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Abbreviations

ACF	Assistant Conservator of Forests
AD	Activity Data
ADB	Asian Development Bank
AF	Arannayk Foundation
AGB	Above-ground biomass
AIGA	Alternative Income Generation Activity
ANR	Assisted natural regeneration
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BCCRF	Bangladesh Climate Change Resilience Fund
BFD	Bangladesh Forest Department
BFI	Bangladesh Forest Inventory
BFIDC	Bangladesh Forest Industries Development Corporation
BFRI	Bangladesh Forest Research Institute
BFRI	Bangladesh Forest Research Institute
BNCC	Bangladesh National Cadet Core
BNH	Bangladesh National Herbarium
BUR	Biennial Update Report
C&I	Criteria and Indicators
CBD	United Nations Conventions on Biological Diversity
CBO	Community Based Organization
CCF	Chief Conservator of Forests
CDM	Clean Development Mechanism
CDVI	Climate and Disaster Vulnerability Index
CEGIS	Centre for Environmental and Geographic Systems (of MoWR)
CERs	Certified Emission Reduction
CHT	Chittagong Hill Tracts
CIF	Climate Investment Funds
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
Cm	centimetre
CMP	Cabinet Manufacturing Plan
CO ₂	Carbon di-oxide
COP	Conference of the Parties to the UNFCCC
CPG	Community Patrol Groups
CREL	Climate-Resilient Ecosystems and Livelihoods
CRiSTAL	Community-based Risk Screening Tool - Adaptation & Livelihoods
CRPARP	Climate Resilient Participatory Afforestation and Reforestation Project
CSO	Civil Society Organization

CSR	Corporate Social Responsibility
CVCA	Climate Vulnerability and Capacity Analysis
DAE	Department of Agricultural Extension
DBH	Diameter at breast height
DFO	Divisional Forest Office
DoE	Department of Environment of MoEF
EF	Emission Factor
EGS	Ecosystem goods and services
FAO	Food and Agriculture Organization of the United Nations
FIGNSP	Forest Information Generation and Networking Support Project
FIP	Forest Investment Programme
FMP	Forestry Master Plan
FRA	Forest Resources Assessment (of FAO)
FRMA	Forest and tree Resources Monitoring and Assessment programme
FRMIS	Forest Resources Management Information System
FSTI	Forestry Science and Technology Institute
FYPs	Five Year Plans
GHG	Greenhouse gas
GIS	Geographic Information System
GoB	Government of Bangladesh
GPS	Global Positioning System
Ha	hectare (also Mha - millions of ...)
HQ	Headquarters
ICT	Information and communication technology
IFESCU	Institute of Forestry and Environmental Sciences, Chittagong University
IFI	International Finance Institution
IFM	Improved Forest Management
IISD	International Institute for Sustainable Development
INDCs	Intended Nationally Determined Commitments
IPAC	Integrated Protected Area Co-management
IPCC	Inter-governmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JJAS	June July August September
km ²	square kilometre
LC	Land cover
LCCS	Land Cover Classification System
LMS	Land Monitoring System
LULUCF	Land Use, Land Use Change and Forestry
M	million (prefix for unit: ha, tCO ₂ e)
M&E	Monitoring & evaluation

m, m2, m3	metre, square metre, cubic metre
MAI	Mean Annual Increment
MIS	Management Information System
MoEF	Ministry of Environment and Forests
MoWR	Ministry of Water Resources
MRV	Measurement, reporting and verification
NAMAs	Nationally Appropriate Mitigation Actions
NAPA	National Adaptation Program of Action
NBSAP	National Biodiversity Conservation Strategy and Action Plan
NC	National Communication to the UNFCCC
NDVI	Normalized Differential Vegetation Index
NFA	National Forest Assessment
NFMS	National Forest Monitoring System
NGO	Non-governmental organization
NICFI	Norway International Climate and Forest Initiative
NPP	Net Primary Productivity
NPV	Net Present Value
NTFP	Non-timber forest product
PA	Protected Area
Pas	Protected Areas
PCVA	Participating Climate Vulnerability Assessment
PoWPA	Programme of Work on Protected Areas of the CBD
PPCR	Pilot Program for Climate Resilience
PPP	Public Private Partnerships
PSP	Permanent Sample Plot
RCP	Representative Concentration Pathways
REDD+	Reducing emissions from deforestation and forest degradation in developing countries, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries
REL	Reference emission level
RF	Reserve Forest
RIMS	Resource Information and Monitoring System
RL	Reference level
RLF	Revolving Loan Fund
ROR	Record of Rights
RS	Remote sensing
SCCF	Special Climate Change Fund
SEALS	Sundarbans Environment and Livelihoods Project
SEI	Stockholm Environment Institute
SFM	Sustainable Forest Management
SLR	Sea Level Rise

SMART	Specific, Measurable, Achievable, Relevant, Time-bound
SMF	Social Management Framework
SRF	Sundarbans Reserve Forest
tCO ₂ e	ton of CO ₂ -equivalent emissions of greenhouse gases (also MtCO ₂ e - millions of ...)
TFA	Tropical Forest Alliance
TFF	Tree Farming Fund
TOF	Trees Outside Forests
UCF	Union level Forest Conservation Forums
UDOR	Undetected Offence Report
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Conference on Climate Change
UNFF	United Nations Forum on Forests
UN-REDD	United Nations REDD+ Programme
USAID	United States Agency for International Development
USF	Unclassed State Forests
VCS	Village Common Forests
VH	Village homestead forest
VU	Vulnerable
WB	World Bank
WTP	Wood Treatment Plant

1 Background

1.1 Country context

Bangladesh is a country of 159.9 million people living in an area of 14.75 million ha, in the low deltaic plains of the great rivers Padma, Jamuna and Meghna and their myriad tributaries and distributaries. The majority of the population of the country are Bengali-speaking Muslims, while Hindus, Christians and Buddhists constitute significant minorities. The hilly districts in the east of the country and some parts of the Madhupur plains are inhabited by ethnic communities, such as Chakmas, Marmas, Tripuris, Tangchangyas, Khasis and Garos, who have racial affinities with the people living in north-eastern India and Myanmar.

There are three distinct seasons in Bangladesh: a hot and humid summer from March to June; a rainy monsoon season from June to October; and a cool, dry winter from October to March. In general, the maximum summer temperatures range between 30°C and 40°C. April is the warmest month in most parts of the country. January is the coldest month, during which the average temperature in most of the country is about 10°C. Most parts of the country receive at least 2000 mm of rainfall per year. Because of its location just south of the foothills of the Himalaya, where the monsoon winds turn west and north-west, north-eastern Bangladesh receives the greatest average precipitation, sometimes over 4000 mm per year. About 80% of Bangladesh's rain falls during the monsoon season.

Figure 1—1 shows the proportions of various land use categories in Bangladesh in 2011. Nearly 65% of the area of the country is arable cropland, while 15.7% is forest and other wilderness (including permanent meadows).

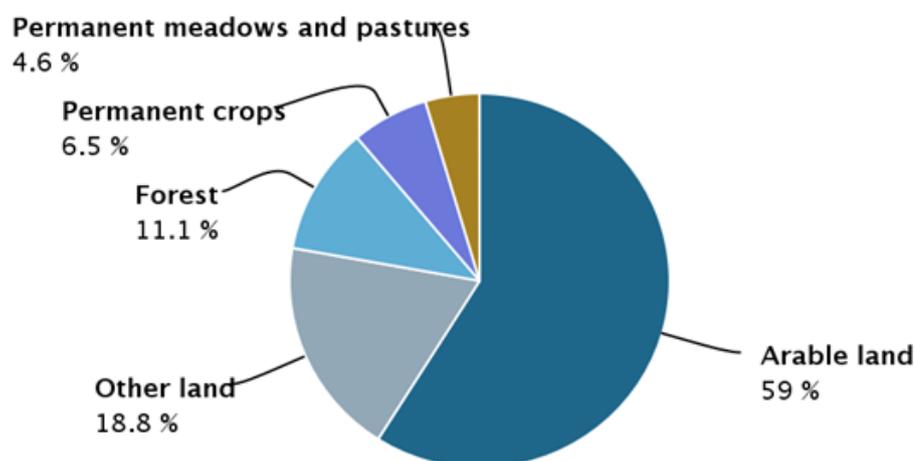


Figure 1-1: Land use proportions in 2011 (FAOstat 2015).

Although Bangladesh has predominantly been an agricultural country, the growth of industries is continuing at a satisfactory pace. According to a Bangladesh Bureau of Statistics release on the contribution of different sectors to the GDP in 2016, the contributions of the agriculture, industries and service sectors amount to \$30.4 billion, \$59.3 billion and \$116.3 billion, respectively.

With a per capita gross domestic product (GDP) of \$1466 in 2016, the economy has been growing at a healthy rate of more than 6% per annum for the last few years (ADB 2016). The annual rate of growth of the population had come down to 1.3% in 2016. The socio-economic indicators of the country have been improving continuously despite serious setbacks caused by natural disasters from time to time. The life expectancy at birth improved from 56 in 1990 to 70.9 in 2015, while the adult literacy rate improved from 37% to 64.6% over the same period. Bangladesh is determined to reach the middle-income group of nations by 2020. The population below the poverty line had dropped from 56.6% in 1992 to 23.6% in 2016. There is a growing trend towards urbanization of the population as the proportion of people living in urban areas grew from 14% in 1990 to 26.9% in 2012. This has a major significance for forestry and the environment. Bangladesh is a low-carbon-emitting country, with a total emission of 57.1 million tons and a per capita emission of just 0.4 tons (2011).

1.2 Forestry context

Bangladesh has a notified forest area of nearly 1.90 million ha, including over 400,000 ha of land expected to accrete from the sea in the near future. Out of the remaining 1.5 million ha of forest land, only about half the area is under natural forests, mostly in the Sundarbans, while the rest is either under different types of plantations (334,093 ha on record in 2013) or degraded or deforested due to various reasons, which have been discussed elsewhere in this document . Establishment of plantations, mainly teak, was started in the hill forests of the country almost 150 years ago. The forest areas of the country are mainly concentrated in the south-western (Sundarbans), eastern and north-eastern regions (hill forests) of the country. There are small patches of sal (*Shorea robusta*) forest in the central and north-western regions. The natural forests of the country are experiencing a sharp declining trend under pressure from illicit felling, encroachments, shifting cultivation and official conversion to other land uses.

Apart from the notified forest in the custody of the Bangladesh Forest Department (BFD), there is nearly 695,000 ha of unclassed state forests (USF) in the Chittagong Hill Tracts (CHT) districts, which is mostly degraded under the impact of shifting cultivation, illicit felling and other factors. Use of the USF area is regulated by the district administration, although some areas have been transferred to the BFD. Large parts of the USF have been leased out for various purposes.

However, Bangladesh has a booming trees-outside-forests (TOF) sector, which meets most of the timber and fuelwood needs of the country. The area under TOF, mostly homestead forests, plantations on roadsides and tea and rubber estates, was estimated to be nearly 1.7 million ha in 2005 (NFA 2005-07) and is believed to be growing further.

1.3 Biodiversity (conservation status, endangered and extinct species and habitats including PAs)

Bangladesh is a part of one of the global biodiversity hotspots and is richly endowed with biological diversity. Her biodiversity is estimated to include 7000 endemic plant species, 113 mammals, 628 birds, 126 reptiles, 22 amphibians, 708 species of fish and 2493 species of insect. The royal Bengal tiger is the most well-known biological heritage of the country.

However, the biodiversity of the country is under serious threat from anthropogenic pressures. According to the International Union for the Conservation of Nature (IUCN; 2016), out of 1619

assessed species, 2% are Regionally Extinct (RE), 3% are Critically Endangered (CR), 11% are Endangered (EN), 9% are Vulnerable (VU), and 6% are Near Threatened (NT). Thirty-one species are categorized as locally extinct in the country, while 390 species (29% of the total species assessed) are in the threatened categories (CR, EN and VU). While no detailed assessment of the forest flora of the country has been made, a number of economically valuable species have become very rare to find in the forests.

Due to serious degradation of the forests, most of the wildlife species have lost their natural habitats. Apart from the Sundarbans, and a few large water bodies, no biome provides sufficiently large habitats to the native species of wildlife. However, the country has created a network of protected areas (PAs) for preserving her wildlife. The current PA system of Bangladesh includes 18 national parks, 20 wildlife sanctuaries, one marine protected area, two safari parks, 10 eco-parks and 10 ecologically critical areas that collectively cover an area of 285,841 ha, amounting to nearly 15.2% of all the legally constituted forests in the country. The plan is to raise this proportion to 30% of the forest area of the country.

1.4 Bangladesh and climate change

Due to its low-lying, deltaic position, poverty, poor infrastructure and limited ability to respond to extreme weather events, Bangladesh has been rated as one of the most climate-vulnerable countries in the world. Global warming and the resultant changes in the global climate, in the form of rising temperatures, changes in rainfall patterns, a sea level rise and a rise in the frequency of extreme weather events, such as storm surges and cyclones, are likely to have a serious impact on the people and the economy of the country. The country is likely to experience warmer winters, more rainfall over a shorter monsoon, more saline seas and intrusion of salinity further upstream in different rivers, and large areas along the coast, particularly mangroves, are likely to be submerged in the future due to the rising sea level. Although the productivity of forest ecosystems is likely to go up due to increased photosynthesis in a warmer climate, at least in the short term, many existing forest habitats may become unsuitable for some species due to changes in habitat condition. The most vulnerable areas are going to be the north-eastern hill forests (Sylhet area), which are likely to experience a reduction in total rainfall.

