Government of Bangladesh

Ministry of Environment and Forests

Bangladesh Forest Department

Management Plan
For
Chunati Wildlife Sanctuary

Bangladesh Forest Department

January 2015

Management Plan
For
Chunati Wildlife Sanctuary

Supported by

Climate-Resilient Ecosystems and Livelihoods (CREL) Project

This publication is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this document do not necessarily reflect the views of the USAID or the United States Government.

Office of the Chief Conservator of Forests
Forest Department, Banabhaban, Agargaon,
Dhaka-1207, Bangladesh
Phone: +88-02-8181737, Fax: +88-02-818174

Office of the Divisional Forest Officer
Wildlife Management and Nature Conservation Division
Sholosahar, Chittagong
Phone: +88- 031-684420, Fax: +88- 031-681167

Office of the CMC
Chunati Range office, Chunati Wildlife Sanctuary

Acknowledgement

The management was prepared with active participation and co-operation of Bangladesh Forest Department and other Stakeholders.

Key contributions came from: Md. Yunus Ali, Chief Conservator of Forest (CCF) for his overall guidance and co operation in preparing this management plan: Mr. Ratan Kumar Majumder, Deputy Chief Conservator of Forest (DCCF), (focal point); Mr. Tariqul Islam, Assistant Chief Conservator of Forest (ACCF); Mr. Dewan Jafrul Hasan, Conservator of Forest (CF), Chittagong Circle; Md. Rakibul Hasan, Divisional Forest Officer (DFO), Wildlife Management and Nature Conservation Division; Abdur Rahman, Assistant Conservator of Forest (ACF), Wildlife management and Nature Conservation Division, Chittagong; and Forest Department staffs of Chunati Wildlife Sanctuary; Mujammel Haque Sikdar, Chairperson of Jaldi CMC; UNO Chakaria Upzila, Cox's Bazar; participants in local planning sessions from the Village Conservation Forum (VCF) of Chunati Wildlife sanctuary and other officials.

I would like to thanks Mr. Paul Thomson, Senior co-management Advisor (CREL), for his effort in preparing and developing the management plan.

I would like to thanks to CREL officials specially Mr. A.K.M Shamsuddin, Ex-CCF and Co-management Coordinator (Forestry), Mr. Shams Uddin, Manager-Landscape Planning, Ruhul Mohaiman Chowdhury, M& E Specialist and his team including field staffs of CREL.

The compilation of the management plan was done by the CREL technical assistance team: A.Z.M. Shamsul Huda, Consultant, Forest Management Plan; Md. Nizam Uddin Bhuiyan Shopnil and Abdullah Al Mamun, Associate Consultant, Forest Management plan, CREL.The process involved: consultations with 17 numbers of FD officers and 8 numbers of civil society representatives and members of 50 village conservation forums and community patrol groups as individuals or small groups; review of existing documents and plans; drafting of an outline plan; and holding of consultation workshops on 6 March, 2015 and 7 March 2015.

Table of Contents

List of Table

List of Figure

List of Annex

List of Acronyms

ACF - Assistant Conservator of Forests

ADB - Asian Development Bank

AIG - Alternative Income Generation

ANR – Assisted Natural Regeneration

BBC- Bangladesh Bird Club

CBC – Community Based Conservation

CBD- Convention on Biological Diversity

CCF - Chief Conservator of Forest

CF - Conservator of Forest

CMC – Co-management Committee

CMC – Co-management Council

CMO – Co-management Organization

CPG – Community Patrol Group

CWS- Chunati Wildlife Sanctuary

DCCF- Deputy Chief Conservator of Forest

DCF- Deputy Conservator of Forest

DFO - Divisional Forest Officer

EIA - Environmental Impact Assessment

FCC- Forest Conservation Club

FD - Forest Department

FG - Forest Guard

FRH- Forest Rest House

FRMP - Forest Resource Management Project

FSP - Forestry Sector Project

GIS - Geographic Information System

GIZ - German Society for International Cooperation

GoB - Government of Bangladesh

HEC – Human Elephant Conflict

IPAC – Integrated Protected Area Co-management

IUCN - International Union for Conservation of Nature

JFM – Joint Forest Management

JWS- Junior Wildlife Scout

LDF - Landscape Development Fund

MIS - Management Information System

NACOM – Nature Conservation Management

NGO - Non-Governmental Organisation

NIC - Nature Interpretation Centre

WS - Wildlife Sanctuary

NSP - Nishorgo Support Project

NTFPs - Non-Timber Forest Products

PA - Protected Area

PF- Protected Forest

PF- Peoples Forum

PCVA- Participatory Community Vulnerability Assessment

PBSA - Participatory Benefit Sharing Agreement

PP - Project Proforma

PRA - Participatory Rural Appraisal

RF - Reserved Forest

RIMS - Resource Information Management System

RO- Range Officer

RRA - Rapid Rural Appraisal

TA - Technical Assistance

UNDP - United Nations Development Program

UNO- Upzilla Nirbahi Officer

UP- Union Parishad

USAID - United States Agency for International Development

VCF- Village Conservation Forum

WC - Working Circle

Executive Summary

Chunati Wildlife Sanctuary is located within Banshkhali and Lohagara Upzilas of Chittagong District, and Chakoria Upzila of Cox's Bazar District, south-eastern region of Bangladesh. It is well connected with Chittagong and Cox's Bazar. This wildlife sanctuary is largely degraded but still important for biodiversity.

This management plan has been developed to cover not only the protected area but also the surrounding impact area; together these are the focus of the Chunati and Jaldi Co-Management Councils and Committees (CMC). This plan was prepared in a consultative, participatory process and becomes the defining reference for activities of Forest Department (as well the two CMCs) within Chunati Wildlife Sanctuary and sets out guidelines and activities for the two CMCs in the impact area for 10 years period **(2015-2025).**

The long term vision is to restore a healthy biodiversity evergreen forest in about 75% of the 7,764 ha Wildlife Sanctuary (WS) that is actively supported and protected by the approximately 10,200 households living within the WS who in the remainder of the WS would operate sustainable natural resource based landuses, diversify their enterprises to be higher return and resilient to climate change, and limit their biomass extraction. Similarly in the 4,615 ha of forest lands that form a buffer zone the aim of this plan is to restore forest cover where possible in a participatory way and link this with improved livelihoods and biomass production by local people in the remainder of this zone and in the wider impact/landscape zone. To support this vision nature based tourism will also be promoted based on suitable visitor facilities that provide sustainable income flows for co-management and livelihoods of local people.

The southern part of Chittagong District is highly vulnerable to extreme climatic event accelerated by global warming. Cyclones, tidal surges, rain storms, landslides and flash floods already cause losses to people, livestock, crops and natural vegetation; and may intensify over time.

The basic principle of this management plan is a people oriented approach where local stakeholders are organized and represented from their villages and interest groups, along with Forest Department and other government agencies in two co-management set ups: Chunati and Jaldi (linked with the two forest ranges where Chunati WS is located), each with a co-management council and its executive committee .The plan assesses the present situation of biodiversity, resource protection and management, human interferences, impact zone landscape positions, and based on this analysis sets out priority management actions for a ten year period.

Chunati Wildlife Sanctuary (CWS) has an area of 7,764 ha , a further 4,615 ha of Forest Department lands form a buffer zone, and a 6,239 ha area has been identified that impacts CWS, giving a combined total landscape area of about 18,781 ha (including 163 ha GIS mapping error).

The boundary of Chunati Wildlife Sanctuary is not well demarcated. Although the WS was notified in 1986, no efforts have so far been made to physically demarcate the boundary in the field. The situation has been exacerbated by heavy human pressure on the forest and encroachment of forest lands. This resulted in fragmentation of remaining forest, loss of forest habitat, and loss of wildlife. Out of the 7,764 ha WS core zone, 1,708 ha (22%) is encroached for settlements and agriculture.

It is a high priority to define and demarcate the boundary and to update the record of rights if this plan of actions is to be implemented.The original forests of Chunati were a mixture of moist deciduous and tropical evergreen forest dominated by *Diptercarpus* spp. (Garjan); now most of the area is mixed grasses and scrub forests. Asian Elephant is the most notable mammal occurring in Chunati Wildlife Sanctuary, which it uses as part of its larger range

moving between forests in southeast Bangladesh. There is a reasonable diversity of other faunal groups, mostly species with a wider distribution, but several sensitive species have been lost due to deforestation.

Non-Timber Forest Products (NTFPs) play an important role in Chunati Wildlife Sanctuary and its buffer-impact zones - providing livelihoods and employment to forest dependent communities. Unfortunately over exploitation of NTFPs including illicit cutting of fuel wood, bamboo, etc. has resulted in the degradation of the forest and NTFP resources. Use rights in terms of sustainable harvests of both timber and NTFPs should be granted to the local communities who are involved in protection activities through Participatory Benefit Sharing Agreements (PBSAs) from reserved forests in the buffer zone (impact area).

Linkages with markets and service providers will be encouraged by the CMC and People's Forum (PF) so that poor people currently exploiting the forest and WS can earn higher incomes while reducing natural resource extraction. This may be by intensifying enterprises on their current lands, or by developing new skills and employment such as in small scale industry, tourism, and cottage industries.

There are 45 villages represented within Chunati CMC, inhabited by 4,700 households (30,916 people) and there are 26 villages represented within Jaldi CMC inhabited by 5,500 households (26,172 people). A total of 24 stakeholder categories have been identified in CWS area, of which eighte are primary ones. **Primary stakeholders** are: forest land encroachers, fuel-wood collectors, illicit loggers, forest produce collectors, hunters, farmers, fruit collectors, and tourists. **Secondary stakeholders** include: timber merchants, brickfield owners, hotel / motel owners, furniture businesses, saw mill owners, and others linked indirectly with forest-based activities. **Institutional stakeholders** include: Forest Department, NGOs, Union Parisheds and Police.

Protection of habitat against illicit felling, encroachment, and grazing are the primary responsibility of FD working with co-managers. CWS needs an additional 38 well trained staff including an Assistant Conservator of Forests to be posted as the responsible officer for the entire WS. Co management is based on two 65-member Co-management Councils each with a 29-member Co-management Committee, representing all local stakeholders, and each including representatives of the respective People's Forum which represent 45 villages (Chunati) and 26 villages (Jaldi). These bodies provide forums to discuss problems and take decisions, and ensure local participation in protecting remaining forest and its regeneration, and promote development of alternative livelihoods to reduce pressure on regenerating forest.

This management plan specifies actions in three zones in accordance with the Wildlife Preservation and Security Act, 2012: core, buffer and landscape/impact zones. During 2015-2025 in the core zone no roads and other substantial infrastructure development will be permitted. Selected existing trails used by encroachers and resource extractors will be designated as visitor walking trails and limited facilities for ecotourism will be developed (such as information boards). Enrichment planting with indigenous forest tree species following the framework method will be taken up in 3300 ha of degraded/barren lands where natural regeneration is not coming up due to lack of mother trees. In the buffer zone only native tree species will be planted. In all zones where there is degraded/bare land soil conservation measures e.g. localized planting of native trees, bamboo and bushes will be taken up to reduce erosion of stream/chara banks. This will include promoting contour cultivation and restoring vegetation on slopes in encroached areas and in private lands in the influence/landscape zone. In the landscape/impact zone landowners will be encouraged to adopt land management practices that stabilize slopes and conserve soil and water, and links between CMC, People's Forum and villages with other relevant agencies and organizations to help enhance their livelihoods and community resilience to climate stresses.

Sapling regeneration and density will be monitored in sample representative areas jointly by the co-management stakeholders (CMC coordinating FD and community patrol groups).

FD will provide/arrange (with outside assistance as needed) suitable training for its staff and co-management stakeholders in protected area management including management of wildlife and nature based tourism, forest restoration, and climate change resilience. Links will be made with agencies that can provide training to local people to enhance enterprises without threatening natural resources.

It is expected the following activity will enhance the sustainability the sanctuary.

- Sufficient flexibility has been kept to make necessary modifications and adjustments to management activities, which are based on: Surveys and demarcation of CWS boundaries and elephant corridors in the buffer and lansdscape zones.
- Strengthening the co-management committee (CMC) of CWS including its ability to raise funds for community development and conservation through benefit sharing arrangements with key stakeholders.
- An activate CMC and to prevent encroachment and illegal extraction from forest.
- Assistant natural regeneration (ANR) and enrichment planting both with indigenous forest tree species in identified priority areas of CWS.
- Developing eco-tourism facilities in Chunati beat near the existing interpretation center and also in Bashkhali eco-park.
- Promoting non-forest based occupations and livelihoods for resource extractors and encroachers, particularly enterprises that are higher value and profitable (such as cultivation of high value crops, nursery, cottage industries).
- Enhancing FD capacity to protect CWS by establishing teams of well motivated, trained and equipped staff to work in the field with community patrols at strategic locations.

The Sanctuary will be publicized in electronic and print media to promote nature based tourism, raise the profile of CWS, and increase use of the WS and existing facilities (such as the interepretive center) as part of formal and informal education.

Private-public partnership will be encouraged to increase resources available for nature conservation based on mutual transparency. This will involve agreed respectful publicity for building up the image of the contributors, CWS, FD and co-managers.

Monitoring and review will assess management activities, NP conditions and achievement of the management plan objectives. The results of monitoring and evaluation may be used to adapt the strategies to improve the management performance.

Introduction

Chunati Wildlife Sanctuary is located in southeastern Bangladesh. It is well connected with Chittagong and Cox's Bazar. It was declared a Wildlife Sanctuary in 1986 due to its biodiversity significance, especially for the presence of Asian Elephants.

A Protected Area management plan was prepared for CWS in 2007 by Nishorgo Support Project. But implementation was limited due to fund constraints. This plan continues the landscape and co-management approaches introduced in 2007.

Co-management enables active participation of local communities in forest management and offers direct and indirect benefits of sustaining their livelihoods, apart from achieving conservation goals. Since the 1990s in many countries, including Bangladesh, co-management has been adopted to address the limitations of previous top-down management. In Bangladesh the Forest Department has formally adopted co-management for protected areas and their landscapes, by actively involving forest dependent communities in decision making and protecting forests and their wildlife.

The Management Plan was developed following a landscape approach core zone, buffer zone and impact zone. The plan focuses on the rehabilitation, protection and conservation of forests and constituent biodiversity, sustainable use of landscape areas to achieve conservation on a broader scale, involvement of local people and other key stakeholders in co-management, resilience to climate change, ecotourism promotion, and livelihood diversification. This Management Plan is expected to guideline in addition to the FD and CMC, policy makers, decision makers, local stakeholders, and funding agencies.

The main long-term management aim of the plan is to bring the maximum feasible area of Chunati WS under biodiverse native evergreen forest cover and other habitats supporting a healthy population of Asian Elephants, and to maintain this forest and its constituent biodiversity in the best possible condition and thus resilient the climate change. In addition to encourage eco-tourism and to ensure sustainable livelihoods and natural resources for adjacent communities based on enhanced diversified occupations and active support for conservation.

PART 1: Current Status of Protected Area

1 Descrpition

1.1 Basic Facts of the Chunati Wildlife Sanctuary

1.1.1 Location

Chunati Wildlife Sanctuary (CWS) is located at 21° 40⁰ North and 92° 07° East, in the country's south-eastern region. It falls within Banshkhali and Lohagara Upzilas of Chittagong District, and Chakoria Upzila of Cox's Bazar District (Figure 1). It covers seven Union Parishads: Chunati, Adhunagar, Herbang, Puichari, Banskhali, Borohatia and Toitong.

The Sanctuary is accessible from Chittagong city via the national highway (to Cox's Bazar), which borders the eastern boundary over a distance of nearly 15 km. It lies halfway between Chittagong and Cox's Bazar – nearly 70 km south of Chittagong.

1.1.2 Area

CWS was created in 1986 and encompasses 7,764 hectares of Reserve Forest (Table 1). The buffer zone of Forest Department land bordering CWS covers 4,615 ha (Table 2). A further 6,239 ha of largely private land forms the impact zone giving a combined PA-buffer-landscape area of 18,781 ha (including 163 ha GIS mapping error). The sanctuary is administrated under the Wildlife and Nature Conservation Division of Chittagong. It is divided into two Forest Ranges and seven Forest Beats: The Chunati range (total area 3,332 ha), consisting of Chunati, Aziznagar and Harbang beats; and the Jaldi range (total area 4,432 ha) including Jaldi, Chambal, Napora and Puichari Beats.

Table 1 Block-wise area of Chunati Wildlife Sanctuary (Core Zone)

Range	Beat	Block	Area(Ha)
Chunati	Chunati	Chunati	811.33
Chunati	Harbang	Goyalmara	1451.42
Chunati	Satgar	Satgar	347.77
Jaldi	Chambal	Chambal	1040.89
Jaldi	Jaldi	Jaldi	1148.58
Jaldi	Napura	Napura	1609.32
Jaldi	Puichari	Puichari	1354.65
		Total	**7763.96**

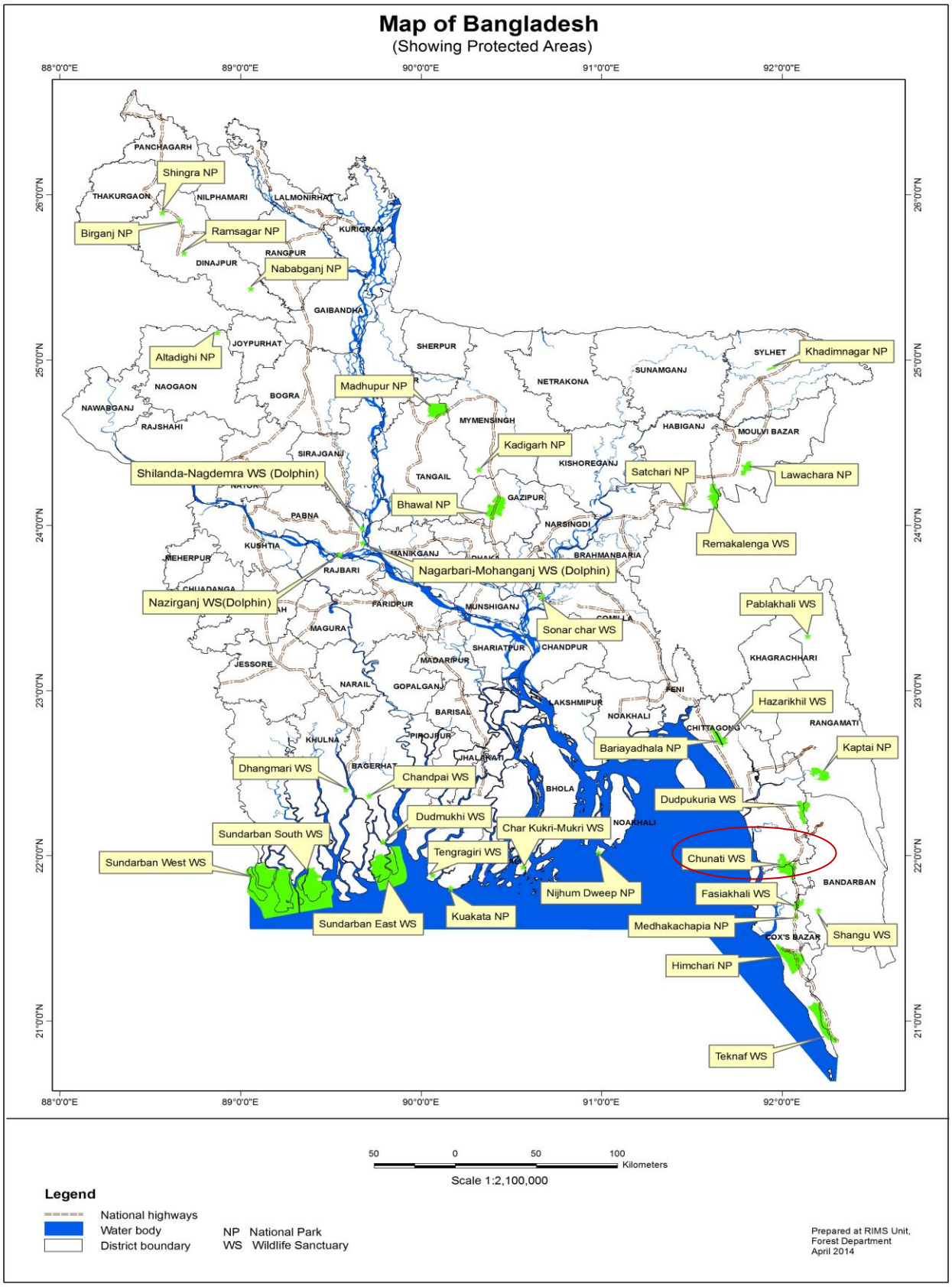


Figure 1 : PAs of Bangladesh showing CWS

Table 2 Block-wise area of Chunati Wildlife Sanctuary (Buffer Zone)

DIVISION	RANGE	BEAT	BLOCK	FOREST	Area (Ha)
Chittagong	Chunati	Satgar	Satgar	Reserved Forest (RF)	170
Chittagong	Chunati	Harbang	Harbang	Reserved Forest (RF)	177
Chittagong	Kalipur (P.F.)	Chechuria	Chechuria	Protected Forest (PF)	357
Chittagong	Chunati	Bara Hatia	Chhota Hatia	Reserved Forest (RF)	463
Chittagong	Chunati	Harbang	Teliakata	Reserved Forest (RF)	467
Chittagong	Chunati	Bara Hatia	Chhota Hatia	Reserved Forest (RF)	542
Chittagong	Chunati	Bara Hatia	Bara Hatia	Reserved Forest (RF)	817
Chittagong	Barabakia	Toitang	Toitang	Reserved Forest (RF)	1623
Grand Total					4615

2.1.3 Boundary

The Sanctuary comprises seven Reserve Forest blocks which were reserved in the early nineteenth century. Working Plans were prepared with topographical maps and specific recommendations for the maintenance of legal boundaries of forest blocks and compartments were given. However, most of the prescriptions of the working plans were not implemented and so the boundaries of forests could not be maintained. As a result, some forest lands have been encroached, mainly for cultivation and settlements. Although the Sanctuary was notified by the Government in 1986, no efforts have so far been made to physically demarcate the boundaries in the field. A total of 145 km boundary of the CWS has been identified from GIS map (Zonation map)

1.1.4 Legal status and regulatory provision

Chunati Wildlife Sanctuary was established through Gazette Notification No. XII/For-I/84/174 dated 18 March 1986 in accordance with Article 23 of the Bangladesh Wildlife (Preservation) (Amendment) Act of 1974. As per provision of the Act, all wildlife (plants and animals) species found in the Sanctuary shall be protected and preserved. As such no commercial forest operation is allowed inside the Sanctuary.

On creation of Wildlife Management and Nature Conservation Division, Chittagong under the Management Planning Wing of FD, during the latest reorganization of the Forest Department (vides Govt. Gazette Notification No. Pa Ba Ma/ Sha-2/ Ban (Pro: Sha:)-22/98(6)/296 dated June 24, 2001), Chunati Wildlife Sanctuary fell under this newly created Division. A full time DFO (Senior Forest Officer) is exclusively since 2001 in charge of the Sanctuary.

1.2 Physical Features

1.2.1 Geology

CWS comprises of low rolling hills of upper tertiary rocks in which soft sandstone predominates. It is a complex of alluviums, terraces with unconsolidated sediments of sand, sandy loam, and loamy clay resulting from erosion of Duptila and Tipam formations and lateritic layers.These sediments are strongly erodible.

1.2.2 Soil

The soils developed on unconsolidated sandstone of the low hills are brown, loamy and acidic. These soils permit deep penetration of tree roots, unless obstructed by the presence of lateritic at shallow depths. The higher hill soils are usually on consolidated or semi-

consolidated sandstone or stratified shale beds. Deeper penetration of tree roots is hindered on steep slopes and stratified hard shale or consolidated sandstone, wherever present at shallow depth. The soils on the alluvial plains and valleys are mainly silt loam to silty clay loam, moderately to strongly structured with neutral to medium acid subsoil. Some of the higher valley soils are moderately well drained and have brown, loamy, moderately structured and very strong acid subsoil. The narrow valley soils are silt clays in basins, usually with imperfect to poor drainage and relatively greyer and sandy loams on ridges having acid reactions.

1.2.3 Topography and Land Forms

The sanctuary area is generally hilly with shallow to deep gullies and gentle to steep slopes. The average elevation is 30 to 90 m.

1.2.4 Water Areas

Chunati is characterized by high rainfall and a large amount of water is drained from the surrounding low hill ranges. The water collects in depressions and valleys which are seasonally flooded through small streams. The Sanctuary forms the catchment of a number of small streams, locally known as *charas (*e.g. Puichara in Jaldi Range*)*.There are four main streams in Jaldi Range totaling about 10 km (Puichari chara, Napora chara, Chambol and Shilcop chara) and eight main streams in Chunati Range totaling nearly 20 km (Harbang, Goyalmara, Sonaichori, Ratakol, Joiddogona, Moskaniachara, Hatia, Rajarchara), these flow into Matamorhori and Sangu rivers. There are also three Dhepa named Kormohori, Vora, and Borohatia Dhepa in this area. They provide good habitat, drainage and water sources for wildlife and local people. Water recharges from surrounding hills during monsoon rains. The water recedes during the dry season, enabling local people to cultivate the land with winter crops. A number of streams/charas pass through the Sanctuary and so riparian vegetation and forest cover are an important part of overall habitat composition.

1.2.5 Physiographic processes (Erosion and Siltation)

The banks of the rivers and creeks and the cultivated tracts are severely eroded especially during the rainy season. Sheet erosion and hill erosion are prevalent.

1.3 Climatic Characteristics

1.3.1 Temperature, Rainfall and Relative Humidity

The climate of Chunati Wildlife Sanctuary in general is warm and humid, but cool and pleasant during winter. The temperature varies on an average from minimum of 14^{o}C in January to maximum of 32^{o}C in May. In 1991-2014 the average increase in temperature in Chittagong region was +0.0176^{0}C per year (+0.0105^{0}C in summer and +0.0197^{0}C in rainy season. Changes of temperature in Chittagong region are shown in (Table 3).

Table 3 Changes of Temperature (^{o}C/yearly) in Chittagong Region last 50 years (Source B.M.D 2012)

Yearly/season	Decades				
	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010
Yearly	+0.0027	+0.0203	+0.0561	+0.0406	-0.0462
Pre rainy season	-0.0369	+0.0246	+0.0579	-0.0273	-0.0129
Rainy season	+0.0097	+0.0225	+0.0512	+0.0114	-0.0103

If the trend continues the average monsoon temperature will 1.5^{o}C higher in 2050 compared with the period 1961-90 (Table 4) which may impact vegetation.

Table 4 Projection of temperature (^{o}C/yearly) in Chittagong region by 2050 (Source B.M.D 2012)

Yearly/season	1961-1990	2030	2050
Yearly	25.51	26.47	26.82
Pre rainy season	27.18	27.75	27.96
Rainy season	27.69	28.73	29.12

Annual average rainfall is about 3,000 mm compared with mean annual evaporation of 1,466 mm), with most rainfall falling during June to September. Pre-monsoon rain is increasing whereas rain in the main monsoon is declining slightly (Table 5) this may positively affect vegetation growth and shift crop seasons.

Table 5 Projection of average Rainfall (mm/yearly) in Chittagong region by 2050 (Source B.M.D 2012)

Yearly/season	1961-1990	2030	2050
Yearly	2811.38	2991.56	3034.53
Pre rainy season	394.32	567.89	620.08
Rainy season	2139.23	2094.08	2073.73

Relative humidity is the amount of moisture in the atmosphere at any given time. It affects atmospheric temperature, cloud formation and sun light intensity. Low relative humidity occurs during winter and summer (but ranges between about 28% and 98%. High relative humidity is experienced during the monsoon season (from 41% (average minimum) to 100% (average maximum)).

1.3.2 Climatic Hazards

In southeast Bangladesh cyclones and floods are common. Cyclones occur mostly during in pre-monsoon (April-May) and also in post-monsoon (September-December). Although CWS is away from the coast wind damage and heavy rain are associated with cyclones, and storm surges affect some parts of the landscape villages. Cyclones affected to some extent the area in 1960, 1961, 1963, 1965, 1970, 1985, 1991, 1994, 1995, 1997 and 2007. In 2009 there was a heavy flood in Chunati and total 1210 households were affected. In 2007 there was a heavy flood in Jaldi and total 1110 households were affected. During 1991-1997 due to heavy Cyclone 3310 households were affected. There was a long drought in 2009.

1.4 Ecosystem, Flora and land uses of PA and Landscape

1.4.1 Flora

Chunati was one of the richest areas of biodiversity in Cox's Bazar in the past. Chunati forests originally supporting mixed tropical evergreen and semi-evergreen forests dominated by *Dipterocarpus spp.* have over the period become substantially degraded due to heavy biotic interference and the low lying areas in valleys have been converted into paddy cultivation. There is hardly any natural forest left except few garjan trees.

Currently CWS has five habitat types: 1) small patches of secondary forest, 2) plantations, 3) Grasslands and Bamboo forest, 4) wetland and water bodies, and 5) cultivated fields (FD 2006). German development co-operation (GIZ) with technical support from the Institute of Forestry and Environmental Sciences, University of Chittagong (IFESCU) conducted a base line survey in CWS during 2011. The survey shows that CWS has an average density of only

239 trees per ha, but 60 percent of the tree stock is composed of planted exotic species (GIZ 2011).The Sanctuary has a few scattered patches of garjan trees (e.g. near Bonpukur in Chunati Beat), but the plantations raised earlier converted high forests of great biodiversity value to plantations of low biodiversity value. Presently the hills are mainly covered by bamboo species e.g. *Bambusa tulda*, *Bambusa vulgaris*, *Melocanna baccifera*, grass, wild banana and many other shrub and scrubby vegetation. A total of 143 plant species, including 17 species favored by elephants, were reported by IUCN (2003).

