outside the Park area in the Guest Houses maintained by Tea Board, Tea Research Institute and reasonable hotel accommodation available at Srimongal. The tourists can travel to Satchuri on a day trip and return back to Srimongal for night halt. Publicity and information materials having basic information about the Park will be provided to visitors by means of fixed signs, brochures, leaflets, printed guides, etc. at key road access points. Some of the possible points are along the old Dhaka-Sylhet Highway starting from the Park HQ Office. An Environmental Education Centre to be established at the Park's office will serve as Nature Interpretation Centre (NIC) with update information. Suitably trained staff will be posted at all of these locations with adequate information and publicity material about the Park's importance and facilities. Additional training on public relations and visitors management will be provided to the Park staff.

7.2.2.2 Nature and Hiking Trails

A network of nature trails will be developed for visitors movement on foot and bicycle traversing key natural and cultural features of interest (e.g. patches of high forests, betel leaf gardens, cultural remnants, natural streams/cheras, religious places). The existing Satchuri FRH will be connected with nature trails. 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. The Environmental Education Centre will be connected by one such trail for visitor access. The following guidelines/standards will be followed while designing, developing and maintaining the trails.

- ➔ Existing trails will be renovated by using local hard soil materials (e.g. laterite soils from nearby forest areas) in order to maintain them in as natural condition as possible;
- ➔ Renovation of trails will be done by maintaining minimum necessary surface area and vegetation clearances will be limited wherever possible for easy access;
- ➔ Sign-posts with adequate information will be provided at main trail heads and printed materials will be distributed by the staff to interested visitors for their education and awareness. A list of dos and don'ts for visitors will also be prepared and made available at visit places;
- ➔ Hygienic conditions will be maintained and simple toilets and litter disposal facilities will be provided at key points; and
- ➔ Motor traffic will not be allowed.

Self-guided trails with adequate information/interpretation will help bring visitors close to nature and provide aesthetic sense. In long-term these visitors will be future ambassadors of biodiversity conservation. A leveled sketch map, depicting significant natural features along the trail, will be posted at the starting point.

As a part of the management planning exercise the following three hiking trails have been identified and mapped (Figure):

1. Short Trail: It is an half hour walk trail of nearly 1 km in length and on an average 1 meter wide, starting (and ending to) from Satchuri Range Office (GPS location 24.12671 N and 91.44347 E) on the main metallic road (adjacent to the entrance road to Range Office) where a signboard, "Wilderness (A Conservation Area), Forest Department" is placed to the south of the road. The trail crosses a wide dry stream twice and is generally flat, except at Tiprapara Forest Village where it passes through a valley of a *tila* (hillock) on which Tiprapara is situated.

Natural vegetation (chupalish, shimul, dummer, sada belpui, bamboo, sheora, nowri, etc.) along the trail is worth enjoying. The plantations of teak, bamboo, cane, etc. are also worth noticing while traversing the trail. Main fauna includes a number of birds, macaques, langur, mangoos, etc. A detailed description of this trail is presented in Annexure 7.2.1.

2. Medium Trail: This 2 km long trail (on an average 1 meter wide) will require nearly one hour trekking. It starts from the eastern side of the metallic road (about 30 m south-east of Satchuri Range Office with GPS location 24.12676 N and 91.44343 E) and ending (GPS location 24.12683 N and 91.44183 E) to the west of the starting point. Main tree species to be encountered along the trail includes chapalish, teak, shimul, dumur, sada belpui, bamboo, sheora, nowri, bamboo, cane, etc. Some private lemon gardens and homesteads of fruit trees are also seen. Important fauna includes many types of bird species, macaques, langur, squirrels, mangoose, frogs and snakes. The Annexure 7.2.2 can be seen for more detailed description of this trail.

3. Long Trail: It is a three hour walk undulating trail, 6 km in length and 2 meter in width in general. The trail starts from the main road (about 100 m east of Satchuri Beat Office with GPS locations 24.12668 N and 91.44347 E) and ending on the same main road (to the east of the starting point with GPS locations 24.12676 N and 91.45703 E) near Chaklapunji Tea Garden. Main plant species to be sighted along the trail include chapalish, dewa, teak, shimul, dumur, sada belpui, rangi, jarul, malacana, eucalyptus, acacia, meogony, rangi, behera, amloki, jalpai, agar, chikrassi, sheora, nowri, teak, bamboo, cane, etc. Main fauna includes a variety of birds (Myna, Tia, Shalik, Ghugu, Vimraj, Bon Morog, Mothura, etc.), macaques, langur, squirrels, hollok, bear, fox, civet, hair, deer, macho bag, frogs and snakes. Further description of this trail can be seen in Annexure 7.2.3.

7.2.2.3 Picnic Facilities

Basic picnic facilities such as sheltered and outdoor tables, simple toilets and litter disposal buckets/boxes will be provided (for visitors in small groups) at the Park's HQ and also along trails. However, the use of loudspeakers, amplifiers and other activities that could affect the use and enjoyment of the area by others will not be permitted inside the Park.

7.2.3 Community-Based Tourism

Guided tourism will be developed over a period of time by involving unemployed youth members/naturalists of co-management committees and user groups as eco-guides. They will be trained on eco-tourism including animal signals and calls, bird identification, biotic influences, local culture, etc. They will be involved in the management of eco-tourism in order to create stakes among them. Involvement of local community-based organizations and organized groups will be sought in developing community-based tourism.

7.2.4 Regulation of Eco-Tourism

Eco-tourism will be restricted to specific areas identified for the purpose. The movement of vehicles and tourists will be regulated within the identified tourists paths for which physical barriers and check posts will be established at appropriate places and manned by adequate staff to regulate the traffic into the core zone. Tourists will be allowed during day time only and all the visitors must leave the core zone by sun set. No night driving will be allowed and entry hours will be specified. Similarly Park may be closed during rainy season. Slow driving (say 25 km/hour) will be allowed for motor vehicles on the northern boundary along old Dhaka-Sylhet road and blowing of horns will not be permitted. Wildlife will not be chased and food from outside will not be allowed. Litting of fire will not be allowed during excursions. Dogs and pets will not be allowed. Empty canes, tins and polythene will not be allowed. The ACF in-charge of Park will regularly get feed back from his field staff about the tourists through periodic reports and briefings.

7.3 Conservation Education, Awareness and Interpretation

The publicity of the Park management activities will be improved for propagating the biodiversity conservation, environment, and wildlife and the cause of its habitat. Electronic and print media (TV, Radio, Videos, newspaper, magazines, brochures, etc.) will be employed for this purpose. Schools and colleges will be targeted for conservation education and building an informed wildlife constituency. Conducting talks, essays writing and competition will be included in neighbouring schools as a part of publicity campaign. Sabuja Vahinis (Green Brigades) will be formed and trained in nearby schools and madarasas. Professional publicity and communication personnel will be invited for such tasks. Communication strategy as developed under NSP will be implemented. Efforts will be undertaken to improve relations and communications between the FD field staff and the media.

7.3.1 Interpretative Media for Tourist Education

Nature interpretation will, as an educational activity, focus on revealing meaning and relationships of complex ecosystems and landscapes. Public awareness of the laws related to wildlife will be enhanced and prosecutions under the laws will be publicized. Nature Interpretation Centres will be developed at accessible place (say at the Park HQ). Landscape features of Park may be depicted in pictorial forms including topographical and biodiversity patterns. Depending upon the availability of resources a sound and light program can be added for explaining to visitors. Local exhibits, murals, dioramas, specimen of plants and wildlife, trophies and photographs may be added. Socio-cultural traditions/features (handicrafts, uniforms, dances, tools, furniture, ornaments, carvings, etc.) of local people including tribals may be added with proper leveling and description.

Appropriate signages will be used for the benefits of tourists in finding their ways without any enquiry. These signages may be i) directional signages showing the way to different places, ii) cautional signages indicating about prohibitory acts, iii) orientational signages helping in tourists orientation and iv) interpretive signages kept at conspicuous places to help interpret strategic themes and issues.

7.3.2 Environmental Education

An existing building at Park Headquarters will be converted as an Environmental Education Centre by renovating with minor modifications. This building will be developed as a Nature Interpretation Centre, the design and development of which will be assigned to a professional organization. It will consist of walk-through displays, audio-visuales, explanatory printed materials, items of historical and conservation significance, computer interactive media, etc. A video film on wildlife and its habitat and cultural aspects may be developed for showing to visitors at NIC. Other relevant topics may include ecological processes at work in the Park, wildlife behavioural ecology, conservation history, role of local people in conservation,

man-wildlife conflicts, etc. A library will be developed at NIC with books, magazines and journals relating to biodiversity, wildlife, environment and forestry.

7.4 Inter-sectoral Conservation Planning

Many times other sectors, particularly land-based sectors, have profound effects (both negative and positive) on the Park management. Therefore, the FD needs to establish clear linkages and programs for collaborative conservation planning with other relevant agencies/institutions both within and outside the country. A collaborative conservation strategy should be developed to provide mechanisms for improving inter-sectoral coordination and information sharing to maximize biodiversity conservation efforts.

7.5 Conservation Partnerships

The concept of public-private partnership will be applied in soliciting the inputs/contributions from private sector for the facilities development in Satchari NP. It has been shown in many countries that nature conservation progresses rapidly when leading members of the private sector perceive nature conservation as good for the economic well being of the country. Nature conservation partnerships can be designed to offer interested businesses a vehicle for contributing to long-term forest conservation in a way that is transparent with low transaction costs, generates beneficial public image for the contributor and makes a long-term difference in forest conservation.

A well designed Partnerships program may be implemented in the following ways:

1. It may help improve livelihoods of local people around the Park by building a strong and mutually self-interested relationship with the local communities. Such a relationship may be formalized by signing co-management agreements under which community representatives maintain joint responsibility for protection with FD, and in return receive benefits generated from the Park or provided by NSP. Contributors can support community needs for improved health and sanitation, womens' empowerment and livelihoods improvements.
2. Contributors can help create visitor facilities including educational exhibits, public utilities, sitting areas and other visitor amenities by making donations in lieu of recognition on appropriate plaques at Park level to attest to their contribution.
3. Contributors may support/co-finance NSP's communication and outreach efforts by help organizing events such as Earth Day, Nishorgo Day, Wildlife Week, etc.
4. NSP may offer an opportunity to potential contributors to license the Nishorgo logo and name for use in creating and selling nature-based products and souvinor including postcards and Tishirts with wildlife pictures. The receipts from the licensing program may be ploughed back either for local community development and/or improved Park management.
5. Private businesses located in the interface landscape zone (e.g Tea Estates) will be rewarded for their Park-friendly behaviour/activities. For example, those businesses supporting Park conservation may be given right to use the, "Certified Nishorgo-Friendly" level.