Though it is considered to be among the countries of the world, worst affected by the impacts of climate change, Bangladesh is a low-carbon-emitting country, and its role in global warming is negligible. The country is participating whole-heartedly in the global effort to combat climate change and needs to develop adequate adaptive capacity in order to protect its people and economy against the impacts of climate change.

(For more details on the impact of climate change, please see Chapter 5)

1.5 Status of National Forestry Policy

Even though some form of forest management had long been practiced in the Indian sub-continent, the British rulers were the first to introduce a proper management of 'forest estates', which in the initial years of British rule in India were managed through the civil administration. Eventually, the management of forests was vested with the BFD after its establishment in the mid-19th century. While the first Forest Act was promulgated in 1865, the first Forest Policy came into effect only in 1894. The main focus of that policy was on supporting the process of reservation of forest lands and the exploitation of their resources for revenue generation.

The key features of the 1955 Forest Policy, which replaced the 1894 policy, included higher priority and increased financial allocation for forestry activities, enhanced afforestation and reforestation programmes and recognition of intangible benefits from forests. The main focus of the policy continued to be revenue generation through exploitation of forest resources.

The National Forest Policy, 1979 emphasized the use of forest lands only for forestry purposes and emphasized the enhancement of plantation programmes, establishment of modern wood-based industries, re-orientation of research, education and training programmes and updating the laws governing the administration of forests.

The National Forest Policy, 1994 underscored the need to bring 20% of the country's landmass under forest cover by 2015 by establishing plantations in the available forest land, private homestead lands and public institutions, roadsides, sides of railway tracks and embankment slopes as well as in the USF in the three hill districts with support from local communities and NGOs to ensure that there was people's participation. This policy highlighted, for the first time, the need for the involvement of communities in forestry activities and has successfully changed the mindset of the BFD personnel and made them community oriented, which has triggered 'social forestry' activities under the leadership of the BFD. However, many of the aforementioned policy interventions could not be implemented successfully.

The focus of forest management has changed from production-oriented forestry to re-building and conserving forest resources in order to deal with new challenges in forest management arising from various impacts of climate change, e.g., repeated cyclones, rising temperatures, changes in rainfall patterns and a rise in the sea level. These effects are expected to cause a reduction in the values of ecosystem services provided by the forests. Large-scale depletion of forests has been recorded, which has resulted in loss of habitats, species diversity and wildlife populations. These are issues of great concern. In addition, the increased demand for forest products, rapid industrialization and overall improvement in the economic conditions of the population exert tremendous pressure on the diminishing forest resources. The commitments arising from the country's ratification of a number of multilateral environmental treaties, including the Paris Climate Agreement, and the launching of Sustainable Development Goals, together with the continuation of a total moratorium on the exploitation of natural forest resources, have necessitated reviewing, revision and re-orientation of the existing forest policy. The new forestry policy must ensure that the main foci of the forestry activities are forest asset building, conservation of the existing forest ecosystem in changed climatic conditions, enhancement of ecosystem services, increased community participation in forestry activities and making forests and dependent communities climate-resilient.

1.6 Implementation status of the Forestry Master Plan, 1995 and the justification for formulating a new plan

Bangladesh was one of the few countries in the world to have a comprehensive Forestry Master Plan (FMP) covering the entire country as early as 1995. The master plan recommended a minimum investment (scenario 1) of Tk.60.24 billion in programmes grouped as 'People-Oriented Forestry', 'Production-Directed Forestry' and 'Institutional Strengthening' over a period of 20 years. Against this, the total development expenditure of the BFD during this period was only Tk.23.7 billion (38.3%). As the FMP had proposed programmes in virtually every aspect of forestry, all the development projects implemented during the relevant period can be treated as a follow-up of the FMP, but in fact few projects were specifically undertaken to implement the

FMP. No projects were taken up in energy conservation, improvement of the sawmilling industry, industrial development, institutional restructuring, etc. despite strong recommendations in the FMP. Separation of the authority and enterprise functions of the BFD has not taken place. The principal forestry activity during this period was the establishment of social forestry plantations on encroached forest land, strip plantations and coastal plantations. No significant long-rotation plantations were raised as recommended in the FMP. Institutionalisation of social forestry through amendment of the Forest Act, 1927 and promulgation of the 1994 forest policy can be seen as the major achievements of FMP 1995. Although the tree cover of Bangladesh has reached the value of 20% (16.88% of total area; 21% of terrestrial land) (NFA 2005), in accordance with the goal of NFP 1994, the country has lost nearly all the sal and hill forests at the same time. Although there has been significant growth of trees outside forests, this has happened mostly without the government's involvement. The extension infrastructure created under various projects is lying unused due to a lack of funds for extension activities.

The principal lesson that emerges from the implementation of FMP 1995 is that overambitious plans are difficult to implement in an environment of deep-rooted cultural inertia. Planners should expect only incremental changes in institutional structures and capacities and only limited financial resources. Any proposal conditional on drastic institutional changes and requiring resources far beyond the current availability are unlikely to see the light of day.

The term of FMP 1995 was for a period of 20 years. Therefore, the need to revise it and reset the sectoral aims, objectives, programmes and strategies in the current context is natural. FMP 1995 came at a time when the many of the current and emerging issues were just taking shape. Although FMP 1995 had noted the extremely high rate of loss of natural forests (3% per annum), its proposals could not reverse this trend, perhaps because they just could not be implemented. Despite the loss of natural forests, the forestry sector has seen a major evolution since then. While the dependence of the paper and pulp industry on local forest resources has declined, the furniture industry has come up as an important growth engine for the country. Large-scale urbanization of the population and easier availability of alternative fuels have reduced the dependence of a large section of the people on wood fuels significantly although the demand is still growing due to a continuous, though slower, growth in population. The urgent need to create a coastal green belt, reforest the denuded hill forests and improve the climate resilience of the country, and the unlikelihood of the government being able to fund these activities through the traditional sources, indicates a requirement of an innovative approach to financing government programmes.

Although the principles and strategies devised by FMP 1995 are still applicable, they need to be set in the current social, environmental and economic context through a new FMP that looks 20 years ahead of today.

2 Forest Ecosystems

Bangladesh, covering an area of 147,570 km², is situated in the north-eastern part of the Indian sub-continent. The country's main landmass is a low-lying delta, traversed by the Padma, Jamuna and Meghna rivers, their numerous branches and tributaries and a number of other rivers. These rivers bring enormous amounts of sediments and nutrients that contribute to the biological richness of the forests, wetlands and water bodies. Bangladesh is considered to be one of the most climate-vulnerable countries in the world. As a lower riparian country with an extensive coastline, floods, storms and cyclones are frequent and intense.

The country's food and economic security is linked closely with its ecological security, for which conservation of forests and wetlands is vital. The country's forest ecosystems, including overlapping wetlands, provide socio-economic and ecological services in terms of life-supporting, provisioning and regulating functions, and have a tremendous impact on reducing the risk of water-induced disasters and on the climate change adaptation of local communities and land resources. Sustainable forest management in densely populated Bangladesh has significant socio-economic and environmental benefits for local communities, which are mainly made up of subsistence farmers and labourers engaged largely in land-based activities. But with climate change becoming the principal concern of the world, particularly for the most vulnerable states such as Bangladesh, the importance of sustainable and climate-resilient forestry is now better appreciated than ever before.

2.1 Current state of various forest types

Forest areas notified under the original Forest Act of 1865 and its successive amendments and the forests acquired or vested in the government, under the East Bengal State Acquisition and Tenancy Act of 1950, amount to 1,879,503 ha, although the total area as per the records of various forest divisions amounts to 1,962,360 ha. Apart from this area, which is under the control of the Bangladesh Forest Department (BFD), an area of 694,983 ha, known as the unclassified state forest (USF), is under the control of the civil administration in the Chittagong Hill Tract (CHT). Despite the application of the term 'forest', the tree cover in these areas is extremely deficient and varies from place to place. Large parts of these forests have been encroached on, are under shifting cultivation or have been transferred to other agencies for various development works. Although it is extremely difficult to assess the areas under encroachment without a proper survey, according to forest department records, an area of 104,154 ha is encroached, while another 125,626 ha has been transferred to other agencies for various land uses. Thus, the approximate extent of the net land in the custody of the forest department is as shown in Table 2-1.

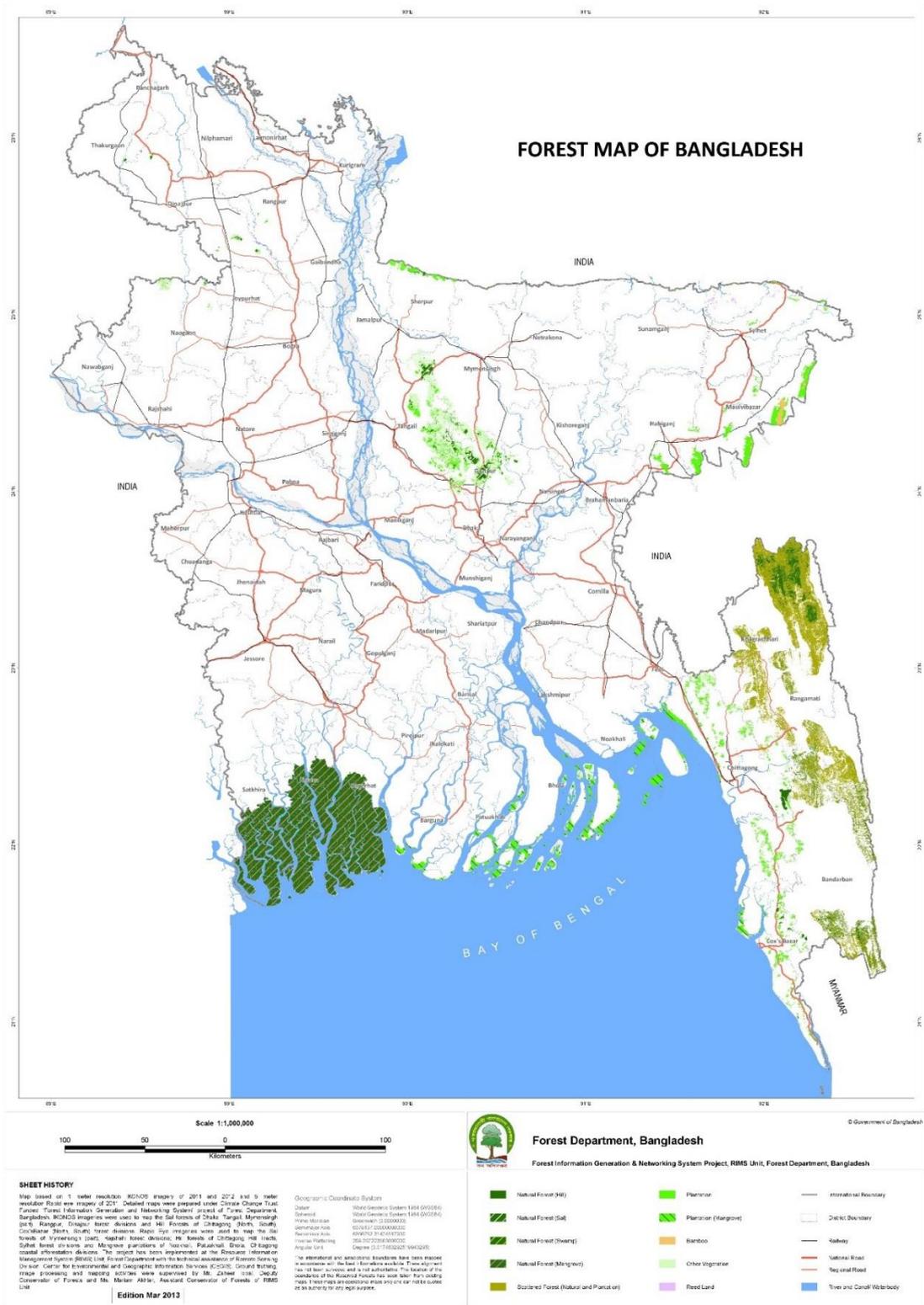
Table 2-1: Current area in the custody of the BFD

Forest Type	Notified/Recorded Area (ha)	Encroached Area (ha)	Transferred Area (ha)	Net Area (ha)
Sal	125,767	45,518	8571	71,678
Hill	722,716	52,535	28,234	641,947
Mangroves	600,385	0	9	600,376
Coastal area	209,789	6101	88,812	114,876
Total	1,658,657	104,154	125,626	1,428,877

Note: Wherever there are any discrepancies between the records of the head office and the forest divisions, the figures reported by the divisions have been presented in the table.

The distribution of forest lands in the country is shown in Map 2-1.

Map 2-1: Distribution of forest lands



While state forest areas are being lost due to various causes, the extent of trees outside (designated) forests (TOF) has been increasing steadily.