Plants that dominate in elephant diet here include many trees and plants of homestead gardens: bamboos, blackberry, chapalish, jackfruit, mango, banana, chon, fuljharu, yams, alu, and jambura. Other native species eaten by elephants could regenerate naturally in the Sanctuary due to good rainfall but do not establish due to heavy human interference. Naturally growing tree species are Baitta garjan, Teliya garjan, Duliya garjan, Goda, Bonchalta, Chapalish, Amloki, Bohera, Dumur, Gotguttya, Bazna, Khudijam, Bot, as well as different species of bamboo and cane. A total of 240 tree species belonging to 156 genera and 61 families, 102 shrub species under 85 genera and 38 families, 211 herbs belonging to 150 genera and 47 families, 106 climber species, 19 fern species, 7 species of epiphytes, 6 species of parasites were recorded in CWS (GIZ). Out of these 96 species were categorized as exotic plants - about 14% of the total recorded species.

There are 924 ha of long and short rotation plantations in Chunati range and 1,519 ha of plantations in Jaldi range, within CWS. The main planted tree species are: Garjan, Jam, Akashmoni, Mehogony, Shegun, Chikrassi, Chapalish, Chatian Jolpai, Dumor, Bohera, Gamar, Sheora, Kat badam, Amloki, Horotoki, Kathal, Lotkon, Bell, Jambura, and Kotbel. A list of plant species and their traditional uses found in CWS is presented in Annex 7.

A list of major NTFPs of CWS has also been given in Annex 18.

1.4.2 Landscape land uses and tenure

The landscape area of the CWS is about 18,781 ha (Table 6) of which 7764 ha is in core zone, 4,615 ha is in buffer zone and 6239 ha is in landscape zone /impact zone. A diversified land cover is found in the Chunati Wildlife Sanctuary. The greatest proportion of land use include: forests including plantations, herb-shrub-bush, fallow or agricultural land, water bodies, wetland and settlement. Degraded lands cover the highest proportion of land body. Areas under each category are presented in Table 6. Around 2443 ha of plantation carried out by FD (Annex 3 & 4). The land use map of Chunati Wildlife Sanctuary is shown in Figure 2.

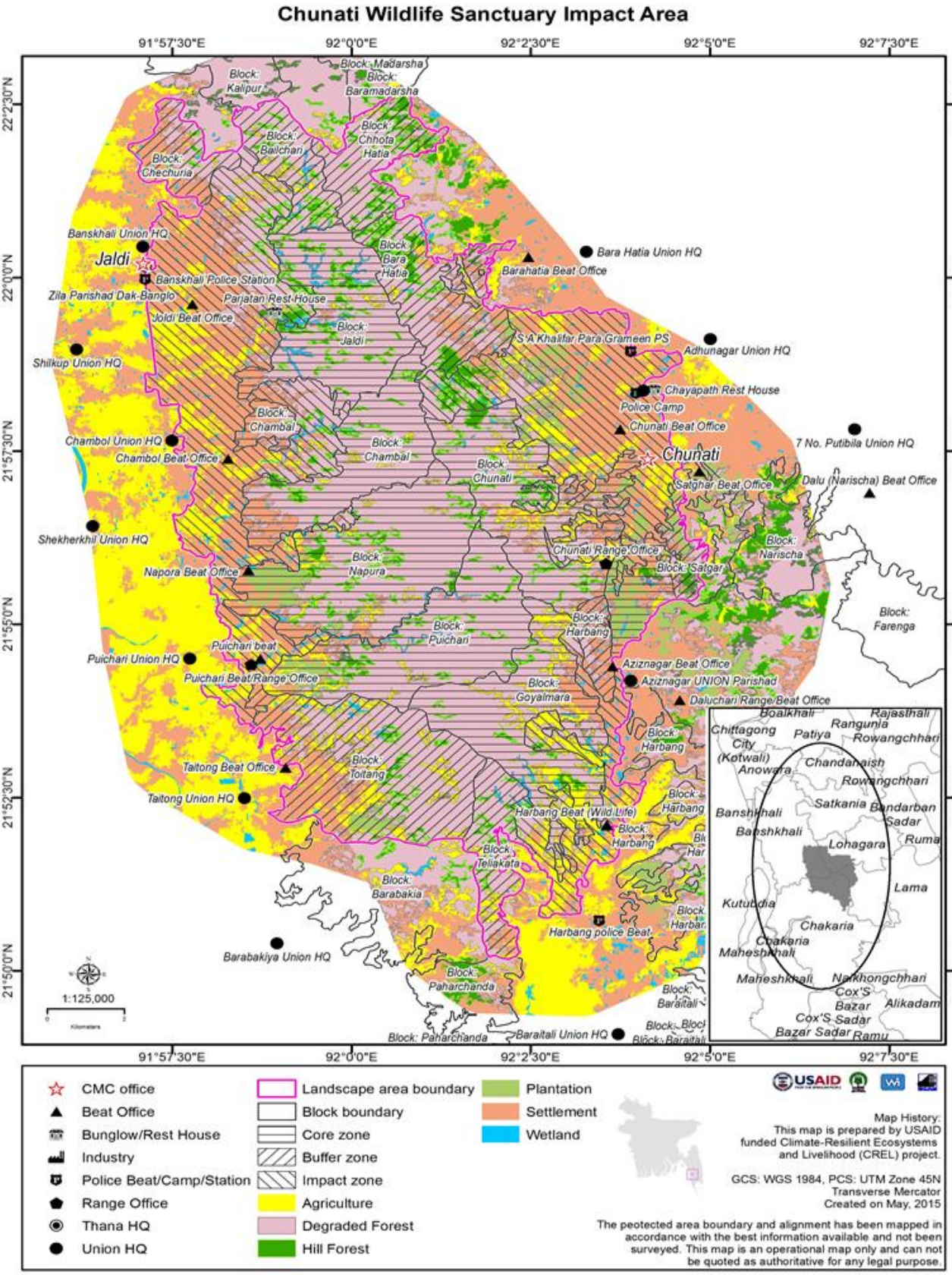


Figure 2 Land use map in CWS landscape area

Table 6 Landcover Statistics of Chunati Wildlife Sanctuary

Landcover	Core (Ha)	Buffer (Ha)	Impact (Ha)
Agriculture	472	379	1242
Degraded Forest	5692	2811	1350
Hill Forest	489	411	191
Plantation	316	101	190
Settlement	848	857	3111
Wetland	111	56	156
Grand Total	7927*	4615	6239

* **163 ha GIS mapping error**

Over the past few decades, land cover has changed significantly due to anthropogenic pressures, such as migration, illegal felling and harvesting, conversion of land to agricultural uses, and encroachment. The land category of the core one and buffer zone is reserved forest land and protected forest land, with the legal title of land ownership held by the Government of Bangladesh through the FD.

Impact zone refers to the area where people live and cultivate who depend partly on resources from the protected area and who may be also affected by influence from the protected area by for example human-wildlife conflict. This zone is also referred to as Interphase landscape.

1.5 Fauna

Once, Chunati Wildlife Sanctuary was very rich in faunal diversity including wild animals, birds, reptiles and amphibians. Asian elephant (*Elephas maximus*) is the most notable wildlife species of this area. A recent study in 2012-2013 by zoology department of Jahangirnagar University funded by GIZ indicated the presence of 23 species of amphibians, 33 species of reptiles, 160 species of birds and 22 species of mammals in Chunati Wildlife Sanctuary (although some are considerd unproven or were recorded outside of the WS); and 21 species of amphibians, 30 species of reptiles, 167 species of birds and 20 species of mammals in Bashkhali Eco-park. In addition monitoring of selected indicator resident bird species has been conducted since 2005 in CWS with support of NSP, IPAC and CREL projects, and records of all birds seen were made during those surveys. In total 219 species of birds (Annex 6) are considered to have been reliably recorded in Chunati WS but of these only 57 are restricted to evergreen forest habitat (Annex 5 lists these and other vertebrate species). Two ground dwelling bird species appear to have recovered in this period but other species dependent on mid-storey and canopy trees have at best been stable (and most of these were not recorded in surveys in 2014), see following figure 3. Among the fauna Asian Elephant, Rhesus Macaque, Barking Deer, Fishing Cat, Crested Porcupine, Indian Pangolin, Great Slaty Woodpecker, White-crested Laughingthrush, Common Hill Myna, are noteable.

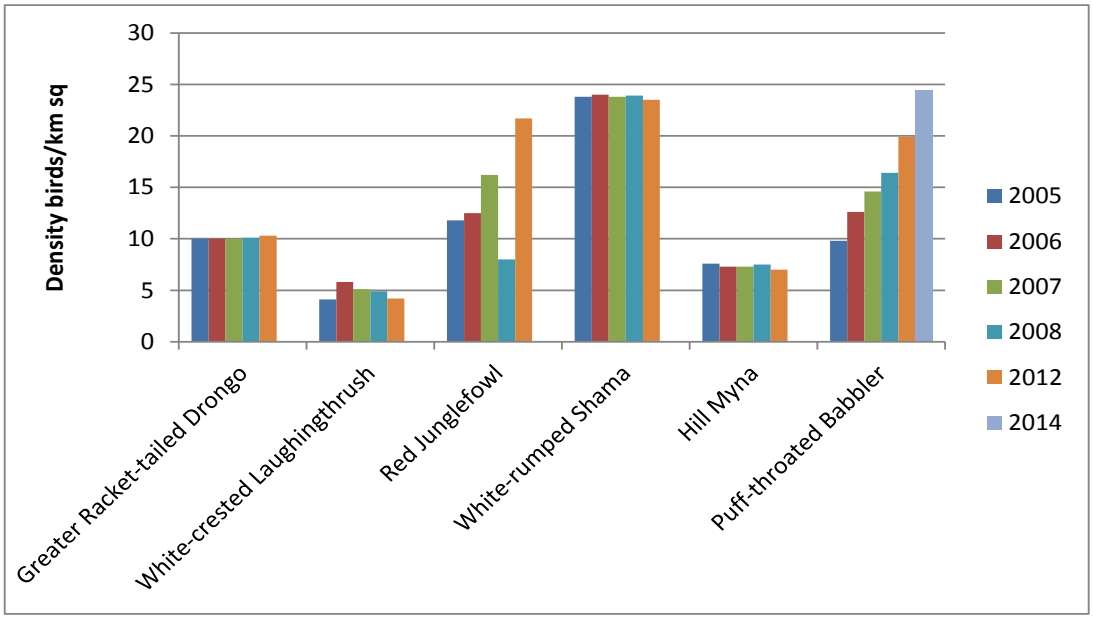


Figure 3 Population density of indictor bird species in Chunati WS

1.6 Socio Economic Profile

1.6.1 Population and settlement

At present, in Chunati Range there are 45 villages under 4 unions (borohatia, adonagar, chunati and harbang) of two Upazills lohagora and Chokoria in Chittagong and Cox's Bazar district. A total of 4700 households live in these villages with a total population of 30916 people (Male 16516 and Female 14400) (approx.). Among them 83% are Muslims and the rest are Hindu and Buddhist. 'Mog' is the only ethnic community lives in the landscape area of the PA. This ethnic group has its own culture and tradition.

In Jaldi Range there are 26 villages under 4 unions (borohatia, adonagar, chunati and harbang) of two Upazills lohagora and Chokoria in Chittagong and Cox's Bazar district. A total of 5500 households live in these villages with a total population of 26172 people (Male 13541 and Female 12631) (approx.). Among them 83% are Muslims and the rest are Hindu and Buddhist.The rate of education of the villagers in CWS is nearly 35 %. Nearly 981.39 hectares of settlements are inside the PA area.

1.6.2 Infrastructure and services

Communication system is good in the landscapearea. There are schools, market area, concrete road, earthen road and different organizations in the landscape area. The infrastructural information is presented in Table 7.

Table 7 Infrastructural properties of Chunati Wildlife Sanctuary area

Name	Area/ number(Chunati Range)	Area/ number(Jaldi Range)
Metalled/Pucca road	15 km	25Km
Earthen road	45 km	30Km
Educational institute	34	25
Cyclone shelter cum school	3	4
Bazaar	7	10

1.6.3 Livelihood activities and resource uses

Nearly 65% populations are living on the poverty line. The main occupation of the local people is agriculture. Total 50% of the populations are engaged in agriculture, 10% are engaged in fishing, 20% are day labors and the rest 20% are engaged in other occupation. Almost all the households in the landscape are involved in rearing livestock for the generation of extra income.NTFP's such as cane, bamboo etc. also play an important role for their income generation (Nishorgo support management plan for CWS 2010-2015). Resources uses by the people of CWS areas is given in table 8 with reason.

Table 8 Resource uses of Chunati Wildlife Sanctuary

Name of resources	Reasons for resource exploitation	Users	Dependency
Fuel wood	HHs consumption and for commercial purpose	Local people, tea stall, hotel owners	High
Timber	Commercial and HH building material	Local people, furniture mart	Low
Sungrass	Commercial and HH thatching material	Local people, Local Market	High
Other NTFPs*	Commercial and HHs Consumption	Local People	High
Wildlife	Commercial and HHs Consumption	Local People	Low
Betel leaf vine cultivation	Commercial use	Local market	High

*Includes bamboo, cane, medicinal plants, fruits, vegetables, dry leaf and grass etc.

1.7 Past Management System and Plans

For the management of reserved forest in Chittagong including Chunati areas the first working plan was prepared for twenty-years by Cowan in 1923. The Chunati forests were heavily depleted dueto the World War II (1942-45). Mr. Q. Ghani prepared a working plan (1950-51 to 1969-70) for Chittagong forest division.After that several working plans were prepared respectivelyby Baten (1968-69 to 1977-78), SA Khan (1978-79 to 1987-88) and E.G. Balmforth and N.I. Howlader (1988 to 1997)where conversion of natural forests for raising plantations oflong rotation, and short rotationspecies.

The management plans of Chowdhury (1991/92-2000/01) and Mabud (2000-09) provided for a preservationworking circle (Chunati WS) for the management of Chunati WS and the main prescription of stopping commercial fellings in Chunati WS was implemented. However, a 3-year GOB funded wildlife scheme (1993-96) was implemented for Chunati bydeveloping some visitor facilities (a rest house and two Watch Towers).

A separatemanagement plan was prepared for Chunati WS by Rosario (1997) and a two year action plan by (Tecsult, 2001). However, these two management plans neither approved nor implemented. Lastly the Nishargo support Project prepared a management plan which also could not be implemented due to non availability of fund and absence of co management organizations.

2 Emerging Issues

2.1 Administration of Forest PA and associated facilities

Chunati Wildlife Sanctuary is administered and managed by the WMNC Division, Chittagong. At present in CWS has only 39 personnel including Ranger, foresters and forest guards (Table 9).

At present the FD staff has no adequate transports facilities and field equipments like Pickup, motor cycle Computer, GPS for proper functioning. The Offices and quarters of range officer and beat officers need to be renovated.

Table 9 Manpower involved in management of Chunati Wildlife Sanctuary

Number of exit in CWS	Chunati range	Jaldi range	Chunati beat	Harbang beat	Azziznagar beat	Jaldi beat	Napora beat	Chambol beat	Puichari beat	Eco-park	Total
ACF	0	1	0	0	0	0	0	0	0	0	1
Forest Ranger	1	1	0	0	0	0	0	0	0	1	3
Deputy Ranger	0	0	1	0	1	0	0	0	1	0	2
Forester	1	0	0	1	0	1	1	1	0	0	5
Forest Guard	0	0	2	1	1	0	1	1	1	1	8
Plantation mali	0	0	0	0	0	0	0	0	0	1	1
JWS	1	0	2	0	2	3	2	2	0	0	12
Boat man	0	0	1	1	0	0	0	0	2	1	5
Security	0	0	0	1	0	0	0	0	0	0	1
Shukani	0	0	0	0	1	0	0	0	0	0	1
Total											39

2.2 Co-management institutions and associated facilities

Traditional management strategies of PA have failed to conserve the forest sustainably, so a co management strategy has undertaken in 2005. 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.

For Chunati Wildlife sanctuary the relevant co-management actors are the FD as legal custodian of PAs, and key stakeholders that play important role in the conservation management.

In the structure of co-management there are co-management council, co-management committee, peoples forum (PF), village conservation forum (VCF), community petrol group (CPG), and Forest conservation club (FCC)/Youth club. The structural format of Co-management organization is presented in table10.

Table 10 Co-management Structure of Chunati Wildlife Sanctuary

SL No	Name of Activity/ Organization	No organization in Two Range		Member	
		Chunati	Jaldi	Chunati	Jaldi
1	Co management Council	1	1	64	61
2	Co management Committee (CMC)	1	1	29	27
3	Peoples Forum (General Body)	1	1	70	52
4	Peoples Forum (Executive Body)	1	1	11	11
5	Community Petrol Group (CPG)	7	5	164	105
6	Village Conservation Forum (VCF)	35	26	1206	1500
7	Forest Conservation Club	2	1		

Co-management council was formed on 24th August 2005 in Chunati Range and 27th July 2006 in Jaldi Range. Last election of co-management council of Chunati range was held in 6th Decembar 2012, with 65 councilors from following categories of people- 5 representative from civil society (local leaders, social workers etc), 16 representative from local government (UNO, UP members, FD etc), 39 representative from local people (resource user groups 4, community petrol group 5, Forest Conservation Club 5, Ethnic community group 5 and 22 representatives of Peoples Forum). The UNO acts as chairperson and either the ACF or the RO acts member secretary of the council.

Last election of co-management council of Jaldi range was held in 18th December 2014, with 60 councilors from following categories of people- 5 representative from civil society (local leaders, social workers etc), 14 representative from local government (UNO, UP members, FD etc), 36 representative from local people (resource user groups 4, community petrol group 5, Forest Conservation Club 5, Ethnic community group 3 and 22 representatives of Peoples Forum). The UNO acts as chairperson and either the ACF or the RO acts member secretary of the council.

A co-management committee, responsible for overall management of a PA in Chunati Wildlife Sanctuary consisting of Chunati and jaldi Range consists of 29 members, elected by the conservation council by following a structured guideline that will contain the number of people to be elected from each representative category, their election procedures and the tasks to be performed by the committee. Members of the committee belongs to the following categories of people- 2 representative from civil society (local leaders, social workers etc), 12 representative from local government (UNO, UP members, FD etc), 14 representative from local people (resource user groups 1, ethnic community 2, FCC 2, CPG 3 and Peoples Forum 6 etc), other government organization representatives 1. Range Officer acts as Member-Secretary of the committee.

People's forum has two bodies, one general body with members of 11 and another is executive body with member of 70, Seven CPGs including 2 Women CPGs was formed with 164 members in Chunati range and Five CPGs was formed with105 members in Jaldi range to protect forest resources of PA. 35 VCF was formed in Chunati Range and 26 VCF was formed in Jaldi with a member of 1756 and. There are two forest conservation club/ Peoples Club in Chunati and One Forest Conservation Club/ Peoples Club with 35 members.

2.3 PA and Boundary Delineation

The CWS Sanctuary comprises 7 blocks of Reserve Forest. Working Plans were prepared with topographical maps and specific recommendations for the maintenance of legal boundaries of forest blocks and compartments were given. Although the Sanctuary was notified by the Government in 1986, no efforts have so far been made to physically demarcate the boundaries in the field.

2.4 Forest and habitat management intervention

CWS and its surrounding landscape zone encompass terrestrial, aquatic and forest ecosystems. The following four ecosystems /habitat types in CWS and its landscape zone can be classified

- Forests including Plantations,
- grasslands and bamboos,
- water bodies, and
- Cultivated fields.

The first three ecosystems are important from the PA management point of view .Forests and grasslands harbor some mammals, birds and reptiles. The water bodies and wetlands harbor fish species, water birds and amphibians. This ecosystem is favorable for Asiatic elephant.

In the past CWS supported mixed tropical evergreen and semi-evergreen forests, which over the period have been substantially changed due to heavy biotic pressure. Forest land encroachments have resulted in conversion of many foothills and low areas into paddy cultivation and settlements. As a result, the habitat has degraded and fragmented, adversely affecting the elephants by restricting their movements. Illegal extractions of forest resources also act as habitat destruction and failed to rejuvenate the forest again. A total of 1500 ha plantation Bangladesh Forest department has been done 1519.45 ha plantation in Jaldi Range and 923.70 ha Plantation in Chunati Range from 2002 to 2011 (see Annex 3 and 4), some of them turned into forest and some failed. Proactive management intervention is needed to successful afforestation and protection.

2.5 Encroachment, illegal extraction and forest destruction

A total of 1708.50 ha Forestland encroachment was found in for settlements, Agriculture, fisheries and planation inside the CWS (Annex 15). Encroachment of forest lands and illegal removal of forest produce (e.g. fuelwood and small timber) are two main problems in CWS. Forest land encroachment for agriculture, betel leaf cultivation, brickfields and settlements is common inside the Wildlife Sanctuary. A large number of betel leaf cultivation have been established in Chunati, Aziznagar and Harbang forest areas where they use bamboo stakes, forest material for fences and roofs.Many brickfields are using fuel woodcollecting illegally from theforests..

Mostly the village elites are directly or indirectly involved with forest land grabbing for establishing homesteads and cultivation. Institutional encroachment is common for setting up school, madrasa, graveyard, mosque, nursery, etc. In some cases the encroachment has been regularized by showing land ownership documents and khas land. This process of forest land encroachment is still continuing and strong measures needs to be adopted to stop.

2.6 Existing dependence on and use of forest resources

The agricultural labors find work for six months in a year in the farm but they do not have any other work for the rest of the period. So they engage themselves in cutting firewood and poles, trees, bamboos and selling these to the nearest market. For their home consumption they always dependent upon forest produce. Most of the villagers are more or less dependent on forest resources. They depend on Fuel-wood collection, Forest land for agriculture and settlement, Bamboo and cane collections, Sun grass collections, Livestock grazing, Wood collections, Green and dry leaf collections. Fuel wood collection is the main factor of forest destruction. Collection of seedlings and saplings for fencing stakes destroys the plantations. Besides a large tract of forest land is encroached by settlers. The encroached land is used for the cultivation of paddy, betel leaf, maize, cucumber, brinjal, potato, green chilli etc.

2.7 Gender, youth and ethnic communities

There are 35 villages within the landscape area of Chunati range of which there are around 4700 householdswith around 30916 people (Male 16516 and Female 14400). Also in jaldi range 26 villages within the landscape area of which there are around 5500 households with around 26172 people (Male 13541 and Female 12631).The rate of literacy of the villagers is 35 %.

'Mog' is the only ethnic community lives in the landscape of the PA. One Mogpara is situated in Aziznagar Beat (Chunati range) near Bandorban, lama. There are no ethnic communities in jaldi range. This ethnic group has its own culture and tradition.

2.8 Ecotourism and education/information

Nature based tourism in the form of Eco tourism will be main objective to promote biodiversity conservation and educate the visitors as enlightened eco-tourists.

Due to the limited accessibility of CWS, it has not been turned in a mass tourism site, which means that there is still potential for real "eco-tourism" if the natural characteristics of the area will be maintained.

CWS provides scenic beauty of green hills with natural forest and trails. It has a rich biodiversity, particularly birds and plants. The specific area of interest for tourist is the Bashkhali Eco-park.The Ecotourism facilities available in Chunati Wildlife sanctuary but lack of proper management (a.Chunati range and in b.Jaldi Range) are given below:

A.Chunati Range

- Natural garjan forest in Banpokur.
- Movement of Asian Elephant.
- Goyalmara natural streams.
- Bonpukur foot trail (Distance- 2.5km and hiking time nearly 45 minute).
- Janggalia foot trail (Distance- 3.5 km and hiking time 1.5 hour).
- Watch tower in foot trail and resting shed.
- Nature interpretation center in Chunati beat.

B. Jaldi Range

- Chambol garjan forest.
- Bashkhali Eco-park
- Dener chara and bamer Chara Lake.
- Mandir, pagoda of local hindu and buddist.

2.9 Existing carbon stock (by land cover)

Carbon stock is an indicator to understand forest situation. It is increasingly important as solutions is sought to address climate change. A carbon inventory was conducted in Chunati Wildlife Sanctuary to identify forest carbon situation to prepare the management plan considering climate change. Table 11 depicted that the status of carbon stock of Chunati Wildlife Sanctuary is low (136.48 **CO_2 Mg ha^{-1}**) indicates the degraded condition of forest.

Table 11 Summary of Carbon Inventory in CWS (source: Latif et al. 2015)

Land cover type	Area (ha)	Nos. Seedlings ha^{-1}	Nos. Saplings ha^{-1}	Nos. Live trees ha^{-1}	CO_2 Mg ha^{-1}
Agriculture	598	0	0	0	18.6
Degraded forest	5,873	810	441	655.26	116.6
Forest	506.9	8,412	3,752	1,321	198
Plantation	361	9,886	4,989	1,745	186
Settlement	981	1,393	1,790	1,278	163.2
Average					136.48

3.10 Management Constraints /Challenges

Management objectives	Management Challenges
To ensure Landscape approach in conservation of CWS where in Asian Elephant is our focal wildlife.	There is no boundary demarcation (Core zone, buffer zone and impact zone). Agricultural activities, settlements, greenfuel wood, bamboo and wild fruits collectionswithin the PA. Lack of transport and modern equipment.
To protect elephant corridor in the landscape of CWS. To restore Elephant Habitats as ecosystems resilient to climate changes impact.	Protection and maintainance of corridor for the movement of wild elephants. Collection of elephant food such as green fuel wood, bamboo, wild fruitswithin the PA. Lack of trained professionals, staffing and infrastructure. Lack of transport and modern equipment.
To strengthen co-management for sustainable Biodiversity conservation in CWS.	Lack of trained professionals who make an effective collaboration among the CMC, Stakeholders and FD. Inadequate financial support for the community petrol group (CPG).
To strengthen eco-tourism facilities in suitable areas within CWS,	Lack of funds. Lack of Awareness among the tourist, local people about the eco-tourism.
To reinforce sustainable livelihoods activities; preferably income generation activities and nature education; in order to build up the CWS dependent communities as resilient to climate change impact.	Lack of funds and training facilities aboutalternative income generation activities such as Nursery practices, homestead forest, cottage industries, fisheries etc. Villagers have no knowledge about the climate resilient agricultural crops or high value.

2.11 Conflicts and Resolution

In Chunati total 24 stakeholders are identified**. Institutional stakeholders** are forest Department, NGOs, Union perished, BGB, and Police. **Primary stakeholders** are forest land encroacher, fuel-wood collector, illicit logger, forest produce collector, hunter, farmer, fruit collector, tourists etc being directly associated with forest resource extraction activities. **Secondary stakeholders** are Timber merchant, brickfield owner, hotel or motel owners, and furniture businessman, saw mill ownerlinked indirectly with forest-based activities.

Primary stakeholders are generally the poor villager and used as driving force of forest destruction and maximum gainers are the elites or secondary stakeholders. Institutional stakeholders always try to use their power over other stakeholders as they are the management authority. The role of different stakehodel in CWS is given in table 12. Again Sources of stakeholder conflict with their resolution is given in table 13.

Table 12 Identified stakeholder groups in Chunati WS

Stakeholder (SH) name/type	SH Description	Role/Description of activities of SH
Fuel wood collector: Primary SH	Local poors; women and children are dominant ones	Mass people (80%) of fuelwood collectors are aware of NSP interventions. About 30% poor fuelwood collectors and daily labours are included in the CPGs under NSP. They are provided with training support, awareness and motivational programme on forest conservation etc.
Forest villagers: Primary SH	Registered villagers with FD	Forest villagers play significant role in forest patrol and often make liaison in forest land encroachment.
Brick Field Owner: Secondary SH	Influential persons from outside	They are aware of rules and regulation of forest laws but due to political support and local needs they are often use fuel from forests and often escape from law enforcement. Sometimes they influence fuelwood collectors in illicit collection of the same from forests.
Betel Leaf Cultivator: Primary SH	Forest villagers and local and outside people	Encroached land, clear vegetation, weed adjacent areas, usesticks as support to vines and fence around the plot that comefrom the forest, lot of cultivation and associated activities.
Tobacoo Cultivators: Secondary SH	Curing of tobacco leaves require huge Fuelwood	Tobacco cultivation is a profitable farming as companies provide incentives to the farmers. Hence a large crop fields are being converted for tobacco cultivation. Most importantly curing leaves entails huge fuelwood which are being collected from nearby forests.
Sun-grass Bamboo Collector: Primary SH	Local poor people and employed labor by rich people,betel leaf cultivator	Collect Sun-grass and after collecting they burn that Chhanmohol. Grows on barren land
Timber merchant: Secondary SH	Local Businessmen	Purchase timber from illegal feller
Farmer: Direct SH	Forest villagers and local people	Usually the tiller encroach plain land and cultivate various crops in the forest and private land

Hunter: Primary SH	Influential local people and some ethnic people.	They hunt/trap wild animals such as deer, pig, wild cock etc.
Political Leader: Indirect SH	Local and adjacent area Leader	They encourage and provide support to illegal activities in the forest and forest resource collection
Dry leaf collector: Primary SH	Children and old women	Collect for own consumption selling in local markets.
Illegal Tree feller: Primary SH	Poor people/employed labor, armed gang.	Collect leaf, burk, fruits and herbs etc.