7.6 Summary of Main Prescriptions

Main prescriptions outlined under the above-developed protection programs are summarized in Table 7.1 as below:

Table 7.1 Summary of Main Prescriptions

Year	Main Activities	Main Outputs/Success Criteria	Responsibility
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1	<ul style="list-style-type: none"> ➤ Identifying tourism areas within the Park ➤ Designing and developing basic picnic facilities for tourists ➤ Identifying suitable sites for nature camps ➤ Designing and preparing publicity materials including pamphlets, brochures and maps ➤ Identifying and training eco-guides ➤ Developing and propagating conservation awareness and education through electronic and print media ➤ Identifying and motivating students and volunteers (Sabuj Vahini) for biodiversity conservation ➤ Identifying an existing building for establishing Nature Interpretation Centre ➤ Identifying and mapping existing nature and hiking trails ➤ Establishing regular contacts with relevant ministries and departments for inter-sectoral conservation planning ➤ Developing a policy on public-private conservation partnership 	<p>Possible tourism areas identified</p> <p>Minimum tourist facilities are in place</p> <p>Possible sites for 1-2 days nature camps identified</p> <p>Publicity material developed</p> <p>Eco-guides identified and trained</p> <p>Conservation awareness program developed</p> <p>Number of schools identified and students motivated</p> <p>Building for NIC selected</p> <p>Existing trails mapped</p> <p>Relevant ministries and departments contacted</p> <p>Public-Private partnership policy drafted</p>	<p>FD</p> <p>FD/NSP</p> <p>FD/NSP</p> <p>NSP/FD</p> <p>NSP</p> <p>NSP/FD</p> <p>NSP/FD</p> <p>FD</p> <p>FD/NSP</p> <p>FD</p> <p>NSP</p>
2	<ul style="list-style-type: none"> ➤ Tourism areas shown on maps and brochures ➤ Regulating tourism within the Park ➤ Developing basic picnic facilities for tourists ➤ Developing suitable sites for nature camps ➤ Preparing publicity materials including pamphlets, brochures and maps ➤ Training eco-guides ➤ Propagating conservation awareness and education through electronic and print media ➤ Motivating students and volunteers (Sabuj Vahini) for biodiversity conservation ➤ Establishing Nature Interpretation Centre (NIC) ➤ Developing existing nature and hiking trails ➤ Holding meetings with relevant ministries and departments for integrating Nishorgo Program with other sectoral programs ➤ Approving a policy on public-private conservation partnership 	<p>Tourism areas notified</p> <p>Tourism regulated</p> <p>Tourist facilities are developed</p> <p>Possible sites for 1-2 days nature camps developed</p> <p>Publicity material development completed</p> <p>Panel of possible Eco-guides trained</p> <p>Conservation awareness propagated</p> <p>Number of students motivated</p> <p>NIC established</p> <p>Existing trails developed</p> <p>Relevant ministries and departments pursued</p> <p>Public-Private partnership policy approved</p>	<p>FD</p> <p>FD</p> <p>FD/NSP</p> <p>FD/NSP</p> <p>NSP/FD</p> <p>NSP</p> <p>NSP/FD</p> <p>NSP/FD</p> <p>FD</p> <p>FD/NSP</p> <p>FD</p> <p>FD/MOEF/NSP</p>
3, 4 and 5	<ul style="list-style-type: none"> ➤ Regulating tourism within the Park ➤ Continuing to develop picnic facilities for tourists 	<p>Tourism regulated</p> <p>Tourist facilities are developed</p>	<p>FD</p> <p>FD</p>

	➤ Maintaining suitable sites for nature camps	Possible sites for 1-2 days nature camps maintained	FD/NSP
	➤ Continuing to distribute publicity materials including pamphlets, brochures and maps	Publicity material development distributed	FD/NSP
	➤ Maintaining the panel on eco-guides	Panel of possible Eco-guides maintained	NSP
	➤ Continue propagating conservation awareness and education through electronic and print media	Conservation awareness propagated	NSP/FD
	➤ Continue motivating students and volunteers (Sabuj Vahini) for biodiversity conservation	Number of students motivated	NSP/FD
	➤ Maintaining Nature Interpretation Centre (NIC)	NIC maintained	FD/NSP
	➤ Developing new nature and hiking trails	New nature trails developed	FD
	➤ Continue liaisoning with relevant ministries and departments for integrating Nishorgo Program with other sectoral programs	Relevant ministries and departments pursued	FD/MOEF/ NSP
	➤ Approving a policy on public-private conservation partnership	Public-Private partnership policy approved	FD/MOEF/ NSP

8. CONSERVATION RESEARCH, MONITORING AND CAPACITY BUILDING PROGRAMS

8.1 Objectives

A research, monitoring and capacity building program will be developed with main objectives i) to better understand the Park's biodiversity resources, ecosystem and landscape environment, ii) to establish a baseline listing of all flora and fauna species for assessing their current abundance, distribution, and functional relationship among biotic communities iii) to develop quantitative population estimates for selected key species (hoolock gibbons and capped langurs), and develop detailed information on their current distribution and habitat use, iv) identify and map key patches of remnant forests and other critical habitats, v) to identify priority research and monitoring topics to help guide the development of Park's management program, and vi) to gradually reduce the extent and degree of uncertainty while taking Park management decisions.

8.2 Conservation Research

Presently conservation research is not being undertaken by FD and there is no funding source earmarked for carrying out such research. It is, therefore, necessary to establish linkages with related research organization such as FRI, BARC and relevant Universities and NGOs. In view of scarcity of funding for conservation research, adequate collaboration and networking with other relevant research organizations is necessary.

Conservation research may include aspects such as diverse types of flora and fauna, status of endangered species, wildlife behavior, socio-economic issues, silvicultural aspects, man-animal conflicts, impact of anthropogenic pressures on natural systems, etc. Applied research relating to management aspects of the Park will be given priority by FD over academic studies, which may be conducted by Universities and research institutes.

8.2.1 Applied Socio-economic Research

Management driven studies for conservation research will be taken up on priority basis. In the absence of research laboratories, pure research will not be taken by FD (and so would be left to other research institutes). Possible topics of investigation may include the institutional development and financial sustainability of co-management committees to be formed at different levels and their federations, impacts and dependence of local people including Tea Estate labourers on habitat, forward and backward linkages of eco-tourism, sustainable collection, harvesting, storage and processing and marketing of NTFPs (means of multiplication), impacts of NTFPs on local economy, collection of NTFPs by the members of co-management committees. Many of these studies will be carried out through action research and by associating the stakeholders. Prioritization of research topics will be decided in a Workshop in which key persons from FD and other stakeholders will participate. A computerized data base and retrieval system will be established.

8.2.2 Applied Biological Research

Some relevant topics of biological research may include wildlife-population viability analyses, population dynamics and feeding behaviour, wildlife habitat/niche use behaviour, wildlife distribution patterns, wildlife seasonal variability and movements, and wildlife health and diseases. Population viability analyses will be taken up to ensure that considerations of minimum population size and population dynamics are taken into account while formulating appropriate habitat management strategy. The needs of species that are dependent on specific habitats (e.g. streamside areas) or specific components (e.g. standing and fallen dead trees) will also be studied for site-specific habitat management. Poaching and illegal wildlife trade will be studied.

8.2.3 Silvicultural Research

Main topics of silvicultural research may include impact of forest grazing and fires on forest regeneration and wildlife (e.g. grazing intensity-how far cattle grazing be allowed), canopy manipulation for improvement of habitat through natural regeneration, habitat improvement through enrichment and under plantings, and monitoring of floristic composition and structure. Main research findings from different silvicultural studies carried out by BFRI will be reviewed in order to draw relevant inferences and frame appropriate recommendations for managing forests in ecosystem zones and habitat management zones. Further research will be required on the effects of selected silvicultural and forest management practices on forest growth, structure and species composition, regeneration of NTFPs bearing plant species, sustainable collection and harvesting of NTFPs,

8.2.4 Ecological Research

Main topics of ecological research will include identification of fragile habitats and ecosystems, environmental impact studies, water bodies studies, impacts of forest grazing and fires on natural regeneration and wildlife, impacts of habitat changes and eco-tourism on wildlife.

8.2.5 Baseline Surveys

Existing literature on resources surveys and research will be reviewed before taking up further studies on additional assessments. The inputs from baseline surveys (for example, current population levels, distribution and habitat use) will be used in refinement and application of habitat management and monitoring.

8.2.6 Conservation Research Dissemination and Utilization

Adequate dissemination and utilization of the results/findings of research studies are very important. Pure research done for academic purposes will find less acceptability by FD and so poor dissemination among the field staff. Research dissemination and use methods may be standardized and circulated among FD staff. Useful research outputs will be included in annual development plans of FD for their implementation.

8.3 Conservation Monitoring

A well developed technique for conservation monitoring in multi-species management scenario is to select one or more key or representative species, and to ensure that habitat suitability for this species or a group of species is retained. The long-term aim will be to maximize gains in quantity and quality of habitat, and quality for these and associated species. A detailed assessment of WNCC/Park data needs will be undertaken before putting an appropriate MIS for the Park as a part of existing RIMS which will be strengthened by including MIS in addition to existing GIS.

Performance Monitoring Plan (USAID, 2003) contains guidelines for designing and implementing different levels of indicators (parameters) and intermediate results (IR) developed to track project performances and to assess project success with respect to project objectives. Within the scope of PMP the following set of core indicators has been designed by Nasim (2004) by following the USAID's guidelines:

- ▶ Indicator 6.2d : Declining incidence in illegal logging in the Park's forests
- ▶ Indicator 6b : Increased production of natural resources in targeted areas of the Park
- ▶ Indicator 6c : Increased biodiversity in targeted areas of the Park

A detailed methodology for establishing benchmark data and measuring the volume of timber loss (cubic meter/ha) during the Project period will be used in using the indicator 6.2d for assessing effectiveness of project interventions in controlling unauthorized logging in the sampled forest patches of the Park. A survey of natural regeneration (density of seedlings and saplings per ha) in the forests of Park will be taken with respect to the indicator 6b. This will be complemented by photo monitoring technique, focusing on changes in plant height as a visual evidence of success of NSP interventions. Forest dwelling bird species will be used for assessing biodiversity status with respect to the indicator 6c. A simple procedure of sighting and counting (either population or nests) the indicator bird species using the forests as their habitat will be 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 impacts of project interventions.

A critical review of the long-term habitat management strategy based on a detailed inventory of biodiversity will be taken up during the final year of implementation of this Plan. Park management practices will accordingly be adjusted.

8.4 Regional Coordination

As a part of NSP implementation a good coordination with related organizations in Asia and elsewhere will be developed. Cross-country exchange visits and training will be arranged to learn from relevant experiences from similar projects being implemented in different Asian countries. Under NSP a working group will be supported for preparing disseminating co-management best practices and lessons learned. Potential organizations for maintaining professional contacts include regional FAO office (Bangkok), RECOFTC (Bangkok), Wildlife Institute of India (Dehra Dun), ICIMOD (Kathmandu), CIFOR (Bogor, Indonesia), etc.

8.5 Conservation Training

Of the total 378 positions (of which only 105 are technical staff) allocated to WNCC, only 259 staff are in position. Although there are 42 positions allocated to WMNC Division, Sylhet, its operation is still to be made functional. This means that the existing territorial staff continue to manage the PA based mainly on traditional forest management practices. There is great necessity of imparting conservation training to the FD field staff responsible for managing the Park. FD does not have any specialized capacity for imparting PA management training. Of the many forestry subjects only one paper relates to wildlife management being taught to cadre officers at Forest Academy, Chittagong. Other subordinate staff do not receive any significant training on PA management, although wildlife management is one of the many taught subjects. There is a lack of permanent faculty on in-situ conservation at ecosystem and landscape levels by involving local communities. However, some forest officers haven undergone overseas training on wildlife and PA management. Unfortunately many of them are working outside WNCC, thereby under-utilizing their expertise.

Other stakeholders including the beneficiaries and NGO staff also need conservation training. An exhaustive conservation training plan, covering both in-country and overseas training, will be developed under NSP and implemented over the project period. A training strategy dealing with both quality and quantity of training including refresher and orientation training courses will form part of the training plan. Significant progress has been achieved in overseas training during the current year when one senior officer was sent to US for short-term training and two ACFs were sent for long-term training at Wildlife Institute of India. Similar training programs will be conducted in future as well.

Adequate training infrastructure has been developed within FD under different donor funded projects including World Bank funded FRMP. Under the present cumbersome appointment procedures it may not be possible to recruit permanent staff in FD training institutes. So networking with other training and research institutes such as BFRI and IFESCU will be necessary.