According to their location and composition, the forests of Bangladesh are known as sal forests, hill forests and mangrove forests. The last country-wide forest and tree assessment was conducted during 2005-2007¹ while the forest cover in the state forests and plantations was again mapped in 2013 (FIGNSP 2013)². On the basis of these two assessments, the status of forest and tree cover in the country is approximately as presented in Table 2-2.

Table 2-2: Forest and tree cover in Bangladesh

Category of Forest or Tree Cover	Area (ha)	Source	Remarks
Hill forest	79,161	FIGNSP 2013	>10% canopy cover; not all RF blocks mapped
Sal forest	17,495	FIGNSP 2013	>50% sal trees
Mangrove forest, natural	390,550	FIGNSP 2013	
Bamboo	15,039	FIGNSP 2013	> 60% bamboo
Plantations (long-term and short-term)	75,872	FIGNSP 2013	
Scattered forest in CHT mixed with teak plantations	116,971	FIGNSP 2013	
Plantations in USF (BFD-controlled)	17,347	BFD	
Plantations, coastal	61,574	FIGNSP 2013	
Plantations, rubber	9217	FIGNSP 2013	
Plantations, strip	62,329	BFD	
Cultivated land with >10% tree density	449,000	NFA 2007	
Rural settlements with >10% tree cover*	1,197,000	NFA 2007	Village/homestead
Total	2,491,555		

*Commonly known as homestead forests.

Trends in forest area

According to FRA 2015³, the forest area of Bangladesh has somewhat decreased while the area under 'other land with trees' has been increasing steadily since 1990, as shown in Table 2-3.

¹ NFA 2007: National Forest and Tree Resources Assessment 2005–2007.

² BFD and CEGIS 2013: Forest Information Generation and Network System Project.

³ FRA 2015: Global Forest Resources Assessment 2015, Country Report Bangladesh Rome, 2014.

Table 2-3: Trend in forest area of Bangladesh (thousand of hectares)

Category	Year				
	1990	2000	2005	2010	2015
Forest	1494	1468	1455	1442	1429
Other wooded land	269	279	284	289	294
Other land with trees	270	934	1408	1882	2356

‘Other land with trees’ includes homesteads, agricultural land and a variety of other lands that have some tree cover. It is noticeable that the extent of tree-covered areas outside notified forests has increased at a remarkable rate since 1990, during which period the actual managed forests have been disappearing at an alarming rate. This has resulted from a combination of over-exploitation of forest resources, failure to protect forests, lack of success in establishing plantations on all available vacant land, pressure on forest land from an ever-expanding population and release of forest land for non-forestry purposes.

However, it is to be noted that the FRA figures, the best assessment available at this point of time, are not based on actual assessments. These figures are projections, based on extrapolation and regression analysis of the data of previous years. On the basis of the projections made in FRA 2015 and the results of the FIGNSP 2013, the trends in the forest area of the various forest types are as shown in Figure 2-1.

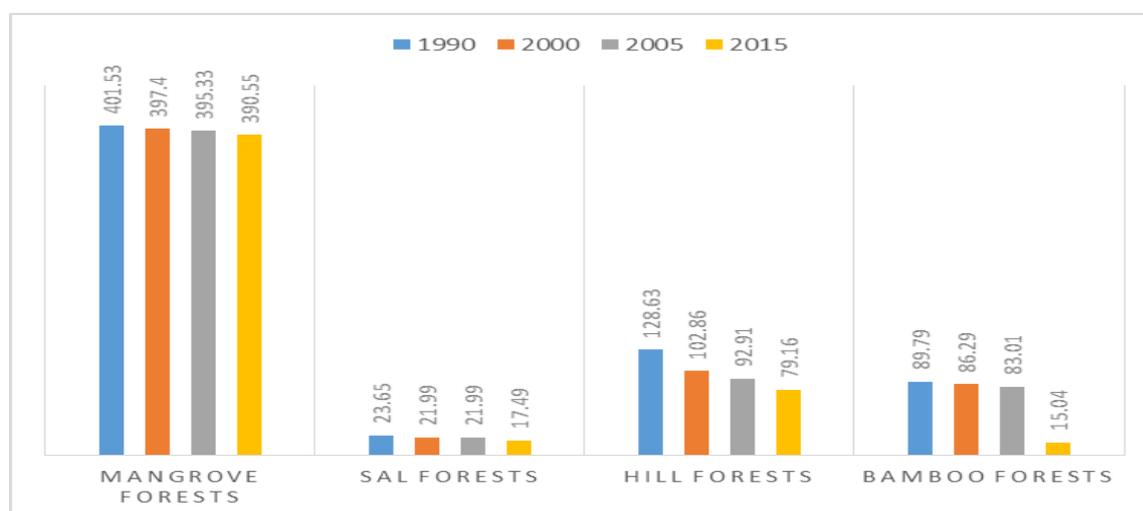


Figure 2-1: Trends in forest area of different forest types (figures in thousands of hectares)

As can be seen, nearly all the forest types, except that of the Sundarbans, are on a declining trend. If this trend is not reversed, almost all the natural forests of the country, except, possibly, that of the Sundarbans, are likely to disappear soon.

From an ecological viewpoint, the forests of Bangladesh may be divided into the following types.

1. **Tropical wet evergreen forests:** The hill forests of the high-rainfall regions of Sylhet and some smaller areas in Chittagong and the Chittagong Hill Tracts (CHT) fall under this category. These forests are multi-storied. The principal evergreen tree species are

chapalish (*Artocarpus chaplasha*), *jam* (*Syzygium* spp.), *sutrong* (*Lophopetalum fimbriatum*) and *ramdala* (*Duabanga sonneratioides*). Their associated species are *garjan* (*Dipterocarpus* spp.), *telsur* (*Hopea odorata*), *chandul* (*Tetrameles nudiflora*), *sal* (*Shorea robusta*), *hargoja* (*Dillenia pentagyna*), *simul* (*Bombax* spp.) and *koroi* (*Albizia* spp.). The second storey consists of *tilsundi* (*Talaruma phellocarpa*), *chikrassi* (*Chukrasia tabularis*), *gondroi* (*Cinnamomum* spp.), *pitraj* (*Amoora* spp.), *toon* (*Toona ciliata*), *chatian* (*Alstonia scholaris*), *nageswar* (*Mesua ferrea*), *gamar* (*Gmelina arborea*), *bahera* (*Terminalia bellirica*), etc. Besides these, these forests are rich in different species of bamboo. The predominant species are *muli* (*Melocanna bambusoides*), *mitenga* (*Bambusa tulda*), *daloo* (*Teinostachyum dullooa*), *ora* (*Dendrocalamus longispathus*), *kali* (*Oxytenanthera nigrosiliata*) and *bazali* (*Teinostachyum griffithii*). The undergrowth is usually a tangle of shrubs in which canes, bamboo and wild banana plants are common. Epiphytes are abundant. Aroids, ferns, mosses, climbers and orchids are very common.

- 2. Tropical semi-evergreen forests:** Most of the hill forests of Chittagong, Cox's Bazar and the CHT belong to this type. Three strata of these multi-storeyed forests are significant and distinct at many sites. The major species of the top canopy are *garjan* (*Dipterocarpus* spp.), *civit* (*Swintonia floribunda*), *narikali* (*Pterygota alata*), *koroi* (*Albizia* spp.), *chandul* (*Tetrameles nudiflora*), *champal* (*Michelia excelsa*), etc. The common and important species in the middle storey are *tali* (*Palaquium polyanthum*), *kaamdeb* (*Calophyllum* spp.), *chapalish* (*Artocarpus chaplasha*), *nageswar* (*Mesua ferrea*), *pitraj* (*Aphanamixis polystachya*), *jam* (*Syzygium* spp.), *banderhola* (*Duabanga sonneratioides*), *cham* (*Michelia champaca*), *toon* (*Cedrela toona*), *raktan* (*Lophopetalum fimbriatum*), etc. The lowest storey consists of *batna* (*Quercus* spp.), *jam* (*Syzygium* spp.), *jarul* (*Lagerstroemia speciosa*), *chalmugra* (*Hydnocarpus kurzii*), *pitalli* (*Trewia nudiflora*), *gamari* (*Gmelina arborea*), *uriaam* (*Mangifera sylvatica*), *bohera* (*Terminalia bellirica*), *horitoki* (*Terminalia chebula*), *jalpai* (*Elaeocarpus robustus*), *ashok* (*Saraca indica*), etc. Bamboo brakes, mostly of *muli* (*Melocanna bambusoides*), are common in this type of forest. Other common bamboo species found in this type of forest are *mitenga* (*Bambusa tulda*), *daloo* (*Teinostachyum dullooa*), *ora* (*Dendrocalamus longispathus*), *kaliserri* (*Oxytenanthera auriculata*), *kali* (*Oxytenanthera nigrosiliata*), *bariala* (*Bambusa vulgaris*) and *bazali* (*Teinostachyum griffithii*).

Under the British rule, starting in 1870s, the hill forests were initially exploited under a selection system in which only large trees were removed. Then the forests were left to regenerate naturally. This practice continued till the 1930s, when the management practices were changed and the forests were worked under a system of clear-felling, followed by the establishment of plantations. While teak was the most preferred species, plantations of some indigenous species were also raised. This practice was discontinued in the mid-1980s, when the focus shifted to reforesting denuded areas and areas where previous efforts to establish plantations had not borne good results with different species including fast-growing pulpwood species. This practice has often resulted in plantations of single species, and many native species, which were abundant, have disappeared.

It may be mentioned here that, during the Second World War, large areas of natural forest in Chittagong and Cox's Bazar were clear-felled to meet the demand of the war. Also, when the Kaptai dam was built, a large area of land upstream, including forests, was inundated, and due to the inaccessibility, very limited extraction of wood was carried out. Large areas of forests

became permanently or seasonally submerged, these forests are permanently lost. One other major cause of damage to the forests is the age-old practice of the locals of burning and clearing forests for shifting cultivation. The accessibility created by the dam greatly facilitated large-scale extraction of forest products from the hill tracts.

Since the early 1970s, the deteriorating law and order situation in the CHT has become a major obstacle to the protection of the natural forests and establishment of plantations, leaving large areas without any worthwhile tree cover. Although a large area of vacant land is available for reforestation in the CHT, it has not been possible for the BFD to resume its normal activities.

No complete assessment of the extent of the hill forests in the country was conducted since NFA 2005-2007. Although NFA 2005-2007 shows that the extent of the natural hill forests is 551,000 ha, FRA 2015 shows, on the basis of long-term trends, that the extent of these forests is only 92,910 ha. The recent assessment (FIGNSP 2013)⁴ carried out by the BFD seems to confirm this trend as only an area of 79,161 ha was recorded. Some small forest blocks could not be mapped. As the areas of these blocks are quite small, their inclusion may not have made a significant difference to the figures. The mapping exercise could locate only about 15,039 ha of bamboo forest. The ongoing inventory of the forests of the country will be able to furnish more accurate information on the actual status of the forests.

The loss of forest cover has created a situation where large-scale establishment of plantations is warranted, particularly in the hill region. However, given the prevailing situation, any work by the BFD has become difficult in a significant portion of the CHT. Implementing new and innovative approaches and options, which are acceptable to all parties in the troubled areas, could be an option. There are other complexities, including land tenure issues and the support of the local people and other relevant government agencies, which will require urgent resolution to ensure smooth operations in the hills. The task involved is too large for the BFD to handle currently because of a chronic shortage of manpower and other resources that are required. A huge financial allocation is needed to undertake the task. In addition to governmental funds and support from traditional donors, substantial additional funding will have to be accessed from other bilateral and multilateral sources, including those specially designed to address climate change issues, such as Reducing Emissions from Deforestation and Forest Degradation (REDD+) and Global Climate Fund. However, the country requires strong institutions, including the Ministry of Environment and Forests (MoEF) and the BFD, and needs to build the necessary capacity for meeting the stringent qualifying requirements for accessing these sources.

- 3. Tropical moist deciduous forests:** The forests occurring in the districts of Dhaka, Mymensingh, Dinajpur, Rangpur and Comilla that are commonly known as sal forests belong to this type. The major species is sal (*Shorea robusta*), and most of the trees of the current crop are degraded coppice growth. Other species found as associates of the sal are the *jarul* (*Lagerstroemia flos reginae*), *sidha* (*Lagerstroemia parviflora*), *joginichakra* (*Gmelina arborea*), *kaikha* (*Adina cordifolia*), *chambol* (*Artocarpus chaplasha*), *amlaki* (*Phyllanthus emblica*), *ajuli* (*Dillenia pentagyna*), *polash* (*Butea frondosa*), *sonalu* (*Cassia fistula*), *kurchi* (*Holarrhena antidysenterica*), etc.

⁴ BFD and CEGIS 2013: Forest Information Generation and Network System Project.

The sal forests in the Dhaka-Mymensingh region were owned by local landlords. While these forests were vested with the BFD in 1950, the department does not have full control over the tract, even today. Patches of forests in this region are often small and interspersed with homesteads or agricultural land, where biotic interferences are common. In addition, most of the trees are poor quality coppice, and frequent forest floor fires have eliminated the possibility of the natural regeneration of the sal. At present only 17,495 ha of forest, or less than 20% of the forest vested with the BFD in 1950, is under tree cover, which is degraded.