Table 13 Sources of conflict with their resolution in Chunati Wildlife Sanctuary

Sources of conflict	Resolution
Land disputes	By arranging local salis through local member and chairman with the help of local elites, meeting with land administrative authorities.
Encroaching forestland	FD and local influential people make negotiation
Tree Felling	Forest cases
To establish influence in the locality	*Salis*
Man- wildlife conflict	Due to destruction of wildlife habitat, elephants often attack settlements and agricultural fields in search of food.Habitat restoration and stop land encroachment in forest areas; fencing the agricultural lands and settlements; Awareness building among local settlers and how to drive the stray elephants back to the forests.
Migrants	Identify the migrants and refugee and rehabilitate the migrants with humanitarian aids and employment opportunities; UN and NGOs should come forward to solve this problem.
Inter-departmental conflict	Allocation of forest land for settlement recording as khas land. Co-ordination with the administrative authority to stop the settlement of forest land

2.12 Climate change impacts on vegetation, fauna and ecosystem services

Climate change has become the most important issue in the recent years. From 1991-2014 average increment of temperature in Chittagong region is $+0.0176^0$c. In summer average increment of temperature per year is $+0.0105^0$ c and $+0.0197^0$ c in rainy season. From 1949-2014 the average increment of rainfall in Chittagong region is +2.1485 mm. There are different types of climatic hazard on Chunati Wildlife Sanctuary which create adverse impact on vegetation, fauna, and flora and on ecosystem.From recent participatory community vulnerable assessment (PCVA) report nine types of climatic disasters have been identified in the Chunati Wildlife Sanctuary (Table 14).

Table 14 Climatic disasters in Chunati Wildlife Sanctuary

Flood	Cyclone and storms	Salinity of water
Heavy rainfall	Landslide	Earthquake
Temperature raise/Drought	Elephant raid	Water logging

Climatic threats identified in the CWS are shown in (Annex 10 and 12).These climatic phenomena have rigorous impact on vegetation, fauna and ecosystem services of CWS. Change in vegetation pattern consequently alters the other ecosystem services. Frequent cyclonic event with heavy rainfall causes severe damage to vegetation particularly trees. The root system of vegetation is the natural barrier to prevent soil erosion and helps to retain soil water through infiltration process. During heavy rainfall vegetation cover retains water and serves the water to the ecosystem all year round, but at present, this situation has drastically changed at CWS. In the absence of forest, heavy rainfall causes landslide and surface run-off and dry season observe shortage of water in all waterfall. Above all ecosystem services of CWS like provisioning (food, fresh water), regulating services (cyclone and storm regulation, water purification), supporting services (soil formation, nutrient cycling) are in extremely vulnerable condition due to climatic effect.

For the determination of climate change impact on forest and livelihood PCVA system is followed under CREL project in Chunati Wildlife Sanctuary. From the recorded data it was observed that the climatic hazards are more than 10-20 years ago and it will be rising in future. Every kind of climatic hazards causes bad impact on vegetation, flora, fauna and on ecosystems.

Adaptation measures to mitigate these climatic hazard with the upcoming situation has also identified in PCVA report. Village wise climatic threats with their management interventions of CWS are shown in (Annex 11-13).

3 Institutions

3.1 Forest Department

Forest Department (FD) has formal responsibility for the protection, conservation and development of the CWS.To complement limited resources co-management has been adopted with active involvement of local communities in supporting protection of remaining forest. Nevertheless for more effective management of the sanctuary a PA-specific team of FD is needed (Annex 9). With existing 39 staffs additional 47 numbers of staffs of different categories has been recommended in the plan.

An enlarged FD team will also need sufficient modern equipment (Annex 17).The current work force has lacking of needed facilities or functioning environment. The range office and beat offices are in ramshackle condition. Lacks of working/field equipments like Pickup, motor cycle (latest model), Computer, GPS, fire-protecting equipments hinder the effective working of the FD personnel. The same condition is for the housings of the respective officers. Offices and quarters of range officer and beat officers need to be renovated and decorated with necessary facilities and equipments. Equipment like one computer in each beat office, 2 computers in each range office, and 1 laptop for ACF is needed.

3.1.1 Management pattern

HNP is currently overseen by the Divisional Forest Officer (DFO) Wildlife Management and Nature Conservation Division, Chittagong who is overall responsible for management, protection and development works. The Range Officer (RO) of Chunati Wildlife Sanctuary Range, Jaldi Range and Banshkhali Eco-park is in charge of the CWS headed by ACF and there are seven beats each managed by a Deputy Ranger/ Forester, responsible for the field activity. The RO is ex officio member secretary of CMC.

3.1.2 Roles and responsibilities of administrative body

The Divisional Forest Officer (DFO) is overall responsible for the management of the PA including administration, protection and improvement of the resources and conservation of biodiversity, environmental management, preparation of budget, and control over all activities within his jurisdiction.

The Range Officer (RO) is the key person who is responsible for overall activities of the PA. He will maintain liaison with other related government departments and local NGOs and other organizations for smooth implementation of co-management activities headed by ACF. The Deputy Ranger/ Forester in Charge of a Beat is responsible for protection and other field activities within his Beat.

3.2 Co-Management Structures

Co-management organization (CMO) consists of the following types of bodies:

- Co Management Committee (CMC)
- Co-management council
- Peoples forum (PF)
- Village conservation forum (VCF)

3.2.1 Structure and roles & responsibilities of Co Management Committee (CMC)

- Divisional Forest Officer (DFO) and Upazila Nirbahi Officer (UNO) are the advisor of the committee and the respective Range Officer (RO) will serve as the Member-Secretary of the CMC;
- The members of the respective categories/groups will elect members for the CMC according to the quota mentioned in government order;
- All members will be elected for 2-year tenure except the nominated (ex-officio) members and no person can be a member for more than 2 consecutive terms;
- The members of the CMC will elect one chairperson, one vice-chairperson one treasurer among themselves;
- The maximum number of members of the committee will be 29.
- To scrutinize the activities of VCF, PF and CPG and forest crime monitoring
- To ease voluntary work in forest conservation and management;
- To facilitate effective management of natural resources;
- To ensure effective participation of all the stakeholders in forest management;
- To ensure security of natural recourses;
- To help in the implementation of adopted development activities;
- To ensure effect distribution among the stakeholders acquired from PA.
- Social forestry activities
- Alternative livelihood development
- Conflict mitigation
- Rapid response team formation
- management of wildlife corridor
- Eco-tourism management
- Land conflict resolution
- Maintaining communication with other government department

3.2.2 Structure and roles & responsibilities of Co-management Council

For the fulfillment of the objectives, co-management council will be formed for management of PA with the full support and active participation of the key & stakeholders of the protected Areas and the landscape. Different categories of stakeholders will select/ elect their own representatives for the Co-management Council. The categories are Civil Society (Maximum 5 persons), Local Administration (Maximum 3 persons), Forest Department (Maximum 8 persons), Local Government (Maximum 5 persons), Local Community (Maximum 39 persons), and representatives from other Government (Maximum 5 persons). Local Parliament Member, Upazila Parisdad Chairman and Divisional Forest Officer are the Advisor of the council. Upazila Nirbahi Officer (UNO) and the respective Range Officer will serve as the Chairman and Member secretary of the Co-management council. The Co-management Council will have maximum 65 members. Out of these, minimum number of women members will be 15.

3.2.3 Structure and roles & responsibilities of Peoples Forum (PF)

The peoples Forum will be formed by election of representative from villages and local communities within the Protected Area landscape. All key stakeholders should be representative, particularly women, the youth, lower income households, and important resource users groups. Thirty-three percent of the members of the people's forum will be women.

- Represents local users of natural resources and ensure that local livelihood issues are taken into account in the preparation and implementation of Protected Area co-Management plans; -Recommend and support initiatives for protecting the natural's resources of the protected Area and conserving biodiversity and assist the Forest Department and Co-management institutions in implementing tree plantation, reforestation, habitat restoration, nature tourism activities and other management activities of the protected area;
- Assist to prepare Protected Area Co-management plans and Annul work plans for landscape area conservation and development in and around the Protected Area;
- Provide any other require assistance to the Co- Management Committee on Protected Area.

3.2.4 Structure and roles & responsibilities of Village Conservation Forum (VCF)

Village conservation forum is an inclusive platform of the Co-Management process where the poor villagers or resources except specific categories like local government member, civil society member and owner of the resources user institutions that ensures direct participatory democracy. It offers equal opportunities to majority village's residence including women and indigenous community to discuss criticize and propose relevant activities for Co-Management Organizations. The following steps to be taken to form VCF:

- Organize village meeting to describe the objective of the census;
- Household census to be conducted for identifying the position and condition of the village people;
- At the time of census, clearly describe the power and responsibilities of the VCF, PF, and CMC; 50% of the committee members should be women;
- Elect Peoples Forum from the VCF.
- VCF can monitor and discuss the implementation of the development projects and suggest PF and CMC to improve the quality of work;
- To select labor for cleaning or any sorts of activities inside the forest. VCF will assist PF, CMC and FD;
- VCF may during the meeting take decision to form its own committee to look into the issues and make suggestions; To control the anti conservation activities;
- VCF is responsible to inform the CMC if any such type of activities happened in their village;
- VCF can ask CMC to provide the project proposal and financial document of CMC to go through for inspection if they have any question or confusion; VCF are responsible to give comments and recommendations of CMC activities through PF, if they are not satisfied by the answer of the CMC they can raise the question in front of Divisional Forest Officer (DFO);
- VCF is mandated to meet at least four times in a year may meet more according to the necessity of community.

3.3 Training and capacity building

The local inhabitants are poor and they are not aware about the livelihood improvement program. Poverty and lack of awareness hinder their capacity of development. Several government and non-government organizations active in the area and they have a great influence over the Chunati Wildlife Sanctuary and its landscape. Some of these institutes work on social welfare, some work on economic solvency, some work on climate change, some work on livelihood programs etc.NGOs are now the leading training and capacity

building institutions that give a number of training to the local people to augment their capacity. From recent participatory community vulnerable assessment (PCVA) report, the list of the institutes with their training and capacity building programs of Chunati Wildlife Sanctuaryis shown in table 15.

Table 15 List of institutes with their training and capacity building programs

Name of NGO/CBOs	Area	Capacity building program
CODEC	Chunati wildlife Sanctuary	Plantation and Education programs.
GRAMEEN BANK	Chunati wildlife Sanctuary	Micro credit, improved cooking stoves (ICS), solar panel
BRAC	Chunati wildlife Sanctuary	Education, Micro credit, Nursery, sanitation.
ASA	Chunati wildlife Sanctuary	Micro credit, Group formation
SHED	Chunati wildlife Sanctuary	Livelihood Programs
CARE	Chunati wildlife Sanctuary	Water and Sanitation, improved cooking stoves (ICS)
PROSHIKA	Chunati wildlife Sanctuary	Micro credit
IDFO	Chunati wildlife Sanctuary	Solar panel
UDDIPON	Chunati wildlife Sanctuary	Micro credit
IUCN	Chunati Wildlife Sanctuary	Human-elephant conflict mitigation
GIZ	Chunati Wildlife Sanctuary	Livelihood

Local level BFD staffs, CMO members, resource users groups as well as other local stakeholders are needed to facilitate with trainings on various subjects and skills such as; organization building, leadership and management for newly formed co management organization, AIGA, sustainability and resilience covering all activities under sustainability and resilience programmed, nature-based tourism management and implementation, human-wildlife conflict mitigation for the conservation natural resource and biodiversity of CWS.

Chunati Wildlife Sanctuary has two CMC although it falls within Banshkhali and Lohagara Upzilas of Chittagong District, and Chakoria Upzila of Cox's Bazar District. As result there is administrative jurisdiction problem to take decision at CMC level. To overcome such problem and for effective administrative management and law enforment to protect CWS CMC may be formed in the following way-

- ***Harbang CMC with Harbang beat, Aziznagar beat and Forest Case Conducting officer (FCCO) Chakaria under Chunati Sancturay Range***
- ***Chunati CMC with Chunati beat, Boro Hatia beat, FCCO Lohagara under Chunati Range***
- ***Jaldi CMC with Puichari beat, Chambal beat, Napura beat and Jaldi beat under Jaldi Range and Banshkhali Eco Park.***

Again for the capacity building of CPG the following equipment is necessary-

Shoe, Raincoat, Uniform, Cold cloth, Torch light, Cap, Honorium and transportation.

Capacity building for sustainable CMO:

CMOs are the main vehicle to support Government for improved management of the Chunati Wildlife Sanctuary. CMO's functional and financial capacity needs to build for their active role in management and conservation. Functional and financial capacity refers to legitimacy of the organization, functional capacity for improved management, organization has good governance and capacity for inclusiveness, has the capacity to prepare participatory and adaptive management plan and resource mobilization capacity for sustainable funding to implement the plan.

Ultimately, it has to continue to deliver valued services or benefits through protecting and sustaining biologically significant eco-systems and improving the lives of people dependent on the area. In this connection system need to introduce for enhancing CMO capacity on regular basis so that they will able to contribute in the PA management. CMO leaders need to know the modern management system that are implemented in other countries through study tour and cross visit, attending and participating in workshops and symposium, need to build leadership capacity, able to enhance knowledge on NRM and climate change through training.

4 Values of protected area

4.1 Ecosystem

Ecosystem is defined as 'a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit'. And ecosystem services as "the benefits people obtain from ecosystems". Ecosystem services have been categorized into provisioning, regulatory, supporting and cultural services. Based on this classification, the ecosystem services of CWS are provided in table 16.

Table 16 Ecosystem services in Chunati Wildlife Sanctuary

Service Type	Services
Provisioning Services	Timber, Fuel wood, Thatching materials
Regulatory Services	Climate regulation, Disease regulation Water regulation,Water purification
Supporting Services	Soil formation, Nutrient cycling, Primary production
Cultural Services	Spiritual and religious,Tourism, aesthetic, Educational

A total of 240 tree species belonging to 156 genera and 61 families, 102 shrub species under 85 genera and 38 families, 211 herbs belonging to 150 genera and 47 families, 106 climber species, 19 fern species, 7 species of epiphytes, 6 species of parasites were recorded in Chunati wildlife Sanctuary (GIZ). In CWS, 96 species were categorized as exotic plants which are about 14% of the total recorded species.

Chunati Wildlife Sanctuary was rich in faunal diversity. At present wildlife of the sanctuary is threatened due to deforestation, habitat fragmentation and human disturbance. Asian Elephant is the key stone species of the Sanctuary. Small and medium sized mammal species e.g. monkeys, small cats, wild pigs etc. are also found in the remaining disturbed and fragmented habitat of the sanctuary. Among birds Jungle fowl is common in CWS.

A diversity of other faunal groups such as reptiles, vertebrates, hanumans, fishes and amphibians is present here. According to recent record in 2012-2013 funded by GIZ indicate the presence of 23 species of amphibians, 33 species of reptiles, 160 species of birds and 22 species of mammals in Chunati Wildlife Sanctuary and 21 species of amphibians, 30 species of reptiles, 167 species of birds and 20 species of mammals in Bashkhali Eco-park. It was more than the record of 1997.

4.2 Socio-economic

People of the region more or less are dependent on forest or forest resources. NTFP's such as bamboo, cane, grass etc. also play an important role for their income generation and consumption. Most of the people in the Chunati area use fuel-wood collect from the forest for cooking.

5 Threats

A number direct and indirect threat has been identified in CWS through focus group discussion. These are given below:

Direct threats (ranking*)

a. Encroachment (1)

b. illicit felling (2)

c. Wildlife hunting (3)

d. Forest fire

Indirect threats (ranking)

a. Weakness in law enforcement (1)

b. Brick field (2)

c. settlement of land inside forest (3)

d. Illegal housing inside forest (4)

e. Exotic species (5)

f. Saw mill (6)

g. Furniture shop (7)

* Highest threat start from ranking number 1

5.1 Resource extraction

Collection of fuel wood and house building materials are widespread within the PA and remain as major threat to the biodiversity of the CWS. Local people collect dry leaf and sungrass, vegetables and fruits. The collection of these forest resources removed the indigenous, non-traditional timber trees and small trees and shrubs. All these contribute to forest degeneration and poor abundance of these exploited species. Road construction inside forest is one of the main reson for illegal resources extraction in CWS.

5.2 Livestock

The introduction of livestock is prohibited according to the Wildlife Act (2012), but livestock grazing is common and destructive particularly by interfering with forest regeneration. Livestock roams freely in the sanctuary. Livestock, mainly cattle grazing is widespread within the PA and thus interfere with natural regeneration of the forest.

5.3 Encroachment

The boundaries of CWS are not maintained and encroachment for cultivation and settlements has taken place. No efforts have been made to physically demarcate the boundaries in the field and the situation was exacerbated with heavy biotic pressure on forests and encroachment of forestland.

Forestland encroachment for degraded land (5872.72 ha), settlements (981.39 ha) and agriculture (598.10 ha) is spread inside the PA. Forestland is encroached slowly; it is occurring mainly for grazing and NTFPs collection. Many times the village elites are directly or indirectly associated with forestland grabbing for establishing homesteads and cultivation. Institutional infringement is common in the buffer zone, for example to establish school, madrassa, graveyard and mosques. In some cases, the encroachment has been regularized in the buffer area by issuing land ownership documents as Khas land. This phenomenon of forestland infringement is continuing and needs to be stopped immediately. Beatwise

encroachment has been shown in Annex 15 is very alarming. The encroachmentin in Chunati range is about 31.11% and 14.39% in jaldi range.

However some reason for encroachment has been identified through focus group discussion in CWS.

- Political influence is the top most reason for encroachment.
- Mutual benefit between FD personnel and encrocher
- Complex eviction process
- Lack of FD's capacity
- Antagonistic tendency of local people
- Cyclone
- Dependency on forest for livelihood i.e. paddy cultivation, betel leaf cultivation, pisiculture,fuel wood collection, bamboo and cane collection, timber collection, sungrass collection, house broom grass collection, grazing etc.
- Poverty
- Lack of awareness

5.4 Human- wildlife conflict

Asian Elephant is the most important wildlife and Keystone or Flagship Species. Fragmentation of elephant habitat, scarcity of fodder species and food and increased human activities are the serious challenges for elephant habitat conservation and human elephant conflict management in Chunati Wildlife Sanctuary. Due to destruction of wildlife habitat, elephants often enter into the settlements and agricultural fields in search of food. Nature of damage by elephants in CWS areas is given in table 17. Again frequency of HEC is identified in CWS is given in table 18.

Table 17 Nature of Damage by Elephants

Topic	Information
Elephant's damaging area	Crop fields, houses, stored food, homestead gardens, commercially raised gardens.
Crops damaged by elephants	Paddy, Banana, Jackfruit, Bamboo, Guava, Coconut, Betel nut, Sugarcane, Melon, Mula, Brinjal, Mango, Potato.
Elephant's damaging/ raiding nature	1) Generally raid crops at night 2) Walk across the paddy fields and eat tender leaves or ripen paddy. 3) Uproot coconut and betel nut trees 4) Come seasonally to nearby homesteads to eat Jackfruit, banana and stored paddy (if available).
Frequent Elephant raiding months	Homestead gardens damage is comparatively higher in the months of May-June (Jackfruit fruiting season), July-August (Guava fruiting season). Elephants damage homestead banana gardens round the year.

Reasons for Human-Elephant Conflict:

- Main reason of HEC is food scarcity in the forests.Elephant's main fodder Bamboo's population reduced drastically due to recent gregarious flowering, illegal and over extraction.
- Local people collect Core part (locally called Bogoli) of wild banana at Chambol, Napora and Jaldi beat which caused rapid reduction of Elephant fodder wild banana.
- Broom grass along with other main fodders in the forest reduced due to extensive commercial extraction
- Plantation is done with elephant's non palatable exotic species like Akasmoni in major parts of CWS. While rests of the hills are either covered by sungrass or barren but rarely possess sound elephant habitat.
- People built their houses on elephant's routes and corridors.

Table 18 HEC survey conducted by IUCN in CWS (No. Within last 4 years)

Beats	Bambo groove	Betel leaf field	Crop field	HS& other property	Food storage	Home stead garden	Commercial garden	Human killed/ injured	Elephant killed/ injured	Total
Aziznagar	-	2	94	2	-	11	3	1	-	114
Baroitali	-	-	19	8	1	12	9	2	-	50
Borhatya	2	-	105	4	3	12	3	1	-	131
Chambol	3	6	60	3	1	14	8	1	-	96
Chunati	1	4	69	6	1	15	-	3	-	107
Eco-park	-	-	40	4	1	8	8	2	1	64
Harbang	3		29	1	1	26	8	-	-	68
Jaldi	1	2	8	10	1	21	17	2	-	64
Napora	1	2	41	1	1	26	2	1	1	76
Puichari	-	1	15	5	-	22	9	2	-	53
Satghar	-	-	56	10	1	15	3	1	-	87
Total	11	17	536	54	10	182	70	10	2	911

5.5 Poaching

Although not widespread, the local hunt /trap some wildlife, the important species sought are Gui shap, jungle fowl, Matura, sometimes monkeys and some species of birds. It is reported that sometimes people from distant places come to the forest for bird hunting. Therefore, pose a threat to the wildlife of the PA as their population is now highly reduced.

5.6 Conflict between conservation and development

For ecotourism development and sustainable and effective management of the CWS some infrastructure development work is needed such in Chunati beat. All the development work should be done near the road side or boundary of the PA to reduce disturbance impact on the forest. Construction a train line inside the sanctuary is also a threat.

PART 2: Analysis of Current Management Practices and Future Program

6 Objectives of PA management

6.1 General policy framework

As a signatory party of the CBD Bangladesh has developed National Biodiversity Strategy and Action Plan (NBSAP).

According to the guideline of NBSAP (GoB 2004) and National Forest Policy (1994) regarding CBD the primary objective of Bangladesh' biodiversity conservation policy is "to establish conditions to conserve, and wherever necessary, to restore the biodiversity of Bangladesh as an essential component to ensure the wellbeing of the present and future generations, and equitable sharing of benefits". This involves maintenance and improvement of environmental stability for proper functioning of ecological systems, and ensuring the preservation of the unique biological heritage of the nation as an asset for the benefit of the current and future generations. Co-management is one of the widely accepted approaches for protected areas management."

6.2 Objectives

The long term vision of the CWS management plan is to maintain the sanctuary as part of the forest landscape and its supported biodiversity in such a way that key species of the area are preserved, while conserving the ecosystem services for the benefit of local populations and future generations to ensure sustainable livelihood and resilience to environmental hazard, including climate change. Additional to that, the sanctuary should be a show case of a well conserved ecosystem as a source for nature based tourism, education and science. Within this perspective, the following management objectives are proposed for Chunati Wildlife Sanctuary:

(1) Protect and maintain physical, biological and aesthetic features of CWS as a part forest ecosystem

- Regulate land use through zoning and zone demarcation of the area, taking into account land value and function as well as crucial and vulnerable habitats of wild species;
- Protect the habitat for wildlife specially the Asian Elephants
- Protect crucial habitats such as resting sites of birds and large trees for monkeys, particularly hoolock gibbon;
- Research, surveys and monitoring of biodiversity resources to understand ecological values, processes and threats;
- Control invasive species, including livestock and other domestic animals in vulnerable habitats;
- Develop and implement effective surveillance and law enforcement.
- Reduce the dependency on the PA by improving livelihood of people by AIGA

(2) Improve food security and resilience of populations to natural hazard including climate change and human-wildlife conflicts

- Resilience to climate change through adaptation (plantation, agriculture);
- Improved watershed management in the PA as well as in the impact zone
- Food and habitat security for key stone species such as for Elephant.

(3) Increasing the revenue generation potential of the sanctuary promoting conservation and local development

- Develop entry fee collection system in Chunati beat for visitors of the sanctuary and maintain quality tourism facilities in bashkhali eco-park;
- Develop benefit sharing for local stakeholders;
- Promote of (re)investment in tourism development.

(4) Realizing and utilizing the sanctury's potential as venue for tourism based on wildlife, recreational, educational, cultural and aesthetic appeal

- Develop tourism infrastructure (information facilities, observation shelters, nature trails, picnic sites);
- Promote of tourism in urban centers of Bangladesh;
- Support local and private initiatives in the field of tourism development;
- Control impact of tourism (pollution, animal disturbance, noise disturbance)

(5) Integrating the sanctuary into local and regional development process, especially surrounding local communities to ensure wider acceptance of the PA's values

- Create awareness among stakeholders including local resource users as well as key actors determining land and resource use, involving also local educational institutes;
- Establish co-management and benefit sharing.

(6) Improving the BFD's staff welfare, motivation and capabilities

- Enhancing office and accommodation facilities for BFD staff;
- Improving logistics and mobility;
- Improving field equipment (uniforms, arms, GPS);
- Training (law enforcement, co-management, and ecotourism.

7 PA and landscape zonation

7.1 Zoning of landscape area

For better management CWS and its landscape are divided into three zones i.e. Core zone, Buffer zone and landscape zone / Impact zone (Figure 4).

7.1.1 Core zone

The entire forest area that was declared as Chunati Wildlife sanctuary in the official gazette is designated as core zone due to its conservation value. The total area of core zone 7,764 ha. However, within this 1708.50 ha have already been encroached to urban use and associated agriculture, fisheries and private plantation (Annex 15). Encroached land of core zone will be reclaimed by voluntary relocation of encroacher and through legal process. The other private land may be acquired following legal process to make a compact core zone for sustainable protection of the core zone. With only 489 ha of remaining hill forest and 316 ha plantation (Table 6) in this area, the target is to protect this area and restore biodiverse hill forest in 3300 ha degraded forest land located in core zone as shown in Fig 3 over the ten year period including 1400 ha enrichment plantation, shown in figure 2 as 1400 ha ANR, 300 ha habitat improvement work and habitat restoration work in 200 ha area. Main aim of the management of core zone is long-term protection of existing vegetation includingremaining forests, degraded forests and mixed plantations, and rehabilitation of the area towards natural forest habitat and biodiversity conservation. 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, poaching, encroachment, grazing and fire) and encouraging natural processes for regeneration and rehabilitation of degraded forests. The visitor use of the core zone will be regulated to allow low impact tourist activities in terms of hiking and wildlife watching; high impact visitor activities such as motorized transport and group pick nicks will not be allowed.

7.1.2 Buffer zone

The Buffer zone is land outside the protected area managed by BFD as Reserved Forest, where human settlement and cultivation is prohibited but where sustainable resource extraction is allowed. In Chunati Wildlife Sanctuary the area of Buffer zone is 4615 ha of which 1500 ha area is expected to cover with plantation during the management plan period. Management of this area will focus on intensive production of replacement resources, particularly fuel wood, poles and timber, and NTFPs maintaining biodiversity and stability for elephant habitat. Existing short and long rotation plantations will be raised with indigenous speciesunder participatory approach. However, the participants will, in addition to the protection of plantations, be responsible for providing biodiversity protection in the CWS areas. These plantations will not be clear felled but instead be managed under selection felling (mainly of exotic species) that the area can be naturally regenerated to be ultimately included in core zone as a mixed forest vacant forest lands without adequate rootstock will be taken up for buffer plantations and managed by following the relevant FSP guidelines as decided by FD. The management of FD lands in this sub-zone will focus on sustainable use of the remaining natural patches, bringing existing plantations under co-management practices, raising participatory plantations of indigenous species in vacant areas, checking conversion of forest land into agriculture and maintaining biodiversity conservation values, creating buffer for Asian Elephants and other wildlife's. Local stakeholders will be identified. and co-management agreements signed for providing livelihood opportunities and protecting habitat.

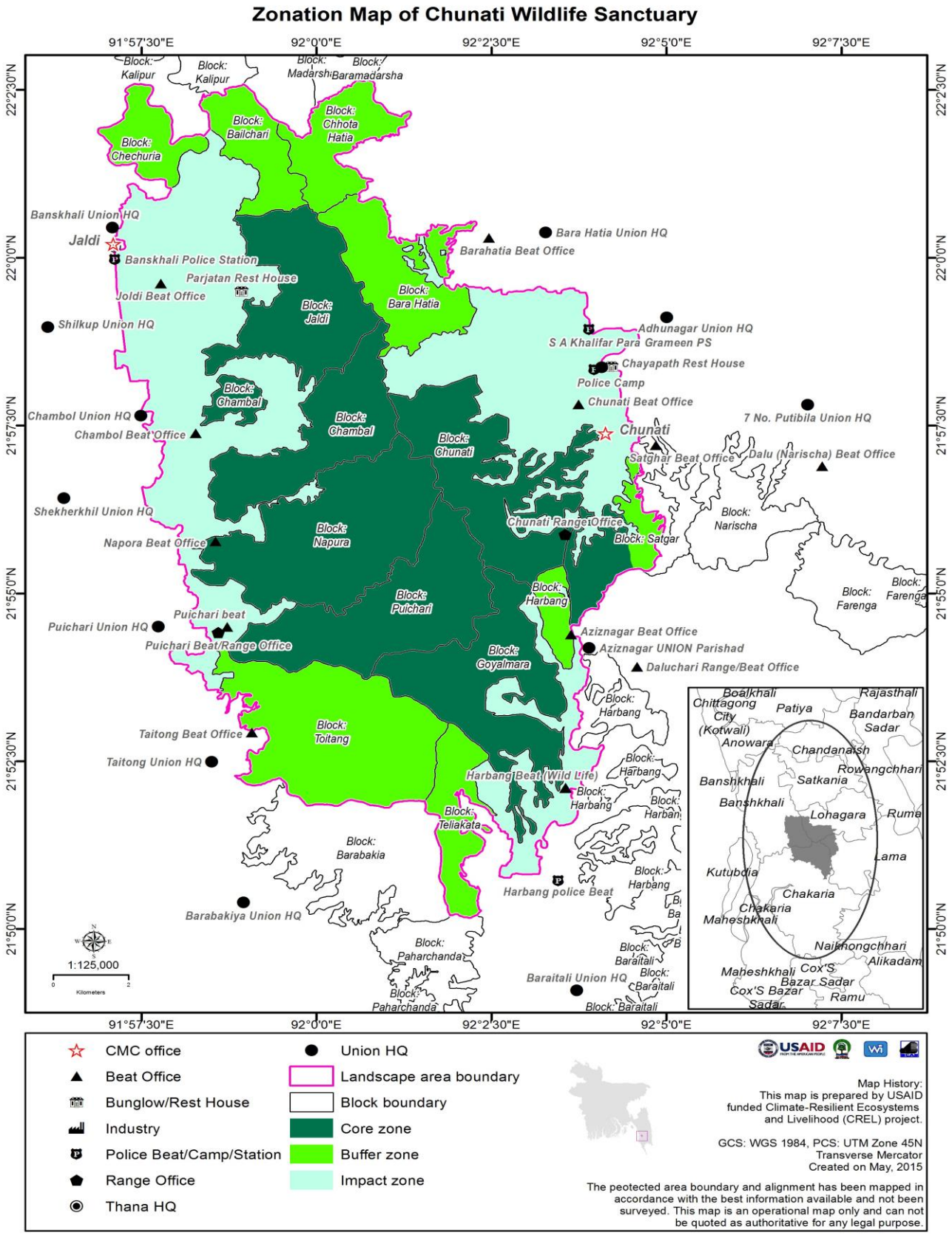


Figure 4 Zonation map of CWS

7.1.3 Impact zone

Landscape zone is 6,239 ha, the remainder areas within the landscape boundary outside the forest land areas. Landscape zone is created around the protected areas to control the biodiversity of the protected areas and reduce the dependency on forest resources and to create corridors for the movement of wildlife especially Asian Elephants. Landscape zones will focus on the surrounding lands that are helpful in protecting and conserving the core zone, and creating congenial habitat for wildlife. As opportunities for receiving tangible benefits from the conservation-oriented management of core zone are limited, adequate provisions will be made for off-forest livelihood opportunities provided to the local stakeholders in the interface landscape. Subsistence consumption needs of local people for fuelwood, NTFPs and timber will be met through co-management practices.