A training needs assessment for participatory PA management was conducted under FSP (TECSULT, 2000). A provisional list of professional specialist skill is presented as below from the study (Art et al, 2004) conducted under NSP:

- ➔ Strategic and Adaptive PA Management Planning
- ➔ Information Technology (MIS)/Spatial Data Management (GIS)
- ➔ Communication Hardware Technology
- ➔ Information, Education and Communication (IEC)/Visitor Services
- ➔ Public Outreach and Extension
- ➔ Community Relations: Conflict Management and Resolution
- ➔ Community Support: Livelihoods Improvement
- ➔ Environment and Wildlife Law/Legal Support
- ➔ Law Enforcement
- ➔ Financial Management Accounting
- ➔ Wildlife Insurance and Compensation
- ➔ Co-management of PAs
- ➔ Conservation Biology
- ➔ Ecological and Biodiversity Inventory and Research
- ➔ Habitat Management of Rehabilitation Applied Research
- ➔ Wildlife Management, Rehabilitation and Species Recovery
- ➔ Socio-economic Research
- ➔ Gender and Ethnic Diversity
- ➔ Leadership Training and Decentralized Management

8.6 Summary of Main Prescriptions

Main prescriptions outlined under the above-developed protection programs are summarized in Table 8.1 as below:

Table 8.1 Summary of Main Prescriptions

Year	Main Activities	Main Outputs/Success Criteria	Responsibility
1	<ul style="list-style-type: none"> ➤ Identifying possible conservation topics for taking up research studies ➤ Holding stakeholders consultations on the proposed list of identified research topics ➤ Identifying and networking with interested national organizations for conducting selected research studies ➤ Developing a set of indicators for conservation monitoring ➤ Collecting and developing benchmark data/information base with respect to core indicators ➤ Identifying regional and international organizations for networking and cross-learning ➤ Preparing an overseas and in-country training plan for imparting training to all stakeholders ➤ Finalizing the draft Wildlife Act 	<ul style="list-style-type: none"> A list of research topics prepared A short list prepared after stakeholders consultations Interested research organizations contacted A set of indicators selected after consultations Benchmark surveys completed Relevant regional organizations contacted Conservation training plan finalized Draft Wildlife Act finalized and submitted to MOEF 	<ul style="list-style-type: none"> NSP/FD NSP/FD/ Stakeholders NSP/FD NSP/FD NSP NSP/FD NSP/FD FD/NSP
2	<ul style="list-style-type: none"> ➤ Prioritizing the identified research topics ➤ Developing ToRs and arranging budget for priority research studies ➤ Contracting interested national organizations for conducting selected research studies ➤ Collecting and developing follow up data/information base with respect to core indicators ➤ Maintaining regular contacts with regional and international organizations for networking and cross-learning ➤ Implementing overseas and in-country training plan for imparting training to all stakeholders ➤ Approving the draft Wildlife Act 	<ul style="list-style-type: none"> Priority list finalized after stakeholders consultations ToRs ready with required budget Interested research organizations contracted Follow up surveys completed Contacts with regional organizations maintained Training plan implemented Draft Wildlife Act submitted to Ministry of Law and other related ministries 	<ul style="list-style-type: none"> NSP/FD/ Stakeholders FD/NSP NSP/FD NSP NSP/FD NSP/FD FD

3, 4 and 5	➤ Implementing conservation research studies on the identified research topics	Priority research studies completed	NSP/FD
	➤ Disseminating and using research findings	FD and NSP staff use research findings	FD/NSP
	➤ Continue follow up data/information base with respect to core indicators	Follow up surveys completed	NSP/FD
	➤ Maintaining regular contacts with regional and international organizations for networking and cross-learning	Contacts with regional organizations maintained	NSP/FD
	➤ Implementing overseas and in-country training plan for imparting training to all stakeholders	Training plan implemented	FD
	➤ Approving the draft Wildlife Act	Draft Wildlife Act gazetted after Parliament approval	FD

9. ADMINISTRATION AND BUDGET PROGRAMS

9.1 Objectives

Main objective of administration program is to ensure that technical and administrative staff required to manage the PAs effectively are approved, developed and posted. Improvements in financial organizational systems will aim for the financial sustainability for the Park.

9.2 Administrative Set Up

As per the approved organogram a Wildlife Management and Nature Conservation Division is to manage the Park within an overall supervision of Wildlife and Nature Conservation Circle (with a total of 378 staff) and each PA will be managed by an ACF/FR who will be assisted by 1 DR/Fr and 3 FG/Boatman. It is recommended to implement the approved organogram by creating functional Divisions and posting the field staff for each PA. Each PA will be an operational unit with greater decentralized authority for decision-making with an assigned ACF.

Presently the Park is managed under the existing Satchari Range of Sylhet Forest Division. Satchari Beat of Satchari Range cover the Park areas. The Park is currently managed within the overall administrative and management structure of Sylhet Forest Division. But a separate wildlife management & nature conservation division has been approved as per the new organogram. It is recommended that the newly approved division be operationalized (the divisional HQ may be located at Moulvibazar, and be made responsible for the management of Lawachara NP, Rema-Kalenga WS and the proposed Satchury NP) and adequate administrative and management structure be put in place as per the approved organogram. This means that a separate division for wildlife management and nature conservation be established along with approved technical and management staff and adequate infrastructure be put in place. The HQ of ACF and Park be at Satchari (the existing Beat Office will be converted to Park HQ).

9.3 Staffing Pattern

Under the approved organogram a separate division for wildlife management and nature conservation is to be made functional for managing the two declared PAs and the proposed Satchury of Sylhet. A staff strength of 34 is approved for the division, including technical staff (one ACF, one DR/Fr and three FG/Boatman). Satchari Park will be an independent management and administrative unit, headed by an ACF. He will have all the administrative and financial powers, which are currently exercised by the concerned Range Officer. Deputy Range Officer, as provided in the approved organogram will function as an attached officer to the ACF, providing assistance as and when required. Over a time the staffing at the Park's HQ and newly created Camp office at eastern boundary of Park at old Dhaka-Sylhet Highway will be strengthened by posting trained Forester at the Camp. In addition, many co-management activities will be carried out in association with the stakeholders and related co-management committees. Participants will have greater role in interface landscape zone.

The ACF will reside at the Park's HQ and as Officer-in-Charge be exclusively responsible for the management of Park as per the Plan. He will be assisted in his office by a Deputy Forest Range Officer in developing and coordinating all Park management activities with specific responsibility for management of field staff and budget. He along with ACF will maintain a close working relationship with the territorial staff of FD in order to coordinate management activities in interface landscape zone and control illicit removals from the Park areas.

Two trained Forest Guards/Foresters will be in Charge of specific areas with Headquarters at Satchari and the Park's eastern boundary. They, reporting directly to ACF, will be responsible for the coordination and implementation of day-to-day management activities in their respective Park areas. Over a time these posts will be upgraded and manned by trained Foresters. Over a period additional staff (say, FGs) will be deployed by establishing petrol camps on the southern boundary of the Park. Active help from local stakeholders and BDR will be sought during patrolling of the Park.

9.4 Duties and Responsibilities

The Park will be managed by an ACF under the overall charge of DFO who will be work under the guidance of Conservator of Forest (Wildlife & Nature Conservation Circle).

Main responsibilities (as per the approved organogram) of CF will i) be responsible for overall administration of the Wildlife and Nature Conservation Circle; ii) supervise and coordinate all the matters related to wildlife protection and management of PAs, ecological critical areas, critical watersheds, wetlands of international

importance, and environmental management under Wildlife Preservation Act and other Ordinance, Rules and Regulations and Directives issued by the government from time to time; iii) be responsible to take necessary measures and efforts to fulfill national obligations towards wildlife, biodiversity and other forestry and environmental related international treaties, protocols and conventions endorsed by the government; iv) be responsible for completion of all works within the budget provision of the Circle and distribution of funds within his budget grant among the Divisions under him; v) be responsible for all correspondences relating to wildlife management from time to time; vi) identify and draw up plans and programme for ex-situ and in-situ conservation for botanical/baldha gardens and PAs; vii) be responsible for taking programme related to conservation and management of PAs. Supervision of environmental management and nature conservation functions outside the PAs; viii) be responsible for drawing up programme for monitoring, survey and research in the PAs in relation to wildlife and biological diversity; ix) ensure the preservation of biodiversity, conservation of gene pool, germ plasm and the natural heritage of the nation; x) be responsible for preparation of budget and revised budget of his circle; xi) be responsible for appointment, promoting, disciplinary action, disposal of appeal cases, writing of ACRs of staff falling within his administrative powers; xii) be responsible for administration and ensuring execution of all functions in the forest division under him as per Policy, Acts, Ordinance, Rules and Regulations and Directives issued by the government from time to time; xiii) be responsible for providing proper executive and operational guidelines to the field staff of the Wildlife & Nature Conservation Divisions. Exercise control and supervision on the Divisions under his jurisdiction; ivx) be responsible for preparation of development/ annual programme related to conservation of biodiversity and eco-tourism; vx) be responsible for preparation and annual inspection of divisional offices within his jurisdiction; vix) be responsible for proper execution of all development programmes within his circle; viix) be responsible for auditing of Divisional accounts and according financial and technical sanctions within his powers; viiix) be responsible for drawing and disbursing in respective offices as well as submission of accounts to the Accountant General; ixx) be responsible for inter-Divisional transfer and posting of Class III and IV staff within the Circle except the staff of his own office; and xx) be responsible for the preparation of preliminary management plan report of the Forest Divisions under his jurisdiction.

As per the approved organogram the DFO (WM & NC), Sylhet Division will i) be responsible for overall administration, management and protection of the resources of the Division and supervise, manage and control over the matters related to biodiversity, wildlife and environmental management. Strict and effective enforcement of laws, rules and regulations related to protection of wildlife including migratory birds and other amphibians and reptiles; ii) be responsible for drawing and disbursing of fund within the division; iii) be responsible for conservation and management of PAs, ecologically critical areas, critical watersheds and wetlands under his jurisdiction with the use of participatory resource management and conservation principles; iv) be responsible for appointment of employees of the Division falling within his powers and dealing with all matters relating to establishment including writing of ACRs of subordinate officers/staff; v) be responsible for transferring and posting of all subordinate staff within the Division except the staff of his own staff; vi) be responsible for preparation of annual budget and revised budget of the Division; vii) be responsible for exercise of powers given under Forest Act (Amendment), Bangladesh Wildlife (Preservation) (Amendment) Act and various Acts and Rules thereunder; viii) be responsible for annual and initiation of programs/activities for habitat improvement within his jurisdiction; ix) be responsible for annual and periodical inspection of PAs and other offices (Range, Beats) under him; x) be responsible for management and in-situ conservation of PAs and execution of all development programme within the jurisdiction of his Division; xi) be Principal Accounting Officer of his Division; xii) be responsible for all types of construction of within his jurisdiction; xiii) be responsible for motivational/contact/public relation and publicity functions within the Division; and xiv) any other responsibility assigned by the CCF/DCCF/CF.

The ACF as officer in Charge for the NP will directly report to the DFO, Wildlife and Nature Conservation Division. He will be responsible for administration, budget, planning, protection, coordination and implementation of management plan and co-management activities for the Park. He will maintain liaison with other related government departments and local NGOs for smooth implementation of co-management activities. He will maintain a close liaison with the territorial staff of Sylhet division particularly in protection of forests and wildlife of the Park.

The following responsibilities for ACF as officer in Charge are as per the approved organogram; he/she will i) be responsible for over all administration of the Park, Range Office and Beat Offices within his jurisdiction; ii) be responsible for exercise of powers given under various Acts and Rules thereunder; iii) help DFO in conducting smooth administration of the Division in which they are posted; iv) help DFO in the matter of all types of construction in the Division; v) help DFO in the matter of maintenance of discipline of the Division; vi) help DFO in the matter of raising plantation and nursery for habitat improvement within his jurisdiction; vii) help DFO in the matter of execution of development programme related to protected area management and wildlife conservation within his jurisdiction; viii) help DFO in the matter of checking theft and pilferage of forest produces and wildlife; ix) help DFO in the matter of checking encroachment of forest areas; and x) any other duties assigned by the CF/DFO.

He will be assisted by a Deputy Range Officer (in discharging his duties effectively), who will be responsible for the management of field staff, park budget and protection. He will reside at Park HQ and be de facto Deputy Officer-in-Charge responsible for all Park related matters.

The Forester in Charge of a Beat will be responsible for all the field management activities under his Beat and will be assisted by a FG/Plantation Mali in discharging his duties satisfactorily. Adequate support staff (e.g. clerks, etc.) will be provided for budgetary and administrative management. The present regulatory management systems will gradually be changed to collaborative management systems. Under the co-management approach the participants and resource management organizations will have defined functions in park management.