4. **Mangrove forests:** While there were natural mangrove forests in Barisal and Chittagong in the past, these are now found in Bagerhat, Khulna and Satkhira districts only. These forests, known as the Sundarbans, spill over into the state of West Bengal in India, forming the largest single tract of this forest type in the world. Here trees grow in the intertidal zones, where the forest floor is inundated regularly by high tides. While in most other major mangrove forests, species of the family Rhizophoraceae are dominant, the most extensively occurring species in the Sundarbans are the *sundari* (*Heritiera fomes*) and *gewa* (*Excoecaria agallocha*). The species diversity of this forest is much greater than that of any other mangrove formation of the world. The other major species are *kankra* (*Bruguiera gymnorrhiza*), *bain* (*Avicennia officinalis*), *kaora* (*Sonneratia apetala*), *goran* (*Ceriops decandra*), *passur* (*Xylocarpus moluccensis*), *jhana* (*Rhizophora mucronata*), etc., and their associates are *golpata* (*Nypa fruticans*), *hantal* (*Phoenix paludosa*), *shingra* (*Cynometra ramiflora*), *kholshi* (*Aegiceras corniculatum*), etc. A report published in 2015 lists 528 species of vascular plant belonging to 356 genera and 111 families that occur in the Bangladesh Sundarbans. Among these species, 24 were pteridophytes and the rest were angiosperms, of which only 24 were true mangroves and 70 were mangrove associates. These species included 345 herbs, 89 shrubs, 94 trees, 64 climbers, 14 epiphytes, six parasites and seven palms (Rahman et al., 2015).

Starting in the late 19th century, the Sundarbans was managed under a simple selection-cum-improvement system of management in which trees above a certain diameter at breast height were first removed, ensuring that such removal does not create any permanent gaps in the forest. This is followed by a thinning operation, combined with the removal of dead and deformed trees. This operation is carried out once every 20 years in an area to allow natural regeneration of the tree cover after exploitation. This system worked well until the forest became over-exploited in the 1980s, which resulted in serious depletion of mature trees of the desired tree species. When the situation became very alarming, a complete moratorium on all extraction was imposed in the Sundarbans. According to the available information, the resilient Sundarbans ecosystem has recovered, and now there is a healthy crop of trees in the forest. However, the *sundari* trees are also suffering from a disease locally known as 'top dying disease'. So far, it has not been possible to control it, and the causes and the remedy of this disease are unknown.

5. **Freshwater wetland forests:** A much smaller area of seasonally inundated freshwater forest is found in the seasonal wetlands (*haors*) of Sylhet. The major tree species are *hijal* (*Barringtonia acutangula*), *koroi* (*Pongamia pinnata*), *borun* (*Crataeva nurvala*), *kadam* (*Anthocephalus cadamba*) and *Salix tetrasperma*. The woody shrubs associated with them are *Asclepias*, *Asparagus racemosus*, *Ficus heterophylla*, *Ipomoea fistulosa*, *Lippia javanica* and *Rosa involucrata*. The common reeds are *Phragmites karka*, *Saccharum spontaneum* and *Lemna* spp. Currently, no management interventions other

than affording protection to these trees are being carried out. In earlier days, pollarding of *hijal* trees for fuelwood was carried out. This practice has long been discontinued.

2.2 Afforestation and reforestation

The first attempt at establishing a forest plantation was made in 1871 with teak, in the CHT using seeds brought in from Burma. The policy of converting mixed forests of high species diversity to plantations continued till 1979, when independent Bangladesh's first forest policy was adopted and commercial exploitation of natural forests was progressively restricted in order to conserve its biodiverse forests. Since then, plantations of fast-growing species and coastal plantations, both mangrove as well as non-mangrove species, for protection of coastal communities, have been the main focus.

The BFD's afforestation/reforestation activities have been very diverse, comprising 70-80 types of plantation, dictated by the requirements of the projects under which they were created. Apart from creating short-rotation social forestry woodlots in denuded or encroached forests, the BFD has also been establishing large-scale strip plantations along roadsides, on coastal embankments and along railway tracks. There are some long-rotation plantations of indigenous species in the core zones of reserve forests and protected areas (PAs) in the hills, but the total extent is insignificant.

Up-to-date information on the extent of plantations of different species is not readily available. According to NBSAP (2016), an area of 474,312 ha had been planted by the government till 2015. According to the information provided by the BFD, an area of 71,022 ha has been planted under their social forestry programme, along with nearly 62,329 km of strip plantations between 1981 and 2015, although FRA 2015 indicates their extent was 73,000 km before 2005, equivalent to about 73,000 ha. As strip plantation activity was also promoted by many non-governmental organizations (NGOs) in the past, as a part of their social forestry programmes, the extent of strip plantations may actually be much more than what the BFD records show. As social forestry plantations are also exploited, and regenerated at the end of the rotation period, the actual area under plantations may be much less as some areas may be recorded more than once.

The extent of the coastal plantations established so far is estimated to be nearly 200,009 ha. Most of the coastal plantations have been developed primarily with the objective of stabilizing newly accreted coastal lands. This land is given to the BFD for a period of 20 years to establish plantations, and it has to be returned to the Ministry of Lands at the end of this period. Under this arrangement, an area of 45,351 ha from different forest divisions has been returned so far to the Ministry of Lands. Due to the failure and destruction of coastal plantations, the actual area under coastal plantations turned out to be only 61,574 ha (FD mapping 2013), against a planted area of more than 200,000 ha, although some young plantations may have escaped detection during assessments carried out with satellite images. The country needs a 2280-km-long green belt along its entire coast, out of which 977 km has already been planted, while 791 km has been adjudged as not suitable for plantation establishment as the land is either unsuitable for plantation establishment or is inhabited. Thus another 512 km needs to be planted.

As plantations are a dynamic entity, due to continuous establishment and felling, the actual area under plantations continues to vary from year to year and in the absence of continuous record keeping is not readily updated. According to the FIGNSP 2013 study, the actual areas under various kinds of plantations were as listed in Table 2-4.

Table 2-4: Actual area under plantations (ha)

Types of plantations	Area (ha)
Plantations (long-term and short-term)	75,872
Scattered forest in CHT mixed with teak plantations	116,971
Plantations in USF (BFD-controlled)	17,347
Coastal plantations	61,574
Rubber plantations	9,217
Strip plantations	62,329
Total	343,310

Homestead and other private forests

Homestead forests are essentially tree gardens around rural habitations. Although a large proportion of the trees in the homesteads are fruit trees such as mango, jackfruit and coconut, most of them are timber-yielding trees as well. In addition, trees are grown in private woodlots, in the premises of institutions and along the sides of roads and railway tracks, and this source of wood is popularly believed to meet nearly 80% (FMP 1995) of the local demand for wood products. NFA 2005-2007 estimated their extent to be far more than those of all other natural and planted forests put together (2,767,000 ha, all plots over 0.1 ha in size). There are indications that the area under homestead plantations has been growing ever since records started to be maintained. This underlines the importance of these resources for the local economy. The Bangladesh Bureau of Statistics (BBS) carried out the 'Household-Based Forestry Survey 2011-2012' in 2014 and recorded that 91.9% of the households in the country owned trees.

Apart from the formally recorded or recognized categories of forests, people of the CHT own private plantations (*jots*) of significant size. The extent of these forests has not been determined by any accurate survey, but the estimated area of the private forests in North Rangamati Division alone is approximately 273,791 ha, consisting mostly of teak and gamar plantations. The newfound interest of the indigenous people of the CHT in horticulture suggests that the extent of these plantations, mostly teak and gamar, may be further declining.

Other plantations

Apart from the foregoing, rubber and agarwood plantations are the other plantations that contribute to the TOF sector. Bangladesh has approximately 32,000 ha of rubber plantations owned by the BFIDC, private growers and the Chittagong Hills Development Board. Agarwood plantations have become popular due to their financial promise and are likely to grow further. The BFD has developed experimental agarwood plantations in the hill districts over an area of approximately 5800 ha. No data are available on the private plantations of agarwood.

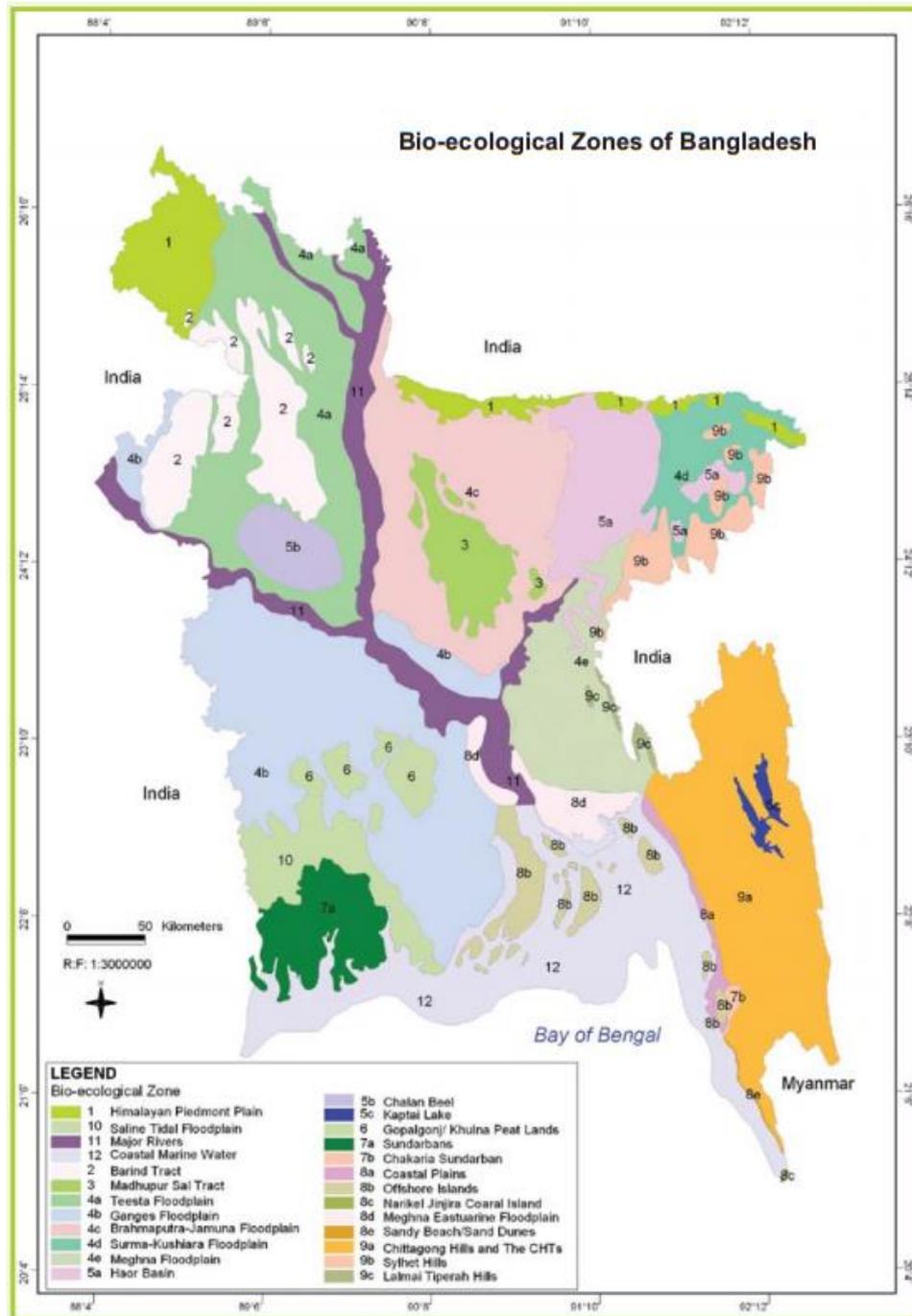
2.3 Status of biodiversity and PAs

2.3.1 Status of biodiversity and wildlife

Despite its small size, Bangladesh has an impressive variety of ecosystems, which support an equally varied flora and fauna. The characteristics of the various landscapes determine the

distribution of the country's wildlife. Ecosystems may be categorized as either terrestrial or aquatic. The terrestrial ecosystems include forested areas, agricultural land and human habitation, while the aquatic ecosystems include seasonal and perennial wetlands, rivers, lakes, coastal mangroves, coastal mudflats and *charlands*, and marine ecosystems. The country is divided into 12 bio-ecological zones and 25 sub-zones. Map 2-2 shows the locations of the ecological zones of Bangladesh.

Map 2-2: Bio-ecological zones of Bangladesh (IUCN, 2015)



The species of plant and animal found in Bangladesh according to NBSAP 2006 are listed in Table 2-5.