7.2 Boundary delineation

All the marginal boundaries of the CWS will be recognized, surveyed and drawn on the maps and on ground. The borders of different management zones will be defined, mapped and also be recognized on the ground during the implementation of the plan. Zoning boundaries should be determined by GPS in the field and where necessary consolidated concrete pillars need to be positioned in the field. The GPS data will be stored and can be mapped showing the boundaries.The benefit of natural features like rivers, streams/*cheras*, bridges, roads, etc. may be taken out during the demarcation. Posts e.g. concrete pillars, or other markers e.g. wooden or iron pillars, trenches, mounds, etc. will be fitted in place at all important and turning points and will be labeled. Every now and then boundary and markers are vulnerable to alteration due to human-interference or natural calamities. Therefore, a regular annual maintenance program will be necessary for boundary and pillar renovation and maintenance. Maintenance of legal documents and land records of FD should be kept properly in all offices upto beat level.

7.3 Actions to address encroachment and tenure issues

A database may be generated with settlement and number of settlers. Continuous update of the database will be carried out time-to-time with the increase or decrease of settlers. Strong communication network needs to be established associating forest villagers, to accumulate information on encroachment. Mapping of encroached areas may be another option to identify the encroached area. Upto-date records should be kept in Range and Beat Offices. Scattered encroachers spreading over the PA core area can be rehabilitated in the periphery and strict measures should be taken to arrest the further encroachment of CWS.

8 Management actions

8.1 Management of PA (conservation priority area)

8.1.1 Rules and norms

The forest area declared and notified as PA in CWS is designated as core zone due to its high conservation value.Forest management in this zone will focus on conserving remaining natural forests and bringing back natural vegetation (composition and structure) and restore habitat for wildlife. This will be achieved by providing protection (against illicit removals of forest produce, poaching, encroachment, grazing and fire) and encouraging natural processes for regeneration and rehabilitation of degraded forests.

8.1.2 Restoring habitat and ecosystems

To improve the existing condition habitat improvement work like, Assisted Natural Regeneration (ANR), Enrichment Plantatsions, shrubs/trees and palatable grasses, rehabilitation of degraded forest areas, soil and water conservation, watershed management may be undertaken. To restore the identified site plantation with indigenous tree species that were previously available are recommended.

- ***ANR (Assistant Natural Regeneration)*** is recommended in the areas where there is natural rootstock or natural regeneration is coming. Total 1400 ha area of core zone (140 ha yearly in seven beat) will be taken for ANR to assist the natural recovery of the forest.
- ***Enrichment plantation*** - As there is limited number of mother tree in CWS, enrichment plantation with indigenous wide crown tree species (e.g. garjan, simul, chikrasi,chapalish, dhakijam, jarul, chalta, amra, bahera, ficus species, jackfruit, jam, dumur, borta, etc.) will be carried out
- Using Thali model (Figure 5A) and fence plantation (Figure 5B). Fence plantation will be raised in patches of one ha each. Thali plantation may also be protected through fencing in several patches.

Around 1400 ha (140 ha yearly in seven beat) of core zone will be brought under enrichment plantation using Thali, or fence with indigenous spps. In Thali plantation recommended spacing is (5m*5m) and in case of fence plantation spacing will be (3m*3m). Given protection against illicit felling and burning, plant succession will progress over a period towards semi-evergreen forests. Exotic species such as acacia, mangium and eucalyptus will not be planted inside the core zone.

- ***Fodder plantation or gully plugging -*** Palatable grasses for fodder plantations may include*Typha angustifolia, Alpimia nigra, Themeda arundinacea, Saccharum arundinaceum, Sacharumnarenga, Sacharum hookeri, Impreta cylinder,Sacharum spontaneum, Cymbopogan flexuosus and Setaria palmafolia.* These grasses may also be used for gully plugging in case soil erosion takes place due to gradient and run off in hillocks.

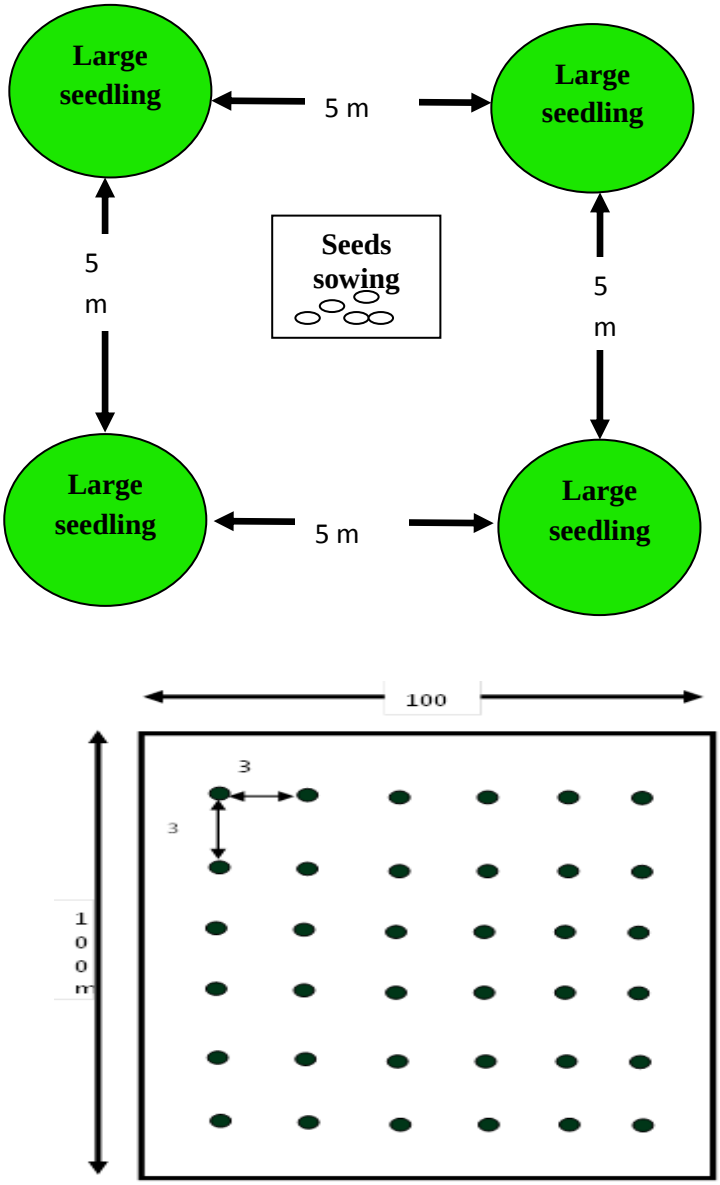


Figure 5 A. Thali plantation B. Fence plantation

- ***Maintenance of water bodies*** - A number of natural water bodies (ponds, lakes, charas) are present in the Sanctuary and they will be maintained and developed both for the use of wildlife and local people. Unauthorized fishing, hunting, cattle grazing should be controlled by involving local people as a part of co-management activities.

8.1.3 Wildlife Conservation and Recovery

For the conservation and recovery of wildlife, their habitat needs to be restored. As Elephant is the key stone species of CWS, elephant habitat should be restored and safe movement should be ensured through movement corridor management. IUCN has taken a project to indentify the **elephant corridors** of Bangladesh. Most of the corridors are in Cox'sbazar, Chittagong and Chittagong Hill Tracts. They have identified 12 numbers of corridors which start from Cox'sbazar south to Kaptai via Cox'sbazar north and Chittagong Forest Division. These corridors connect most of the Wildlife Sancturies and National Parks within the areas. The list of the corridors has been shown in annex 19. There is some water bodies locally called Dhepas within the PA which needs to be marked as the Dhepas are favorite places for

Elephant where they take rest at times. Palatable species for wildlife food may be introduced in CWS. It is recommended to introduce elephant preferred tree or grasses such as; Chapalish, bamboo, banana, bhuikumra, chalta, kanthal, sungrass, gilla lata etc. Elephant movement corridor needs to protect from all types of human interference and keep continuty from further fragmentation. For Birds Over-storey trees with twisted boles, furrowed bark or natural cavities will be retained (say 3-5 no/ha) to provide shelter for birds. Fruit and NTFPs bearing trees will also be retained and needs to be planted.

Again to reduce human wildlife conflict in CWS following action need to be taken-

- Prohibition of exotic species
- Plantation and conservation of indigenous species
- plantation of banana and bamboo
- Conservation of elephants reproduction site
- Conservation of water pool
- Ensuring safe movement of elephant through movement corridor
- Fire protection in wildlife habitat
- Less disturbance should be ensured incase of trainline construction inside the sanctuary to connect Cox'sbazar.

8.1.4 Action to improve Climate Change resilience

Climate resilience is the capacity to absorb stresses and continue functioning and adapt, reorganize, and evolve into more desirable configurations that improve the sustainability for future climate change impacts. Increasingly, climate change is threatening human communities around the world in a variety of ways such as rising sea levels, frequent severe storms, and tidal surges and floods.

Temperature rise contributes to global warming due to various factors like use of more fossil fuel, industrialization, forest degradation etc, while forest plantation and conservation mitigates climate change. To improve the situation in the protected areas the following measures will be taken.

- Conservation of natural forests from disturbances and by assisting the establishment of plantations with adapted and acceptable species.
- Measures that facilitate ecosystem shift or evolution aims to ease and manage natural adaptation processes. Such measures will include the reduction of fragmented landscapes, conserving genetic diversity and a large spectrum of forest types for their value and higher resilience, adopting species and genotypes that are adapted to future climates in forest plantations, planting mixed species in an uneven age structure.
- Encourage to use the renewable energy resource like solar energy and biogass

8.1.5 Smart Patrolling (CPGs, FD)

For effective protection of CWS SMART (Special Monitoring and Reporting Tool) patrolling may be apply by the FD with CPG. With the technical support from CGEIS, BFD has developed in the the Sundarban Reserved Forest a GIS/ GPS based system for the systematic collection of patrolling data (Anon, 2003). The following diagram may be apply in smart patrolling for effective protection of the sanctuary.

Community Patrol Group (CPG) is the most significant element of co-management concept. Their main duty is to protect forest against any criminal activities with the help of forest guards. In CPG man's group and woman's group are separated for their roles and responsibilities in forest management. Women have to duty just near their house while men have to visit the forest sites away from their dwelling house. Men and women are divided in sub-group for patrolling in different times. In every sub-group, number of manpower is 5-6. The manpower of Forest Department is very limited. After organizing of CPG, the condition of forest is now comparatively much better and forest crime has been reduced remarkably. Local people have joined in CPG mainly for the purpose of forest protection. Moreover they get some remuneration.

Illegal removal of forest products within the CWS considerably checked through widespread joint patrolling (FD staff, CPG member) inside the forests, particularly the core areas. The villagers from nearby village participation in protection activities are helpful as local people are well informed about the points and routes of biotic pressure. Communication network particularly needs strengthening by installing a radio communication network and by mobilizing more walki talkies, mobile telephones and vehicles. At least one four wheel jeep along with sufficient nos. of motor cycles needs to be provided for the use of the field staff; each beat would have at least one motor cycle.

In Chunati Range 7 and in Jaldi Range 4 CPGs are present. They are guided by the Forest Department. From 7 CPGs in Chunati, 4 are needed to be continuous patrolling in core zone area of Chunati Rangeand in Jaldi Range 2 out of 4 are needed to be patrolling in this core area. At present (2014) Tk 10 is provided per person for patrolling and Tk 100 is proposed to be given to CPG members. A reward system is required for good work for the members to motivate their conservation in the forest.

8.2 Management of PA (non-conservation priority areas)

8.2.1 Rules and norms

The Management of PA within CWS where there is large scale encroachment and the areas are under litigation will be addressed separately as non-conservation priority areas. Such areas will be marked and delineated separately and intensive awareness program will be

taken. Homestead planting around the paras and villages may be done and effort should be taken to re-settle from core zone to buffer or impact zone.

Forest management in this zone (Non-conservation priority areas) will focus on conserving remaining natural forests and bringing back natural vegetation (composition and structure) and restore habitat for wildlife mainly Elephant from encroachment.This will be achieved by providing awareness building, plantation and protection (against encroachment, settlements etc) and encouraging restoration by watershed management, stream side plantation, biomass production.

8.2.2 Limits on encroachment, settlement and land uses

In CWS total core zone is 7764 ha and non-conservation priority area in core zone is 1580 ha (Agricultural land 598.10 ha. And settlement is 981.39 ha. See in Table 6) where mostly encroached by homestead and agriculture and with litigation.

In the core zone there are some scattered settlements and encroachments which should be evicted and rehabilitated from the core zone to other areas. Provision of funds for the rehabilitation of settlers has been kept in the budget (Annex 14a and 14b).

It is expected to have political commitment and administrative support from the law enforcing agencies to arrest the situation.

Two main measures for non-conservation priority areas are:

1) With the co-operation of all agencies and well established co-management committee and the initiative of FD can play a vital role to prohibit further encroachment (for agricultural land and settlement) and reverse the situation.
2) Agricultural lands and settlements will be converted to plantation, woodlot, agroforestry in Chunati and Jaldi range by 70 ha yearly (10 ha per beat) and **shifted the encroachers to impact zone day by day.**

8.2.3 Restoration activities

Watersheds will be identified for carrying out habitat management practices within the natural boundaries of a drainage area. An identified watershed will provide a context for a meaningful participation of local people. Appropriate land management 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 husbandry technologies (e.g. half moon trenches, contour furrows, staggered trenches, mulching, hedgerows, small check dams, impounding pits, small tanks, soil barriers and traps, diversion ditches, etc.), which can be implemented by local stakeholders by contributing their voluntary labor, will be implemented in the identified watersheds. ***Streamside*** will be planted with favorable tree species for control of landslide and erosion and for perennial water-flow.

8.2.4 Participatory biomass production

Main objective to manage this zone is to reduce the pressures on the Sanctuary by planting the vacant lands with suitable fast growing indigenous tree species and develop agroforestry systems on the lands being used for cultivation. Agroforestry (alley model or trees on farm boundary) may be suitable in those lands where farmers are raising agricultural crops and to meet the need of wood either for self-consumption or for cash sale. However, detailed consultations will be held with co-management committee and FD before finalizing any land-based management intervention for which technical support may be provided by local FD

staff. Fuelwood plantation must be increased to meet their need and to reduce the use of cowdung as fuel.

8.2.5 Smart Patrolling (CPGs, FD)

In Chunati Range 7 and in Jaldi Range 4 CPGs are present. Among this group 4 of Chunati Range and 2 of Jaldi Range are suggested for patrolling in core zone (8.1.5 patrols). From 7 CPGs in Chunati, remaining 3 are needed to be continuous patrolling in Buffer zone area of Chunati Range and remaining 2 out of 4 are needed to be patrolling in this Buffer area Jaldi Range.

8.3 Management of Buffer zone

8.3.1 Rules and Norms

Management of this area will focus on intensive production of replacement resources, particularly fuel wood, poles and timber, and NTFPs maintaining biodiversity and stability for elephant habitat. Existing short and long rotation plantations will be raised with indigenous species under participatory approach. However, the participants will, in addition to the protection of plantations, be responsible for providing biodiversity protection in the CWS areas. These plantations will not be clear felled but instead be managed under selection felling (mainly of exotic species) that the area can be naturally regenerated to be ultimately included in core zone as a mixed forest. The overall aim of this zone is to protect the core zone of CWS.The management of FD lands in this sub-zone will focus on sustainable use of the remaining natural patches, bringing existing plantations under co-management practices, raising participatory plantations of indigenous species in vacant areas, preventing conversion of forest into cultivated lands and maintaining biodiversity conservation values. Local stakeholders will be identified and co-management agreements signed for providing livelihood opportunities and protecting habitat.

Main management prescription of this zone will be specifically two types:

1) Plantation and
2) Grassland management

1) Plantations

- Social forestry practice involving co-management stakeholders. Species that are economically valuable and fast growing will be used in case of social forestry.
- Fuel wood plantation with fast growing species like *Acacia auriculiformis*.
- NTFP plantations will be promoted (e.g. bamboo, cane etc)
- For the conservation of biodiversity fruit bearing tree plantation.
- Introduction of indigenous species in1400 ha area through enrichment plantation, annually 140 ha of enrichment plantation (20 ha in each beat) will be done.

2) Grassland (Sunkhola) management:

Protection, development and sustainable use of the grasslands (sunkholas) patches in Chunati very important as a large number of poor people depend on them for their livelihood (sungrass being sold in local markets as thatch roof material). Grasslands have evolved in Chunati under an unplanned system of forest fires, forest grazing and site deterioration due to deforestation. The grasses are the most evolved species of plants and have short life cycle (takes short time to grow) which can sustainably managed annually. They can support a rich diversity of fauna, and are also efficient in absorbing rain water. The grassland

patches, interspersed with enrichment plantation will attract bird species and other fauna. In addition, sporadic patches of grasslands are good for elephants that regularly use them as their movement corridors. However, excessive exploitation of the sunkholas has made them unsustainable and immediate interventions are required for restoring the degraded sites. A controlled use of grasslands through rotational harvesting should be immediately put in place by thetwo CMCs in order to avoid unsustainable exploitation of sunkholas. So special groups of grassusers may be formed and linked with the CMCs.

8.3.2 Smart Patrolling (CPGs, FD)

According to section 8.1.5 and 8.2.5

8.4 Management of impact zone/ Landscape zone

8.4.1 Rules and norms

Landscape zone is created around the protected areas to control the biodiversity of the protected areas and reduce the dependency on forest resources and to create corridors for the movement of wildlife especially Asian Elephants. Landscape zones will focus on the surrounding lands that are helpful in protecting and conserving the core zone, and creating congenial habitat for wildlife. As opportunities for receiving tangible benefits from the conservation-oriented management of core zone are limited, adequate provisions will be made for off-forest livelihood opportunities provided to the local stakeholders in the interface landscape. Subsistence consumption needs of local people for fuelwood, NTFPs and timber will be met through co-management practices.

8.4.2 Social forestry

Social Forestry programs will be encouraged with a view to meet the forest product requirements of local population and to reduce dependency on forest, to reduce the process of ecological and climatic degradation through proper soil and water conservation and to improve the socio economic condition of the People. Due to scarcity of land, marginal and fallow land (slopes of roads, rails and embankments) will be brought under social forestry. Local people will be involved in social forestry program. The Plantation established under social forestry program will be harvested at the end of rotation (10 years) and the sale proceeds are distributed according to clause-20 of Social Forestry Rules-2004. Strip plantation (300 km) is recommended on both sides of the village roads involving local community. Awareness and training program will be conducted to make the people capable of homestead plantation.

8.4.3 Livelihood diversification and enhancement

As commercial harvesting is not allowed inside the PA and so no benefits flow to local people formally from the core areas as per the Wildlife (Preservation) (Amendment) Act, 1974. Other benefits for local communities needs to be explored through alternative income generation activities (AIGA) at the level of villages, user groups, collectives and individuals. Main objective of livelihood programs for landscape development is to develop appropriate linkages with livelihood programs and other projects/initiatives that will reduce biotic pressure on forests by providing alternative livelihood opportunities to poor stakeholders living in and around the PA. The Landscape Development Fund (LDF) will be created to provide sustainable funding for the members of user groups under the Co-Management Organization. Members and their associations will be encouraged to set up micro-enterprises to generate added value locally. The benefits from eco-tourism may also be ploughed back for the development of local communities and CWS. The following

appropriate production technologies, which may be implemented as a part of off-PA development interventions, were identified based on field investigations done by NGOs:

- **Integrated Homestead farming:** this activity will include component like vegetables (on open fields, machines, and other unutilized places around houses), cash crops (Betel leaf, Betel nut), horticultural and tree nursery, and apiculture (domesticated wild bees).
- **Cultivation of high value crop:** High value crops that are more nutritive, high price and more demand will be introduced.Suitable high value crops for the surrounding landscape include papaya, strawberry and mushroom cultivation.
- **Drought or salinity resilient rice:** Drought resilient paddy seeds (BRRI-42, BRRI-43), Salinity tolerant paddy seeds (BINA-7,8, 9, 10 & BRRI-40, 41, 47), BR- 22, 23, 29; Potato- Diamond, Genola; Cucumber-Queen, BARI-1&2; Bitter Gourd- BARI-3&4; Brinjal- BARI-4; Kakrol- Localvariety: Chilli- 1701; Summer Tomato- BARI 4 &6; Winter tamato- Surma and Udayan; Mug variety- BARI 4 &6) will be suggested from PCVA report of CREL.
- **Village tree nurseries:** Promotion of village tree nurseries for timber, fruit, vegetable, flower, fuel wood, fodder, medicinal and other NTFPs bearing species.
- **Agro forestry and homestead NTFPs production** If the promotion of agroforestry and NTFPs (such as planting bamboo, cane, medicinal plants *etc*) in the homestead then it can be easily accessible to the people and they can be economically benefited and pressure on forests may be reduced.
- **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 household's nutrition and cash sale.
- **Livestock rearing and fisheries** focusing on species which are not related to environmental degradation, such as broiler, layer, boar, rabbits and ducks.Fish culture (in micro-ponds), Duck-cum-fish culture (in family ponds),
- **Cottage industries** Bamboo plantation and promotion of cottage industries- based on bamboo and cane products or handicrafts.
- **Ecotourism** Local people may be trained as eco-guide and they can be economically benefitted.

8.4.4 Actions to reduce fuel wood collection/use

Fuel wood collection is one of the major problems of CWS. Most of the people in and around the Sanctuary are fully dependent on fuel wood for cooking. The poor landless female and young boys are engaged in collection of fuel wood from the CWS area. Even they cut seedlings and saplings and even bamboos for fuel wood. It is creating heavy pressure on the forest areas of CWS. To reduce the pressure on the forest the following measures may be taken.

- Introduction of improved cooking stoves (ICS)
- Facilitate training program about the benefits of ICS
- Biogas may be considered as another good substitute for fuelwood.
- Compressed rice husk (brickets) may be supplied
- Fuel wood plantation (e.g. *Acacia auriculiformis*) may be raised in the social forestry programs.
- Use of Solar energy to be introduced

8.4.5 Measures to improve community level resilience to hazards and climate change

CWS is vulnerable to a number for climatic effect like drought, cyclone and storms, flood, landslide etc. On the basis of recent Participatory community vulnerable assessment (PCVA) report of CREL following number of adaptive measures may be taken to improve community level resilience to hazards and climate change (Annex 10-11).

- Tree plantation in the degraded land, stream bank plantation, homestead etc and deep rooted tress and creepers will be used for controlling landslide.
- Drought and saline tolerant tree and crop species needs to be introduced
- Excavation and re-excavation of new and existing ponds for supply of clean drinking water;
- Rainwater harvesting and conservation in community ponds, community reservoirs and household tanks and motki (earthen jar)
- Installation of deep tube wells for the supply of drinking water.
- Village based information center may be established to give warning about natural disasters
- Community based cyclone shelter may be established.
- Mass awareness, training and campaign about various natural calamities
- Construction of embankments with appropriate drainage, height and width taking into account cyclone water levels;
- For the rehabilitation of affected people contact will be established with various government and non-government organization
- High rise ponds to protect fishes from the risks of flood and high tidal inundation may be another adaptation option to climate change.

8.4.6 Measures needed to improve elephant habitat conservation and reduction wildlife-human conflict

Specific measures to reduce wildlife human conflicts are:

1) Assure connectivity by identifying and conserving elephant corridors through interdiction of cultivation and settlement in these areas and habitat improvement through elephant favorable tree plantation.
2) All CMO members will need to be supported by sustainable AIGs which would help ensure better protection of elephant habitat.
3) CMO members, non- members, FD officials will be trained in elephant related issues and awareness building activities.
4) Applying electric fencing and bio fencing to protect Villages and cultivated areas;
5) Create salt licks to assist in elephant redistribution.
6) Development and implementation of human-elephant conflict compensation scheme;
7) Training CPGs and farmers in human elephant conflict management and early warning such as:
    - People shout loudly to alert surrounding people,
    - People gather to make noise, request elephants by shouting loudly saying "*Mama*".
    - At night they use torch light, sometimes fire flame to alleviate elephants.
    - Produce sound by beating drum or tin, blank gun fire, sound grenade (*Patka/baji*) etc.
8) Alternate agriculture inside forest boundaries which are elephant non-preferred crops. List of crops are given in annex 16.

8.5 Management Information System of PA

Management Information System (MIS) of Protected Area is envisaged as an integrated system which will be used to support the planning, implementation and monitoring of multi-objective forest management activities. The MIS can be used for strategic, tactical and operational planning and implementation, and operational control in and across administrative units and levels of the organizational hierarchy. Besides the databases and models required to support decision-making in the many programs of the Department, the MIS also has the ability to maintain current forest inventories, generate maps of spatially-oriented data, land cover types, plantations of various years, location of landscape villages etc. The MIS will facilitate archiving,

- Land records management e.g. boundary demarcation, land records updating, digital mapping etc.
- Information on PA land cover classes, years of plantation and distribution, landscape area zonation, co-management organizations and members, landscape villages with population statistics;
- Forest inventory data and analysed results;
- Plantation and harvest records including, nursery information (species wise stock details by beat and range), plantation journals and felling records.
- Human resources records from FD personnel including list of concerned officers and staffs with duration of each posting.
- project based intervention records, including list of projects with relevant project documents, lists of beneficiaries, members of various components of co-management organizations e.g. community patrol groups, eco-tour guides, local service providers etc.
- Socio-economic studies including CMO scorecard assessments, project beneficiaries, sample beneficiary surveys, gender scorecard analysis, value chain assessments etc.
- Forest offence records including encroachments, illicit harvests/removal of resources, poaching, human-wildlife conflicts etc.
- Technical studies conducted from projects, academic institutions and others.

8.5.1 Archiving PA information

- Protected Area Management Plan with associated data
- Land records with notifications
- Maps of PA landscapes with land cover, plantations, zonation, forest administrative units, distribution of VCFs, and other line and point features;
- Spatial data of the protected areas including GIS, GPS, remote sensing and Google Earth information
- Plantation and nursery records.
- CMC related information; profile, list of members in Council and Committees, list of VCFs, VCF member information, CPG information,
- CMC's project implementation information
- List of projects and relevant information including project activities;
- List of beneficiaries;
- Survey data and results including forest inventory, resident forest bird surveys, household surveys, etc.
- Forest Offence Records

9 Ecotourism

9.1 Eco-tourism

An environmentally sound eco-tourism or nature based touism system in the form of nature conservation, education and interpretation and to generate alternate income of the local community through the co-management organization will be established. The key tasks of the CWS management and other BFD units with regard to tourism development are:

(1) Zonation of tourism activities to reduce friction between eco-tourism, economic activities and biodiversity conservation.

(2) Quality management through staff accommodation and facilities, infrastructure, garbage management;

(3) Information and promotion (with support Wildlife Centre);

(4) Awareness and education (with support Wildlife Centre);

(5) Monitoring and enforcement (e.g. tourist entries, revenues, impacts).

9.2 Appropriate locations/zones in CWS and visitors level

Chunati Wildlife sanctuary has a great potentiality of ecotourism. This sanctuary is also full of natural beauty with rare flora and fauna. Beautiful hilly sites with Asiatic elephants and mother tree *Dipterocarpus turbinatus* which are the main attraction of this sanctuary. Main Eco-tourism places in Chunati Wildlife Sanctuary are zoning such as:

- Chunati Picnic spot at Chunati Range
- Bashkhali Eco-Park in Jaldi Range
- Natural beauty of puichari beat in Jaldi Range Office.

Annual visitor data is not available in CWS. To determine appropriate visitor level, a study is needed in CWS.

9.2.1 Chunati Eco-tourism Spot at Chunati Range

In Chunati Range near Chunati Beat there is scope of Ecotourism. Some tourist spot like natural garjan forest of bonpukur, bonpukur foot trail (distance nearly 2.5km and hiking time 45 minute) starts from the Lohagara Upazilla of Chittagong-Cox's bazaar highway near bonpukur where a basic information signboard stands, janggalia foot trail (distance nearly 3.5 km and hiking time 1.5 hour) starts from 1km south of Chunati range office Chittagong-Cox's bazaar highway. There is a watch tower and resting shed facilities for the visitors in Janggalia foot trail to watch Elephant and natural beauty of forest. There is a Nature Interpretation Center (NIC) near Chunati beat for the visitors, students which are a medium of nature education.One water body present near NIC between two hills where Elephant and other animals like monkey and deer comes for drinking water and resting. One suspension bridge will be constructed for tourist attraction.

9.2.2 Natural beauty of Puichari beat in Jaldi Range Office

There is a patch of natural Garjan Forest in Puichari to Toittang in Jaldi Range which is a remarkable site for tree lovers. If some development works such as; road construction from Prembazar to beat office, foot trail for forest visit, maintenance of Puichari Chara etc can be done in these areas it will be an attractive place for eco-tourism.