9.5 Code of Conduct for Forest Officials

1. Have a clear understanding of the Ministry of Environment and Forest approved Nishorgo Vision-2010.
2. Develop awareness about Nishorgo Program among community people living in and around the Protected Areas (PA).
3. Help people living in and around the PAs to get involved in alternative income generating activities and other such community development initiatives on education, health, drinking water, sanitation, etc.
4. Facilitate smooth functioning of Co-management Councils/Committees.
5. Create scope for women and ethnic people in PA management and show proper respect to them.
6. Develop gainful partnership with local people and ensure their participation in regeneration, conservation and development of the forests and biodiversity.
7. Develop close working relationships with people living within a defined landscape and provide support to them in getting involved in development initiatives.
8. Ensure Nishorgo conservation and the co-management of PAs with the help and participation of the members of the local government, local administration, NGOs and voluntary initiatives/institutions.
9. Achieve main objectives of Nishorgo Support Project by maintaining close relationships with program implementing agencies.
10. Maintain professional integrity and honesty while discharging official duties.

9.6 Staff Amenities

The existing Satchari Beat Office will be the HQ of ACF to be posted exclusively for managing Satchari NP. He will be provided official residence at Stachari along with other technical staff.

9.7 Financial Systems

The existing financial organization systems are adequate and appropriate in most areas but needs a detailed review in order to identify specific areas of financial strengthening in future. For example, under the existing budget codes neither there is any specific budget code for PA head (the WNCC is created in 2001 only whereas the budget codes were designed quite early) nor separate budget is allocated for WNCC for PA management. In many countries separate allocations are made for operational funds exclusively for the management of PAs and wildlife. This system needs to be implemented in Bangladesh in order to ensure a certain required level of annual financial stability for in-situ biodiversity conservation in the PAs managed under the WNCC. The funds flow to PA management need to be augmented by retaining and ploughing back a part (say 20%) of the total revenues generated from the PAs. Eco-tourism activities and entry fees for the PA will be a good source of revenue in future.

10. THE BUDGET

The budget requirements for the implementation of Satchari Management Plan are projected based on the information gathered from FD field offices and official documents.

10.1 Input Requirements and Indicative Cost Estimates

This proposed schedule of inputs and costs is based on the major input requirements identified in Part II of the Plan. It is intended as both a summary of the major inputs required during the five year life of the Plan, and as a guide to further detailed costing by FD staff charged with its implementation. Costs shown are subject to revision during the Plan implementation period.

Table 10.1 Input Requirements and Indicative Cost Estimates for Strategic Programs

Strategic Programs	Unit	Quantity/ Year						Unit Cost '000 Taka	Total Cost '000 Taka	Notes
		Y1	Y2	Y3	Y4	Y5	Total			
1. Habitat Protection Programs										
1.1 Updating of Land Use/Forest Cover Map	ha	4000					4000		200	note 1
1.2 Boundary Demarcation										
1.2.1 signboards	nos	10	15				25	3	75	note 2
1.2.2 outer and zonal boundary posts	km	25	25				50	5	250	note 3
1.3 Formation of groups and signing of participatory conservation and benefit sharing agreements by user groups	User groups (@20 participants/group)	200	100	50			350	2	700	
1.4 Signing of co-management agreements with co-management committees	lump sum								20	
1.5 Control of illicit felling, poaching, encroachment, forest fires and grazing by user groups	lump sum								200	note 4
1.6 Communication networks: walki talkies, mobile telephones, etc.										
1.7 Provision of arms and ammunition for control of organized smugglers										
1.8 Rewards/Incentives for biodiversity protection efforts										
1.9 Resolution of forest conflicts	no. of meetings	30	25	20	20	15	110	1	110	note 5

Strategic Programs	Unit	Quantity/ Year						Unit Cost '000 Taka	Total Cost '000 Taka	Notes
		Y1	Y2	Y3	Y4	Y5	Total			
2. Management Programs										
2.1 Landscape Management Zoning										note 6
2.2 Core Zone Management										
2.2.1.1 Protecting forests and other biodiversity	ha									note 7
2.2.1.2 Canopy opening and enrichment planting	ha							8.8		note 8
2.2.2.2 Replanting framework species	ha							24		note 9
2.2.2.3 Short-rotation plantation (woodlot) management	ha							24		note 10
2.2.2.4 Habitat improvement works	ha							15		note 11
2.2.2.5 Habitat restoration works	ha							10		note 12
2.2.2.6 Renovations of existing Water bodies	No.	5					5	100	500	note 13
2.3 Interface Landscape Zones Management										
2.3.1 Sustainable Use Sub-Zone	ha									
2.3.1.1 Delineating the forest land assigned to Forest Villagers	ha							0.3		
2.3.1.2 Delineating short rotation plantations and assigning to local groups	ha							0.3		
2.3.1.3 Motivating Forest Villagers for biodiversity conservation	HH	24	24	24	24	24	120	0.2	24	
2.3.1.4 Signing PCBSAs with Forest Villagers	HH	24					24	0.2	4.8	
2.3.2 Village Use Sub-Zone										
2.3.2.1 Delineating the habitation of Forest Villagers	HH	24					24	0.3	7.2	
2.3.3 Intensive Use Sub-Zone										
2.3.3.1 Maintaining existing FD buildings										
2.3.4 Support Sub-Zone										
2.3.4.1 Managing existing plantations and natural vegetation	ha							1		
2.3.4.2 Forming groups and implementing livelihood programs for the identified villages	No. of villages									note 14
2.3.5 Transport Corridors Sub-Zone	ha									note 15
2.3.5.1 Liaisoning with Land Owning Agencies										

Strategic Programs	Unit	Quantity/ Year						Unit Cost '000 Taka	Total Cost '000 Taka	Notes
		Y1	Y2	Y3	Y4	Y5	Total			
2.3.5.2 Raising strip plantations along roads and railway lines										
2.3.6 Tea Estate Land Sub-Zone										note 16
2.3.6.1 Liaisoning with Tea Employers Association										
2.3.6.2 Forming user groups of Tea Estate workers										
2.3.6.3 Implementing livelihood programs for workers' user groups										
3. Livelihoods Programs										
3.1 Selecting priority production technologies										
3.1.1 Conducting reconnaissance surveys and demand-supply assessment										
3.1.2 Identifying a list of feasible production technologies										
3.1.3 Stakeholders' Consultations on the proposed production technologies										
3.1.4 Agreeing on priority production technologies										
3.2 Developing demonstration Centers										
3.2.1 Identifying Farmers' Field Schools										
3.2.2 Developing identified fields as demonstration centers										
4. Facility Development Programs										
4.1 Facilities and Infrastructure										
4.1.1 Headquarters (Satchuri Range Office)										
4.1.1.1 Conversion of Beat Officer's Quarters to Forester's Quarters	m ²	80					80	5	400	
4.1.1.2 conversion to Forest Department Quarters	m ²	40					40	5	200	
4.1.1.4 Demolition and removal of derelict buildings	nos	100 %					100%			
4.1.1.5 Construction of ACF's Quarters	m ²	120					120	10	1200	
4.1.1.6 Construction of Ranger's Quarters	m ²	100					100	10	1000	

Strategic Programs	Unit	Quantity/ Year						Unit Cost '000 Taka	Total Cost '000 Taka	Notes
		Y1	Y2	Y3	Y4	Y5	Total			
4.1.1.7 Construction of Guard's Quarters (2, each ~60 m ²)	m ²	120					120	10	1200	
4.1.2 Headquarters										
4.1.2.2 Conversion of an Office Building to Environmental Education Centre	m ²		250				250	5	1250	
4.2 Nursery										
4.2.3 Removal of derelict buildings	nos		100%				100%			
4.2.4 Construction of Forester's Quarters	m ²		80				80	10	800	
4.2.5 Construction of Guard's Quarters (2, each ~60 m ²)	m ²		120				120	10	1200	
4.2.6 Construction of Plantation Mali's Quarters (2, each ~40 m ²)	m ²		80				80	10	800	
4.2.7 Construction of Public Toilet	m ²		10				10	10	100	
4.5 Vehicles										
4.5.1 Double-cab pickups	nos	2					2	1800	3600	
4.5.2 100 cc motorcycles	nos	5					5	130	650	
4.6 Equipment										
4.6.1 Office equipment	misc	40%	60%				100%	100	100	
4.6.2 Field equipment	misc	40%	60%				100%	200	200	
5. Visitor Use and Visitor Management Programs										
5.1 Nature Interpretation Centre										Note 17
5.2 Nature trails	km	0	5	5	5	0	15	8	120	
5.3 Identifying suitable sites for Nature Camps		2					2	2	4	
5.4 Toilets/Restrooms	no.	1	1	1			3	75	225	
5.5 Resting Facility	no.		1				1	100	100	
5.6 Trash cans	no.	5	3	2			10	1.5	15	
5.7 Identifying & training eco-guides	no.	5					1	5		
5.8 Preparing publicity materials	no.	9000	700 0	500 0	300 0	100 0	25000	0.01 5	375	
5.9 Motivating Sabuj Vahinis	no.	500	400	300	200	100	15000	0.02 5	375	
5.10 Film making (audio-visuals) for NIC	no.	1					1	300	300	
6. Conservation Research, Monitoring and Capacity Building Programs										
6.1 Conservation Research										
6.1.1 Floral and faunal inventories	m-m	2	2				4	30	120	

Strategic Programs	Unit	Quantity/ Year						Unit Cost '000 Taka	Total Cost '000 Taka	Notes
		Y1	Y2	Y3	Y4	Y5	Total			
6.1.2 Research studies	m-m	5	4	3	2	2	16	75	1200	
6.2 Conservation Monitoring										
6.2.1 Biodiversity health monitoring	m-m	12	2	2	2	2	20	30	600	
6.2.2 Socio-economic monitoring	m-m	4	1	1	1	1	8	30	240	
6.3 Conservation Capacity Building										
6.3.1 Overseas study tours (1 DFO, 1 ACF, 1 Forest Ranger)	m-m						2.5	200	450	
6.3.2 Overseas training (2 PG Diploma in Park Management)	m-m	20					20		800	note 18
6.3.4 In-country training (ACF (1), Forest Ranger (1), Deputy Forest Ranger (1), Foresters (4), Forest Guards (8), NGO staff (3))	m-m	11					11	12	132	note 19
6.3.5 In-country training of members of user groups and co-management committees	no.									
6.3.6 Overseas tour of user groups	No.	25	25				50	20	1000	note 20
7. Administration and Budget Programs										
7.1 Staffing										
-DCF (1)	m-m	12	12	12	12	12	60	10	600	
-ACF (1)	m-m	12	12	12	12	12	60	5	300	
-Forest Ranger/Deputy Forest Ranger (1)	m-m	12	12	12	12	12	60	3	180	
-Foresters (3)	m-m	36	36	36	36	36	180	2.5	450	
-Forest Guards (3)	m-m	36	36	36	36	36	180	2	360	
-Plantation Malis (3)	m-m	36	36	36	36	36	180	2	360	
7.2 Operating Costs										
-support staff, utilities, vehicle fuel and upkeep, etc.	months	12	12	12	12	12	60			

Notes:

- 1 based on an area of ----- ha for the Park, proposed extension and landscape zones including a ~2400 ha in a 1 km wide surrounding area. Mapping to be produced by RIMS based on 1996 satellite imagery (more recent IKONOS, if available), updated Forest Department plantation records, ground-truthing by Park staff, and socio-economic surveys.
- 2 based on number of signboards to be placed at main access points and elsewhere along the Park boundary (estimated ---) and to designate participatory use areas (estimated -----).
- 3 calculated as actual boundary length (approximately ----- km) x 2 to account for internal zonation.
- 4 estimated mainly for conducting group meetings before proceeding for patrol duties. Vehicles and other equipments are covered under facility development programs
- 5 estimated expenses for conducting village level meetings for conflict resolution
- 6 cost for landscape management zoning (based on an area of ----- ha for the Park, proposed extension and support zones) is covered under item 1.1
- 7 cost of protection is covered under item 1
- 8 based on ----- ha in the proposed Park extension that may be subject to selective felling or other silvicultural treatment.
- 9 based on an area of ----- ha of long-rotation plantation in the proposed Park extension. This area will be replanted with native framework species and managed for a rapid return to forest cover and eventual incorporation in the Core Zone.
- 10 based on current area of plantations in the Core Zone (----- ha) plus part area of Support Sub-Zone (----- ha).
- 11 rough estimates for a number of site specific activities as listed in the text (Section 4.3.2.1); the funds requirements will be precisely estimated after inspecting the sites.
- 12 rough estimates for a number of site specific activities as listed in the text (Section 4.3.2.2); the funds requirements will be precisely estimated after inspecting the sites.
- 13 rough estimates for a number of site specific activities as listed in the text (Section 4.3.2.1.5); the funds requirements will be precisely estimated after inspecting the sites.
- 14 costs are covered under livelihoods programs (Chapter 5 of Part II).
- 15 strip plantations being raised under buffer zone planting of FSP will be used for raising linear plantations in Transport Corridor Sub-Zone
- 16 Tea Estate workers will be covered under livelihoods programs as covered under Chapter 5 of Part II.
- 17 this item is already covered under 4.1.1.2
- 18 costs per PG Diploma are calculated as travel costs (US\$450 or Tk 27,000) plus tuition fee (US\$5000 or Taka 300,000) plus living costs and miscellaneous (Tk 7,200/month).
- 19 based on training duration of 5 weeks for ACF, 3 weeks for Forest Ranger/Deputy Forest Ranger and 2 weeks for Forester/Plantation Malis/Forest Guards/NGOs
- 20 members of user groups will visit nearby West Bengal by making bus journeys from Dhaka to north Bengal.