Table 2-5: Recorded and estimated numbers of wild plant species of different plant groups

Category	Number recorded	Estimated number
Algae	3600	6000
Brvophytes	290	400
Pteridophytes	200	250
Gymnosperms	5	5
Angiosperms	3000	5000

Table 2-6: Numbers of animal species belonging to the major taxonomic groups

Major Taxonomic Group		Number of Species
Monera (Eubacteria, etc.)		166
Protista (protozoans, viruses, etc.)		341
Animalia: Invertebrates	Poriferans	7
	Cnidarians	68
	Platyhelminths	23
	Nematodes	105
	Annelids	62
	Arthropods	1547
	Molluscs	347
	Echinoderms	6
Animalia: Vertebrates	Fishes	735
	Amphibians	23
	Reptiles	136
	Birds	778
	Mammals	125
Total number of species		4469

The royal Bengal tiger (*Panthera tigris*) and Asiatic elephant (*Elephas maximus*) are the two flagship wild animals of Bangladesh. In the hill forests, the important wild animals include the Asian elephant, spotted deer (*Axis axis*), barking deer, langur, Phayre's monkey, hoolock gibbon, numerous snakes and birds. In the plain sal forest, in the districts of Gazipur, Mymensingh, Tangail, Comilla, Rajshahi, Rangpur and Dinajpur, the wildlife includes the rhesus monkey (*Macaca mulatta*), barking deer (*Muntiacus muntjak*), spotted deer, langur, fishing cat, marbled cat and jackal (*Canis aureus*); in the mangrove forests of the Sundarbans, the wildlife includes the royal Bengal tiger, spotted deer, wild boar (*Sus scrofa*), rhesus macaque, estuarine crocodile (*Crocodylus porosus*), snakes, birds (300 species) and fish. The wildlife in the

freshwater wetlands, including the *haors* and *baors*, is characterized by various species of bird (208 species), turtle, tortoise and fish (144 species).

The royal Bengal tiger, masked finfoot, mangrove pitta, brown-winged kingfisher, lesser adjutant stork, Indian skimmer, Gangetic dolphin, Irrawaddy dolphin and estuarine crocodile are some of the most threatened species of wildlife found in Bangladesh.

IUCN Red List

The International Union for the Conservation of Nature (IUCN) has recently carried out an assessment of the conservation status of various groups of wildlife found in the country. According to IUCN (2015),

'Among 1,619 assessed species, 50% of species are found as Least Concern (LC), 2% as Regionally Extinct (RE), 3% as Critically Endangered (CR), 11% as Endangered (EN), 9% as Vulnerable (VU), and 6% as Near Threatened (NT). Thirty one species are categorized as extinct from the country, while 390 species (29% of the total species assessed) are under the threatened categories (CR, EN and VU). Besides, 17% [of the] species are categorized as Data Deficient (DD) due to a lack of appropriate data and information required to justify the criteria used for categorizing.

Extinct species of Bangladesh (IUCN 2015)

Thirteen species were marked as extinct from the country in the Red List of 2000, which were reassessed along with all other species under this project. Among 1,619 species of Bangladesh, of seven faunal groups, 31 species are assessed as extinct from the country, which is termed as regionally extinct (RE). These include 11 mammals, 19 birds, and 1 reptile. No species was found as regionally extinct from other four groups (Amphibian, Freshwater Fish, Crustacean and Butterfly). Ten species of mammals were evaluated as Extinct in the previous Red List. Among these extinct species Gaur and Hog Deer have been rediscovered during the last decade. However, the recent edition of Red List has enlisted one more species of mammal, Sloth Bear as Extinct from the country. According to the present assessment, 17 more bird species are newly declared as regionally extinct, while only two species were adjudged as extinct in the last assessment. Marsh Crocodile (Reptile) was listed in the list of extinct species Red List 2000 extinct list, which is also assessed as also in Red List 2015 The updated list of extinct species of the country is presented in Table 2-7.

Table 2-7: *Extinct wildlife species of Bangladesh*

Mammals	Birds	Birds/Reptiles
Striped hyaena	Bar-tailed tree creeper	Pink-headed duck
Blackbuck	Spot-breasted parrotbill	Rusty-fronted barwing
Sumatran rhinoceros	Green peafowl	White-bellied heron
Swamp deer	Swamp francolin	White-winged duck
Banteng	Bengal florican	Black-breasted parrotbill
Indian rhinoceros	Greater rufous-headed parrotbill	Indian peafowl

Mammals	Birds	Birds/Reptiles
Blue bull	Greater adjutant	Grey francolin
Wild buffalo	Lesser florican	Spot-billed pelican
Grey wolf	Rufous-throated partridge	Marsh crocodile (mugger crocodile)
Javan rhinoceros	Sarus crane	
Sloth bear	Red-headed vulture	

The conservation status of important groups of wildlife in Bangladesh is described below (IUCN 2015):

Mammals

'Among 1,619 species of seven wildlife groups, 138 mammalian species were considered; out of which, 11 are Regionally Extinct, 17 Critically Endangered, 12 Endangered, and 9 Vulnerable. Apart from those, there are 39 Data Deficient, 34 Least Concern, 9 Near Threatened, and 7 Not Evaluated species.

Birds

Birds as a group have the highest number of species that were evaluated, 566 species. Among them 19 have been evaluated as Regionally Extinct and 39 species as under Threatened Category, of which 10 as Critically Endangered, 12 as Endangered and 17 as Vulnerable. Another 39 species have been categorised under the Near Threatened Category; the highest number, 424 had been evaluated as Least Concern.

Reptiles

Reptiles have 167 species and one has become Regionally Extinct. The Mugger or Marsh Crocodile that used to live in the freshwater river ecosystem of the country has possibly disappeared by the 1960s. Of the 38 threatened species, 17 are Critically Endangered, 10 Endangered and 11 Vulnerable. The remaining species have been evaluated as: 18 Near Threatened, 63 Least Concern, 27 Data Deficient, and 20 Not Evaluated.

Amphibians

A total of 49 Amphibians were evaluated. There are 2 species Critically Endangered, 3 Endangered, and 5 Vulnerable. Apart from the threatened categories, 6 species are Near Threatened, 27 species are Least Concern, and 6 species are Data Deficient.

Freshwater fishes

Two hundred fifty three Freshwater Fishes were assessed. Nearly one fourth (64 species) of the species are under threat, among them 9 Critically Endangered, 30 Endangered, and 25 Vulnerable. This has been followed by 26 species as Near Threatened. Outside the purview of the Threatened and Near Threatened Categories, there are 123 species that were assessed as Least Concern and rest of the 40 as Data Deficient.

Crustaceans

As one of the new animal groups for the first time included in the national Red List of Bangladesh, so far, 141 species of Crustaceans were evaluated. This group has no species that are registered as Regionally Extinct or Critically Endangered. Eleven species have fallen under the threatened categories of which only 1 was categorised as Endangered and another 10 as Vulnerable. Out of the rest, 48 species were evaluated as Least Concern and 79 as Data Deficient.

Butterflies

Butterfly is another new group included in the current process of evaluation that included 305 species. As newly assessed group, 62% species (188 species) are under Threatened Categories of which only 1 is categorised as Critically Endangered, 112 as Endangered, and 75 as Vulnerable. Of the rest 85 are categorised as Least Concern and 32 as Data Deficient.'

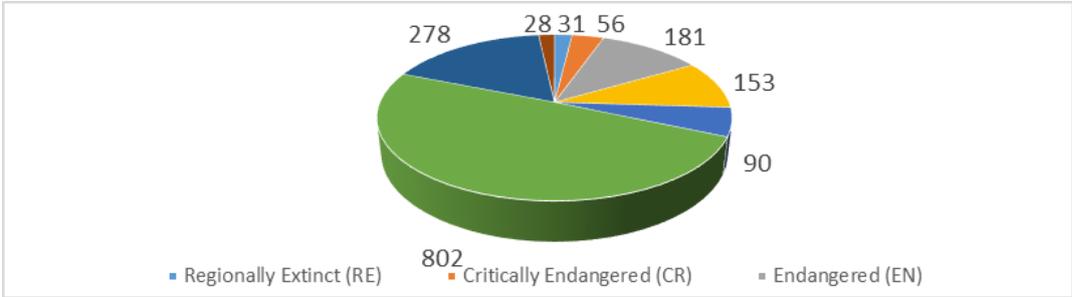


Figure 2-2: Endangered animal species of Bangladesh

A summary of the threat status of various groups follows (Table 2-8):

Table 2-8: Summary of the Red List of Bangladesh 2015⁵

Category	Mammals	Birds	Reptiles	Amphibians	Fresh water Fishes	Crustaceans	Butterflies	Total
Regionally Extinct (RE)	11	19	1	0	0	0	0	31
Critically Endangered (CR)	17	10	17	2	9	0	1	56
Endangered (EN)	12	12	10	3	30	2	112	181
Vulnerable (VU)	9	17	11	5	25	11	75	153
Near Threatened (NT)	9	29	18	6	27	1	0	90
Least Concern (LC)	34	424	63	27	122	47	85	802
Data Deficient (DD)	39	55	27	6	40	79	32	278
Not Evaluated (NE)	7	0	20	0	0	1	0	28
Total	138	566	167	49	253	141	305	1619

As can be seen, a large number of species of mammal, bird and reptile are threatened, while 31 are already extinct locally. In view of the growing population and prosperity of the people, the pressure on natural resources is going to mount further in the future. Therefore, if special efforts are not made to preserve the threatened species, the losses in the future may be even more severe.

2.3.2 Protected areas

The National Biodiversity Conservation Strategy and Action Plan (NBSAP) 2004, which is currently under revision, has identified the conservation of 'megafauna and megafauna' as one of the priorities in the country.

The Wildlife (Protection and Security) Act, 2012 is the principal legal instrument that regulates the conservation of biodiversity in the wild. This legislation empowers the state to designate PAs in which representative biota and their habitats are protected. This act provides for the creation of several types of PAs, namely, sanctuary, national park, community conservation area, safari park, eco-park, botanical garden, wildlife breeding centre, landscape zone or corridor, buffer zone, core zone, national heritage and *kunjban*. All the categories enjoy the same level of protection as a wildlife sanctuary (sections 14, 15 and 16) although no special protection is available to some categories, namely, community conservation areas, buffer zones and corridors.

As the sizes of wildlife habitats have shrunk drastically and some of these have become fragmented, it is necessary to extend the extent of the protected areas to at least 30% of the

⁵ IUCN Bangladesh. 2015. *Red List of Bangladesh: A Brief on Assessment Result 2015*. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, pp. 24.

forest area of the country. A larger area of the Sundarbans, which is very rich in floral and faunal biodiversity, needs to be brought under the PA system. In addition, all the watersheds and other sensitive areas, including rehabilitated watersheds, need to be brought under the coverage of the protected areas.

The current PA system of Bangladesh includes 17 National Parks, 20 Wildlife Sanctuaries, 2 Special Biodiversity Conservation areas, 1 Marine Protected Area, 1 eco-park, and 10 Ecologically Critical Areas (in 13 patches). The following areas have been declared PAs by the BFD under different acts and rules.

PROTECTED AREAS				
List of notified Protected Areas (PA) of Bangladesh				
National parks				
Sl. No.	National Park	Location	Area (ha)	Date of Notification
1	Bhawal National Park	Gazipur	5022.29	11 May 1982
2	Modhupur National Park	Tangail/ Mymensingh	8436.13	24 February 1982
3	Ramsagar National Park	Dinajpur	27.75	30 April 2001
4	Himchari National Park	Cox's Bazar	1729.00	15 February 1980
5	Lawachara National Park	Moulavbazar	1250.00	7 July 1996
6	Kaptai National Park	Ctg.Hill Tracts	5464.78	9 September 1999
7	Nijhum Dweep National Park	Noakhali	16,352.23	8 April 2001
8	Medha Kassapia National Park	Cox's Bazar	395.92	4 April 2004
9	Satchari National Park	Habigonj	242.91	10 October 2005
10	Khadeem Nagar National Park	Sylhet	678.80	13 April 2006
11	Baraiyadhala National Park	Chittagong	2933.61	6 April 2010
12	Kadigar National Park	Mymensingh	344.13	24 October 2010
13	Shingra National Park	Dinajpur	305.69	24 October 2010
14	Nababgong National Park	Dinajpur	517.61	24 October 2010
15	Kuakata National Park	Patuakhali	1613.00	24 October 2010
16	Altadeghe National Park	Nagaon	264.12	14 December 2011
17	Birgonj National Park	Dinajpur	168.56	14 December 2011
	Sub-Total		45,746.53	

Wildlife Sanctuaries				
Sl. No.	Wildlife Sanctuary	Location	Area (ha)	Date of Notification
18	Rema Kalenga Wildlife Sanctuary	Hobigonj	1795.54	7 July 1996
19	Char Kukri Mukri Wildlife Sanctuary	Bhola	40.00	19 December 1981
20	Sundarbans (East) Wildlife Sanctuary	Bagerhat	122920.90	29 June 2017
21	Sundarbans (West) Wildlife Sanctuary	Satkhira	119718.88	29 June 2017
22	Sundarbans (South) Wildlife Sanctuary	Khulna	75310.30	29 June 2017
23	Pablakhali Wildlife Sanctuary	Ctg. Hill Tracts	42,069.37	20 September 1983
24	Chunati Wildlife Sanctuary	Chittagong	7763.97	18 March 1986
25	Fashiakhali Wildlife Sanctuary	Cox's Bazar	1302.42	11 April 2007
26	Dudh Pukuria-Dhopachari Wildlife Sanctuary	Chittagong	4716.57	6 April 2010
27	Hazarikhil Wildlife Sanctuary	Chittagong	1177.53	6 April 2010
28	Shangu Wildlife Sanctuary	Bandarban	2331.98	6 April 2010
29	Teknaf Wildlife Sanctuary	Cox's Bazar	11615.57	09 December 2009
30	Tengragree Wildlife Sanctuary	Barguna	4048.58	24 October 2010
31	Sonarchar Wildlife Sanctuary	Patuakhali	2026.48	24 December 2011
32	Chandpai Wildlife Sanctuary	Bagherhat	560.00	29 January 2012
33	Dudmukhi Wildlife Sanctuary	Bagherhat	170.00	29 January 2012
34	Daingmari Wildlife Sanctuary	Bagherhat	340.00	29 January 2012
35	Nagarbari-Mohangonj Dolphin (Platanistaganetica) Sanctuary	Pabna	408.11	1 December 2013
36	Shilanda-Nagdemra Wildlife (Dolphin) Sanctuary	Pabna	24.17	1 December 2013
37	Nazirgonj Wildlife (Dolphin) Sanctuary	Pabna	146.00	1 December 2013
	Sub-Total		39,8485.37	

Special Biodiversity Conservation Areas				
Sl. No.	Special Biodiversity Conservation Area	Location	Area (ha)	Date of Notification
38	Ratargul Special Biodiversity Conservation Area	Sylhet	204.25	31 May 2015
39	Altadighi water based Special Biodiversity Conservation Area	Naogaon	17.34	09 June 2016
Sub-Total			221.59	

Marine Protected Areas				
Sl. No.	Marine Protected Area	Location	Area (ha)	Date of Notification
40	Swatch of No-Ground Marine Protected Area	South Bay of Bengal	173,800.00	27 October 2014

Eco-Parks				
Sl. No.	Eco-Park	Location	Area (ha)	Date of Notification
41	Char-muguria Eco-Park	Madaripur	4.20	25 August 2015

The Department of Environment (DoE) of the MoEF has declared the following 13 areas as Ecologically Critical Areas. Nothing visible has been done by the DoE towards the management or maintenance of these ECAs.