9.2.3 Bashkhali Eco-Park in Jaldi Range

Bashkhali eco-park is the main tourist attractive place in Chunati Wildlife Sanctuary. The Banskhali Eco-Park is a cluster of hills; which creates exceptionality and attraction to the people. It covers total 1000 hectares area. Two resting sheds, two rest houses, two hilltop observation towers have been built for the tourists, necessary step will be taken There is a 400 feet long hanging bridge in this park; which has connected two hills. Another 100 feet long suspension bridge on the canal connecting Daner Chhara (5km long) and Bamer Chhara (3km long) has been constructed in Banskhali Eco Park.This park was enriched with many animal species and plant species. It was a semi-evergreen forest. In a study 625 plant species, 21 species of amphibians, 30 species of reptiles, 167 species of birds and 20 species of mammals was idetified in Bashkhali Eco-park which was guided by zoology department of Jahangir nagar University under the fund of GIZ in 2012-2013. White-barred Kukri Snake was recorded first time in Bangladesh during this study in Bashkhali eco-park. Now the park is being planted with trees of timber value. Some ornamental and medicinal trees are also available here.

The main attraction of Banskhali Eco Park was the lake. At present the Eco-park in depleted condition due to damage of dam and the lake is dry. Infrastructures like road inside park, resting shed, zoo, watch tower, hanging bridge etc are also in bad condition. Security for the tourist inside park is not sufficient andnearly 4 km main Road of entrance from Monsuria bazaar to Eco-park is damaged. Shortage of staff is another problem of management. Proposed additional staff list are shown in (Annex 9) Last year in Bashkhali Eco-park nearly 23103 visitors came to visit the Eco-park and the revenue is 162000Taka from visitors and 43113Taka from parking fees. It will be more if the infrastructures and others facilities of the park are developed immediately.

The importance of other beat like Chambol, Jaldi, Napora is also attractive for the tourist. Nature camps (of 1-2 days duration) may be organized at places of interest within the Wildlife Sanctuary for students and youths for learning by experience and discussions on biodiversity conservation issues.

9.3 Entry fees

Among the identified sites entry fees is collected in Bashkhali Eco-park. At present the rate of entry fees fixed by the Govt. is shown in the Table 19.

Table 19 existing rate of entry fees fixed by the Govt. in Bashkhali Eco-park

Visitors Type			Present Fess(TK)	Proposed fees (TK)
1.	Adult (age above 15 years)		7	20
2.	Students (age below 15 years)		5	10
3.	Student group (below 100)		100	200
4.	Student group (above 100)		200	300
5.	Foreign tourist		5 $ (equal of Bangladeshi Tk)	50 $ (equal of Bangladeshi Tk)
6.	Vehicle	Bus	25	50
		Car/Microbus	15	30

If these sites are properly developed than it is possible to upgrade the entry fees at proposed level.A certain amount of entry feeTk.10 can be fixed in Chunati Beat and in Puichari Beat for the visit of Interpretation Center and natural beauty. The collected revenue can be used for the conservation of biodiversity and development of local people.

9.4 Facilities and infrastructure developments

Tourism facilities and maintenance operations are sustainable, durable, environment friendly, moderately priced, clean and self-sufficient need to be promoted in and around the Wildlife Sanctuary. List of facilities and infrastructural development work that are highly needed in Chunati Wildlife Sanctuary for sustainable Eco-tourism development are shown in Table 20.

Table 20 Facilities and Infrastructure development in Chunati Wildlife Sanctuary

Facilities and Infrastructures	Location and Development work
Basic Picnic Facilities	Resting shed and outdoor tables, simple toilets and litter disposal buckets/boxes, water facilities will be provided in the identified picnic spots (Mainly Bashkhali Eco-park and Chunati Beat) and in foot Trails.
Nature Trails	Nature trails (Puichari to Tuittang) will be developed for visitors' movement on foot, traversing key natural and cultural features of interest (e.g. Garjan forest, natural choras etc.) and maintenance of trails in Chunati.
Watch Tower	Renovation and maintenance of watch tower and Nature trails in Bashkhali Eco-park is necessary.
Hanging Bridge	One in Chunati beat.

Rest House and Dormitory	Two student dormitories and Rest house (Bashkhali Eco-park & Chunati beat) will be built to provide accommodation to students. Local entrepreneurs will be encouraged to set up nature camps and cottages for tourists in the impact zone.
Nature Interpretation Center	Maintenance of Interpretation center in Chunati beat. Establishment of one Interpretation Center in Bashkhali Eco-park.
Water bodies/ Lake	Maintenance of existing main water bodies such as daner chara lake, bamer chara lake in Bashkhali eco-park, puichari chara in puichari beat and water bodies in Chunati beat near interpretation center.
Sign-post and guidelines	Sign-posts with adequate information will be provided at main foot trail heads and insides.
Road construction	4km road construction from Munsuria bazaar to Bashkhali eco-park.

Basic picnic facilities such as Resting shed and outdoor tables, simple toilets and litter disposal buckets/boxes, water facilities will be provided along the foot trails and in the identified picnic spots of Wildlife sanctuary (Mainly Bashkhali Eco-park and Chunati Beat)

Nature trails will be developed for visitors' movement on foot, traversing key natural features (e.g. patches of dense forests, caves, cliffs, cultural remnants, natural streams/charas, religious places, tribal areas, etc.). Renovation of trails will be done by maintaining minimum necessary surface area and vegetation clearances will be limited. One hanging bridge is needed in chunati beat near interpretation center because there is a large water bodies (Dhepas) and its use by the wildlife mainly Elephant for water and resting. A list of do's and don'ts for visitors will also be prepared and made available at important visit places. Forest Rest Houses (FRHs) and student's dormitory will be built to provide accommodation to eco-tourists. Local entrepreneurs' will be encouraged to set up nature camps, lodges, dormitories, huts and cottages for tourists in interface landscape zone. A Nature Interpretation Centre in Bashkhali Eco-park will be established where landscape features of Wildlife Sanctuary may be depicted in pictorial forms including topographical and biodiversity patterns. Local exhibits, specimen of plants and wildlife, trophies and photographs may be added with proper leveling and description.

9.5 Promoting visits (publicity etc.)

The publicity of the Wildlife Sanctuary will be improved for propagating the scenic beauty of the Chunati Wildlife Sanctuaryincluding waterfall, Charas, green hills, and unique biodiversity etc. Adequate coverage in the electronic and print media (TV, Radio, Videos, newspaper, magazines, brochures, etc.) will be ensured for this purpose. Publicity and information materials having basic information about the Wildlife Sanctuary(mainly for Bashkhali Eco-park) will be provided to visitors by means of fixed signs, brochures, leaflets, printed guides etc. at key road access points. Mass Communication Officer of FD will have to play strong role in this program.

9.6 Ecotourism services (guides, training)

Guided tourism will be developed by involving unemployed youth members/naturalists of co-management councils/committees and user groups as eco-guides. 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.). They will also be trained on animal signals and calls, bird identification, biotic influences, local culture, etc. and how to move, walk and enjoy scenery without disturbing the nature.

9.7 Education and interpretation

Schools and colleges will be targeted for conservation education and increase awareness about ecotourism. Conducting talks, essays writing and competition will be included in neighboring schools as a part of awareness development. Sabuj Vahinis (Green Brigades) will be formed and trained in nearby schools and madarsas. A Nature Interpretation Centre, as a part of environment education will be established at Bashkhali Eco-Park where landscape features of WS will be displayed in pictorial forms including topographical and biodiversity patterns. Local exhibits, specimen of plants and wildlife, trophies and photographs may be added with proper leveling and description. It will consist of walkthrough displays, audio-visuals, explanatory printed materials, items of historical and conservation significance, etc. A video film on wildlife and its habitat and local cultural aspects may be developed for showing to visitors at Nature Interpretation Centre. An NTFP museum may be established to introduce local product base livelihood and culture**.**

10 Funding and resource mobilization

10.1 Budget requirements/ costs

Funding and resource mobilization is very important for implementing the management plan. To implement the management plan several activities were identified which needs a total budget of Tk **1975.770** million (**1048.440** million for Jaldi CMC and **927.330** for Chunati CMC) (Annex 14a and 14b) for 10 years period. These budget requirements cannot be fulfilled by the FD. The revenue budget of Government mainly confined for meeting the salary of FD staffs. Separate budget is needed to allocate to FD in ADP for implementing the plan. So development scheme is needed to implement the plan.

10.2 Resource mobilization

Internal financing within the PA, landscape, entry fees, Government revenue allocations and fund from local communities may be extracted for the sustainable management of CWS. At present no such fund are being mobilized for the management and improvement of PA. FD allocation towards the management of CWS is very negligible from which nothing can be managed or developed. Generally the development budget is an important source of funding for implementing the projects. There is no separate or specific allocation for the PA for the management of the protected areas. Separate project can be taken for the management of PA. Part retention 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- entry fee, rest house fee, donation etc.

10.3 External fund raising strategy

Externally derived funds are required to implement the management prescriptions of this plan. This may involve donor funded projects taken up by FD and/or CMC for the management of the PA and support to sustaining the landscape communities. Potential agencies include: GEF, carbon funds, World Bank, Asian Development Bank, European Commission, Japan International Co-operation Agency, and international NGOs. Smaller projects may be taken up with trust funds or foundations.Charitable donations including conservation and private sector may be for specific tasks or for general conservation of species.

10.4 Potential for ecosystem services payment (carbon payments)

CWS has some opportunity to generate its required funding through its ecosystem services especially through carbon trade. Because it has limited carbon stock at present, but through the effective implementation of this management plan scope of carbon trading will be enhanced tremendously because it is expected that forest cover will be augmented during the implementation period of this management plan.

11 Monitoring, adjustment of plans and research

11.1 Monitoring, adjustment of plans and research

Monitoring and research are tools for assessing the performance of conserving CWS and natural resource management in its buffer and landscape zones, as well as improving understanding of the functions of the CWS in order to sustainably manage constituent forests and biodiversity. An appropriate monitoring and research program will be developed with the following main objectives:

- To understand the trend of change upgrading or degradation of CWS ecosystem;
- To understand the biodiversity resources, ecosystem and landscape environment of CWS;
- To establish a baseline listing of all flora and fauna species for assessing their current abundance, distribution, and functional relationship among biotic communities;
- To develop quantitative population estimates for selected key species (Elephant for CWS) and develop detailed information on their current distribution and habitat use;
- To identify priority research and monitoring topics to help in the management program and gradually reduce the extent and degree of uncertainty while taking the management decisions for the Sanctuary.

11.2 Monitoring forest protection

One of the main parameters of monitoring forest protection may be “Declining incidence of illegal cutting”. All the activities and information regarding this parameter will be properly monitored time to time and documented by the association of FD staff and co-management organizations and reporting of the site manager (s) Beat officer to Range Officer andRange Officer to ACF, DFO. Indicators for forest monitoring are:

1) patrolling by FD officials with CPGs
2) Arrests (date, place, offence, conviction)
3) Awareness events, training delivery (when, target group, message/skill)
4) Revenue collection (when, resource, revenue collected)
5) consultations (when, target group, purpose)
6) Services rendered (e.g. a forestation/reforestation support, wildlife-human conflict management).

11.3 Monitoring changes in habitat/biodiversity/indicator species

A well-developed technique of monitoring in multi-species management scenario is to select one or more key species, and to ensure that habitat suitability for this species or a group of species is retained. Main species considered for purposes of macro-level habitat management while implementing this Management Plan is the elephant, requiring regenerating forest areas with grasses and bamboo for food and shelter, and water bodies for drinking and bathing. The long-term aim will be to maximize gains in quantity and quality of habitat, and quality of associated species.

Occurrence and abundance of animal species are important indicators for biological monitoring, particularly of birds (Aziz et al. 2004) and mammals, other vertebrates or

invertebrates may be used as indicator species. Changes of forest cover can be monitored by comparing remote sensing data of different years, or by recording vegetation class boundaries with a GPS. Variable width transects surveys along forest trails may be useful to determine the relative abundance of mammals. The strip transect sampling method will be applied at protected areas to conduct bird survey by Bangladesh bird club in 2014 funded by CREL project. This method is a combination of quadrate sampling and line transect sampling where object are counted from straight, long and narrow strips. Further this opportunistic survey method is suitable for recording the species diversity, composition and other important information.

Monitoring of environmental threats is important and using modern technology environmental monitoring can be done with RS/GIS analysis by RIMS.

The following parameters may be used to monitor changes in habitat and biodiversity in CWS (Table 21).

Table 21 Monitoring changes in habitat/biodiversity/indicator species and review plan

Important task	Responsible officer	Time	activities	indicators
Bird survey	WMCC	yearly	Field survey by BBC	Abundance of Density (number/sq.km) of indicator species.
Survey of animals	WMCC	yearly	Field survey	Abundance of animals.
Forest cover survey	BeatOfficer, RO,ACF,DFO,RIMS	yearly	Field survey Remote sensing	% increase of crown cover.
Carbon stock inventory	BeatOfficer, RO,ACF,DFO,RIMS	yearly	Field survey Remote sensing	% increase of basal area and density
Forest protection monitoring	Beat officer to DFO	Half yearly	Logbookkeeping reporting	Patrolling, Arrests, Awarenessevents, Revenue collection
Improved elephant status	Beat officer to DFO	yearly	Maintenance of elephant corridor and availability of food.	Increased the number of elephant. Damage to local inhabitants will be reduced.
Review management plan	DFO,WMCC	Every 10 year		Updated management plans

11.4 Research

Research at CWS is the task of research institutes such as universities and institutes for fundamental and applied research. Relevant research themes for the conservation of the CWS are:

(1) A study on connectivity of CWS in relation to other wildlife areas and land use planning

(2) Elephant ecology

(4) Biodiversity and ecology of amphibians

(5) Current hunting practices and impact on wildlife

(6) Economic valuation of ecosystem services of CWS

11.4.1 Socio-economic research

Socio-economic research is an integral part of proper management of resources and may be taken up on priority basis based on management objectives. Possible topics of investigation may include:

- the institutional development and economic sustainability of co-management council/committee and user groups formed at different levels,
- impacts and dependence of local people on the CWS,
- impacts of human activities on natural habitats,
- forward and backward linkages of nature tourism,
- sustainable collection, harvesting, storage and processing and marketing of NTFPs

Many of these studies will be carried out through action research and by associating local stakeholders. Prioritization of research topics will be decided in a Workshop in which key persons from FD and other relevant stakeholders will participate. A computerized data base and retrieval system will be established.

11.4.2 Ecological and biological research

Main topics of ecological research may include identification of fragile habitats and ecosystems, environmental impact studies, water body studies, evaluation of the contribution of the CWS in water yield and conservation, impacts of forest grazing and forest fires on natural regeneration and wildlife, and impacts of habitat changes and eco-tourism on wildlife.

Some relevant topics of biological research may include wildlife-population viability analyses, population dynamics and feeding behavior, wildlife niche use behavior, wildlife distribution patterns, wildlife seasonal variability and movements, and wildlife health and diseases. 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.

12 Gender, youth and ethnic community

12.1 Gender, youth and ethnic communities

There is a “Mog” para at Aziznagar beat in Chunati range living within the CWS. These ethnic groups have their own culture and tradition. Capacity building program may be taken to reduce gender inequality and ethnic community to reduce their dependency on forest. Youth empowerment program may be taken through club or co-operatives formation.

For empowerment and lifestyle improvement of women, youth and ethnic community of CWS area the following step may be taken;

- Formal and informal education for youth, men, women and ethnic community
- Technical training for livelihood improvement
- Special donation
- Awareness building for biodiversity conservation.
- Training to Youth Tourism
- Handicrafts
- Tailoring
- Improved vegetable Cultivation
- Improved Cooking Stroves
- Technical Training
- Economic supports
- Job placement
- Fuel Wood plantation in Homesteads
- Substitutte of pole in betel leaf cultivation
- Nursery
- Mushroom
- Compost manure

13 Model structure for annual plans

Table 22 model structure of annual plans

Program	Activities	Timing	Main output	Responsibilities
Coordination	Meeting	Monthly	Resolution forest land tenure problem Increased administrative support	DFO and Deputy commissioner, Cox's Bazar
	Meeting with law enforcing Agency	Quarterly	Reduced forest offence and crime Increased security support Increased forest protection support	Police, Army with FD
	Co-management committee meeting (CMC)	Monthly	preparation of monthly plan Improvement of forest protection	CMC and FD
	Co-management committee meeting (CMC)	Quarterly	Quarterly progress assessment	CMC and FD
	council meeting (CMC)	Half-yearly	Decision making and planning Strengthening CMO	CMC and FD
Habitat protection program	Mapping	First year, second year and third year	Zoning map Boundary map	FD and CMC
	Boundary demarcation	First year, second year and third year	Delineating boundaries	FD and CMC
	Control of illicit felling through patrolling	Full planning period	Reduced biotic interference Increased vegetation cover Increased regeneration	FD/ CMC

			Increased biodiversity	
	Control of forest grazing through patrolling	Full planning period	Reduced biotic interference Increased vegetation cover Increased regeneration Increased biodiversity	FD/CMC/CPG
	Control of encroachment through patrolling and motivation, law enforment	Full planning period	Prevent encroachment Recovery of forest land	FD/CMC
	Resolving forest conflicts	Full planning period	Increased forest protection	FD/ CMC
Core zone management **(conservation priority area)**	Enrichment plantation	Full planning period(yearly)	Increased vegetation cover Increased biodiversity	FD
	Assisted natural regeneration	Full planning period(yearly)	Increased Vegetation cover Increased natural regeneration Increased biodiversity	FD
	Biodiversity conservation through protection	Full planning period(yearly)	Increased biodiversity	FD
Core zone management **(non-conservation priority area)**	Homestead plantation	Full planning period(yearly)	Livelihood / habitat improvement	FD/CMC
	Agroforestry	Full planning period(yearly)	Livelihood / habitat improvement	FD/ CMC
Buffer zone management	Enrichment plantation	Full planning period(yearly)	Increased vegetation cover	FD/ CMC/
	Participatory afforestation	Full planning period(yearly)	Increased vegetation cover along with mitigation of demand	FD/CMC
	Elephant corridor management	Full planning period(yearly)	Food and shelter movement ensured	FD/CMC
	NTFP regeneration	Full planning period(yearly)	Supplement the demand of local	FD/CMC

			people	
	Involving stakeholder in forest protection	Full planning period(yearly)	Biodiversity conservation and resolved habitat	FD/CMC
Landscape zone/ Community services and actions	Climate resilient activity described in annex 11	Full planning period	Adaption to climate change impact	CREL with close coordination of FD
	Homestead plantation	Full planning period(yearly)	Livelihood improvement	CREL/FD
	Climate resilient cultivation	Full planning period(yearly)	Increased food security	CMC/ CREL
	Community based cylone shelter building	Second year	Increased safety of life Increased social development	CREL with close coordination of FD
	Elephant corridor involving stakeholders in forest protection	Full planning period(yearly)	Providing food and shelter (improved habitat)	CREL/ FD/CMC
	Alternative Income Generating Activities (AIGA)	Full planning period(yearly)	Improved livelihood Reduced dependency on forest resources	CREL/ CMC/ NGOs
Infrastructure including visitor facilities	Renovation and maintenance of Forest rest house	Full plan period (yearly)	Improved visitor facilities	FD/CREL
	Renovation and maintenance of staff quarter	Full plan period (yearly)	Improved staff facilities	FD/CREL
	Nature trail development descrived in tourism	First Year and second year	Improved ecotourism	FD/CREL
	Nature interpretation center and museum	second year, third year and fourth year	maximum enjoy minimum impact on the PA	FD/CREL
	Observation tower	second year and third year	Improved tourism facilities	FD/CREL
	Gol Ghar (resting facilities)	Second year and third year	Improved tourism facilities	FD/CREL
	Construction and maintenance picnic site	second year and third year	Improved tourism facilities	FD/CREL
	Sign board	second year	Improved ecotourism	FD/CREL

	Tube well	Full planning period	Improved quality of ecotourism	FD/CREL
	Toilet	First year and second year	Improved ecotourism	FD/CREL
	Gate	First year and second year	Improved management	FD/CREL
	Ticket counter	First year	Improved tourism management	FD/CREL
	Waste bin	First year and fourth year	Improve waste management Less pollution	FD/CREL
	Student dormitory	second year, third year and fourth year	Increase learning	FD/CREL
	gate	First year and second year	Increase protection	CREL/FD
	Parking place	First year and second year	Sustainable traffic management	CREL/FD
	Tourist shop and cafeteria	First year, second year and third year	Increase tourism facilities Local Livlihood	CREL/FD
Visitor management	Development code of conduct	First year and second year	Increased ecotourism management	FD/CREL
	Monitoring and recoding visitors entry	Full planning period	enhanced ecotourism management	FD/CREL
	Training eco-guides	Full planning period(yearly)	Trained eco-guide for nature conservation	FD/ CMC
	Publicity materials	Full planning period(yearly)	Awareness about nature based tourism	FD/ CMC
	Entry fee collection	Full planning period	revenue earning	FD/CMC
Capacity building and research	PA archive development	Full Planning period	Knowledge management help effective decision making	FD/ CMC
	Training assessment for participatory PA management	Full Planning period	Training identified	FD/CMC
	Training of staffs and stakeholders on conservation	Full planning period	Trained personnel	FD/CMC

	Meeting and workshop	Full planning period	Capacity building	FD/CMC
	Conservation research studies	Full planning period	Develop Guidelines for conservation	FD/CMC
	Biological research	Full planning period	Develop Guidelines	FD/CMC
	Research on utilization	Full planning period	Develop Guidelines	FD/CMC
	Ecological research	Full planning period	Develop Guidelines	FD/CMC
	Silvicultural research	Full planning period	Develop Guidelines	FD/CMC
	Carbon inventory	Full planning period	Capacity building	FD
	Human- elephant conflict management	Full Planning period	Biodiversity conservation Reduce property damage	FD/ CMC
Capacity building for Livelihood program	Selecting priority production technologies (reconnaissance surveys)	First year and second year	Assessed Demand – supply	FD/CMC
	Identifying a list of feasible production Technologies	First year and second year	Feasible production technologies identified	FD/CMC
	Stakeholders' Consultations on the proposed production technologies	First year and second year	Locally accepted Effective approach identified	FD/CMC
	Developing skills and loan for alternative income generation (poultry, fisheries, nursery, sewing etc.)	First year and second year	Livelihood development	FD/CMC
Staffing and resource need	Staff recruitment described in annex 9	First year and second year	Effective management	FD/ CMC
Fund raising Plan	Potential financial sources described	Full planning period	Financial efficiency	FD/ CMC

Bibliography

Art, H.M., Alam, M.K. and Bari, A. 2004. Assessment of Forest Department's Institutional Organization and Capacity to Manage the Protected Area System of Bangladesh. Nishorgo Support Project, Bangladesh.

Aziz N., Haque E., Thompson P., DeCosse P.J., Collis W.J., 2004. Using Participatory Bird Counts to Assess Protected Area (PA) Management Impacts: A Proposal and Design for Bangladesh. Nishorgo Support Project, IRG.

Bangladesh forest department 2010, http://www.bforest.gov.bd

Bangladesh Bird Club. 2014. Preliminary report on Resident Forest bird Survey.

BCAS, 2013, "Data analysis for CREI Project by Karmakar, S."

BMD, 2012, 'Climate data collected up to 2012 from Bangladesh Meteorological Department".

Co-management Plan of Chunati Wildlife Sanctuary, Chunati Co-management committee, Lohagara, Chittagong (2010-2015).

Co-management Plan of Chunati Wildlife Sanctuary, Jaldi Co-management committee, Jaldi, Chittagong (2010-2015).

CREL. 2014. Participatory Community Vulnerability Assessment report on Chunati beat of Chunati Range, Chittagong.

CREL. 2014. Participatory Community Vulnerability Assessment report on Jaldi beat of Jaldi Range, Bashkhali, Chittagong.

CREL. 2014. Participatory Community Vulnerability Assessment report on Chambol beat of Jaldi Range, Bashkhali, Chittagong.

CREL. 2014. Participatory Community Vulnerability Assessment report on Napora beat of Jaldi Range, Bashkhali, Chittagong.

CREL. 2014. Participatory Community Vulnerability Assessment report on Puichari beat of Jaldi Range, Bashkhali, Chittagong.

Dudley N., 2007. Management Effectiveness Tracking Tool, Reporting Progress at Protected Area Sites: Second Edition. WWF/The World Bank

FD (Forest Department). 2006. Management Plan for Chunati Wildlife Sanctuary. FD, Government of Bangladesh, Nishorgo Support Project:Dhaka.

GIZ. 2011. Baseline survey for management of natural resources and community forestry in Chunati Wildlife Sanctuary Project, Chittagong. Unpublished Report. German development co-operation: Dhaka.

GIZ, 2015. Forest Cover Change using RS-GIS Chunati Wildlife Sanctuary (FCC-CWS)

GOB. 1992 . Forestry Master Plan. Conservation. Government of Bangladesh. ADB TA No. 1355-BAN.

Nishorgo. 2004. Site-level Field Appraisal for Protected Area Co-management: Chunati Wildlife Sanctuary, Chittagong.

Nishorgo. 2003. Secondary data collection for pilot Protected Area: Chunati Wildlife Sanctuary, Chittagong.

IUCN. 2003. Action Research for Conservation of Asian Elephants in Bangladesh. Report-2 submitted to US Fish and Wildlife Service.

Latif, M.A., Netzer Michael and Chowdhury, Ruhul Mohaiman, 2015. Forest carbon inventory 2014 at eight protected areas in Bangladesh.

Management Plans for Chunati Wildlife Sanctuary. 2006. Nishorgo Support Project, Bangladesh.

Management Plans for Teknaf Wildlife Sanctuary. 2006. Nishorgo Support Project, Bangladesh.

Nasim, A. 2004. Core Indicators for Protected Areas. Nishorgo Support Project, Bangladesh.

Rosario, E. A. 1997. The Conservation Management Plan of the Protected Areas other than those in the Sundarban in Bangladesh. Forest Resource Management Project, Forest Department, Bangladesh.

Tecsult. 2001. First Five Year Management Plan for Lawachara National Park. Forestry Sector Project, Bangladesh.

USAID .2003. Performance Monitoring Plan. USAID, Washington.

.

Annex

Annex 1: Gazette Notification of Chunati Wildlife Sanctuary

THE BANGLADESH GAZETTE, MARCH 18 1986

MINISTRY OF AGRICULTURE AND FOREST

Section XII

NOTIFICATION

Dhaka, the 18th March, 1986

No. XII/ For- 1/84/174. In exercise of the power conferred under article 23 (1) of Bangladesh Wildlife (Preservation) (Amendment Act, 1973 (P.O. No. 23 of 1973), the Government is pleased to declare the following are of Reserved Forests under the Chittagong Forest Division to be "Wildlife Sanctuary" with effect from the date of issue of this notification:-

Compartment	Legal Status of proposed Sanctuary	Area (in Acres)	Total area
1, Chunati (Portion on west of Chittagong- Cox's bazaar road).	Reserved Forests	2004	
2. Satgarh (Portion on west of Chittagong- Cox's bazaar road).	Do	839	
3. Goyalmara	Do	3585	
4. Puichari	Do	3346	
5. Napura	Do	3975	
6. Jaldi	Do	2837	
7. Chambal	Do	2571	19,157

BY ORDER OF THE PRESIDENT
Sd/-S.A MAHMOOD (Secretary)

No. XII/For-1/84/174

Copy forwarded for information and necessary action to:

1. Secretary, Ministry of L.A. & L.R. Dhaka
2. Commissioner, Chittagong Division
3. Chief Conservator of Forest, Ban Bhavan, Mohakhali, Dhaka
4. Conservator of Forest, Eastern Circle, Chittagong
5. Deputy Commissioner, Chittagong
6. Sudt. of B.G. Press, Tejgaon, Dhaka. He is requested to kindly publish the notification in the next issue of the Bangladesh Gazette and supply 50 copies to the Ministry for official use.

Sd/- A.K.M. Serajul Islam
Section Officer

No. CCF (WL)/2M-240/86/124

Dated 1-4-8

Copy forwarded to the Divisional Forest Officer, Chittagong Division for information and necessary action. He is requested to engage his staff to protect the wildlife sanctuary.

(S.M. Sarker)
Conservator of forests
General Administration & Wildlife

Annex 2: Useful glossary

Biodiversity	The variety of life and its processes including complexity of species, communities, gene pools and ecological functions.
Buffer zone	*It is an area peripheral of Chunati Wildlife Sanctuary, where restrictions are placed upon resource use or special development measures are undertaken to enhance the conservation values of the area*. *This peripheral area* can provide the local inhabitants with the privilege of regular consumption of forest products.
Core zone	These areas are securely protected sites for conserving biological diversity. The entire forest area 7764 ha that was declared as Wildlife Sanctuary in the official gazette is designated as core zone.
Framework tree species	**The framework species method involves planting mixtures of 20-30 indigenous forest tree species, which are typical of the target forest ecosystem. these species** 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 ecosystemcan return naturally.
Impact 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.
Landscape	Landscape comprises the visible features of an area of land, including the physical elements of landforms such as mountains, hills, water bodies such as rivers, lakes, ponds and the sea, living elements of land cover including indigenous vegetation, human elements including different forms of land use, buildings and structures, and transitory elements such as lighting and weather conditions. Ecologically landscape consists of mosaic of natural communities – associations of plants and animals and their related processes and interactions.
Keystone species	Animals or plants which by virtue of their presence or absence alter the structure of a community.
Succession stage:	A stage or recognizable condition of a plant community which occurs during its development from bare ground to climax.