The budget estimates as presented in the above-stated Section 11.1 are based on the information gathered from FD field offices and are subject to variations depending upon the site locations and actual work periods. It is recommended to prepare annual plans with revised budgets taking into consideration work sites and availability of labour.

10.2 Financing Sources for Management Plans Implementation :

Possible sources for funding required for implementing the recommendations made under the management plans are listed as below:

10.2.1. Government of Bangladesh (GOB)

The budget is annually allocated by GOB in the ADP for the implementation of forestry schemes/projects. The development budget is an important source of funding for implementing many activities listed in the Management Plans. However, under the existing budget codes neither there is any specific budget head for PA allocations nor separate budget allocations are made for operational funds for the management of wildlife and PAs. A separate budget head may be essential in order to ensure a certain required level of annual financial stability for PA management.

The revenue budget from GOB are available mainly for meeting the salary needs of the FD staff working in Pilot PA areas.

10.2.2. Donors

Presently the following two donor funded projects are implemented by FD in the PAs:

- i) ADB supported Forestry Sector Project (ending by June 2006) is supporting some activities (such as buffer plantations, user groups formation, motivation, etc.) in 7 PAs (including Lawachara, Rema-Kalenga and Teknaf covered under NSP), and;
- ii) Nishorgo Support Project (NSP) is supporting co-management activities in 5 pilot PAs.

Possible future sources for external funding could include GEF, CDM, Carbon Funds, Multilateral Funds (World Bank, ADB, EC, UNDP, etc.), Bilateral Funding, Trust Funds, Foundations, etc.

10.2.3. Public-Private Partnerships

Nature conservation can progress rapidly when leading members of private sector and NGOs perceive nature conservation as good for the economic well being. Nature conservation partnerships can be designed to offer interested businesses a vehicle for contributing to long-term forest conservation in a way that is transparent, generates beneficial public image for the contributor and makes a long-term difference in forest conservation.

10.2.4. Internal Financing

Part retention (say 25%) of locally generated revenue from the visitors to PAs can be achieved (on the pattern of social forestry plantations – an account, opened on the pattern of TFF, can be managed by FD) for funding PA management activities. Possible sources of revenue generation from entrance and special use may include:

- i) Park Entry Fee
- ii) Guest House Fee
- iii) Hiking Fee,
- iv) Fines,
- v) Donations, etc.

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VOLUME 2

SUPPORT MATERIAL

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1. NOTIFICATION

The following is an unofficial translation of the original notification in Bangla.

Government of the People's Republic of Bangladesh
Ministry of Environment and Forests
Section – III

No. PBM (S-3)/31/2004/1125

Date: October 10, 2005 A.D.

Notification

In exercise of the powers conferred by Article 23(3) of the Bangladesh Wildlife (Preservation) Order, 1973 (President's Order No. 23 of 1973) the Government is hereby declare 600 acres (242.91 hectares) of notified Reserved Forests of the 10,000 (4048.58 hectares) acres Raghunandan Hill Reserve on the basis of Notification No. 4238R on October 1914 under the Section 17 of The Assam Forest Regulation (VII of 1891) as National Park as described in the schedule bellow:

Schedule

600 acres (242.91 hectares) of bearing Reserved Forestland (Satchari National Park) of Raghunandan Hill Reserve Forests under Satchari Beat included in Satchari Range of District-Habiganj, Upazila-Chunarughat as in the schedule bellow:

Boundary

North:

A RCC pillar, situated at the Northwest corner of Chaklapunji Tea Estate at the southern side of Madhabpur – Chunarughat Road (old Dhaka – Sylhet Road) has been deemed to be the No. S4 station, North: - from No. S4 Station to No. B2 Station the following bearings and distances line reaches Satchari Tea Estate.

Bearing	Distance
279° – 0'	181' – 0"
297° – 15'	197' – 0"
314° – 15'	331' – 0"
283° – 15'	203' – 0"
303° – 15'	181' – 0"
294° – 45'	61' – 0"
259° – 30'	180' – 0"
243° – 30'	197' – 0"
235° – 0'	303' – 0"
274° – 0'	177' – 0"
242° – 0'	284' – 0"
238° – 0'	105' – 0"
227° – 15'	302' – 0"
242° – 30'	111' – 0"
260° – 15'	187' – 0"
284° – 0'	121' – 0"
337° – 0'	292' – 0"
323° – 0'	142' – 0"
305° – 15'	203' – 0"
289° – 0'	131' – 0"
274° – 0'	175' – 0"
264° – 15'	199' – 0"
253° – 30'	302' – 0"
250° – 30'	136' – 0"
245° – 30'	291' – 0"
256° – 30'	100' – 0"
275° – 15'	153' – 0"
275° – 0'	200' – 0"
270° – 0'	101' – 0"

Bearing	Distance
264° – 15'	216' – 0"
283° – 30'	103' – 0"
296° – 45'	151' – 0"
278° – 45'	100' – 0"
264° – 30'	142' – 0"
263° – 30'	156' – 0"
258° – 0'	120' – 0"

West:

The following bearings and distances line reaches the No. U2 Station from the aforementioned No. B2 Station to Satchari Tea Estate and Reserve Forests.

Bearing	Distance
127° – 30'	150' – 0"
148° – 0'	272' – 0"
159° – 0'	1570' – 0"
152° – 45'	100' – 0"
156° – 0'	575' – 0"
155° – 0'	200' – 0"
155° – 0'	175' – 0"
156° – 0'	183' – 0"
154° – 0'	700' – 0"
154° – 0'	620' – 0"
160° – 0'	58' – 0"
145° – 30'	550' – 0"
148° – 30'	245' – 0"
139° – 0'	200' – 0"
145° – 30'	850' – 0"
142° – 0'	380' – 0"
146° – 0'	215' – 0"
143° – 0'	240' – 0"
144° – 0'	480' – 0"

South:

The following bearings and distances line reaches the No. J3 Station via West side of teak garden of 1962 and 1966, from the aforesaid No. U2 Station.

Bearing	Distance
43° – 45'	100' – 0"
63° – 30'	100' – 0"
48° – 30'	100' – 0"
92° – 0'	145' – 0"
74° – 0'	70' – 0"
41° – 15'	260' – 0"
62° – 0'	235' – 0"
9° – 0'	100' – 0"
352° – 0'	100' – 0"
66° – 0'	132' – 0"
67° – 0'	100' – 0"
82° – 0'	140' – 0"
81° – 30'	150' – 0"
104° – 0'	100' – 0"
19° – 0'	200' – 0"

Thereafter the boundary line reaches the following bearings and distances No. T3 Station to north side of No. J3 Station of via west side of forest garden 1988 A.D.

Bearing	Distance
290° – 0'	150' – 0"
313° – 0'	315' – 0"
327° – 0'	116' – 0"

Bearing	Distance
339° – 30'	90' – 0"
360° – 0'	110' – 0"
18° – 30'	212' – 0"
344° – 0'	118' – 0"
318° – 0'	250' – 0"
351° – 0'	259' – 0"
9° – 0'	255' – 0"

From the aforementioned No. T3 Station up to the distances 90 bearings at U3, 1600 feet reaches the boundary of Chaklapunji Tea Estate, thereafter the bearings distances from U3 Station as in the following.

East:

From No. U3 Station to Chaklapunji Tea Estate and Reserve boundary line via No. S4 Station, south side of Dhaka – Sylhet road at the following bearings.

Bearing	Distance
28° – 0'	280' – 0"
359° – 0'	92' – 0"
302° – 0'	90' – 0"
348° – 30'	185' – 0"
31° – 0'	240' – 0"
229° – 0'	180' – 0"
35° – 30'	320' – 0"
315° – 0'	370' – 0"
353° – 0'	165' – 0"
8° – 0'	180' – 0"
7° – 30'	162' – 0"
337° – 0'	225' – 0"
347° – 0'	135' – 0"
17° – 0'	150' – 0"
328° – 30'	90' – 0"
25° – 0'	33' – 0"
332° – 0'	135' – 0"
350° – 30'	125' – 0"
338° – 0'	150' – 0"
3° – 0'	180' – 0"
324° – 30'	240' – 0"
2° – 30'	239' – 0"
323° – 0'	168' – 0"
5° – 0'	170' – 0"

By order of the President

No. PBM (S-3)/31/2004/1125 /1(7)

Date: October 10, 2005 A.D.

Copy circulated for information and necessary action:

1. Secretary, Ministry of Lands, Bangladesh Secretariat, Dhaka.
2. Divisional Commissioner, Sylhet, Dhaka.
3. Chief Conservator of Forests, Directorate of Forest, Dhaka (Requested to take necessary actions for distribution to all concerned).
4. Deputy Commissioner, Sylhet/Moulvibazar/Habiganj/Sunamganj.
5. Deputy Controller, Bangladesh Government Printing Press, Tejgaon, Dhaka (Notification to be published in the next issue and 100 (one hundred) copies to be sent to the Ministry (Section – 3).
6. Conservator of Forests, Central Circle, Directorate of Forests, Mohakhali, Dhaka.
7. Divisional Forests Officer, Sylhet Forest Division, Sylhet.

Kazi Liakat Ali
Senior Assistant Secretary
Phone: 7164539

No. PBS (Wildlife) 2M-122/05/1802

Date: November 08, 2005 A.D.

Copy circulated for information and necessary action to the following officials:

1. Deputy Chief Conservator of Forests,
2. Conservator of Forests,
3. Divisional Forests Officer, Wildlife Management and Nature Conservation Division, Sylhet

Md. Shamsur Rahman
Conservator of Forests
Wildlife and Nature Conservation Circle
For, Chief Conservator of Forests
Bangladesh

2. USEFUL GLOSSARY

Biodiversity: The variety of life and its processes including complexity of species, communities, genepools and ecological functions (USDA Forest Service 1993).

Den tree: A standing live tree with cavity in branches or in the bole in use or having potential for use by wildlife.

Keystone species: Animals or plants which by virtue of their presence or absence alter the structure of a community.

Limiting factor: The environmental influence through which the toleration limit of an organism is first reached, which acts as the immediate restriction in one or more of its functions or activities or in its geographic distribution.

Pinch period: A season during which either food or water or both are minimal in their quantity, quality or distribution, causing stress in animal populations.

Riparian zone: An area identified by the presence of vegetation that requires free or unbound water or conditions more moist than normally found in the area.

Sensitive site: A site vulnerable to rapid change in its biological attributes or physical character in the face of management activity or resource uses either due to its small size or due to existing species/communities, which are tolerant to change or are exacting in their habitat requirements or fragile rock/soil formation.

Stand: Plant communities, particularly of trees, sufficiently uniform in composition, constitution, age, spatial arrangement or condition to be distinguishable from adjacent communities.

Succession stage: A stage or recognizable condition of a plant community which occurs during its development from bare ground to climax.

Influence zone: The extent of area outside the legal boundaries over which local villagers have a traditional PA based forests based dependency and/or over which significant wildlife damage occurs.