Sl. No.	Name of the ECA	Type of Ecosystem	Location	Area (ha)	Year of Declaration
1	Cox's Bazar-Teknaf Peninsula	Coastal-marine	Cox's Bazar	20,373	1999
2	Sundarbans (10 km landward periphery)	Coastal-marine	Bagerhat, Khulna and Satkhira	292,926	1999
3	St. Martin's Island	Marine island with coral reefs	Teknaf Upazila, Cox's Bazar	1214	1999
4	Hakaluki Haor	Inland Freshwater wetland	Sylhet and Moulvi Bazar	40,466	1999
5	Sonadia Island	Marine island	Moheshkhali Upazila, Cox's Bazar	10,298	1999
6	Tanguar Haor	Inland freshwater wetland	Moulvi Bazar	9727	1999

Sl. No.	Name of the ECA	Type of Ecosystem	Location	Area (ha)	Year of Declaration
7	Marjat Baor	Oxbow lake	Kaliganj Upazila of Jhenaidah and Chaugacha Upazila of Jessore	325	1999
8	Gulshan-Baridhara Lake	Urban wetland	Dhaka City	101	2001
9	Buriganga	River	Around Dhaka	1336	2009
10	Turag	River	Dhaka	1184	2009
11	Sitalakhya	River	Dhaka	3771	2009
12	Balu, including Tongi Canal	River	Dhaka	1315	2009
13	Jaflong-Dawki	River	Jaflong, Sylhet	1493	2015

Wildlife management

It is against the law in Bangladesh to hunt or trap wild animals for consumption or trade. However, wildlife is declining rapidly primarily due to the loss of habitats and illegal exploitation. The royal Bengal tiger, which was found in other forest areas of the country in the not so distant past, is found only in the Sundarbans now. It is the most important wild animal of the country, from the points of view of both threats and popularity. It is one of the two flagship species of the country, while another flagship species, the Asian elephant, can be found in the forests of the eastern and northern regions. The tiger is under severe threat from poachers feeding illegal markets. Its current population is estimated to be about 106 animals only. In the past, elephants were abundant in the hilly regions of the country. At present their numbers have greatly dwindled, and they are listed as Critically Endangered. Up to 30% of Bangladesh's elephant population is transient, migrating over the borders into neighbouring India or Burma. Some also temporarily enter Bangladesh from Burma and India in search of food. In 1996, the total number of elephants in Bangladesh was estimated to be 200-250 (Santiapillai, IUCN 1996). Habitat loss and human presence in their habitats drove them to a few limited and isolated areas. The IUCN conducted a survey on elephants in 2004 and estimated the total number in the country to be about 239, of which 94 were captive (used either for logging or in circuses). The IUCN listed this mammal as Critically Endangered in 2010. The IUCN estimated that 80-100 migratory elephants occasionally cross the borders with Burma and India. It needs to be mentioned here that Bangladesh has no active elephant conservation programme.

Although Bangladesh is not an important source country for the international wildlife trade, it is on an important route for smuggling South Asian wildlife and wildlife products to the South-East Asian markets. However, tiger skins and other body parts are reported to be illegally exported from the country. In Bangladesh, most animals are killed for food. Some birds and reptiles are also captured for the pet trade.

The Forest Act, 1927 and the Wildlife (Conservation and Security) Act, 2012 are the two main legal instruments for protecting wildlife and habitats. Apart from the creation of new protected areas, the country is in the process of setting up a wildlife centre for capacity building, recovery and rehabilitation of stranded animals, research and management of wildlife information. The arrangements for wildlife crime control need to be strengthened. A wildlife forensic lab for aiding prosecution is under development. There are seven wildlife divisions whose main job is to

control wildlife crime. Despite the proactive approach adopted by the BFD to control wildlife crime in the country, several institutional issues militate against success in this area. Both the laws have some serious flaws, which need to be rectified urgently. For example, the Wildlife Act has no provision for empowering forest officers to arrest wildlife criminals, while the Forest Act is not applicable outside the forests, where most of the wildlife offences are committed. Moreover, the Wildlife Act is not yet fully operational because several important rules and notifications are not yet in place. Field officers are also handicapped in providing effective protection to wildlife due to a lack of necessary equipment, including manpower, transport and funds for patrolling, travelling and prosecution. As a result, only a small proportion of the wildlife offences are detected and prosecuted. Nearly 60% of the registered cases are ones in which the criminals could not be identified (UDOR cases), and 78% of the prosecuted cases take more than 8 years for decisions to be arrived at in the courts. Thus, the laws do not act as effective deterrents against wildlife offences.

Although the new law provides for co-management of only sanctuaries, this system is already operational in many protected areas that are not wildlife sanctuaries. In many areas, the co-management is only cosmetic in nature because the management has no money to pay communities for their services and does not share any revenue with them. Most protected areas suffer from an acute shortage of staff and funds. Some, like Madhupur National Park, suffer from heavy encroachment and social unrest. Pablakhali Sanctuary, which is one of the largest PAs outside the Sundarbans, is severely damaged by encroachment and illicit felling.

Though tourism is the only revenue-earning component of protected area management, for all practical purposes there is no scientific management of the PAs. Till 2016, the BFD had declared about 51 locations 'PAs'. Management plans have been written for only a few of them, and the application of these plans is not yet a reality. It seems that some of these PAs are getting overcrowded with visitors, which not only disturbs the wildlife but also adversely affects the ecosystems. Such locations include Katka (Sundarbans East Wildlife Sanctuary), Lawachara (Sreemongal, Sylhet), Bhawal National Park (Dhaka), Satchari (Habigonj), Ratargul (Sylhet) and Modhupur National Park (Mymensingh). The large crowds of visitors very often cause serious pollution and adversely affect the pristine ecosystems⁶. The BFD needs to determine the carrying capacity of each PA and restrict the number of visitors accordingly. It is high time that the BFD promulgated rules for the management of the protected areas, prohibiting pollution and imposing punishments on polluters. The BFD needs to undertake systematic and scientific management of all the PAs under its control.

2.4 Demand and supply

Forest products contribute significantly to the economy of the country. They provide not only numerous products but also different important services for the nation. Timber and firewood are in great demand for use by the population, and thus there is a huge demand for forest products. The demand for non-timber forest products (NTFPs) is also high. These high demands have caused over-exploitation. In a densely populated country like Bangladesh, land is one of the scarcest resources, and there is tremendous competition for it.

⁶ Tourism: An Emerging Threat to Sundarbans Ecosystem. (An article in the book 'Sundarbans' published by Nymphaea Publication, Dhaka, Bangladesh. ISBN: 978-984-90160-0-7.) 2013

Demand for forest land

Land is the pivot of forests and forestry. Forest land is perhaps one of the most precious commodities in a land-scarce country, and there is pressure to grab it from all quarters. In many instances, there are land disputes between local people and the government over the ownership of forest land. The laws protecting forest estates are not properly implemented, and often court cases instituted against encroachers take a very long time to be settled. In the sal forests, many forest patches have been occupied by people on the basis of dubious documents purportedly obtained during the *zamindari* days. For many poor people, cultivation on a patch of forest is the easiest way of making a living. The situation in the CHT is even worse. A lack of demarcation or regular surveys and mapping of forest boundaries and weak implementation of the relevant laws are among the principal reasons for this situation. In this situation, it is a very challenging task to secure land for creating new forests. Afforestation on new accretions along the coast is facing various administrative and political barriers. Forest lands are being encroached by locals, and this often happens with the support or active involvement of powerful people. According to the BFD records, till 2016, about 104,154 ha is reported as encroached forest land, and this extent is increasing every day. The actual figure is likely to be much higher than the reported figures. Besides these, the government has transferred about 125,626 ha of forest land to other agencies for non-forestry purposes. Another area of conflicting demands for forest lands is shifting cultivation. While this traditional practice requires access to unlimited expanses of wild land, successful conservation of forest resources depends on the discontinuation of this practice in such areas. Although shifting cultivation is legally permitted in the USF lands only, it has affected nearly all the RF areas in the CHT region.

Newly accreted land along the coasts is transferred by the government to the BFD for afforestation for a fixed period of 20 years, and at the end of this period, the land has to be re-transferred back to the Lands Department. There is often a serious conflict over the possession of such land between the BFD and locals, often led by influential people. This has, in many cases, resulted in wilful destruction of plantations. A continuous plantation along the entire coast of Bangladesh is being planned as a green belt for protection against storms from the sea. As the green belt will be a permanent belt of plantations, the land under the green belt plantations will have to be permanently transferred to the BFD, and its protection needs to be ensured. Necessary legal provisions will have to be made in this respect.

Timber and fuelwood

No estimates of the total production of timber and fuelwood in Bangladesh are available. FAO estimates the production and consumption of round-wood, which includes both timber and fuelwood, in 2014 as 26.6 m³, but there is no independent estimate for the timber component alone. On the basis of a survey of the round-wood consumption of the nearly 15,880 sawmills of the country, and estimates of the total growing stock, the annual production of timber in the country is estimated to be approximately 7 million m³ per annum. Thus the total current consumption of firewood can be presumed to be approximately 19.6 million m³. As has been mentioned previously, nearly all the timber and firewood is produced by private tree growers as there is a ban on cutting of trees in government forests.

The Brick Burning Act of 1989 imposed a ban on the use of fuelwood for brick manufacture and introduced licensing for brick kilns. In spite of this ban, because of large-scale non-compliance and ineffective implementation of this provision of the act, a very large quantity of fuelwood is still being used in brick manufacture. According to Khan (2013) about 1.9 million tons of

fuelwood is annually used in the brick industry. According to this study, the consumption of fuelwood in brick burning is estimated to be growing at a rate of 2-3% annually. Unless effective control of this use is ensured, the use of firewood for brick manufacturing will continue to increase. Manufacturing bricks is a major cause of the destruction of the tree cover in villages and of removal of trees, as fuelwood, from forests. Brickfields are a major pollutant and, according to Khan (2013), generate 9.8 million tons of CO₂ annually. The use of natural gas and modern fuel-saving brick manufacturing technologies can result in a substantial reduction in the fuel consumption. However, as there is no likelihood of supplying natural gas for brick manufacture, providing coal, as a substitute for fuelwood, to brick manufacturing units, particularly in rural areas, where the use of fuelwood is more prevalent, is necessary.

In the absence of time-series data of past consumption levels, it is difficult to make projections about the future demand for timber. However, a reasonable guess about future demands can be made on the basis of various demographic features and the changing socio-economic conditions of the country. While the demand for timber is likely to go up in proportion to the rise in the population, the demand for fuelwood is likely to be modified by the changes in fuel preferences due to increasing urbanization and the availability of alternative fuels such as bottled gas and electricity.

Based on these factors and assumptions, the demands for industrial round-wood and fuelwood in the future are estimated as in Table 2-9 and Table 2-10.