Annex 3: Plantation information of Chunati Range (Source respective range office)

Year	Project Name	Plantation Type	Chunati Range (Ha)	Total area in (Ha)
2002-2003	Non development Project	Fodder Plantation Herbal Plantation	20.0 05.0	25.0
2003-2004	Biodiversity Conservation Project	Fodder Plantation. Biodiversity Conservation Project	25.0 20.0	45.0
2004-2005	Non development Project	Herbal Plantation	5.0	05.0
2005-2006	Nishorgo Support Project	Buffer Plantation Enrichment Plantation	15.0 20.0	35.0
2006-2007	Nishorgo Support Project	Buffer Plantation Enrichment Plantation. Foods and Production Plantation	15.0 30.0 47.22	92.22
2007-2008	Biodiversity Conservation Project. Nishorgo Support Project	Long rotation Plantation. Buffer Plantation	90.0 65.0 43.08	173.8
2008-2009	Biodiversity Conservation Project. Nishorgo Support Project	Long rotation Plantation. Buffer Plantation Coppice Plantation	60.0 30.0 20.0	110.0
2009-2010	Biodiversity Conservation Project.	Long rotation Plantation.	100.0	100.0
2010-2011	Biodiversity Conservation Project.	Long rotation Plantation.	150.0	150.0
2011-2012	IPAC Project	Social Forestry Plantation	8.0	08.0
2012-2013	Biodiversity Conservation and Eco-tourism Project.	Fodder Plantation. Aesthetic Plantation	20.0 40.0	20.40
2013-2014	M.N.R.C.F-Chunati	Buffer Plantation A.N.R Plantation	60.0 100.0	160.0
			Total	**923.70**

Annex 4: Plantation information of Jaldi Range (Source respective range office)

Beat	Year Planted Area (ha)								Type of Plantation
	02-03	03-04	05-06	06-07	07-08	08-09	03-11	Total	
Puichori					5.76				
Napora			10	10	10				
Chambol			10	20.90	10				Enrichment Plantation
Jaldi								76.66	
Total			20	30.90	25.76				
Puichori			5		29.74	18.97			
Napora				5	30	15			
Chambol					25	15		198.79	Buffer Plantation
Jaldi				10	30	24			
Total			5	15	114.74	63.97			
Puichori				15	15				
Napora				7				52	Fodder Plantation
Chambol				5	5				
Jaldi				5	5				
Total				32	20				
								5	Grass Plantation
Chambol				5					
Total				5					
Puichori	15	10							
Napora		10							
Chambol		10						85	FSP
Jaldi	40								
Total	55	30							
Puichori							205		
Napora							206	837	LR
Chambol							196		
Jaldi							230		
Total							837		

									GIZ Project SR ANR
								90	
								175	
Total								**1519.45**	

Annex 5: List of wildlife species

A number of flora and fauna inventories have been completed for Chunati forests. Although Hussain's (1991) floral inventory is the most exhaustive, other recent studies give updated flora situation in Chunati. The following list of wildlife species of Chunati is based on:

BCAS (1997) *Biological Survey*. Bangladesh Centre for Advanced Studies, Dhaka

Scientific name	**Family name**	**Common name**
Spilornis cheela	Accipitridae	Crested Serpent-Eagle
Alcedo atthis	Accipitridae	Common Kingfisher
Halcyon amyrnesis	Accipitridae	White-throated Kingfisher
Cypsiurus parvus	Apodidae	Palm Swift
Ardeola grayii	Ardeidae	Indian Pond-Heron
Bubulcus ibis	Ardeidae	Cattle Egret
Egretta garzetta	Ardeidae	Little Egret
Bufo melanostictus	Bufonidae	Common Toad
Pericrocotus cinnamomeus	Campephagidae	Small Minivet
Cuon alpinus	Canidae	Red Dog, Wild Dog, Dhole
Megalaima lineate	Capitonidae	Lineated Barbet
Macaca mulatta	Cercopithecidae	Rhesus Macaque (Banor)
Ptyas mucosus	Columbidae	Common Rat Snake
Columba livia	Columbidae	Rock Pigeon
Streptopelia chinensis	Columbidae	Spotted Dove
Streptopelia orientalis	Columbidae	Rufous Turtle Dove
Streptopelia tranquebarica	Columbidae	Red Collared-Dove
Coracias benghalensis	Coraciidae	Indian Roller
Corvus macrorhynchus	Corvidae	Large-billed Crow
Corvus splendens	Corvidae	House Crow
Dendrocitta vagabunda	Corvidae	Rufous Treepie
Centropus sinensis	Cuculidae	Greater Coucal
Rhopodytes tristis	Cuculidae	Malkoha,
Dicrurus adsimilis	Dicruridae	Black Drongo
Dicrurus aeneus	Dicruridae	Bronzed Drongo
Dicrurus leucophaeus	Dicruridae	Ashy Drongo
Elephus maximus	Elephantidae	Indian Elephant

Hirundo rustica	Hirundinidae	Barn Swallow
Aegithinia tiphia	Irenidae	Common Iora
Sterna aurantica	Laridae	River Tern
Anthus novaeseelandiae	Motacillidae	Australasian Pipit
Motacilla alba	Motacillidae	Whie Wagtail
Acrocephalus Agricola	Muscicapidae	Paddyfield Warbler
Acrocephalus dumetorum	Muscicapidae	Blyth's Reed-Warbler
Capsychus saularis	Muscicapidae	Oriental Magpie-Robin
Orthotomus sutorius	Muscicapidae	Tailor Bird
Rhabdophis submunata	Muscicapidae	Rednecked Keelbeck
Nectarinia zeylonica	Nectariniidae	Purple-rumped Sunbird
Oriolus xanthornus	Oriolidae	Black-hooded Oriole
Dinopium benghalense	Picidae	Woodpecker, Red-backed
Psittacula alexandri	Picidae	Red-breasted Parakeet
Pycnonotus cafer	Pycnonotidae	Red-vented Bulbul
Pycnonotus jocosus	Pycnonotidae	Red-whiskered Bulbul
Rana cyanophlyctis	Ranidae	Skipper Frog
Rana limnocharis	Ranidae	Cricket Frog
Mabuya carinata	Sciuridae	Common Skink
Callosciurus pygerythrus	Sciuridae	Irrawaddy Squirrel
Acridotheres fuscus	Sciuridae	Orange-bellied Squirrel
Acridotheres tristis	Sciuridae	Jungle Myna
Sturmus contra	Sciuridae	Common Myna
Sus scrofa	Suidae	Indian Wild Pig
Zosterops palpebrosa	Zosteropidae	White Eye Indian Small

Annex 6: List of Birds Recorded in Chunati WS (NSP, IPAC, CREL)

Sl	**English Name**	***Genus***	***Species***	**St.**	**Ha**	**Status in CWS**
1	Red Junglefowl	*Gallus*	*gallus*	r	F	r
2	Lesser Whistling Duck	*Dendrocygna*	*javanica*	W/r	W	uc
3	Rock (Feral) Pigeon	*Columba*	*livia*	R	V	c
4	Oriental Turtle-Dove	*Streptopelia*	*orientalis*	r	Fe	r
5	Eurasian Collared Dove	*Streptopelia*	*decaocto*	R	V	uc
6	Red Turtle-Dove	*Streptopelia*	*tranquebarica*	R	V	uc
7	Western Spotted Dove	*Spilopelia*	*suratensis*	R	V	c
8	Grey-capped Emerald Dove	*Chalcophaps*	*indica*	R	F	r
9	Grey-fronted Green Pigeon	*Treron*	*affinis*	r	Fe	uc
10	Thick-billed Green Pigeon	*Treron*	*curvirostra*	r	Fe	1
11	Yellow-footed Green Pigeon	*Treron*	*phoenicopterus*	R	F	uc
12	Large-tailed Nightjar	*Caprimulgus*	*macrurus*	R	F	uc
13	Asian Palm-Swift	*Cypsiurus*	*balasiensis*	R	V	uc
14	House Swift	*Apus*	*nipalensis*	R	V	c

Sl	English Name	*Genus*	*Species*	St.	Ha	Status in CWS
15	Greater Coucal	*Centropus*	*sinensis*	R	V	uc
16	Lesser Coucal	*Centropus*	*bengalensis*	R	B	r
17	Green-billed Malkoha	*Phaenicophaeus*	*tristis*	R	F	r
18	Jacobin (Pied) Cuckoo	*Clamator*	*jacobinus*	S	V	r
19	Chestnut-winged Cuckoo	*Clamator*	*coromandus*	s	Fe	r
20	Western Koel	*Eudynamys*	*scolopacea*	R	V	uc
21	Violet Cuckoo	*Chrysococcyx*	*xanthorhynchus*	r	Fe	1
22	Banded Bay Cuckoo	*Cacomantis*	*sonneratii*	r	Fe	r
23	Plaintive Cuckoo	*Cacomantis*	*merulinus*	R	V	c
24	Large Hawk Cuckoo	*Hierococcyx*	*sparverioides*	w	Fe	r
25	Common Hawk Cuckoo	*Hierococcyx*	*varius*	R	V	c
26	Indian Cuckoo	*Cuculus*	*micropterus*	R	V	c
27	White-breasted Waterhen	*Amaurornis*	*phoenicurus*	r	W	uc
28	Watercock	*Gallicrex*	*cinerea*	r	Wh	1
29	Common Moorhen	*Gallinula*	*chloropus*	r	W	r
30	Asian Openbill	*Anastomus*	*oscitans*	r	W	1
31	Yellow Bittern	*Ixobrychus*	*sinensis*	r	Wp	r
32	Cinnamon Bittern	*Ixobrychus*	*cinnamomeus*	R	Wp	uc
33	Black Bittern	*Ixobrychus*	*flavicollis*	r	Wp	1
34	Malayan Night Heron	*Gorsachius*	*melanolophus*	r	Fe	1
35	Black-crowned Night Heron	*Nycticorax*	*nycticorax*	R	Wp	r
36	Green-backed (Striated) Heron	*Butorides*	*striatus*	R	W	r
37	Indian Pond Heron	*Ardeola*	*grayii*	R	W	uc
38	Cattle Egret	*Bubulcus*	*ibis*	R	W	uc
39	Great (White) Egret	*Ardea*	*albus*	R	W	r
40	Intermediate (Yellow-billed) Egret	*Ardea*	*intermedia*	R	W	uc
41	Little Egret	*Egretta*	*garzetta*	R	W	uc
42	Little Cormorant	*Microcarbo*	*niger*	R	W	c
43	Little Ringed Plover	*Charadrius*	*dubius*	Wr	Wr	r
44	Red-wattled Lapwing	*Vanellus*	*indicus*	R	W	uc
45	Greater Painted-snipe	*Rostratula*	*benghalensis*	r	W	uc
46	Bronze-winged Jacana	*Metopidius*	*indicus*	r	W	uc
47	Pintail Snipe	*Gallinago*	*stenura*	W	W	r
48	Common Snipe	*Gallinago*	*gallinago*	W	W	r
49	Common Sandpiper	*Actitis*	*hypoleucos*	W	Wr	r
50	Green Sandpiper	*Tringa*	*ochropus*	W	Wr	r
51	Wood Sandpiper	*Tringa*	*glareola*	W	W	r
52	Barred Buttonquail	*Turnix*	*suscitator*	r	Fe	uc
53	Common Barn Owl	*Tyto*	*alba*	r	V	r
54	Brown Boobook (Hawk Owl)	*Ninox*	*scutulata*	R	V	c
55	Asian Barred Owlet	*Glaucidium*	*cuculoides*	R	Fe	r
56	Spotted Owlet	*Athene*	*brama*	R	V	c
57	Collared Scops Owl	*Otus*	*lettia*	R	VF	r
58	Oriental Scops Owl	*Otus*	*sunia*	R	F	r
59	Dusky Eagle-Owl	*Bubo*	*coromandus*	r	Fd	1
60	Brown Fish Owl	*Ketupa*	*zeylonensis*	r	VF	r
61	Osprey	*Pandion*	*haliaetus*	w	W	r
62	Black-shouldered Kite	*Elanus*	*axillaris*	R	V	uc
63	Oriental Honey-buzzard	*Pernis*	*ptilorhynchus*	r	F	uc
64	Jerdon's Baza	*Aviceda*	*jerdoni*	r	Fe	1

Sl	English Name	*Genus*	*Species*	St.	Ha	Status in CWS
65	Black Baza	*Aviceda*	*leuphotes*	w	Fe	r
66	Crested Serpent Eagle	*Spilornis*	*cheela*	R	FV	c
67	White-rumped Vulture	*Gyps*	*bengalensis*	r	V	r
68	Changeable Hawk Eagle	*Nisaetus*	*cirrhatus*	r	F	r
69	Shikra	*Accipiter*	*badius*	R	V	r
70	Besra	*Accipiter*	*virgatus*	r	Fe	uc
71	Brahminy Kite	*Haliastur*	*indus*	R	V	uc
72	Black Kite	*Milvus*	*migrans*	R	V	uc
73	Red-headed Trogon	*Harpactes*	*erythrocephalus*	r	Fe	r
74	Common Hoopoe	*Upupa*	*epops*	r	V	uc
75	Blue-bearded Bee-eater	*Nyctyornis*	*athertoni*	r	Fe	1
76	Asian Green Bee-eater	*Merops*	*orientalis*	R	V	uc
77	Chestnut-headed Bee-eater	*Merops*	*leschenaulti*	r	Fe	uc
78	Blue-tailed Bee-eater	*Merops*	*philippinus*	r	V	?
79	Indian Roller	*Coracias*	*benghalensis*	R	V	uc
80	(Oriental) Dollarbird	*Eurystomus*	*orientalis*	ps	Fe	r
81	Common Kingfisher	*Alcedo*	*atthis*	R	W	c
82	Pied Kingfisher	*Ceryle*	*rudis*	R	Wr	r
83	Stork-billed Kingfisher	*Pelargopsis*	*capensis*	R	W	uc
84	White-breasted Kingfisher	*Halcyon*	*smyrnensis*	R	V	uc
85	Coppersmith Barbet	*Psilopogon*	*haemacephalus*	R	VFd	c
86	Blue-eared Barbet	*Psilopogon*	*cyanotis*	r	Fe	r
87	Lineated Barbet	*Psilopogon*	*lineatus*	R	F	c
88	Blue-throated Barbet	*Psilopogon*	*asiaticus*	R	Fe	c
89	Eurasian Wryneck	*Jynx*	*torquilla*	w	V	uc
90	White-browed Piculet	*Sasia*	*ochracea*	r	Fe	1
91	Greater Flameback (Goldenback)	*Chrysocolaptes*	*guttacristatus*	R	F	r
92	Black-rumped (Lesser) Flameback (Goldenback)	*Dinopium*	*benghalense*	R	V	r
93	Lesser Yellownape	*Picus*	*chlorolophus*	R	Fe	r
94	Bllack-naped (Grey-headed) Woodpecker	*Picus*	*guerini*	R	Fe	1
95	Great Slaty Woodpecker	*Mulleripicus*	*pulverulentus*	r	Fe	r
96	Fulvous-breasted Woodpecker	*Dendrocopos*	*macei*	R	V	c
97	Common Kestrel	*Falco*	*tinnunculus*	w	V	uc
98	Vernal Hanging Parrot	*Loriculus*	*vernalis*	r	FeB	1
99	Red-breasted Parakeet	*Psittacula*	*alexandri*	R	FeB	uc
100	Rose-ringed Parakeet	*Psittacula*	*krameri*	R	V	c
101	Blue-naped Pitta	*Pitta*	*nipalensis*	r	Fe	2
102	Hooded Pitta	*Pitta*	*sordida*	s	Fe	r
103	Ashy Woodswallow	*Artamus*	*fuscus*	R	V	uc
104	Common Iora	*Aegithina*	*tiphia*	R	FV	uc
105	Large Woodshrike	*Tephrodornis*	*gularis*	R	Fe	r
106	Common Woodshrike	*Tephrodornis*	*pondicerianus*	R	Fd	c
107	Large Cuckooshrike	*Coracina*	*macei*	R	F	c
108	Black-winged Cuckooshrike	*Coracina*	*melaschistos*	w	F	r
109	Black-headed Cuckooshrike	*Coracina*	*melanoptera*	r	Fd	r
110	Rosy Minivet	*Pericrocotus*	*roseus*	w	Fe	r
111	Ashy Minivet	*Pericrocotus*	*divaricatus*	v	F	r
112	Small Minivet	*Pericrocotus*	*cinnamomeus*	r	Fd	c

Sl	English Name	*Genus*	*Species*	St.	Ha	Status in CWS
113	Scarlet Minivet	*Pericrocotus*	*flammeus*	R	Fe	c
114	Brown Shrike	*Lanius*	*cristatus*	W	V	c
115	Long-tailed Shrike	*Lanius*	*schach*	R	V	c
116	Grey-backed Shrike	*Lanius*	*tephronotus*	w	B	uc
117	Black-naped Oriole	*Oriolus*	*chinensis*	r	F	1
118	Black-hooded Oriole	*Oriolus*	*xanthornus*	R	V	uc
119	Maroon Oriole	*Oriolus*	*traillii*	w	Fe	1
120	Black Drongo	*Dicrurus*	*macrocercus*	R	V	uc
121	Ashy Drongo	*Dicrurus*	*leucophaeus*	W	F	r
122	Bronzed Drongo	*Dicrurus*	*aeneus*	R	F	c
123	Hair-crested Drongo	*Dicrurus*	*hottentotus*	R	F	r
124	Greater Racket-tailed Drongo	*Dicrurus*	*paradiseus*	R	Fe	c
125	White-throated Fantail	*Rhipidura*	*albicollis*	r	V	c
126	Black-naped Monarch	*Hypothymis*	*azurea*	R	F	r
127	Asian Paradise-flycatcher	*Terpsiphone*	*paradisi*	r	F	r
128	(Common) Green Magpie	*Cissa*	*chinensis*	r	Fe	r
129	Rufous Treepie	*Dendrocitta*	*vagabunda*	R	VFd	uc
130	Grey Treepie	*Dendrocitta*	*formosae*	R	Fe	r
131	House Crow	*Corvus*	*splendens*	R	V	c
132	Jungle (Large-billed) Crow	*Corvus*	*macrorhynchos*	R	V	r
133	Great Tit	*Parus*	*major*	r	Fd	uc
134	Barn Swallow	*Hirundo*	*rustica*	Wr	V	c
135	Red-rumped Swallow	*Hirundo*	*daurica*	w	V	uc
136	Bengal (Rufous-winged) (Bush) Lark	*Mirafra*	*assamica*	R	B	c
137	Zitting Cisticola	*Cisticola*	*juncidis*	R	V	c
138	Grey-breasted Prinia	*Prinia*	*hodgsonii*	R	B	c
139	Plain Prinia	*Prinia*	*inornata*	R	B	uc
140	Black-headed Bulbul	*Pycnonotus*	*atriceps*	R	Fe	r
141	Black-crested Bulbul	*Pycnonotus*	*melanicterus*	R	F	r
142	Red-whiskered Bulbul	*Pycnonotus*	*jocosus*	R	FB	c
143	Red-vented Bulbul	*Pycnonotus*	*cafer*	R	VB	c
144	Olive Bulbul	*Iole*	*virescens*	r	Fe	1
145	White-throated Bulbul	*Alophoixus*	*flaveolus*	R	Fe	c
146	Common Tailorbird	*Orthotomus*	*sutorius*	R	VB	c
147	Dark-necked Tailorbird	*Orthotomus*	*atrogularis*	R	Fe	r
148	Striated Grassbird	*Megalurus*	*palustris*	R	W	uc
149	Asian Fairy Bluebird	*Irena*	*puella*	R	Fe	r
150	Blue-winged Leafbird	*Chloropsis*	*cochinchinensis*	r	Fe	r
151	Golden-fronted Leafbird	*Chloropsis*	*aurifrons*	R	F	c
152	Blue Rock Thrush	*Monticola*	*solitarius*	w	V	uc
153	Blue Whistling Thrush	*Myophonus*	*caeruleus*	w	F	uc
154	Orange-headed Thrush	*Zoothera*	*citrina*	r	F	r
155	Taiga (Red-throated) Flycatcher	*Ficedula*	*albicilla*	W	FV	c
156	Verditer Flycatcher	*Eumyias*	*thalassina*	w	F	uc
157	Pale-chinned (Brooks's) Blue Flycatcher	*Cyornis*	*poliogenys*	r	Fe	r
158	Grey-headed Canary-Flycatcher	*Culicicapa*	*ceylonensis*	W	F	c
159	Oriental Magpie-Robin	*Copsychus*	*saularis*	R	V	c

Sl	English Name	*Genus*	*Species*	St.	Ha	Status in CWS
160	White-rumped Shama	*Copsychus*	*malabaricus*	R	F	r
161	Black Redstart	*Phoenicurus*	*ochruros*	w	VB	r
162	White-tailed Robin	*Myiomela*	*leucura*	r	Fe	1
163	Black-backed Forktail	*Enicurus*	*immaculatus*	r	Fe	1
164	Common Stonechat	*Saxicola*	*torquata*	W	VB	c
165	Pied Bush Chat	*Saxicola*	*caprata*	r	B	r
166	Asian Glossy Starling	*Aplonis*	*panayensis*	r	Fe	1
167	Chestnut-tailed Starling	*Sturnus*	*malabaricus*	R	V	uc
168	Pied (Myna) Starling	*Sturnus*	*contra*	R	V	c
169	Common Myna	*Acridotheres*	*tristis*	R	V	c
170	Jungle Myna	*Acridotheres*	*fuscus*	R	V	uc
171	Common Hill Myna	*Gracula*	*religiosa*	R	Fe	c
172	Velvet-fronted Nuthatch	*Sitta*	*frontalis*	r	F	1
173	Oriental White-eye	*Zosterops*	*palpebrosus*	R	F	c
174	Blyth's Reed Warbler	*Acrocephalus*	*dumetorum*	W	VB	c
175	Dusky Warbler	*Phylloscopus*	*fuscatus*	W	BW	uc
176	Tickell's Leaf Warbler	*Phylloscopus*	*affinis*	W	B	uc
177	Yellow-browed Warbler	*Phylloscopus*	*inornatus*	W	F	c
178	Greenish Warbler	*Phylloscopus*	*trochiloides*	W	F	uc
179	Golden-spectacled Warbler sp	*Seicercus*	*sp*			1
180	White-crested Laughingthrush	*Garrulax*	*leucolophus*	r	Fe	r
181	Lesser Necklaced Laughingthrush	*Garrulax*	*monileger*	r	Fe	r
182	Greater Necklaced Laughingthrush	*Garrulax*	*pectoralis*	R	Fe	r
183	Rufous-necked Laughingthrush	*Garrulax*	*ruficollis*	R	B	uc
184	Abbott's Babbler	*Malacocincla*	*abbotti*	R	Fe	c
185	Puff-throated (Spotted) Babbler	*Pellorneum*	*ruficeps*	R	F	c
186	Large Scimitar Babbler	*Pomatorhinus*	*hypoleucos*	r	Fe	r
187	White-browed Scimitar Babbler	*Pomatorhinus*	*schisticeps*	r	Fe	r
188	Rufous-fronted Babbler	*Stachyris*	*rufifrons*	r	Fe	r
189	Grey-throated Babbler	*Stachyris*	*nigriceps*	r	Fe	r
190	Striped Tit Babbler	*Macronous*	*gularis*	R	Fe	c
191	Chestnut-capped Babbler	*Timalia*	*pileata*	r	BG	r
192	Striated Babbler	*Turdoides*	*earlei*	R	B	r
193	Thick-billed Flowerpecker	*Dicaeum*	*agile*	r	F	uc
194	Pale-billed (Tickell's) Flowerpecker	*Dicaeum*	*erythrorynchos*	R	VF	c
195	Plain Flowerpecker	*Dicaeum*	*concolor*	r	F	r
196	Scarlet-backed Flowerpecker	*Dicaeum*	*cruentatum*	R	Fe	c
197	Ruby-cheeked Sunbird	*Anthreptes*	*singalensis*	R	F	c
198	Purple-rumped Sunbird	*Nectarinia*	*zeylonica*	R	V	uc
199	Purple-throated Sunbird	*Nectarinia*	*sperata*	R	Fe	c
200	Purple Sunbird	*Nectarinia*	*asiatica*	R	VB	c
201	Crimson Sunbird	*Aethopyga*	*siparaja*	R	F	c
202	Little Spiderhunter	*Arachnothera*	*longirostra*	R	Fe	c
203	Streaked Spiderhunter	*Arachnothera*	*magna*	r	Fe	1
204	House Sparrow	*Passer*	*domesticus*	R	V	r
205	Forest Wagtail	*Dendronanthus*	*indicus*	p	F	c
206	White Wagtail	*Motacilla*	*alba*	W	VW	c
207	White-browed Wagtail	*Motacilla*	*maderaspatensis*	r	W	c

Sl	English Name	*Genus*	*Species*	St.	Ha	Status in CWS
208	Citrine Wagtail	*Motacilla*	*citreola*	W	W	r
209	Yellow Wagtail	*Motacilla*	*flava*	W	VW	c
210	Grey Wagtail	*Motacilla*	*cinerea*	W	VW	uc
211	Paddyfield Pipit	*Anthus*	*rufulus*	R	VG	c
212	Olive-backed Pipit	*Anthus*	*hodgsoni*	W	FB	c
213	Streaked Weaver	*Ploceus*	*manyar*	r	W	1
214	Baya Weaver	*Ploceus*	*philippinus*	R	V	c
215	Indian Silverbill	*Lonchura*	*malabarica*	r	V	r
216	White-rumped Munia	*Lonchura*	*striata*	r	Fe	uc
217	Scaly-breasted Munia	*Lonchura*	*punctulata*	R	V	c
218	Black-headed Munia	*Lonchura*	*malacca*	r	W	r
219	Common Rosefinch	*Carpodacus*	*erythrinus*	w	V	1
	No of species recorded					**219**

St – National Status: resident=r, winter=w, passage=p, summer (monsoon)=sStatus in CWS: common=c, uncommon=uc, rare=r, 1-5 records=number

Hab (Habitat): Forest (all)=F, Evergreen forest=Fe, Mangroves=Fm, Wetland=W, Haors=Wh, Rivers=Wr, Villages=V, Bushes=B, Coast=C, Grassland=G

Annex 7: List of plant species

A number of flora and fauna inventories have been completed for Chunati forests. The following list of plant species reported from the Chunati Forest area is based on the survey conducted by GIZ in 2011 with the coordination of Instutite of Forestry and Environmental Sciences, University of Chottagong.