3. FRAMEWORK TREE SPECIES

The framework species method of forest restoration was first developed in the late 1980's in Queensland, Australia, where planting just 20-30 carefully selected "framework" tree species resulted in rapidly regenerating forests, accumulating up to 80 tree species, within 6-10 years. The method relies on selecting tree species that: i) are fast-growing with dense spreading crowns that rapidly shade out competing weeds and ii) are attractive to seed-dispersing wildlife, especially birds and bats. In addition, framework species must be easy to propagate in nurseries. High quality seedlings of 20-30 framework tree species, 5-60 cm tall (30 cm for the fastest growing species) are planted 1.6 – 1.8 m apart at the beginning of the rainy season. Weeds are vigorously controlled and fertilizer is sometimes added, but after 2-3 rainy seasons the canopy closes, the forest becomes self-sustaining and no further maintenance is required. Once the "framework" of a forest has been re-established, the other components of the ecosystem can return naturally (Elliott et al. 1998).

- The following have been identified as potentially suitable "framework" species for use in forest restoration and enrichment planting in Chunoti Wildlife Sanctuary. The list comprises species that are known to occur in Chunoti forests, and that satisfy the above criteria.

The following list is not intended to be comprehensive and can be added to based on the criteria outlined above. Species indicated in **bold** may be available from BFRI or other nurseries. Wild seed collection will be required for other species.

Family	Species
Moraceae	Artocarpus lacucha
Euphorbiaceae	Bischofia javanica
Rhizophoraceae	Carallia brachiata
Leguminosae	Cassia fistula
	Cassia siamea
Fagaceae	Castanopsis indica
	Castanopsis tribuloides
Dilleniaceae	Dillenia pentagyna
Elaeocarpaceae	Elaeocarpus spp.
Juglandaceae	Engelhardtia spicata
Ternstroemiaceae	Eurya acuminata
Moraceae	Ficus benghalensis
	Ficus benjamina
	Ficus comosa
	Ficus hispida
	Ficus infectoria
	Ficus racemosa
	Ficus religiosa
	Ficus rumphii
	Ficus semicordata
Verbenaceae	Gmelina arborea
Euphorbiaceae	Macaranga spp.
	Mallotus spp.
Magnoliaceae	Michelia champaca
Fagaceae	Quercus spp.
Theaceae	Schima wallichii
Moraceae	Streblus asper
Myrtaceae	Syzygium fruticosum
	Syzygium grande
Verbenaceae	Vitex spp.
Leguminosae	Xylia dolabriformis

4. GUIDELINES FOR FACILITY DEVELOPMENT

4.1 General Principles

As noted in the Introduction, these guidelines focus on the development of facilities for low volume ecotourism in existing conservation areas, and on the development of support facilities required for conservation area management. This approach implies no or low impacts on natural and cultural resources, based on the following underlying principles:

- ➔ environmentally responsible design specifications, site planning and construction techniques; and,
- ➔ ongoing monitoring and mitigation of impacts through environmental audits and other measures.

In combination these will require:

- ➔ limiting the physical and ecological impacts of all facilities developments;
- ➔ limiting the visual impacts of all facilities developments; and,
- ➔ limiting the cultural impacts of all facilities developments.

General guidelines for limiting physical and ecological impacts are:

- ➔ put the environment first;
- ➔ know and follow existing environmental regulations;
- ➔ conduct an environmental assessment for all new facilities proposals;
- ➔ where possible, select development sites where natural vegetation cover has already been removed or disturbed;
- ➔ avoid siting facilities in or near key wildlife habitats or other ecologically sensitive areas;
- ➔ avoid any disturbance to aquatic habitats;
- ➔ limit construction and working area footprint to the minimum necessary;
- ➔ limit the use of machinery on site;
- ➔ limit construction to the dry season;
- ➔ specify and follow construction cleanup requirements;
- ➔ rehabilitate/reclaim working areas disturbed during construction;
- ➔ utilise applicable energy and water conservation technology and practices;
- ➔ avoid all use of toxic materials, plastics, styrofoam and other persistent wastes;
- ➔ ensure that all solid and liquid wastes are properly disposed of;
- ➔ develop and deliver an education programme to avoid visitor impacts on vegetation and wildlife;
- ➔ identify and deal with problems as they occur;
- ➔ conduct regular environmental audits to track and mitigate erosion problems, changes in drainage patterns, changes in adjacent habitats and other evidence of site degradation; and,
- ➔ develop and deliver an environmental awareness programme to all staff.

General guidelines for limiting visual impacts are:

- ➔ cluster facilities in groups;
- ➔ use natural materials and colours;
- ➔ standardise exterior designs and finishes, and maintain a regular schedule of maintenance;
- ➔ educate visitors in order to prevent graffiti and other damages to facilities;
- ➔ use only locally occurring species for landscaping;
- ➔ rehabilitate/reclaim disturbed areas, water catchment ponds *etc.* to natural contours and shapes;
- ➔ screen support facilities (*e.g.*, generators, septic tanks, staff housing) from public view;
- ➔ identify and deal with problems as they occur; and,
- ➔ conduct regular environmental audits to track and mitigate evidence of littering and other negative visual impacts.

General guidelines for limiting cultural impacts are:

- ➔ involve local communities in all aspects of conservation area management, including facilities development;
- ➔ identify local community boundaries and use areas during the planning stage of facilities development;
- ➔ respect facilities development and visitor restrictions requested by communities; and,
- ➔ develop and deliver a cultural awareness programme to all staff and visitors.

Facilities also need to be cost-effective, but at the same time fit in with environmental and cultural aesthetics.

General guidelines for achieving this balance are:

- ➔ ensure that there is an existing demand or requirement, or reasonable expectation of such demand developing in the near future, before planning and developing any physical facility;
- ➔ ensure that all facilities are relevant and appropriate to the management and visitor use of natural conservation areas;
- ➔ utilise local architectural styles, and maximise the use of local materials and labor;
- ➔ utilise and promote appropriate technologies in all facilities, including indigenous or locally developed energy and water conservation practices;
- ➔ avoid use of expensive or inappropriate materials (e.g., marble, terrazo, rare or exotic woods);
- ➔ avoid live animal displays, which require a high level of expertise and are expensive to maintain properly, and may have negative impacts on biodiversity conservation; and,
- ➔ provide an attractive, natural and safe environment for all visitors.

These principles and guidelines need to be followed, as applicable, during the planning, construction and operation of all conservation areas facilities.

4.2 Facility Development Guidelines

Specific guidelines for each type of facility development anticipated in FSP-supported areas are provided below, in the following order:

4.2.1 Access Roads

4.2.1.1 Paved Access Roads

Paved (asphalt-surfaced) access roads pass through Lawachara National Park and immediately adjacent to Madhupur NP, Teknaf Game Reserve and Chunati Wildlife Sanctuary. These roads are variously the responsibility of RHD and LGED, but their proper use and maintenance within the conservation area context will require cooperation between RHD/LGED and FD staff to prevent unnecessary widening of the road rights of way, to minimise habitat loss, to control vehicle speeds and hence minimise wildlife road kills, and to minimise vehicle noise.

Guidelines for Paved Access Roads:

Do	Don't
<ul style="list-style-type: none"> ➤ use asphalt or other hard surfacing only on access roads with high traffic volumes, used by heavy vehicles, or requiring constant access during the rainy season ➤ limit vegetation clearing during road maintenance to within 1 m of pavement ➤ conduct roadside vegetation clearing by hand only ➤ avoid use of chemicals in roadside vegetation management ➤ post speed limits and no littering signs ➤ limit use of horns to emergency situations ➤ maintain working contacts with other responsible agencies to ensure that all guidelines and restrictions are followed 	<ul style="list-style-type: none"> ➤ permit the routing of new road alignments through conservation areas, except as specifically required for conservation area management purposes ➤ permit the use of sand, gravel, fuelwood or any other material harvested from conservation areas to be used in road maintenance

4.2.1.2 Unpaved Access Roads

Unpaved access roads (including brick or aggregate-surfaced roads and earthen tracks) are located in or adjacent to all FSP-supported conservation areas. Some of these roads are the responsibility of LGED, and as above their proper use and maintenance within the conservation area context will require cooperation between LGED and FD staff. Others have been established to provide access to FD plantations, while still others appear to have been informally established along the route of existing foot and cart trails and are passable to vehicle traffic only during the dry season, if at all. However even these require management attention to ensure that improved but unwanted vehicle access to the interior of conservation areas is not inadvertently created.

Guidelines for Unpaved Access Roads:

Do	Don't

Do	Don't
<ul style="list-style-type: none"> ➤ use natural surfacing (herringbone brick, crushed gravel, earth), as appropriate to traffic levels, on interior access roads ➤ limit public access (using gates, barriers <i>etc.</i>) on roads created specifically for conservation area management purposes ➤ limit earthwork and vegetation clearing during road maintenance to within 1 m of road edge ➤ conduct roadside vegetation clearing by hand only ➤ avoid use of chemicals in roadside vegetation management ➤ immediately revegetate/stabilise bare areas created during road maintenance ➤ limit access development and maintenance to single lane ➤ post signs indicating speed limits, no littering, and no use of horns except in emergency situations ➤ maintain working contacts with other responsible agencies to ensure that all guidelines and restrictions are followed 	<ul style="list-style-type: none"> ➤ permit the routing of new road alignments through conservation areas, except as specifically required for conservation area management purposes ➤ permit the use of sand, gravel, fuelwood or any other material harvested from conservation areas to be used in road maintenance

4.2.1.3 Bridges and Culverts

Access roads into or through established conservation areas are primarily the responsibility of RHD or LGED. However, some forest roads and trails are the responsibility of neither of these agencies, and will need to be maintained by FD if their use is required either for patrolling or for visitor access. These roads are likely to be unsurfaced (or at most surfaced by herringbone brick) and hence adequate precautions against scouring and erosion will be required, particularly at stream crossings.

Guidelines for Bridges and Culverts:

Do	Don't
<ul style="list-style-type: none"> ➤ maintain bridges and culverts sufficient to prevent washouts, and to keep key roads and trails passable ➤ where development of new access is required, design to minimise the number of watercourse crossings ➤ limit installation work to the dry season, utilising manual labor to the extent possible ➤ limit stream crossings to single lane ➤ minimise disturbance to stream banks and vegetation ➤ make adequate provision at culvert inlets and outlets and at bridge approaches and anchor points to minimise erosion ➤ periodically inspect all bridges and culverts and effect maintenance and repairs as necessary 	<ul style="list-style-type: none"> ➤ overdesign (<i>e.g.</i>, don't install a bridge designed for 4-wheel vehicle traffic where management access is by motorcycle and/or visitor access by foot) ➤ install any crossings that block stream flow (<i>e.g.</i>, log clusters with earth fill) ➤ operate any machinery in any watercourse during bridge or culvert installation ➤ permit ford crossings except where traffic levels are low, where water flow depths are <0.5 m, where approaches are low gradient with low (<1 m) bank heights, and where stream substrates are solid (gravel or rock)

4.2.2 Accommodation

4.2.2.1 Staff Accommodation

All FSP-supported conservation areas are managed under FD's territorial system, which includes *in situ* accommodation for field staff (Range Officers, Beat Officers, Forest Guards, Plantation Malis) primarily clustered around Range and Beat Offices. This accommodation generally follows GoB space standards but there often are insufficient units for numbers of staff, and existing units generally are in poor repair. FSP planning completed to date indicates a need for new or renovated accommodation for all staff levels, including higher level officers (ACFs, Forest Ecologists, Social Scientists) newly posted to conservation areas.