Table 2-9: Projections of timber demand

Year	Estimated Population (millions)	Estimated Demand (million m ³)
2016	163	10.57
2030	186	12.06
2050	202	13.09

Table 2-10: Projections of fuelwood demand

Year	Population (millions)	Proportion of Population Using Fuelwood (%)	Total Population Using Fuelwood (millions)	Estimated Demand for Fuelwood (million m ³)
1991	110	44.27	48.4	18.392
2011	153	34.8	52	19.76
2030	186	25	46.5	17.67
2050	202	15	30.3	11.514

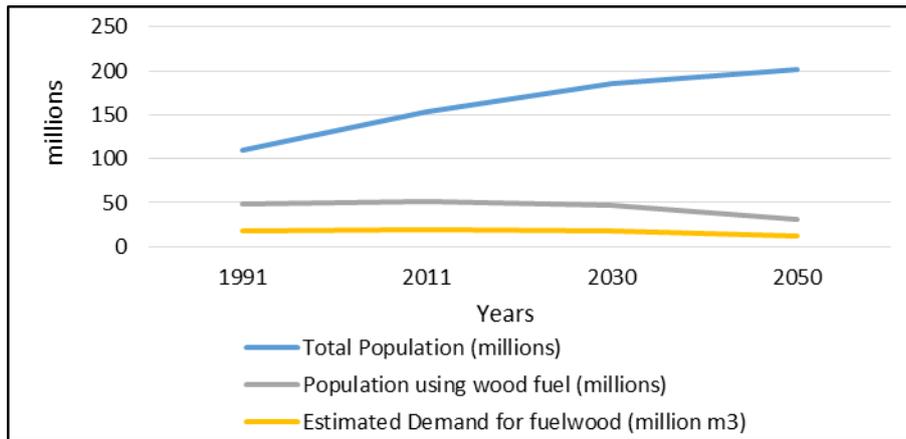


Figure 2-3: Projection of fuelwood demand

These tables and Figure 2-3 show that while the demand for timber will continue to grow as the population rises, the demand for fuelwood is likely to fall from the current consumption of 19.9 million m³ per annum to 17.67 million m³ in 2030 and to 11.5 million m³ in 2050 despite the rise in the population, due to the impending demographic and socio-economic changes. This trend augurs well for the country as it will go a long way in helping to regenerate its forests.

Non-timber forest products

Good time-series data regarding the production of various NTFPs are not available for any of the forest divisions. However, on the basis of the general trends, it is clear that the demand for bamboo will continue to rise. The demand for *murta* from the Sylhet Forest Division, which is the principal producer of forest *murta*, is going down due to a declining supply, emigration of craftsmen and their opting for other professions. With the increasing population, the demand for fish and honey will continue to grow, but the production is declining.

Golpata is collected from the Sundarbans by individuals under permits. Thus the quantity collected can safely be considered to be the demand. The data relating to *golpata* production in the Sundarbans during 1970-2010 are shown graphically in Figure 2-4.

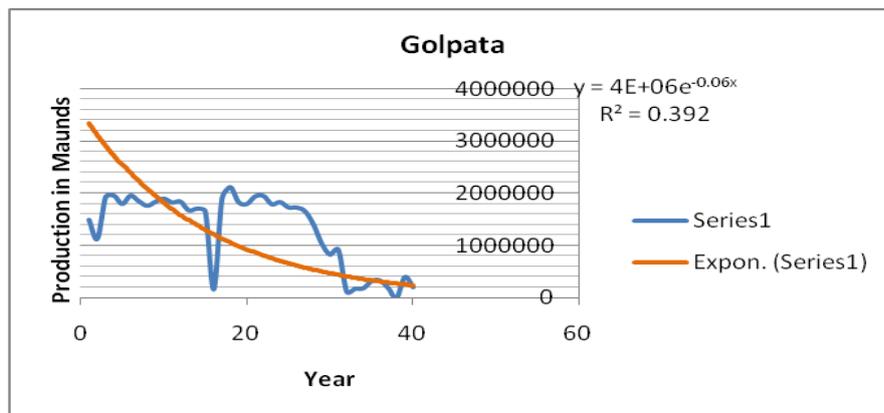


Figure 2-4: Golpata production trend

This graph clearly indicates that the demand for *golpata* fluctuates over a great range and that the overall trend of consumption is declining.

A graph of the wild honey production data for the period 1970-2010 in the Sundarbans is shown in Figure 2-5.

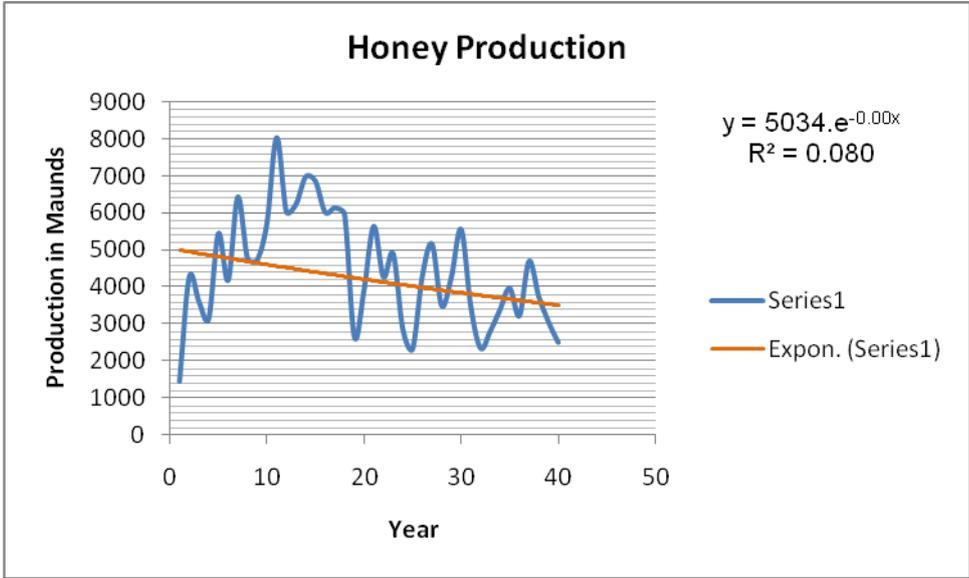


Figure 2-5: Honey production trend

This graph indicates that there are tremendous fluctuations from year to year and that there is an overall declining trend. There is every reason to believe that this declining trend is indicative of a declining availability of honey-producing flowering plants in the forests.

The demand for raw materials for paper and paperboard is increasing, but in the absence of local availability, this demand is met mostly through imports. The consumption of wood charcoal is also growing and will continue to increase in the future. Charcoal making is estimated to consume nearly 2 million m³ of round-wood annually.

Medicinal plants are another commodity that come partly from the forests. With the declining natural forest, the supply of these plants from the forests has gone down. An SEDF/IC study reported that the total value of the medicinal plants used in Bangladesh annually, is \$14 million, with \$8.4 million worth being imported. The major forest species are amloki, haritoki, arshwagandha, bohera, peepul, cheerota, mutha, Agar, etc., and there is a demand for a large number of forest herbs and shrubs from the pharmaceutical industry. The demand for medicinal plants is continuously increasing both locally and internationally.

In spite of a drop in the price of rubber in recent years, production of rubber still remains profitable. Rubber plantations have been established by the BFIDC, many tea estates and individual entrepreneurs. If the sector is promoted properly and incentives are given to private parties, establishment of rubber can play an important role in the greening of the country.

Agarwood and oil are high-value commodities in the international market. While the agar trees have disappeared from the hill forests where they grew naturally, plantations of the species have been established in both the public and private sectors in the Sylhet and Chittagong regions. Agar has great potential. The government needs to take the necessary steps to promote this high-value, foreign currency-earning commodity.

2.5 Ecosystem services and their valuation

Ecosystem services, or ecosystem goods and services (EGS), encompass all provisions from nature. The EGS can be divided into the following categories for the sake of simplification:

- **Provisioning services.** Food, raw materials, freshwater, medicines
- **Regulating services.** Moderation of the climate and extreme events, erosion control, pollination, carbon sequestration, waste water treatment, biological control, soil fertility
- **Habitat or supporting services.** Biodiversity, wildlife, genetic diversity
- **Cultural services.** Recreation, tourism, spiritual value

Most of these ecosystem services are intangible and thus cannot be measured directly. However, continuous progress is being made to quantify the bounties of nature in order to understand their importance to human existence and progress. A brief description of the EGS provided by the various forest ecosystems of the country is provided in the following.

Mangroves

Like all ecosystems, the Sundarbans provide both tangible and intangible services. Among the tangible or provisioning services provided by the mangroves are fuelwood, thatching materials, herbs, ornamental plants and food items such as honey, fish, shrimps and crabs. Other ecosystem services provided include detritus and nutrient production, water purification, sediment trapping and surface water storage. NTFPs are also used for medicinal, cosmetic and cultural purposes in the form of fibres, resins, gum and plant and animal products. The Sundarbans is also one of the most important ecotourism destinations in the country. The major ecosystem services of the Sundarbans include serving as a breeding and nursery ground for a large number of aquatic organisms including fishes and crustaceans. *Nypa*, honey and wax are the other critical goods provided by these mangroves. But the more critical roles of the Sundarbans are the protection it provides to the coast and coastal communities against sea storms, tidal surges and other sea-related vagaries of nature, the provision of a habitat for hundreds of species such as the tiger, crocodiles and fishes and the maintenance of the oxygen and carbon cycles in the region. The productivity of the fisheries in the country is dependent on the breeding and migration sanctuary provided by the Sundarbans to various fish species. The Sundarbans also holds the largest stock of sequestered carbon in the country.

This ecosystem has experienced some deterioration because of the over-exploitation of resources in the past. The over-exploitation of the *sundari* and *gewa* and the top dying disease, which killed large numbers of *sundari* trees, have been the main causes of deterioration of forest stands in the Sundarbans. However, the prevailing moratorium on timber extraction, imposed almost 20 years ago, has borne results and has helped the recovery of the ecosystem considerably. The diversion of water after the construction of the Farraka Barrage and withholding of water upstream have decreased the freshwater flow, which has increased the salinity, affecting the health and distribution of the flora. This is adversely affecting the *sundari*, economically the most important tree species in the Sundarbans, which thrives best in conditions of low salinity. The resulting reduction in tree density has made these areas more vulnerable to cyclones. Permanent retention of stagnant water inside coastal embankments has made the land unsuitable for agriculture or animal husbandry. As the population in the area has access to very few other income-generating activities, this situation has made it more

dependent on the Sundarbans. This situation has affected the health, nutrition, workload and livelihood strategies of the local communities.

Hill forests

The upland or hill forests are located in the Sylhet, Chittagong hills and CHT districts. Timber, fuelwood and NTFPs, including bamboo, are the principal resources provided by this ecosystem. These forests also protect catchments and watersheds, provide water for irrigation and generate electricity. The floral and faunal diversity of the hill forests is rich. These forests are home to a large number of animal and plant species, particularly the Asiatic elephant, hoolock gibbon, spectacled monkey, Phayre's leaf monkey and slow loris. However, the denudation of the forests has resulted in a major loss of habitats, and a large number of species have disappeared from these forests. The watershed services provided by the hill forests feed the perennial rivers, recharge the aquifers and provide protection against flash floods. The forests also help maintain healthy populations of pollinating insects and birds, which ensure the productivity of agriculture in the surrounding areas.

However, due to the degradation and deforestation in these areas, the services provided by them are dwindling. Due to the moratorium on the exploitation of natural forests, the production of timber has officially stopped, but the degradation of the forests has continued. The available information indicates that the tree cover in the hill forest is continuing to decline. As there is limited demand, particularly in the CHT, the timber must have somehow made its way to the markets far downstream! Due to the deforestation, most of the NTFP production has also declined or stopped. The establishment of monoculture tree plantations has affected this ecosystem by increasing the risk of erosion and by degrading forest soils. Man-wildlife conflicts are also increasing as elephants are now causing more damage as a result of the destruction of their habitat.

Agar (*Aquilaria agallocha*) plantations have been raised in some areas in Sylhet, Chittagong and Bandarban districts. Valuable aromatic oil is extracted from the infected wood of this species. Depending on the quality of the oil processed, it fetches a price of about \$5000 or more per kilogram at the grower's level and, depending on the quality, a much higher price in the retail market. Agarwood chips are also in demand in the Arab countries for burning as incense.

Sal forests

The lowland forests of sal, including the plantations that have replaced the natural forests, provide a number of services and goods such as timber, fuelwood, NTFPs, tubers, wild fruits, berries and medicinal plants. However, the sal forests have shrunk to a small portion of what was vested with the BFD. This has happened due to the failure to complete the process of reservation of the vested forests, large-scale encroachment and other human interference. With the loss of the sal forests, most of the biodiversity and the goods and services it provided have disappeared.

While the area under actual tree cover in the state forests has been diminishing steadily, the tree cover in the area outside the forests has increased significantly, and in the absence of the supply of timber and other wood products from the forests, TOF have become the main source of these commodities in the country. Although TOF can be no substitute for natural forests, without them the natural forests would have been under much more pressure.

Although the agro-ecosystem is still reasonably healthy and the production is still growing, the increase in chemical inputs, as well as over-exploitation of groundwater, has started telling on

its health. If the pesticides affect the populations of pollinator insects and birds, the impact on agricultural production may be disastrous in the absence of adequate forest/tree cover to replenish those populations.

Thus, it is obvious that the ecosystem services in general are on a diminishing trend due to various stresses on the ecosystems. The only reasonably intact natural ecosystem is the mangrove forest. The provisioning services, such as the production of wood and non-wood products, have suffered tremendously, while the other services, such as flood control and water recharge have been equally badly affected. While the goods can either be produced elsewhere or imported, there is no alternative to ensuring an uninterrupted supply of the support services as life will be difficult without them, if not impossible.