Table: [F = Fuelwood, FD = Food and Fodder, M = Medicinal, N = Miscellaneous, T= Timber and Nk= Not known]

Tree species recorded from Chunati WS along their uses			
Scientific Name	**Family**	**Local name**	**Uses**
Accacia auriculiformis	Mimosaceae	Akashmoni	F, N,T
Accacia hybrid	Mimosaceae	Hybrid Acacia	F,T
Accacia mangium	Mimosaceae	Mangium	F, Fd, T
Acronychia pedunculata	Rutaceae	Bonjamir	Fd, M, N, T
Aegle marmelos	Rutaceae	Bel	Fd, M, T
Albizia chinensis	Mimosaceae	Chakua Koroi	Fd, M, T
Albizia lebbeck	Mimosaceae	Kalo Koroi	F, N, T
Albizia odoratissima	Mimosaceae	Tetoya Koroi	Fd, M, N, T
Albizia procera	Mimosaceae	Sada Koroi	F, N, T
Albizia richardiana	Mimosaceae	Raj Koroi	N,T
Allophylus cobbe	Sapindaceae	Chita	F, M
Alstonia scholaris	Apocynaceae	Chatim	M, N
Anacardium occidental	Anacardiaceae	Kaju Badam	Fd, M, T
Annona reticulate	Annonaceae	Ata	Fd, M, N
Annona squamosal	Annonaceae	Sharifa	Fd, M

Anogeissus acuminate	Combtreteceae	Sikori	N, T
Antidesma acidum	Euphorbiaceae	Elena	Fd, M
Antidesma bunius	Euphorbiaceae	Bonshiaboka	Fd, M
Antidesma ghaesembilla	Euphorbiaceae	Khudijam	M
Antidesma velutinum	Euphorbiaceae	Elena	F
Aporosa dioica	Euphorbiaceae	Pat Kharolla	Fd, T
Aporosa wallichii	Euphorbiaceae	Castoma	Fd
Aphanamixis polystachya	Meliaceae	Pitraj	M, T
Araucaria cunninghamii	Araucariaceae	Christmas Tree	N
Aqualaria agallocha	Thymeliaceae	Agar	N
Ardisia colorata	Myrsinaceae	Siaberala	M
Ardisia paniculata	Myrsinaceae	Barochallya	Nk
Areca catechu	Arecaceae	Supari	Fd, M, T
Artocarpus chama	Moraceae	Chapalish	Fd, T
Artocarpus heterophyllus	Moraceae	Kanthal	Fd, N, T
Artocarpus lacucha	Moraceae	Borta	Fd, M, T
Barringtonia acutangula	Lecythidaceae	Hijol	M
Bauhinia purpurea	Caesalpiniaceae	Rakta Chandan	M, N, T
Bhesa robusta	Celastraceae	Salkachra	T
Baccaurea ramiflora	Euphorbiaceae	Lotkon	Fd, N, M
Bombax insigne	Bombacaceae	Bontula	N
Borassus flabellifer	Arececeae	Tal	Fd, M,N, T
Brownlowia elata	Tiliaceae	Moos	T
Bombax ceiba	Bombacaceae	Shimultula	M, T
Butea monosperma	Fabaceae	Palash	Fd
Caesalpinia pulcherriama	Caesalpiniaceae	Radhachura	M, N
Callicarpa arborea	Verbenaceae	Bormala	Fd, M, N
Callicarpa macrophylla	Verbenaceae	Boro Bormala	M
Carallia brachiate	Rhizophoraceae	Keyabong	M, N, T
Cassia fistula	Caesalpiniaceae	Sonalu	Fd, M, N, T
Cassia nodosa	Caesalpiniaceae	Bon Sonalu	N, T
Chukrasia tabularis	Meliaceae	Chikrassi	M, N, T
Cinnamomum glaucescens	Lauraceae	Gonoroi	T
Cinnamomum iners	Lauraceae	Tez-Bohol	M, T
Citrus maxiam	Rutaceae	Jambura	Fd, M, N
Citrus reticulate	Rutaceae	Komla	Fd, M,
Cocos nocifera	Arecaceae	Narikel	Fd, N
Cordia dichotoma	Boraginaceae	Bohal	Fd, M, N, T

Cordia fragrantissima	Boraginaceae	Kaladuti	N, T
Cordia serata	Boraginaceae	Koratsora	Fd
Dalbergia sissoo	Fabaceae	Sossoo	Fd, T
Delonix regia	Caesalpiniaceae	Krishnachura	N
Dillenia indica	Dilleniaceae	Chalta	Fd, M, T
Dillenia scabrella	Dilleniaceae	Hargeja	F, T
Diospyros balacoi	Ebenaceae	Bilati Gab	Fd, T
Diospyros malabarica	Ebenaceae	Deshi Gab	Fd, M, N, T
Diospyros Montana	Ebenaceae	Bon Gab	N, T
Diospyros pilosula	Ebenaceae	Khalta Gab	T
Diospyros spp.	Ebenaceae	Gab	T
Dipterocarpus alatus	Dipterocarpaceae	Dollia Garjon	M, T
Dipterocarpus costatus	Dipterocarpaceae	Baitta Garjon	F, N, T
Dipterocarpus turbinatus	Dipterocarpaceae	Tellia Garjon	N, T
Duabanga grandiflora	Sonneratiaceae	Bandarhola	T
Elaeocarpus floribundus	Elaeocarpaceae	Titpai	Fd, N, T
Elaeocarpus tectorius	Elaeocarpaceae	Jalpai	Fd, T
Erythrina fusca	Fabaceae	Panya Mandar	N
Erythrina variegate	Fabaceae	Mandar	F, N, M
Eucalyptus citridora	Myrtaceae	Eucalyptus	N, T
Ficus auricilata	Moraceae	Lal Dumor	Fd
Eucalyptus camaldulensis	Myrtaceae	Eucalyptus	F, N, T
Ficus benjamiana	Moraceae	Pakur	F, N
Ficus conloblata	Moraceae	Bata Dumor	Fd
Ficus elasta	Moraceae	Indian Rubber	N
Ficus geniculate	Moraceae	Baragula	Fd, M, N
Ficus hispida	Moraceae	Dumor	F
Ficus lamponga	Moraceae	Jigbot	F
Ficus lanceolata	Moraceae	Buti-Dumor	Fd
Ficus microcarpa	Moraceae	Jigbot	M, N
Ficus bengalensis	Moraceae	Bot	Fd, M , N
Ficus racemosa	Moraceae	Jogyadumor	Fd, M, N
Ficus semicordata	Moraceae	Chokorgola	Fd, M, N
Garcinia cowa	Clusiaceae	Kao	Fd, M, T
Garcinia lanceaefolia	Clusiaceae	Badijja Gola	Fd, M
Garcinia speciosa	Clusiaceae	Moigga Kao	T
Gardenia coronaria	Rubiaceae	Konnayari	F, T
Glochidion arborescens	Euphorbiaceae		F, T

Glochidion lanceolarium	Euphorbiaceae	Lomba Kechua	Fd, M, T
Gmelina arborea	Verbenaceae	Gamar	M, T
Grewia nervosa	Tiliaceae	Assargola	F, M
Grewia sapida	Tiliaceae	Naricha	Fd, N
Grewia serrulata	Tiliaceae	Naricha	Fd
Helicia excels	Proteaceae	Baka Pakan	T
Helicia robusta	Proteaceae	Baro Pakan	T
Holarrhena antidysenterica	Apocynaceae	Kuroj	M
Hopea odorata	Dipterocarpaceae	Telsur	M, N, T
Lagerstroemia speciosa	Lythraceae	Painna Jarul	M, T
Lagerstroemia thorelli	Lythraceae	Bilati Jarul	N
Lepisanthes rubiginosa	Sapindaceae	Rubiharina	Fd, M, T
Lepisanthes senegalensis	Sapindaceae	Gotaharina	Fd, M, T
Lepisanthes tetraphylla	Sapindaceae	Chariharina	T
Leucaena leucocephala	Mimosaceae	Ipil-Ipil	Fd, N, T
Litchi chinnensis	Sapindaceae	Litchu	Fd, M
Lithucarpus acuminate	Fagaceae	Dholibatna	T
Lithucarpus elegans	Fagaceae	Kali Batna	F, N, T
Lithucarpus polystachya	Fagaceae	Batna	F, T
Litsea angustifolia	Lauraceae	Chotosial Buka	Fd
Litsea glutinosa	Lauraceae	Karjoki Menda	M, N
Litsea monopetala	Lauraceae	Kat Meda	M
Maesa remantacea	Myrsinaceae	Lalmoricha	Nk
Maesa peniculata	Myrsinaceae	Kuljoni	M
Mallotus philippensis	Euphorbiaceae	Sindur	F, Fd, M
Maesa indica	Myrsinaceae	Maesa	Fd, M
Mallotus roxburghianus	Euphorbiaceae	Chotobura	N
Mallotus tetracoccus	Euphorbiaceae	Nunia Kachi	F
Mangifera indica	Anacardiaceae	Aam	F, Fd, T
Mangifera sylvatica	Anacardiaceae	Uriam	Fd, N, T
Melia sempervirens	Meliaceae	Goranim	M, N, T
Mesua ferra	Clusiaceae	Nagesswar	M, N, T
Michalia champaca	Magnoliaceae	Champa	N, T
Mimusops elengi	Sapotaceae	Bokul	M, N, T
Mitragyna parvifolia	Rubiaceae	Dakrum	F, T
Murraya peniculata	Rutaceae	Kamini	M,T
Neolamarckia cadamba	Rubiaceae	Kadam	M,T
Neulitsea cassia	Lauraceae	Saya Nayachita	M,T

Olax acuminata	Olacaceae	Olamina	Nk
Olea diocia	Oleaceae	Kau	M, T
Olea salicifolia	Oleaceae	Olisal	F, T
Ormosia robusta	Fabaceae	Hokkanali	T
Oroxylum indicum	Bignoniaceae	Thona	M, T
Palaquium polyanthum	Sapotaceae	Tali	N, T
Phoebe lanceolata	Lauraceae	Dulia	T
Phoebe pallida	Lauraceae	Fibli	Nk
Phoenix sylvestris	Arecaceae	Khejur	Fd, M, N
Phyllanthus emblica	Euphorbiaceae	Amloki	Fd, M, N
Pinus oocarpa	Pinaceae	Pine	T
Plumeria ruba	Apocynaceae	Katgolap	M, N
Polyalthia longifolia	Annonaceae	Debdaru	N, T
Protium serratum	Burseraceae	Gotgutia	Fd, T
Psidium guajava	Myrtaceae	Peyara	F, Fd, M, N
Pterospermum semisagittatum	Sterculiaceae	Lana- Assar	M, T
Pterygota alata	Sterculiaceae	Buddanarikel	N, T
Quercus gomeziana	Fagaceae	Khossa Batna	M
Ricinus cumminis	Euphorbiaceae	Varenda	M
Samanea saman	Momosaceae	Rain Tree	F, Fd, N, T
Sapium baccatum	Euphorbiaceae	Cham Phata	F, Fd, T
Saraca asoka	Caesalpiniaceae	Ashok	M, N
Schima wallichii	Theaceae	Kanak	M, N, T
Senna siamea	Caesalpiniaceae	Minjiri	Fd, N, T
Shorea robusta	Dipterocarpaceae	Sal	M, N, T
Stereospermum colais	Bignoniaceae	Dharmara	M, T
Stereospermum suavaolens	Bignoniaceae	Parul	M, T
Streblus asper	Moraceae	Sheora	Fd, M
Sterculia villosa	Sterculiaceae	Baro Udal	M, N
Swientenia mahagoni	Meliaceae	Mahagoni	T
Swientonia floribunda	Anacardiaceae	Civit	N, T
Syzygium claviflora	Myrtaceae	Nolijam	Fd
Syzygium cumini	Myrtaceae	Kalojam	F, Fd, M, T
Syzygium firmum	Myrtaceae	Dhakijam	Fd, N
Syzygium fruticosum	Myrtaceae	Putijam	F, Fd, N
Syzygium jambos	Myrtaceae	Gulapjam	Fd, M, T
Syzygium magacarpum	Myrtaceae	Chaltajam	F, T
Syzygium praecox	Myrtaceae	Poorajam	Fd, T

Syzygium ramosissium	Myrtaceae	Ram Jamrul	Fd, T
Tamarindus indica	Caesalpiniaceae	Tentul	F, Fd, M, N
Tamilnadia ulignosa	Rubiaceae	Mankanta	M
Tectona grandis	Verbenaceae	Shegun	M, T
Terminalia arjuna	Combretaceae	Arjun	M, T
Terminalia bellirica	Combretaceae	Bohera	Fd, M, T
Terminalia catappa	Combretaceae	Katbadam	Fd, M, T
Terminalia chebula	Combretaceae	Haritaki	M , N, T
Toona ciliate	Meliaceae	Chondon Suruj	T
Trema orientalis	Ulmaceae	Jiban	M
Trewia nudiflora	Euphobiaceae	Pitali	M
Vitex glabrata	Verbenaceae	Goda Arsol	Fd, M, T
Vitex peduncularis	Verbenaceae	Goda	Fd, M, T
Vitex pinnata	Verbenaceae	Horina Goda	T
Xanthophyllum andamanicum	Xanthophyllaceae	Hansuk	T
Xanthophyllum flavescens	Xanthophyllaceae	Bazna	F, T
Xylia xylocarpus	Mimosaceae	Lohakath	M , N, T
Zanthoxylum rheta	Rutaceae	Bajna	M , N, T
Ziziphus mauritiana	Rhamnaceae	Boroi	F, Fd

[F= Fuelwood, Fd= Food and Fodder, M= Medicinal, N= Miscellaneous, and Nk= Not known]

Shrub species recorded from CWS			
Scientific Name	**Family**	**Local Name**	**Uses**
Abelmoschus moschatus	Malvaceae	Mushak Dana	N, M
Abutilon indicum	Malvaceae	Petari	M, N
Acacia caesia	Mimosaceae	Sue	Nk
Acalypha hispida	Euphorbiaceae	Bara Hatisur	M
Aganosma marginta	Apocynaceae	Chhoto Kuruj	N
Allamanda cathartica	Apocynaceae	Mike Ful	M, N
Ardisia elliptica	Myrsinaceae	Sayatica	Fd
Ardisia humilis	Myrsinaceae	Chaudhoa	M, N
Bambusa tulda	Poaceae	Mitinga	Fd, N
Bambusa vulgaris	Poaceae	Baijja	Fd, N
Bauhinia acuminata	Caesalpiniaceae	Sada Kanchan	N, M
Breynia retusa	Euphorbiaceae	Silpati	M
Bridelia stipularis	Euphorbiaceae	Patkhoi	Fd, M
Bridelia tomentosa	Euphorbiaceae	Khoi	M
Buddleja asiatica	Loganiaceae	Neemda	M

Cajanus cajan	Fabaceae	Arhor	Fd, M
Calotropis gigantea	Asclepiataceae	Akhand	M
Calycopteris floribunda	Combretaceae	Guicha Lata	M
Canthium angustifolium	Rubiaceae	Kantanalia	Nk
Canthium parvifolium	Rubiaceae	Bish Main	M
Capparis zeylanica	Capparaceae	Kalolkra	Fd, M
Citrus aurantifolia	Rutaceae	Lebu	Fd, M
Clausena suffruticosa	Rutaceae	Kali Moricha	Fd, N
Clerodendrum indicum	Verbenaceae	Bamunhatti	M, N
Clerodendrum serratum	Verbenaceae	Borangi	Fd
Clerodendrum viscosum	Verbenaceae	Bhant	M
Combretum latifolium	Combretaceae	Sada Guicha	M
Combretum acuminatum	Combretaceae	Sada Guicha	Nk
Croton caudatus	Euphorbiaceae	Horokjala	M
Croton roxburghii	Euphorbiaceae	Baragacha	M
Dendrocnide sinuata	Urtiaceae	Bangaladandi	F, N
Desmodium heterocarpon	Fabaceae	Karpo Modi	Nk
Duranta repens	Verbenaceae	Kanta Mehedi	M, N
Ficus heterophyla	Moraceae	Bhiu Domur	Fd, M
Ficus heteropleura	Moraceae	Domur	F, Fd
Flemingia macrophylla	Fabaceae	Bara-Salphan	M
Flemingia strobilifera	Fabaceae	Simbusak	Nk
Gardenia augusta	Rubiaceae	Ghandoraj	M, N
Helicia erratica	Proteaceae	Khara Pakan	Fd
Hibiscus rosa-sinensis	Malvaceae	Joba	M, N
Hibiscus surattensis	Malvaceae	Ram Bhindi	Fd, M
Ixora acumnata	Rubiaceae	Nata Rangan	N
Ixora chinensis	Rubiaceae	Rongon	Nk
Ixora cuneifolia	Rubiaceae	Beoful	Nk
Justicia adhatoda	Acanthaceae	Basok Pata	M
Justicia gendarussa	Acanthaceae	Kala Basak	N
Lantana camara	Verbenaceae	Lantana	M, N
Leea aequata	Leeaceae	Kak Jhonga	Nk
Licuala peltata	Arecaceae	Kuruk Pata	N
Mallotus repandus	Euphorbiaceae	Gunti	M
Manihot esculenta	Euphorbiaceae	Shimul Alu	M
Ipomoea fistulosa	Convolvulaceae	Dhol Kolmi	Fd, M
Murraya koenigii	Rutaceae	Choto Kamini	Fd, M, N

Mussaenda erythrophylla	Rubiaceae	Muchanda	N
Mycetica longifolia	Rubiaceae	-	Nk
Oxyceros kunstleri	Rubiaceae	Mohis Kanta	M
Pedilathus tithymaloidies	Euphorbiaceae	-	M
Phyllanthus reticulata	Euphorbiaceae	Chiki	M
Premna esculenta	Verbenaceae	Lalana	Fd, M
Sarcochlamys pulcherrima	Urticaceae	Korobi	F, Fd
Schefflera elliptica	Araliaceae	Jengli	M
Sida rhombifolia	Malvaceae	Lalberela	M
Solanum melongena	Solanaceae	Begun	Fd, M
Solanum torvum	Solanaceae	Tit Begun	Fd, M
Tabernamontana recurva	Apocynaceae	Tagor	M, N
Tabernamontana divaricata	Apocynaceae	Tagor	M, N
Tecoma stans	Bignoniaceae	Holde	M, N
Tephrosia candian	Fabaceae	Bogamedola	M
Thuja orientalis	Cupressaceae	Thuja	M, N
Thespesia lampas	Malvaveae	Bonderi	M, N
Trevesia palmata	Araliaceae	Vombal	Nk
Urena lobata	Malvaceae	Ban-Okra	M, N
Vitex trifolia	Verbenaceae	Nilnisinda	M, N
Wendlandia tinctonia	Rubiaceae	Tulalodh	Nk
Wikstroemia indica	Thymeliaceae	Sotopata	M
Ziziphus oenoplia	Rhamnaceae	Bonboroi	Fd, M, N
Morinda angustifolia	Rubiaceae	Banamali	M, N
Meyna pubescens	Rubiaceae	Moina	Nk
Melocanna baccifera	Poaceae	Muli	Fd, N
Fissistingma wallichii	Annonaceae	Litchi Bhehudi	Nk

[F= Fuelwood, Fd= Food and Fodder, M= Medicinal, N= Miscellaneous, and Nk= Not known]

Herbs recorded from CWS			
Scientific Name	**Family**	**Local name**	**Uses**
Abelmoschus esculentus	Malvaceae	Vendi	M, T
Achyranthes aspera	Amaranthaceae	Apang	M
Acroceras tonkinense	Poaceae	Cerastonki	Fd
Ageratum indianum	Scrophulariaceae	Barakesuti	Nk
Ageratum maxicana	Asteraceae	Floss Flower	N
Aglaonema hookerianum	Araceae	Nimahook	N
Allium cepa	Liliaceae	Piyaj	Fd, M
Allium sativum	Liliaceae	Rashun	Fd, M

Alpinia conchigera	Zingiberaceae	Khetranga	M
Alpinia galanga	Zingiberaceae	Pala	M, N
Alpinia nigra	Zingiberaceae	Jongli Ada	M
Amaranthus spinosus	Amaranthaceae	Kanta Shak	Fd, M
Amaranthus tricolor	Amaranthaceae	Lalshak	Fd
Amaranthus viridis	Amaranthaceae	Notay	M
Ananas comosus	Bromeliaceae	Anarosh	Fd, M, N
Anisomeles indica	Lamiaceae	Mura Tulsi	M
Arundo donax	Poaceae	Baronol	Fd, N
Axonopus compressus	Poaceae	Carpet Durba	Fd, N
Brachiaria distachya	Poaceae	Cori Ghas	Fd, N
Brachiaria reptans	Poaceae	Para Ghas	N
Brassica oleracea	Brassicaceae	Phulkapi	Fd, M
brassica oleracea	Brassicaceae	Bandhakapi	Fd, M
Calendula officinalis	Asteraceae	Calendula	M, N
Capsicum frutescens	Solanaceae	Morich	Fd
Carex indica	Cyperaceae	-	N
Carica papaya	Caricaceae	Pepe	Fd, M
Centella asiatica	Apiaceae	Thankuni	Fd, M
Chromolaena odorata	Asteraceae	Assam Shak	M
Colocasia esculenta	Araceae	Fd, M	Fd, M
Commelina erecta	Commelianaceae	Monayan	Fd, M
Commelina diffusa	Commelianaceae	Jata Kanchira	Fd, M
Conyza semipinnatifida	Asteraceae	-	Nk
Cosmos bipinnatus	Asteraceae	Cosmos Flower	N
Courtoisina cyperoides	Cyperaceae	-	M
Crotalaria juncea	Fabaceae	Jhun-Jhuni	M
Crotalaria pallida	Fabaceae	Jhun-Jhuni	N
Crotalaria verrucosa	Fabaceae	Bara Jhun-Jhuni	M
Croton bonplandianus	Euphorbiaceae	Bankhira	M
cyperus compactus	Cyperaceae	Bandorghassi	Nk
Cyperus exaltatus	Cyperaceae	Tata Ghass	N
Cyperus haspan	Cyperaceae	-	N
Cyperus tuberosus	Cyperaceae	Dimamutha	Fd
Cyrtococcum patens	Poaceae	-	Fd
Cyrtococcum trigonum	Poaceae	-	Nk
Dahlia variabilis	Asteraceae	Dahlia	N
Desmodium heterophyllum	Fabaceae	Bon Motsoti	Nk

Desmodium oblongum	Fabaceae	-	Nk
Desmodium pulchellum	Fabaceae	-	M
Desmodium triquetrum	Fabaceae	Kalaliya	Nk
Desmodium gangeticum	Fabaceae	Salpani	N
Digitaria sanguinalis	Poaceae	Anguli Ghass	Fd
Dipteracanthus prostratus	Acanthaceae	-	Fd
Drosera burmannii	Droseraceae	Surja Sisir	N
Eclipta alba	Asteraceae	Kalokeshi	M
Eleocharis retroflexa	Cyperaceae	_	Nk
Emilia sonchifolia	Asteraceae	Bon-Tulsi	Nk
Enhydra fluctuans	Asteraceae	Helencha	Fd, M
Eragrostis ciliaris	Poaceae	Lomkoni	Fd
Eragrostis coarctata	Poaceae	Chikna Ghas	Nk
Fimbristylis aestivalis	Cyperacea	-	Nk
Fimbristylis bisumbellta	Cyperacea	-	Nk
Fimbristylis dipsaceae	Cyperacea	-	Nk
Fimbristylis falcata	Cyperacea	Bindimathi	Nk
Fimbristylis miliaceae	Cyperacea	Bara Javani	Nk
Fimbristylis rigidula	Cyperacea	-	Nk
Fimbristylis squarrosa	Cyperacea	Zumka Chech	Nk
Gnaphalium luteo-album	Asteraceae	Bara Kamra	Nk
Gnaphalium polycaulon	Asteraceae	Kulaklomi	M
Heliconia psittacorum	Heliconiaceae	Kolaphul	N
Lasia spinosa	Araceae	Kanta-Kachu	Fd
Leucas aspera	Lamiaceae	Shetrodrona	M
Limnocharis flava	Limnocharitaceae	Lettuce Pana	N
Lindernia antipoda	Scropholariaceae	Zai Ghass	Nk
Lindernia crustacea	Scropholariaceae	Chapra Ghass	M
Lindernia procumbens	Scropholariaceae	Bokpuspo	M
Lindernia pusilla	Scropholariaceae	-	Nk
Mimosa diplotricha	Mimosaceae	Bara Lajjabati	N
Musa ornate	Muaceae	Ramkola	Fd
Musa paradisiaca	Muaceae	Champa Kola	Fd
Oryza sativa	Poaceae	Dhan	Fd, M, N
Panicum brevifolium	Poaceae	-	Nk
Panicum maximum	Poaceae	Gini Ghass	Fd, M
Panicum repens	Poaceae	Dhani Ghass	Fd
Persicaria flaccida	Polygonaceae	Lal Bishkatali	M

Persicaria orientalis	Polygonaceae	Bara Panimoricha	M
Raphanus sativus	Brassicaceae	Mula	Fd, M
Rungia pectinata	Acanthaceae	Pindi	M
Saccharum officinarum	Poaceae	Akh	Fd, M, N
Senna tora	Caesalpinaceae	Chakunda	M, N
Sida acuta	Malvaceae	Kureta	M, N
Sida cordifolia	Malvaceae	Shet-Berela	M, N
Tagetes eracta	Asteraceae	Gada	M, N
Tagetes petula	Asteraceae	Genda	M, N
Vernonia cinerea	Asteraceae	Kuksim	Fd
Zea mays	Poaceae	Bhutta	Fd, M
Zingiber offinalie	Zingiberaceae	Ada	Fd, M
Zinnia elegans	Asteraceae	Zinnia	N
Cyperus cephalotes	Cyperaceae	Gothubi	Nk
Mimosa pudica	Mimosaceae	Lajjabati	M
Croton labatus	Euphorbiaceae	-	Nk

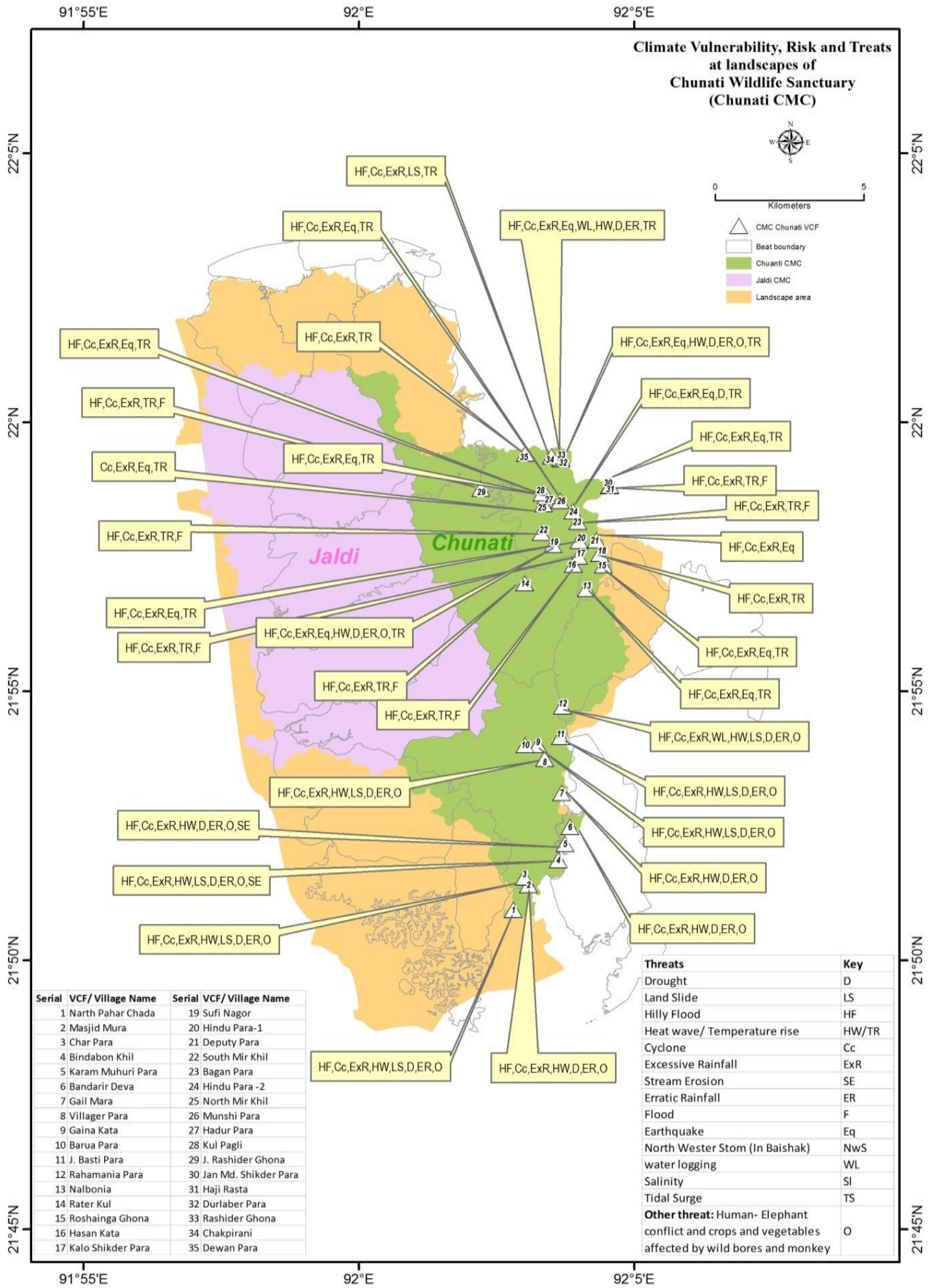
Annex 8: Traditional use of plant species of different habit forms found in Chunati WS

Uses Catagory	Tree species (No)	Shrub species (No)	Herb species (No.)	Climber species (No)	Fern species (No)	Ephiphytic species (No)	Parasitic species (No)	Total (No)
Timber	**133**	**-**	**-**	**-**	**-**	**-**	**-**	**133**
Fuelwood	**42**	**4**	**-**	**-**	**-**	**-**	**-**	**46**
Food , fodder	**90**	**20**	**65**	**33**	**5**	**-**	**-**	**213**
Medicine	**116**	**57**	**101**	**66**	**7**	**5**	**1**	**353**
Miscellaneous	**100**	**40**	**59**	**29**	**10**	**3**	**2**	**243**
Multiple uses	**72**	**3**	**7**	**3**	**-**	**-**	**-**	**86**

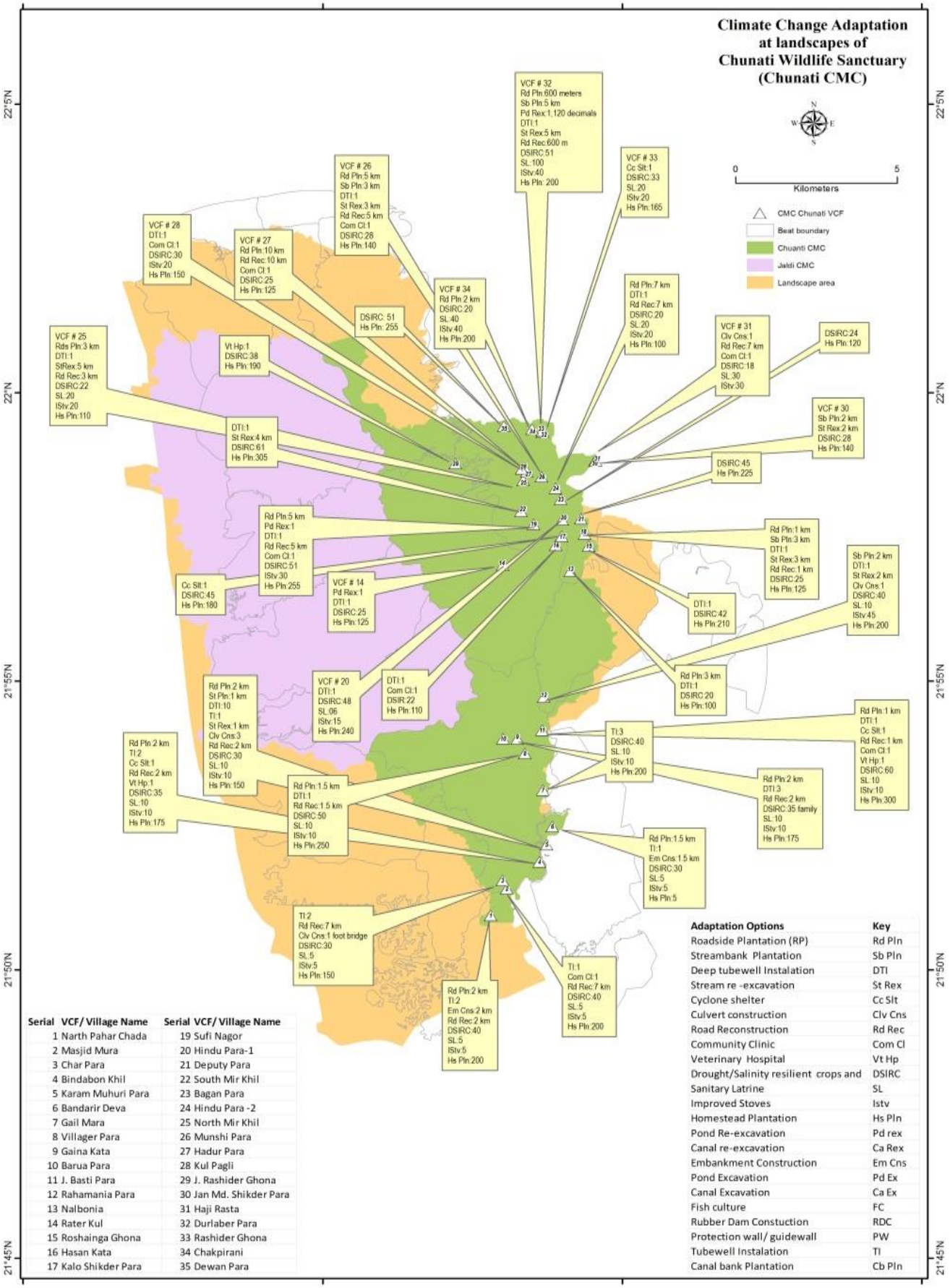
Annex 9: Additional Staffs Requirements at Range and Beat offices