Guidelines for Staff Accommodation:

Do	Don't
<ul style="list-style-type: none"> ➤ provide staff housing and basic amenities (e.g., electricity, running water) to a sufficient standard to ensure a positive effect on staff morale and efficiency. ➤ ensure that unused or underused buildings (e.g., as constructed by FD's Wildlife Conservation and Management Project) are put to appropriate use, when otherwise suitable as specified below ➤ renovate and use existing buildings only if they will remain functional throughout at least a 5 year period ➤ remove all derelict buildings and reclaim sites ➤ ensure that building renovations, and new building designs and locations, are functionally and aesthetically appropriate ➤ make maximum use of local building and living technologies (e.g., sanitary latrines, production and use of biogas, fuel efficient stoves, etc.) ➤ make maximum use of natural lighting and airflow in building design ➤ locate staff accommodation out of view of visitors/ visitor traffic flow ➤ implement a regular inspection and maintenance programme to ensure that all staff accommodation is kept in clean and habitable condition 	<ul style="list-style-type: none"> ➤ permit occupation of staff quarters by other than assigned staff and immediate family members ➤ permit unauthorised construction of outbuildings or other structures

<p>Suggested minimum area standards for staff accommodation: ACFs, Forest Ecologists, Social Scientists: 120 m² Range Officers: 100 m² (200 m² when combined with office) Beat Officers: 80 m² (120 m² when combined with office) Forest Guards: 60 m² Plantation Malis: 40 m²</p>
<p>All staff housing should include adequate living space, kitchen and toilet facilities, and access to clean water</p>

4.2.2.2 Visitor Accommodation

All FSP-supported conservation areas, with the exception of Himchari, currently provide limited on-site visitor accommodation in the form of Forest Department resthouses. These resthouses are intended primarily for the use of visiting FD staff, although they also are available for use by VIPs and other visitors. Accommodation is typically limited to 1-3 bedrooms, and a maximum of 6 persons. Cooking and cleaning services are provided by a resident caretaker.

FSP planning completed to date has identified a need for additional resthouses in Himchari NP, Teknaf GR, Chunati WS and Hazarikhil WS, primarily for the use of FD staff, NGO staff and others working on a short-term basis in these revised/expanded areas. Current planning for ecotourism-related facilities is based on the assumption that most ecotourism activities will be small scale and/or primarily day use, and no additional development of visitor accommodation within conservation areas is proposed. Should future use of conservation areas raise demand levels for overnight visitor accommodation, this would best be provided by Parjatan Corporation (e.g., as per their most recent development in the Teknaf area) or the private sector (as per recent hotel developments in Cox's Bazar). Any such additional accommodation should be developed outside of conservation area boundaries.

Immediate needs in terms of FSP/FD inputs are for renovation of existing resthouses and construction of new facilities in priority areas.

Guidelines for Visitor Accommodation:

Do	Don't
<ul style="list-style-type: none"> ➤ provide facilities primarily for the use of FD staff and others engaged in area management on a short-term or periodic basis ➤ renovate and use existing buildings only if they will remain functional throughout at least a 5 year period ➤ remove all derelict buildings and reclaim sites ➤ ensure that building renovations, and new building designs and locations, are functionally and aesthetically appropriate ➤ make maximum use of local building and living technologies (e.g., sanitary latrines, production and use of biogas, fuel efficient stoves, etc.) ➤ use natural materials (e.g. wood, stone, brick) for exteriors, stairs and flooring. Avoid use of bare concrete and terrazzo ➤ use tile, wooden shingles and other natural materials for roofing. Avoid CI and plastic sheeting ➤ make maximum use of natural lighting and airflow in building design ➤ implement a regular inspection and maintenance programme to ensure that all visitor accommodation is kept in clean and well-maintained condition 	<ul style="list-style-type: none"> ➤ use visitor accommodation for other purposes (e.g., staff housing) ➤ initiate construction unless adequate capital and maintenance funds are available

Resthouses constructed by the Forest Department were previously based on wood-frame and siding construction, with airflow and cooling maximised by raising the structure on stilts and by appropriate placement of window openings. Recently constructed resthouses have all been concrete construction, with a utilitarian or futuristic design that is out of place in a natural setting, and with a finish that deteriorates and becomes unsightly very rapidly. In addition, generally little or no attention is paid to natural cooling and lighting. A return to previous design principles, using natural materials, and maximising the use of natural airflow and lighting, is required for newly constructed resthouses in conservation areas.

4.2.3 Landscaping

Landscaping is an important consideration in high public use areas, such as around conservation area offices, environmental education/visitor information centres, and picnic areas. It also includes reclamation and revegetation of earthworks such as tanks and roadways.

Guidelines for Landscaping:

Do	Don't
<ul style="list-style-type: none"> ➤ minimise clearing of natural vegetation (and hence the need for landscaping) to the immediate vicinity of facilities ➤ use low maintenance landscaping designs ➤ mimic 'natural' vegetation structure (e.g., layering, non-geometric planting patterns) ➤ use indigenous species to the extent possible ➤ incrementally replace exotic tree plantings (e.g., eucalypts) along roadsides with indigenous species ➤ minimise fencing. Where fencing is necessary use natural materials (stone, wood, bamboo, living fencing) to the extent possible ➤ revegetate bare areas (e.g., roadsides, tank margins) as soon as possible after completion of earthworks ➤ design artificial waterbodies (tanks, reservoirs etc.) to look as natural as possible. Use natural shoreline shapes and bank grades, and shoreline and bank revegetation. Avoid square or rectangular shapes, steep banks, and unvegetated areas 	<ul style="list-style-type: none"> ➤ use geometric planting designs (straight lines, squares, circles etc.) ➤ use elaborate planting designs ➤ use exotics ➤ use barbed wire fencing ➤ locate facilities in areas requiring felling of large trees, or clearing of extensive areas of natural vegetation and subsequent landscaping

4.2.4 Litter Collection

Litter collection facilities are required in all areas of high public use, including park/sanctuary offices, environmental education/visitor centres, and picnic areas.

Guidelines for Litter Collection Facilities:

Do	Don't
<ul style="list-style-type: none"> ➤ provide litter collection facilities in all public contact and public use areas ➤ ensure that litter collection facilities are well sign-posted ➤ use natural materials and colors, at least for outer containers ➤ ensure that litter collection facilities are animal-proof and waterproof ➤ empty litter collection facilities on a regular basis (daily or as otherwise required) and dispose of at an established, preferably offsite sanitary waste disposal facility ➤ ensure that final disposal of litter has no or low environmental impact ➤ implement a regular inspection and maintenance programme for all litter collection facilities ➤ ensure that disposal of organic litter such as leaves and other vegetation (e.g., by burning, composting) has no visitor impact 	<ul style="list-style-type: none"> ➤ permit litter collection sites to become general dumping areas for domestic waste; confine use to conservation area visitors only

4.2.5 Observation Towers and Platforms

Towers and platforms provide points from which to observe wildlife, vegetation and scenery. However, they need to be properly sited with a specific purpose in mind. Also, as these facilities can be difficult and expensive to construct and maintain, they should be developed primarily where there is a reasonable expectation of at least moderate visitor use.

Guidelines for Observation Towers and Platforms:

Do	Don't
<ul style="list-style-type: none"> ➤ for maximum field of view, locate observation towers and platforms on hilltops, or in open habitats (wetlands, meadows, forest edges) when in flat terrain ➤ ensure that there is an appropriate "point of interest" (e.g., panoramic or scenic view, wildlife feeding area, variety of trees and other vegetation) ➤ where possible use a screened or concealed approach ➤ make the facility as inconspicuous as possible, using natural materials and colors. Avoid use of bright or gaudy colors ➤ orient to avoid views directly into the sun ➤ ensure that towers and platforms are safe for public use; this will require solid construction, adequate guard rails, caution signs, and frequent inspection and maintenance 	<ul style="list-style-type: none"> ➤ locate towers and platforms where public use will result in negative impacts on wildlife ➤ rely on observation towers as a means of policing illicit use of forest products, as they provide a very limited field of view in flat, densely wooded terrain (foot patrols are a much more effective means of controlling forest use)

4.2.6 Offices

Comfortable and functional office facilities for senior field staff are an essential requirement in every conservation area. Although these should not be large or elaborate, sufficient space and support facilities need to be provided to ensure efficient administration of each area. In some areas the park/sanctuary office will also function as the contact point at which visitors obtain information, and hence needs to be open and presentable to the public.

As all FSP-supported conservation areas are managed under FD's territorial system, Range Offices and/or Beat Offices have already been established in or adjacent to each area. In general one of these locations can be selected to function as a main park/sanctuary office. However, existing buildings generally are in poor repair, and will need to be renovated or replaced as appropriate.

Guidelines for Offices:

Do	Don't
<ul style="list-style-type: none"> ➤ provide facilities adequate for the use of all senior FD staff and others engaged in area management (<i>i.e.</i>, ACF, Forest Ecologist, Social Scientist, Range Officers, Beat Officers) ➤ in areas without other environmental education/ visitor information facilities, locate offices where they are easily accessible to the public, and clearly identify with appropriate signs ➤ utilise natural landscaping around all office buildings ➤ renovate and use existing buildings only if they will remain functional throughout at least a 5 year period ➤ remove all derelict buildings and reclaim sites ➤ ensure that building renovations, and new building designs and locations, are functionally and aesthetically appropriate ➤ use natural materials (<i>e.g.</i> wood, stone, brick) for exteriors, stairs and flooring. Avoid use of bare concrete and terrazzo, and of rugs or other unwashable flooring ➤ use tile, wooden shingles and other natural materials for roofing. Avoid CI and plastic sheeting ➤ make maximum use of natural lighting and airflow in building design ➤ implement a regular inspection and maintenance programme to ensure that all offices are kept in clean and well-maintained condition 	<ul style="list-style-type: none"> ➤ use security fencing; this gives the wrong message to the public ➤ initiate construction unless adequate capital and maintenance funds are available

4.2.7 Picnic Areas

Available information on existing outdoor recreation demand/use patterns in Bangladesh suggests that picnicking is likely to be the main visitor use of conservation areas that are easily accessible by road. Several tens of thousands of visitors annually visit Bhawal National Park outside of Dhaka for just this purpose, and FD has gained significant experience in developing facilities to meet this demand. Among FSP-supported areas, Madhupur NP and to a lesser extent Lawachara NP already are used by picnickers, and demand is likely to increase in future.

This activity often involves large groups travelling by bus, and may involve other activities (*e.g.*, the use of loudspeakers, and attraction of hawkers and concessionaires) that are not appropriate in a conservation area setting, and that impact the use and enjoyment of the area by others. Providing appropriate facilities, but at the same time maintaining adequate controls, presents a unique set of challenges to conservation area managers.

Guidelines for Picnic Areas:

Do	Don't
<ul style="list-style-type: none"> ➤ provide information on picnic facilities at vehicle entrance points ➤ confine picnicking, including vehicle parking, to designated areas ➤ space facilities to achieve a balance between limiting the physical footprint and avoiding crowding ➤ wherever possible, locate picnic sites and parking in areas where natural vegetation cover has already been removed or disturbed ➤ use natural landscaping to prevent the development of bare/eroded areas. Rotate heavy use areas as necessary to allow ground vegetation to recover ➤ provide easy vehicle access appropriate to facilities location and spacing (<i>e.g.</i>, linear, branched or ring road design) and to prevent off-road driving ➤ develop appropriate signage and facilities ➤ provide adequate information on use restrictions (<i>e.g.</i>, no loudspeakers or amplified music; no collection of plants, fossils or other natural materials; no cutting of vegetation; no feeding or harassment of wildlife; no off-road vehicle use; no graffiti; no damage to facilities; no littering) 	<ul style="list-style-type: none"> ➤ use security fencing; this gives the wrong message to the public ➤ develop picnic sites in or adjacent to key wildlife habitats, including natural wetlands ➤ initiate facilities construction unless adequate capital and maintenance funds are available

Do	Don't
<ul style="list-style-type: none"> ➤ train staff in visitor management, and control and supervise use of all designated sites ➤ provide adequate litter disposal facilities ➤ provide adequate drinking water facilities ➤ provide adequate toilet facilities and keep clean and in working order ➤ ensure that toilets and grey water disposal do not pollute surface or groundwater sources ➤ provide picnic shelters (providing shelter from rain and sun) and picnic tables as required. Use standard, sturdy designs, and maximise use of natural materials and natural color schemes appropriate to a conservation area setting ➤ provide fuelwood (e.g., from harvest of plantations) ➤ control contractors and unauthorised concessionaires (e.g., food sellers, animal rides, boat rentals etc.), and ensure that services provided are appropriate to the setting and public use programme ➤ provide access to simple nature trails and other interpretive facilities to broaden visitor experience ➤ develop a mechanism for obtaining and using visitor feedback ➤ keep all facilities clean and free of litter. Clean up all sites immediately after use ➤ implement a regular inspection and maintenance programme 	

4.2.8 Public Toilets

Toilet facilities are required in all areas of high public use, including park/sanctuary offices, environmental education/visitor centres, and picnic areas.