Number ofadditional required staff	Chunati range	Jaldi range	Chunati beat	Harbang beat	Azziznagar beat	Jaldi beat	Napora beat	Chambol beat	Puichari beat	Eco-park	Total
ACF	1	0	0	0	0	0	0	0	0	1	2
Forest Ranger	0	0	0	0	0	0	0	0	0	0	0
Office assistant cum computer operator	1	1	0	0	0	0	0	0	0	0	2
Deputy Ranger	0	0	0	0	0	0	0	0	0	0	0
Forester	1	1	0	0	0	0	0	0	0	1	3
Forest Guard	0	0	2	2	2	2	2	2	2	2	16
Plantation mali	0	0	3	3	3	3	3	3	3	2	23
Care taker	1	1	0	0	0	0	0	0	0	0	2
Total											48

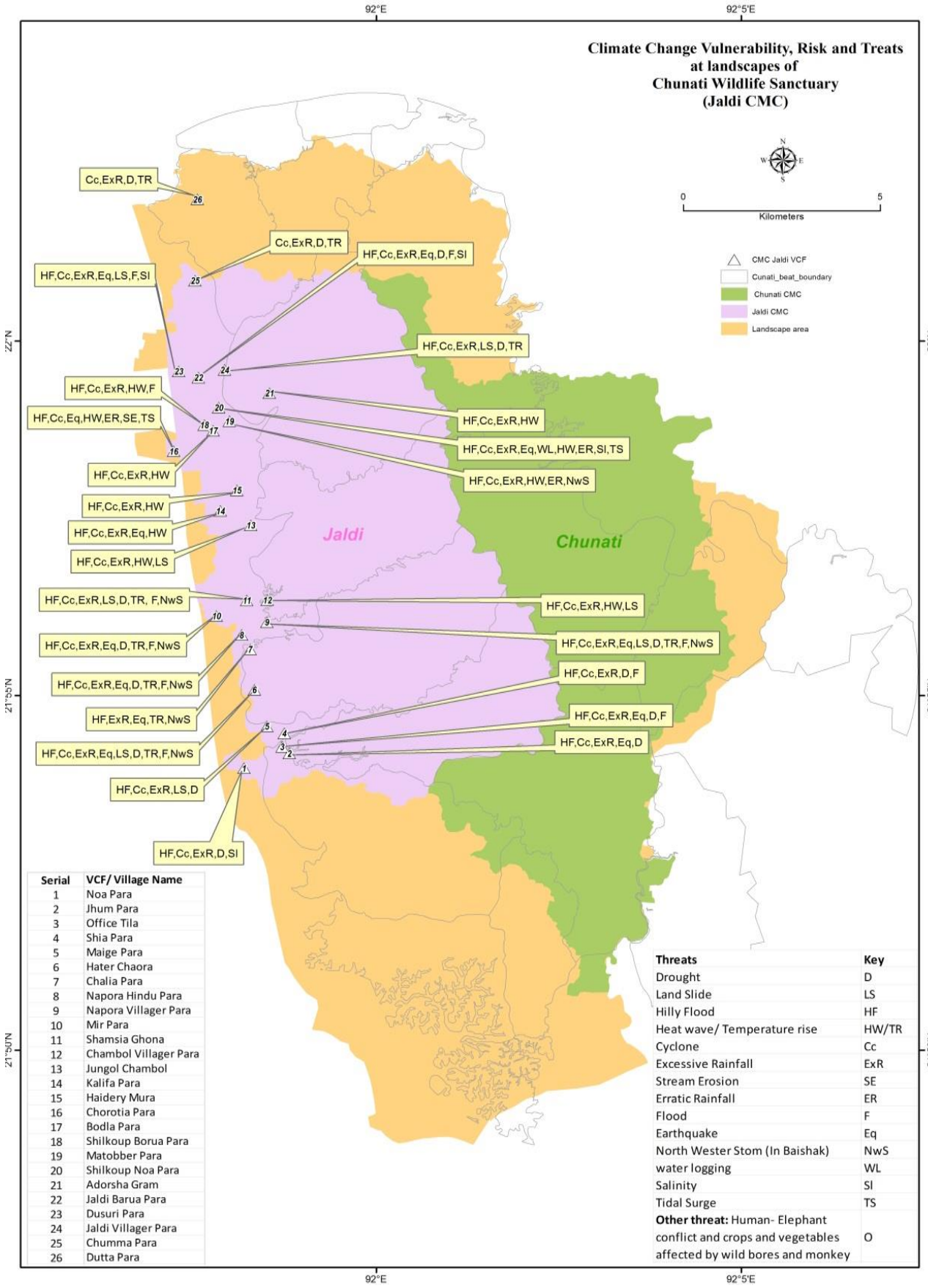
Annex 10: Climatic threat map identified in the Chunati CMC



Annex 11: Management interventions map to adapt climate change in Chunati CMC



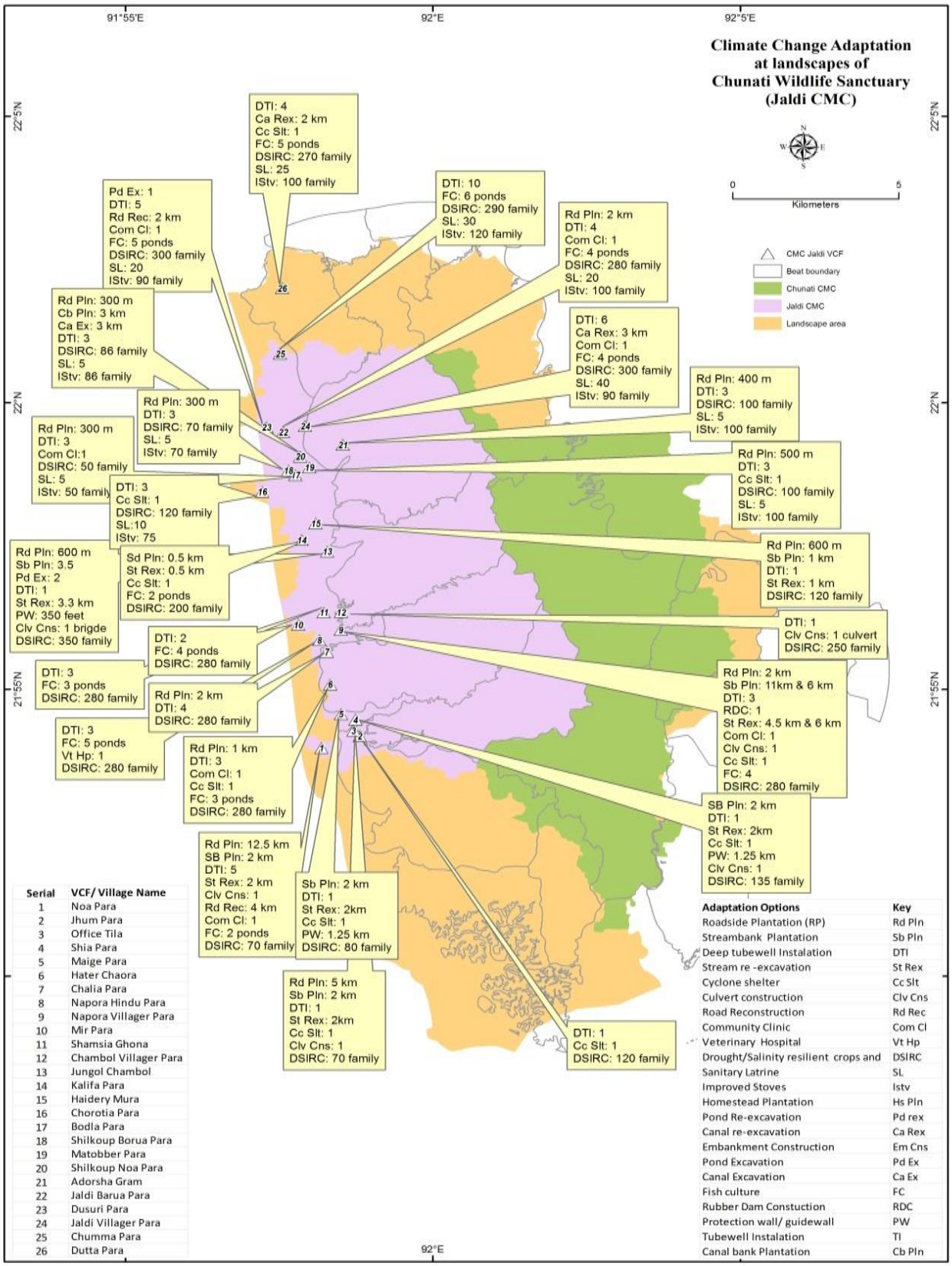
Annex 12: Climatic threat map identified in the Jaldi CMC



Serial	VCF/ Village Name
1	Noa Para
2	Jhum Para
3	Office Tila
4	Shia Para
5	Maige Para
6	Hater Chaora
7	Chalia Para
8	Napora Hindu Para
9	Napora Villager Para
10	Mir Para
11	Shamsia Ghona
12	Chambol Villager Para
13	Jungol Chambol
14	Kalifa Para
15	Haidery Mura
16	Chorotia Para
17	Bodla Para
18	Shilkoup Borua Para
19	Matobber Para
20	Shilkoup Noa Para
21	Adorsha Gram
22	Jaldi Barua Para
23	Dusuri Para
24	Jaldi Villager Para
25	Chumma Para
26	Dutta Para

Threats	Key
Drought	D
Land Slide	LS
Hilly Flood	HF
Heat wave/ Temperature rise	HW/TR
Cyclone	Cc
Excessive Rainfall	ExR
Stream Erosion	SE
Erratic Rainfall	ER
Flood	F
Earthquake	Eq
North Wester Stom (In Baishak)	NwS
water logging	WL
Salinity	Sl
Tidal Surge	TS
Other threat: Human- Elephant conflict and crops and vegetables affected by wild bores and monkey	O

Annex 13: Management intervention map to adapt climate change at Jaldi CMC



Annex 14a : Activities and indicative cost estimates for Jaldi (J) CMC

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
Habitat protection program	Updating maps	LS						1	100	1000	1	150	1500	2	2500
	Boundary demarcation (Pillars)	Km	30	30	30	30	30	75	400	30000	75	600	45000	150	75000
	Control of illicit felling , forest grazing, encroachment	Ls								2000	LS		3000		5000
	Eviction /resettlement	Family (No.)						200	500	100000	200	500	100000	4000	200000
	CM council and CM committee meeting	No.							20	700	LS		1000	LS	1700
	PF, VCF, CPG meetings	No.								2000	LS		3000	LS	5000
	Remuneration of CPG	No.								3000	LS		5000	LS	8000
	Rewards for biodiversity protection	Tk								300	LS		500	LS	800

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	efforts														
	Resolving forest conflicts	LS								500	LS		750	LS	1250
Core zone management	Enrichment planting	Ha	70	70	70	70	70	350	120	42000	LS	150	52500	700	94500
	ANR	Ha	70	70	70	70	70	350	120	42000	LS	150	52500	700	94500
	Habitat improvement works	Ha	20	20	20	20	20	100	120	12000	LS	150	15000	200	27000
	Habitat restoration works	Ha	20	20	20	20	20	100	120	12000	LS	150	15000	200	27000
Buffer zone management	Enrichment plantation	Ha	70	70	70	70	70	350	120	42000	LS	150	52500	700	94500
	Participatory afforestation (seedlings)	No.(000)	5	5	5	5	5	25	0.05	1250	25	0.05	1250	50	2500
	Elephant corridor	LS								10000	LS		30000		40000
	NTFP regeneration	LS								5000	LS		7500		12500
Influence zone/ Impact zone	Social forestry (seedlings)	No. (000)	10	10	10	10	10	50	0.05	2500	50	0.05	2500	100	5000
	Strip plantation	Km	10	10	10	10	10	50	0.05	2500	50	0.05	2500	100	5000

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	Homestead plantation (seedling distribution)	No. (000)	10	10	10	10	10	50	0.10	5000	50	0.10	5000	100	10000
	Climate resilient cultivation	LS								10000	LS		15000		25000
	Elephant corridor involving stakeholders in forest protection	LS								10000	LS		15000		25000
	Installation of tube well	No.						15	100	1500	LS		2500		4000
Livelihood development program	Identifying a list of feasible production Technologies	LS								500	LS		750		1250
	Stakeholders' Consultations on the proposed production technologies	LS								500	LS		750		1250
	Developing skills and loan for alternative	LS								5000	LS		7500		12500

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	income generation (poultry, fisheries, nursery, sewing)														
Tourism and visitor management	Nature Interpretation Centre	No.							20000	20000	LS		1000		21000
	NTFP Museum	No.	1						20000	20000	LS		1000		21000
	Watch Towers	No.							20000	20000	LS		1000		21000
	Student Hut / Dormitory	No.						1	15000	15000	LS		1000		16000
	Construction and maintenance of Picnic Area	No.						1	1000	1000	LS		1500		2500
	Nature trails construction and maintenance	No.							2000	2000	LS		2500		4500
	Supension bridge construction	No							20000		LS		1000		1000

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
Tourism and visitor management	Identifying suitable sites for Nature Camps	No.							100	100	LS		150		250
	Sign arrow/ boards	No.						35	30	1050	LS		1500		2550
	Toilets construction and maintenance	No.							200	800	LS		1200		2000
	Resting Facility (golgarh)	No.							200	700	LS		1000		1700
	Tube well for picnic spots and toilets	No.							100	400	LS		600		1000
	Trash cans	No.						25	4	100	LS		150		250
	PA gate construction and maintenance							1	20000	20000	LS		1000		21000
	Identifying & training eco-guides	LS								250	LS		400		650
	Preparing publicity	LS								5000	LS		7500		12500

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	Materials														
	Film making (audiovisuals) for NIC	No.							2000	2000	LS		3000		5000
Training and research	Training assessment for participatory PA management	LS								500	LS		750		1250
	MS degree in Park management (For ACF)	LS								20000	LS		25000		45000
	Training of staffs and stakeholders	LS								5000	LS		7500		12500
	Workshop	LS								500	LS		750		1250
	Floral and faunal Inventories	No.						1	1000	1000	LS		1500		2500
	Carbon inventory							1	2000	2000	LS		3000		5000
	Conservation research studies	LS								1000	LS		1500		2500

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	Ecological research	LS								2000	LS		3000		5000
	Silvicultural research	LS								2000	LS		3000		5000
Administrative staff Recruitment	ACF	m-m													0
	Foresters	m-m													0
	Office Assistant	m-m													0
	Care taker	m-m													0
	FG	m-m													0
	Plantation Mali	m-m													0
Facility Development Programs	Renovation and Maintenance of FRH	No.													0
	Renovation and maintenance of Range officers quarters	No.							1000	1000	LS		1500		2500

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	Renovation and maintenance of Beat Officers' quarters	No.						4	1000	4000	LS		6000		10000
	Renovations and maintenance of FGs barrack	No.						4	1000	4000	LS		6000		10000
	Construction and maintenance of ACF's Quarters	No.						1	15000	15000	LS		1000		16000
	Double-cab pickups	No.						1	2000	2000	LS		1000		3000
	100 cc motorcycles	No.						4	200	800	LS		800		1600
	Computer	No.						4	100	400	LS		600		1000
	Field equipment (survey ins.+GPS+fire protection+ torch+ binocular)	LS								1000	LS		1500		2500

Program	Activity-	Unit	Quantity/year							Total cost (000)TK for 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost (000) TK		Qty Total	Unit Cost (000) TK		Qty for 10 Years	Cost (000)Tk
	Rifle	No.						12	40	440	LS		600		1040
	Digital camera	No.						5	100	500	LS		750		1250
	PA Archive development and maintenance	LS								2000	LS		2500		4500
	Laptop and maintenance	LS								200	LS		200		400
Total										**516990**			**531450**		1048440

Annex 14b : Activities and indicative cost estimates for Chunati (C) CMC

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
Habitat protection program	Updating maps	LS							10000	10000		LS	8000	1	18000
	Boundary demarcation (Pillars)	Km	15	15	15	15	15	75	400	30000		LS	15000	75	45000

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
	Control of illicit felling , forest grazing, encroachment	LS								2000		LS	3000	LS	5000
	CM council and CM committee meeting	No.							20	700			1000		1700
	PF, VCF, CPG meetings	No.								2000			3000		5000
	Remuneration of CPG	No.								3000			5000		8000
	Rewards for biodiversity protection efforts	Tk								300			500		800
	Resolving forest conflicts	LS								500		LS	1000	LS	1500
Core zone management	Enrichment planting	Ha	70	70	70	70	70	350	120	38000	350	150	52500	700	90500
	ANR	Ha	70	70	70	70	70	350	120	38000	350	150	52500	700	90500
	Habitat improvement works	Ha	20	20	20	20	20	100	120	12000	100	150	15000	200	27000
	Habitat restoration works	Ha	10	10	10	10	10	50	120	6000	50	150	7500	100	13500
	Eviction of encroachers from	LS								100000			100000		200000

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
	CZ to other areas														
Buffer zone management	Enrichment plantation	Ha	70	70	70	70	70	350	120	38000	350	150	52500	700	90500
	Participatory afforestation (seedlings)	No.(000)	5	5	5	5	5	25	0.05	1250	25	0.07	1750	50	3000
	Elephant corridor	LS								10000			15000		25000
	NTFP regeneration	LS								5000			8000		13000
Influence zone/ Impact zone	Social forestry (seedlings)	No. (000)	10	10	10	10	10	50	0.05	2500	50	0.07	3500	100	6000
	Strip plantation	Km	10	10	10	10	10	50	0.05	2500	50	0.07	3500	100	6000
	Homestead plantation (seedling distribution)	No. (000)	10	10	10	10	10	50	0.10	5000	50	0.12	6000	100	11000
	Climate resilient cultivation	LS								10000			15000		25000
	Elephant corridor involving stakeholders in forest protection	LS								10000			15000		25000
	Installation of tube well	No.						15	100	1500	15	150	2250	30	3750

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
Livelihood development program	Identifying a list of feasible production Technologies	LS								500			700		1200
	Stakeholders' Consultations on the proposed production technologies	LS								500			700		1200
	Developing skills and loan for alternative income generation (poultry, fisheries, nursery, sewing)	LS								5000			8000		13000
Tourism and visitor management	Nature Interpretation Centre	No						1	LS	5000	M	LS	5000		10000
	Watch Towers	No							LS	5000	M	LS	5000		10000
	Student Hut / Dormitory	No.						1	LS	10000		LS	10000	LS	20000
	Construction and maintenance of Picnic Area	No.						1	1000	1000	M	LS	1000		2000
	Nature trails construction and	No.							2000	2000		LS	1000	LS	3000

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
	maintenance														
	Supension bridge construction	No						1	20000	20000	M	LS	10000	1	30000
Tourism and visitor management	Identifying suitable sites for Nature Camps	No.							100	100		LS	100		200
	Sign arrow/ boards	No.						35	30	1050	35	40	1400	70	2450
	Toilets construction and maintenance	No.						3	200	600	M	LS	400	3	1000
	Resting Facility (golgarh)	No.							200	700			600		1300
	Tube well for picnic spots and toilets	No.						3	100	300	3	150	450	6	750
	Trash cans	No.						25	4	100	25	6	150	50	250
	PA gate construction& maintenance							1	5000	5000	M	LS	4000	1	9000
	Identifying & training eco-guides	LS								250			300		550
	Preparing publicity	LS								5000			8000		13000

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
	Materials														
	Film making (audiovisuals) for NIC	No.							2000	2000			2000		4000
Training and research	Training assessment for participatory PA management	LS								500			600		1100
	Training of staffs and stakeholders	LS								5000			8000		13000
	Workshop	LS								500			800		1300
	Floral and faunal Inventories	No.						1	1000	1000		LS	1500	1	2500
	Carbon inventory							1	2000	2000			3000		5000
	Conservation research studies	LS								1000			1500		2500
	Ecological research	LS								2000			3000		5000
	Silvicultural research	LS								2000			3000		5000
Administrative staff Recruitment	ACF	m-m													
	Foresters	m-m													
	Office Assistant	m-m													

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
	Care taker	m-m													
	FG	m-m													
	Plantation Mali	m-m													
Facility Development Programs	Renovation and Maintenance of FRH	No.													
	Renovation and maintenance of Range officers quarters	No.						1	1000	1000	M	LS	1500	1	2500
	Renovation and maintenance of Beat Officers' quarters	No.						3	1000	3000	M	LS	4000	3	7000
	Renovations and maintenance of FGs barrack	No.						3	1000	3000	M	LS	4000	3	7000
	Construction and maintenance of ACF's Quarters	No.							15000	15000	M	LS	10000		25000
	Double-cab pickups	No.						1	2000	2000	M	LS	2000	1	4000
	100 cc motorcycles	No.						3	200	600	M	LS	500	3	1100
	Computer	No.						3	100	300	3	150	450	6	750

Program	Activity-	Unit	Quantity/year							Total cost (000) For 1st 5 Years	Y6-Y10		Cost for Y6-Y10	Grand Total	
			Y1	Y2	Y3	Y4	Y5	Qty Total	Unit cost(000) Tk		Qty Total	Unit cost(000) Tk		Qty for 10Years	Cost (000) Tk
	Field equipment (survey ins.+GPS+fire protection+ torch+ binocular)	LS								1000			1500		2500
	Rifle	No.						11	40	480	M	LS	500	11	980
	Digital camera	No.						5	50	250	5	70	350	10	600
	PA Archive development	LS								1000			1500		2500
	Laptop	LS								150			200		350
Total										**434130**			**493200**		**927330**

Activities and Indicative Cost Estimate

The budget requirements for the implementation of the Management Plan for CWS are projected based on the information gathered from FD field offices and official documents. This proposed schedule of activities and costs is based on the major input requirements identified in the Management Plan. It is intended as both a summary of the major inputs required during the ten-years 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.

Annex 15: Encroached Area of Chunati Wildlife Sanctuary (Range and Beatwise in hectre)

Range	Beat	Encroached (Crop Land)	Encroached (Forest)	Encroached (Settlement)	Encroached (Pond)	Encroached (Total)	Encroached (%)
Chunati	Chunati	192.47	102.34	56.29	5.76	336.86	27.94
	Aziznagar	123.13	52.02	68.42	-	243.57	31.19
	Harbang	167.34	163.18	72.13	-	402.65	34.21
Subtotal	**Chunati**	**482.94**	**317.54**	**196.84**	**5.76**	**983.08**	**31.11**
Jaldi	Jaldi	50.40	29.25	27.70	-	107.38	19.69
	Ecopark	29.87	27.76	-	-	57.63	7.68
	Napura	40.48	53.44	0	-	98.40	5.87
	Chambol	21.05	129.95	32.38	-	183.38	12.83
	Puichuri	55.17	216.38	7.08	-	278.63	25.89
Subtotal	**Jaldi**	**1162.85**	**1091.86**	**39.46**	**-**	**2691.58**	**21.82**
G. Total	**CWS**	**679.91**	**774.32**	**236.3**	**5.76**	**1708.50**	**22.75**

Annex 16: Elephant non-preferred crops

Elephant non-preferred crops			
Bangle name	**English name**	**Suitability**	**Preference**
Loti kochu	Taro stolon	In moist soil	Highly preferred by crops
Morich	Chili	Upland	Highly preferred by crops
Sheem	Bean	Upland	
Borboti	String beans	Upland	
Tit-korolla	Bitter gourd	Upland	Highly preferred by crops
Sorisha	Mustard	Upland	
Dherosh	Okra	Upland	
Dhone pata	Coriander	Upland	

Annex: 17 proposed equipment for CWS

Name	No. unit
Digital Camera (1 in each beat office+ 2 in each Range office)	11
Binocular (1 in each beat office+ 2 in each Range office)	11
GPS (1 in each beat office+ 2 in each Range office)	11
Torches	50
Desktop computer and printer (1 in each beat office+ 2 in each Range office)	11
Laptop computer (For ACF)	1
Rifle (1 for each FG)	16
Double cab Pick up (1 for each Range office)	2
Motor bike 100 cc (1 in each beat office+2 in each Range office)	11
Rain coat	50
Solar	9

Annex 18: Major NTFP spceies in CWS

Sl No	Name	Scientific Name	Use
01	Borta	*Artocarpus lecucha*	Fruit
02	Shimul tula	*Bombax ceiba*	Cotton
03	Mitinga	*Bambusa tulda*	Bamboo
04	Baria	*Bambusa vulgaris*	Bamboo
05	Muli	*Melocana Beccifera*	Bamboo
06	Jali bet	*Calamus guruba*	Bet
07	Korak bet	*Calamus latifolius*	Bet
08	Murta	*Schumannianthus dichotomus*	Pati pata
09	Bohera	*Terminelia bellirica*	Medicine
10	Haritaki	*Terminelia cebula*	Medicine
11	Dumur	*Ficus hispida*	Food ,Medicine
12	Amloki	*Phyllanthus emlica*	Medicine
13	Agar	*Aquilaria agallocha*	Perfume,Medicine
14	Sungrass	*Saccharum spontanium*	Thatch material
15	Kalichari Bash	*Gigantachia andamanica*	Fencing bamboo
16	Dhekia	*Diplazium polypodioides*	Vegitable
17	Alulata	*Dioscirea pentaphylla*	Food,Medicine
18	Gilalata	*Entada rhedii*	Medicine
19	Kalilata	*Derris trifoliata*	Food,Rope
20	Bees	*Apis dorsata*	Honey,Wax
21	Ful jharu	*Thysanolaena maxima*	Broom

Annex 19: List elephant corridors of Bangladesh identified by IUCN

Sl. No.	Name of Corridors	Connectivity	Corridor Location	
			Forest Division/Range/ Beat	District/ Upzila/Union
1	Ukhia- Sowankhali	Nikhongchari-Kutupalong- Gundum-Tumru- Azuhaya to Madhuchara- Bot toligona- Balukhali-Palongkhali- Sowankhali	Cox'sbazar South FD/Ukhia Range/ Ukhia Beat Survey	Cox'sbazar/ Ukhia/ Rajapalong
2	Tulabagan-Panerchara	Razarkul- Tulabagan to Panerchara to Himchari	Cox'sbazar South FD/ Panerchara Range/ Panerchara Beat	Cox'sbazar/ Ramu/ Dokkhin Mithachari
3	Nikhongchari-Tulabagan	Nikhongchari-Sonaichari- Razarkul to Tulabagan- Panerchara-Himchari	Cox'sbazar South FD/ Razarkul Range/ Razarkul Beat	Cox'sbazar/ Ramu/ Razarkul
4	Vomoriagona-Rajghat	Tulatoli- Panerchara-Vomoriagona to Rajghat- Khuntakhali	Cox'sbazar North FD/ Idgaon Range/ Vomoriagona Beat	Cox'sbazar/ Ramu/ Razarkul
5	Tulatoli- Idgar	Idgar- Lama to Tolatoli-Machuakhali- Kalirchara	Cox'sbazar North FD/ Idgaon Range/ Tulatoli Beat	Cox'sbazar/ Ramu/ Idgar
6	Khuntakhali-Medhakacchapia	Lama- Dulahazara-Bogachari- Khuntakhali-Medhakacchapia to Bahaltoli	Cox'sbazar North FD/ Fulchari Range/ Medhakacchapia Beat	Cox'sbazar/ Chakaria/ Khuntakhali
7	Fasiakhali-Chairakhali	Fasiakhali and Dulahazara to Chairakhali, Ringvong, Sagirsaha Kata	Cox'sbazar North FD/ Fasiakhali Range/ Fasiakhali Beat	Cox'sbazar/ Chakaria/ Fasiakhali
8	Fasiakhali- Manikpur	Fasiakhali- Dulahazara in South, Kumari- Lama in East and Manikpur-Kakara- Nolbila in North	Cox'sbazar/ Chakaria/ Fasiakhali	Cox'sbazar/ Chakaria/ Fasiakhali
9	Chunati- satgar	Satgar, Harbang, Baroitali, Daluchari, Dalu, Sarai, Tongkawati, Faitong to Chunati Wildlife Sanctuary (Chunati, Aziznagar, Harbang, Napura, Poichari, Chambal, Jaldi) Banshkhali Eco Park, Madarsha and Kalipur Range	Chittagong Wildlife and Nature Conservation Division/ Chunati Range/ Chunati Beat	Cox'sbazar/ Chakaria/ Chittagong, Lohagara
10	Lalutia- Barduara	Lalutia- Dohazari-Dudpukuria- Dhopachari WS- Potiya to Barduara-Hangur- Tongkawaty-	Chittagong South FD/ Podua Range/ barduara Beat	Chittagong, satkania, Bajalia

		Dalu		
11	Sukhbilash- Kodala	Srimai- Komolchari- Kurusia- Sukhbilas to Shilok, Kodala- Kaptai	Chittagong South Forest Division/ Khurusia Range/Sukhbilash Beat	Chittagong, Rangunia, Podua
12	Narischa- Kodala		Chittagong South Forest Division/ Rangunia Range/Narischa Beat	Chittagong, Rangunia, Podua