Guidelines for Public Toilets:

Do	Don't
<ul style="list-style-type: none"> ➤ provide toilet facilities, including clean water, in all public contact and public use areas ➤ provide adequate signage to ensure that facilities are easy to find ➤ provide separate facilities for men and women ➤ keep toilets clean and in working order ➤ ensure that toilets and grey water disposal do not pollute surface or groundwater sources ➤ implement a regular inspection and maintenance programme 	<ul style="list-style-type: none"> ➤ develop facilities in or adjacent to key wildlife habitats, including natural wetlands ➤ initiate facilities construction unless adequate capital and maintenance funds are available

4.2.9 Signs and Markers

A well-designed sign system helps accomplish two main operational goals, providing an enjoyable and safe experience for all visitors, and helping to protect the land base and on-site facilities
(Alberta Community Development 1993)

4.2.9.1 Boundary Signs and Markers

Clear and unambiguous marking of outer boundaries is a priority in all FSP-supported conservation areas, and will be one of the first steps in gaining effective management control. Participatory management and use areas, wherein local residents will have access to forest resources on a sustainable use basis, also need to be clearly marked.

Guidelines for Boundary Signs and Markers:

Do	Don't
<ul style="list-style-type: none"> ➤ based on boundary descriptions in the conservation area notification, delineate and mark all outside boundaries at turning points and at maximum 200 m intervals along straight stretches ➤ delineate and mark all zonal boundaries ➤ ensure that the boundary marking system is as tamper-proof as possible, to prevent removal or shifting of boundary markers ➤ conduct periodic inspections to ensure that boundary marking remains intact ➤ develop, install and maintain sturdy, tamper-proof signboards at access points to external and zonal boundaries (trail and road crossings) giving the conservation area's name and summarising key use restrictions with symbols and in Bangla 	<ul style="list-style-type: none"> ➤ create wide cleared corridors along boundaries ➤ blaze trees along boundaries unless no other boundary marking option is feasible

4.2.9.2 Entrance Signs

Each of the FSP-supported conservation areas has one or more main entrance points, and these need to be clearly sign-posted. As they create the visitor's first impression of the conservation area, it is important that entrance signs be designed for both attractiveness and clarity.

Guidelines for Entrance Signs:

Do	Don't
<ul style="list-style-type: none"> ➤ post a large entrance sign indicating the area's name, and readable from a moving vehicle, at the main road entrance or entrances of the conservation area ➤ post a large area sign/information board near the entrance sign, providing a simplified map of the site showing road and trail systems, and recreational and other facilities ➤ utilise natural materials and colors in sign construction 	<ul style="list-style-type: none"> ➤ clutter up the entrance with too many signs. Two large signs as indicated are better than a proliferation of small signs

6.2.9.3 Facility/Amenity Signs

Facility and amenity signs are necessary to let visitors know where they are, or how to get to where they want to go.

Guidelines for Facility/Amenity Signs:

Do	Don't
<ul style="list-style-type: none"> ➤ identify each major facility accessible to the public (environmental education/visitor information centre, offices, picnic areas, toilets, water supply points) with a clear and unambiguous sign at the location entrance ➤ supplement these with directional signs (indicating direction and distance) as necessary ➤ utilise natural materials and colors in sign construction 	<ul style="list-style-type: none"> ➤ use too many signs

4.2.9.4 Trail Signs

Nature trails are likely to be developed in the three FSP-supported national parks, and could also be developed to a limited extent in wildlife sanctuaries. Well-posted trails are a low cost, effective means of providing both recreation and environmental education to conservation area visitors.

Guidelines for Trail Signs:

Do	Don't
<ul style="list-style-type: none"> ➤ provide a trail entrance sign, which identifies the trail head and provides the visitor with information on the trail name, length and walking time ➤ provide supplementary directional signs to orient the user at decision points (e.g., forks in the trail) ➤ provide supplementary interpretive signs, providing information at points of interest, or keyed to a more comprehensive, written trail guide ➤ utilise natural materials and colors in sign construction 	<ul style="list-style-type: none"> ➤ use too many signs

Conservation area signs need to be both effective and quiet

"A sign system is effective when it allows visitors to move with safety and minimum confusion to their destination, as well as informing them of the site's facilities, opportunities, points of interest, and regulations. It is quiet when it accomplishes these objectives with minimum intrusion on the natural beauty of the area. In general, an effective and quiet system is composed of a variety of signs"

(Alberta Community Development 1993)

4.2.10 Trails

4.2.10.1 Nature Trails

As noted above, nature trails are likely to be developed in the three FSP-supported national parks (and possibly to a limited extent in wildlife sanctuaries), providing both recreation and environmental education to conservation area visitors. Care needs to be taken both to ensure visitor safety, and to avoid environmental impacts.

Guidelines for Nature Trails:

Do	Don't
<ul style="list-style-type: none"> ➤ develop nature trails in areas of ecological interest, utilising existing trails to the extent possible ➤ vary trail lengths to cater to a variety of visitor interest levels and physical capabilities ➤ clearly mark all trails with identification and directional signs, and provide supplementary printed information ➤ provide guidelines on expected visitor behaviour (e.g., no littering, no defacing of trees or rock faces, no collecting of plants or harassment of wildlife) ➤ provide litter disposal facilities along the trail ➤ ensure visitor safety, at least on longer trails, through a registration system and frequent patrols by conservation area staff ➤ minimise trail width and grooming (clearing of adjacent vegetation and maintenance of the trail surface) to the minimum necessary to maintain easy passage and to prevent erosion problems ➤ maintain natural surfacing and use natural erosion controls (live vegetation, plant debris, rock) to the extent possible ➤ monitor visitor use and develop a system for obtaining and 	<ul style="list-style-type: none"> ➤ develop trails through key wildlife habitats, including natural wetlands ➤ clutter up the trail with too many signs ➤ permit motor vehicles, including motorcycles, on the nature trail system (except for motorcycles used by conservation area staff on patrol)

using visitor feedback	
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4.2.10.2 Patrol Trails

All FSP-supported conservation areas have existing road and trail systems that have been developed in conjunction with plantation establishment, that link settled areas, or that are used by local residents for access to forest resources. These also provide an access network that can be used by conservation areas staff for patrolling each area.

Guidelines for Patrol Trails:

Do	Don't
<ul style="list-style-type: none"> ➤ develop a patrolling system which regularly covers all parts of the conservation area, utilising existing trails to the extent possible ➤ except as required for approved public access (e.g., leading to main conservation area facilities) close minor roads and trails to all vehicles with four wheels or more ➤ maintain patrol trail system for foot or motorcycle access only ➤ minimise trail width and grooming (clearing of adjacent vegetation and maintenance of the trail surface) to the minimum necessary to maintain easy passage and to prevent erosion problems ➤ replant bypass areas and avoid future "braiding" of trails through wet areas ➤ maintain natural surfacing and use natural erosion controls (live vegetation, plant debris, rock) to the extent possible ➤ monitor use of patrol trails by local residents and illicit resource users 	<ul style="list-style-type: none"> ➤ develop trails through key wildlife habitats, including natural wetlands

4.2.11 Utility Corridors

Existing utility corridors in FSP-supported conservation areas are limited to power transmission and telephone lines, although future developments could conceivably include other linear facilities such as gas pipelines. When constructed through forested areas, such developments involve direct permanent loss of habitat, habitat fragmentation (e.g., preventing arboreal species such as gibbons from crossing the cleared corridor), and major human and mechanical disturbances during the construction phase. They also require periodic inspection and maintenance which may include repeated clearing of regenerating woody vegetation along the long, narrow strip occupied by the utility. These are important considerations in management of conservation areas, and negative impacts need to be minimised to the extent possible.

Guidelines for Utility Corridors:

Do	Don't
<ul style="list-style-type: none"> ➤ zone existing utility corridors as designated use areas during conservation area management planning, and specify use conditions and limitations ➤ limit vegetation clearing to the immediate RoW ➤ conduct vegetation clearing by hand only ➤ maintain connectivity of vegetation cover wherever possible (e.g., in shrub and lower canopy layers) to facilitate wildlife movements ➤ avoid use of chemicals in vegetation management ➤ maintain working contacts with agencies responsible for existing utilities to ensure that all guidelines and restrictions are followed 	<ul style="list-style-type: none"> ➤ permit the routing of new utility corridors through conservation areas, except as specifically required for conservation area management purposes ➤ develop new aerial facilities (e.g., power and telephone lines) where buried lines are a viable option

5. GUIDELINES FOR ENVIRONMENTAL ANALYSES

The purpose of environmental analysis is to ensure that the forests/plantation management options under consideration are environmentally sound and sustainable and that the environmental consequences are recognized early and taken into account. The activity is designed I) to identify and assess the potential impacts of the activities proposed ;to be undertaken, aiming at regeneration of forests, ii) to assess the degree to which environmental safeguards are incorporated in the existing plans iii) to interpret and communicate the information about such impacts, and iv) to recommend appropriate measures for strengthening the environmental management in the plans.

The steps involved in environmental analysis could be detailed as below:

- ➔ List all activities envisaged in the plan,
- ➔ Identify their potential impacts,
- ➔ Predict the magnitude of potential impacts on physical and social environment,
- ➔ Evaluate, and interpret the significance, urgency and irreversibility of the impacts,
- ➔ Formulate the mitigatory strategies, and
- ➔ Communicate the results of environmental analysis.

Screening of activities is a process involving a quick run through the list of proposed activities that have significant potential adverse impacts. A check list of questions, providing basic; check of any disorder in the environmental components that could be associated with any activity of the plan, is drawn. Such questions could be as follows:

Land

- ➔ Will the activity alter the landscape character and visual quality
- ➔ Does the work involve excavation and earth moving and would lead to soil erosion
- ➔ Will the activity alter the fertility of the soil
- ➔ Will the activity lead to land pollution
- ➔ Is restoration of the site possible.

Water

- ➔ Will the activity affect the water table
- ➔ Will the activity alter the direction of ground water flow
- ➔ Will the activity pollute the surface and/or ground water
- ➔ Will the activity lead to flood/drought condition
- ➔ Is mitigation possible.

Air

- ➔ Will the activity generate gaseous emissions
- ➔ Will the activity generate particulate emission
- ➔ Will the activity lead to air pollution
- ➔ Are mitigation measures available.

Biota

- ➔ Is the activity compatible with ecological conditions of the area
- ➔ Will the activity have negative effect on floral and/or faunal diversity
- ➔ Will the activity adversely affect any function of the ecosystem (including mycorrhiza)
- ➔ Is mitigation possible

Social

- ➔ Will the activity have impact on subsistence and/or commercial needs of the community
- ➔ Are mitigatory measures (alternative sources) available to the community
- ➔ Does the community agreed to such alternate arrangement.

Having determined the range of impacts associated with proposed activities it is crucial to determine the seriousness and magnitude of the identified impacts. The impact matrix provides a mix of negative and positive impacts of activities without providing any rating of their significance. This would decide whether the impacts are acceptable or would require mitigatory measures. The significance of the negative impacts is determined by asking the following questions.

- ➔ How importance is the impact in relation to others
- ➔ What proportion of the local population is affected by this impact
- ➔ How much important is the impact to the affected people
- ➔ How much importance is the impact to the affected people

- ➔ How much of a particular resources will be affected over which the effect will be felt
- ➔ How much area and time duration the impacts would affect.

The urgency of impact is the function of rate at which is significant problem will get worse if the negative impact is allowed, ;how quickly the natural system might deteriorate and how much time is available for it's stabilization or enhancement.

Whether the impact is negative or positive, direct or indirect, net of residual, long or short term, reversible or irreversible, is what would determine the ability to mitigate the effects of potential negative impacts of proposed activities. It is ultimately the outcome of decision on the magnitude of impact that would aid developing the mitigatory strategies.

The environmental analysis is expected to result in following outputs:

- ➔ Identification of positive and negative impacts on physical and social environment
- ➔ Suggestions for mitigatory measures ;which might reduce or prevent the adverse impacts.
- ➔ Identification of the residual adverse impacts ;which can not be mitigated
- ➔ Identification appropriate monitoring strategies to tract the impacts and provide ;early warning system.
- ➔ Incorporation of environmental information related to the proposed activities into decision making process, and
- ➔ Selection of optimum alternatives