Economic value of ecosystem services

Despite the poor condition of the forests of the country, the economic value of the ecosystem services provided by the forests and tree cover is quite significant although most of the ecosystem services are not measurable at present. The forests and tree resources of the country contribute to the national economy in many ways, such as providing consumable goods like wood and non-wood products for trade and industry and providing direct and indirect employment to the people involved in the collection, processing and trade of forest products. As many of the forest products are traded or consumed without entering a formal market and most of the employment generated by forests is very diverse in nature, an exact estimate of the contribution of the forestry sector to the economy of the nation is difficult to make. However, on the basis of estimates made in other countries, and some limited estimates made in Bangladesh for some areas, the economic value of the forests of Bangladesh can be summarized as follows:

- The economic value of the protective role of the Sundarbans against storms and cyclones cannot be measured directly. But the Sundarbans Environment and Livelihoods Project has indicated that for every cyclone that passes over the Sundarbans, it saves human lives worth Tk.870 billion (equivalent to \$11 billion).
- The existence value, cultural value, biodiversity conservation services and many supportive services cannot be measured in economic terms. The health of the fisheries and aquaculture businesses significantly depends on the breeding environment and sanctuaries provided by the mangroves. The tiger occurs in the Sundarbans because the forest provides the necessary habitat and sanctuary. This value cannot be monetized directly.
- Forests are perhaps the only effective tool for removal of greenhouse gases, doing this by sequestering them in the vegetation. The role played by forests in mitigating climate change, which has huge economic implications for human beings, is one of the most significant services provided by forests. The carbon sequestered by forests can also be traded through various international mechanisms, to generate money. For example, the carbon sequestered by the Sundarbans is estimated at \$1.1 million per year, at the current rates for carbon in the international market.
- According to the BBS (2014), 5.8 million persons are employed, full-time or part-time, in private and homestead forestry. Nearly 2 million persons are employed in over 71,000 furniture manufacturing enterprises, nearly 365,000 persons are employed in bamboo- and cane-based occupations, and nearly 600,000 persons are involved in the collection, trade and processing of NTFPs from Sundarbans alone. The BBS lists at least 33

occupations/industries based on forest products. Thus, the total employment generated by the forestry sectors is at least 10 million persons. The wealth created by these jobs, even at very conservative rates of Tk.3000 per month, would be nearly Tk.360,000 crores per annum (\$4.5 billion).

- The value of the timber and fuelwood produced in the country is conservatively estimated to be \$2.5 billion.
- IUCN—Bangladesh developed a vision for the year 2050, and an assessment of all current EGS yielded an estimate of \$456.32 to \$1191.84 per hectare per year or \$273 to \$714 million per year for the entire Sundarbans.
- The contribution of 'Forests and related services', which includes only timber, fuelwood, bamboo and 'minor products', to the GDP of Bangladesh in 2013-2014 is recorded as Tk.184,014 million (1.43% in 2014), but the contribution of the wood-based manufacturing businesses, worth Tk.101,041 million, has not been included in contribution of the forestry sector. This contribution is shown in the manufacturing sector. Even if a part of this contribution is credited to the forestry sector, the recognition of the sector as a source of GDP and jobs will at least double. If the full value of all the ecosystem services is considered in the national accounting, the contribution of the forestry sector would be much higher.

2.6 Trees outside forests

'TOF' generally refers to the plantations and scattered trees outside recognized forests. However, in this case, TOF also includes all trees outside managed forests, including natural tree growth.

Unclassed state forests

'Unclassed state forest' (USF) refers to the government forest land in the Chittagong Hill Tracts, which are administered by the district administrations. The land under this classification comprises an area of about 712,418 ha, of which nearly 17,347 ha is currently under the control of the BFD. As mentioned previously, there is no information on the exact extent of the forest cover within this area, but it is recognized that most of the lands under this category are barren and denuded. A large chunk of this land is being cultivated intensively, resulting in a loss of topsoil and fertility. While the area available is large, there is no major initiative now to bring these lands under tree cover. Most of the land is covered by intensive cultivation in a sloping terrain, where the topsoil and soil fertility have been lost. Because of the prevailing political situation in parts of the CHT, the BFD has not been able to undertake any plantation programme on these lands for quite some time. As this is one of the biggest tracts of land available for establishing plantations, it is important that a suitable mechanism acceptable to all parties be found so that these areas are again brought under tree cover. Some small-scale plantation programmes are being implemented successfully by some NGOs in collaboration with local communities, and these programmes need to be scaled up and implemented on a greater extent of land. All the parties involved have also agreed to the implementation of a watershed project funded by UNDP. If this is successful, it could be a pathfinder. Homestead and other private forests

Homestead forests are essentially tree gardens around rural habitations. Although a large proportion of the trees in the homesteads are fruit trees, this sector is reported to meet around

80% of the fuelwood and timber needs of the country. NFA 2005-2007 estimated their extent to be far more than those of all other natural and planted forests put together (2,767,000 ha, all plots over 0.1 ha in size). The tree cover in the homestead vegetation is fairly dense, as shown in Table 2-11.

Table 2-11: Village homestead area by tree cover classes (figures in thousands of hectares)⁷.

No Tree Cover	<5%	5-10%	10-30%	30-70%	>70%
40	752	873	675	491	31

The table shows that nearly 40% of the villages have tree cover, which is comparable with any forest area of the country. Previous studies showed that the per capita availability of bamboo and trees in the homesteads increased between 1981 and 1991. It is presumed that the same trend has continued in the recent past and that the area and number of trees in the homesteads must be more than those recorded here. NFA 2005-2007 shows that the village homestead stands and cultivated lands contain more than double the commercial volume (105 million m³) of round-wood in the nation’s forest areas (43 million m³). This underlines the importance of these resources for the local economy.

Homestead forests consist of mixed fruit, fuelwood, shade and other multipurpose trees, as well as bamboos. In the upper stratum, it is common to find trees such as *Albizia procera*, *A. lebbeck*, *Aphanamixis polystachya*, *Artocarpus heterophyllus*, *A. lacucha*, *Polyalthia longifolia*, *Alstonia scholaris*, *Azadirachta indica*, *Dillenia indica*, *Mangifera indica*, *Cordia dichotoma*, *Elaeocarpus floribundus*, *Bombax ceiba*, *Syzygium cumini*, *Samanea saman*, *Swietenia macrophylla*, *Tamarindus indica*, *Toona ciliata*, *Acacia nilotica*, *Lagerstroemia speciosa*, *Ficus benghalensis*, *F. religiosa*, *F. racemosa*, *Anthocephalus chinensis*, *Eucalyptus camaldulensis*, *Areca catechu*, *Borassus flabellifer*, *Cocos nucifera* and *Gmelina arborea*. In the middle stratum, the major part is composed of small trees and bamboos (Alam, 2014).

Apart from the formally recorded or recognized categories of forests, some people in the CHT and Chittagong and Dhaka regions own significant chunks of private forest areas. No accurate survey has been conducted of the extent of these forests, although the estimated area of the private forests in North Rangamati Division alone is approximately 273,791 ha, these forests consisting mostly of teak and gamar plantations (pers. comm., DFO). Cultivation of different types of fruit tree has proved financially more rewarding within a shorter period of time compared with forest trees and has gained acceptance in the hill districts. This may result in reduced interest in planting forest trees unless appropriate and acceptable farming models involving forest and fruit trees are introduced.

The BBS carried out the ‘Household Based Forestry Survey 2011-12’, and the results were published in 2014. A summary of the results of this survey of homesteads and other private lands is furnished in Table 2-12.

Table 2-12: Household-based forestry activity, 2011-2012 (BBS 2014)

⁷ BFD: NFA 2005-07

Item	Estimate	Remarks
No. of households reporting	13,270,322	91.9% reported owning trees
Total no. of trees (millions)	1447.31	—
Total value of trees (million Tk.)	1,346,100	—
Total wood production (cubic feet)	35,785,000	—
Value of wood produced (million Tk.)	11,582	—
Total bamboo production (No.)	6,027,000	—
Value of bamboo produced (million Tk.)	1067	—
Firewood production (million tons)	5,191,835	—
Value of firewood (million Tk.)	46,505	—
Gross output of household-based forestry activity (million Tk.)	133,712	—

This study divided the overall private tree planting activity into two categories: homestead trees and planned forests away from homesteads. It estimated the area of the planned forests to be only 606,600 acres (245,587 ha), and no estimate of the area under homestead plantations was provided. Apparently, the results of this study are not comparable with those of the earlier assessments, and most of the values seem to be underestimates.

Strip plantations

Bangladesh has been undertaking planting of fast-growing exotic species, primarily *Acacia auriculiformis* and *A. mangium*, on the strips of land along roads, railway lines and canals under the social forestry programme. While there are conflicting records of the total extent of these plantations, it is reasonable to believe that the area under plantations is growing as the result of the recurring annual establishment of plantations as well as the security provided by the communities participating in the social forestry programme. According to the records of the BFD, approximately 62,329 km of strip plantations was established between 1980-1981 and 2014-2015, although FRA 2015 indicates that their extent was 73,000 km before 2005, equivalent to about 73,000 ha. Since then 23,512 km of additional strip plantations was established till 2014-2015, making the total length close to 100,000 km. As strip plantation activity has also been promoted by many NGOs as a part of their social forestry programmes, the actual extent of the strip plantations may be much more than what the BFD records show.

Other plantations

Apart from the foregoing forest categories, rubber plantations and agarwood plantations are the other plantations that contribute to the TOF sector. Bangladesh has approximately 40,000 ha of rubber plantations owned by the BFIDC, tea gardens and individual entrepreneurs. The BFD has so far has raised agar plantations over 5800 ha in Sylhet, Bandarban, Chittagong and Cox's Bazar. Besides these, there are many small private agar plantations, especially in the Sylhet region. Agar has become quite popular and is being used as a cash crop. No reliable data, however, are available on the total extent of the private plantations of agarwood.

3 Review of Policies, Acts, Regulations

3.1 National policies

Article 18 A of the Bangladesh Constitution states that

‘The state shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens.’

This article of the Bangladesh Constitution paves the way for harnessing all resources for improving, sustaining and conserving natural resources and for formulating the necessary policies, laws and rules. A critical review of the prevailing policies and laws is necessary to determine whether they contribute to achievement of the constitutional objectives. A brief review of the current national policies of the sectors that have interfaces with the forestry sector is presented in the following.

National forest policies

The forest policy of the country has evolved over a very long period. The first formal forest policy was declared in 1894 by the then British colonial government. The national forest policy of 1894 provided the basic guidelines for formulating acts and rules for the management of forests in the Indian sub-continent. The salient features of this policy were these:

- State forests are to be administered for benefits to the public.
- The rights and privileges of people living nearby may be regulated.
- Forests on hill slopes should be conserved.
- Valuable forests should be managed for generating revenue for the state. Cultivable land within a forest may be kept under cultivation.
- Low-yielding forests may be opened for grazing livestock.

Agriculture was preferred over forestry in this policy. The Forest Act, 1927 was formulated under this forest policy. Most of the reserve forests (RFs) of Bangladesh were declared under the Forest Act, 1927, although some were notified even previously. Most of the rules were also framed under this act.

The present tract of Bangladesh emerged as ‘East Pakistan’ in 1947. In 1955, a revised forest policy was enunciated. The salient features of the forest policy of 1955 are:

- The forestry sector should receive priority and increased allocations.
- Forests should be classified on the basis of their utility.
- Intangible benefits of forests should be recognized.
- All forests should be managed through an approved working plan.
- Areas by the sides of roads and canals should be afforested.
- Sound management of private forests should be ensured.
- Adverse use of land should be controlled. Soil should be conserved.

Since revenue earning was still a major target, clear-felling followed by artificial regeneration became the general practice. Many working plans were written under this policy.

Bangladesh emerged as an independent country in 1971. The first National Forest Policy for Bangladesh was announced in 1979. Here are the salient features of this forest policy:

- Government forests shall not be used for non-forestry purposes.
- Forest should be carefully preserved and scientifically managed.
- The rate of plantation establishment is to be enhanced.
- Forest-based industries shall be set up.
- Research, education and training shall be re-organized and emphasized.
- A cadre of officers shall be constituted for managing the forestry sector.
- The relevant laws of the forestry sector shall be updated.
- Conserve forests and wildlife and utilize the recreation potential of the forestry sector.
- Mass motivation and awareness programmes shall be taken up.
- The National Forestry Policy of 1979 was a little vague and was not implemented in its full spirit. The subsequent forest policy, which is currently under revision, was adopted in 1994 with 29 policy statements. The salient features of this policy are highlighted here:
- The government shall take all measures to bring 20% of the land under forests by the year 2015 to maintain the ecological balance and attain self-sufficiency in forest products. To achieve this objective, the government shall work jointly with non-government organizations (NGOs) and ensure the participation of the people.
- Since the area under government-managed forests is very limited, the afforestation activities shall be extended to village areas, newly accreted mudflats and denuded areas of unclassed state forests (USFs) of the Chittagong Hill Tracts (CHT).
- People will be encouraged to plant trees in their own fallow and marginal lands, on the banks of tanks and in homesteads. Technical advice and assistance will be provided for pursuing agro-forestry farming practices. When introducing agro-forestry in state-owned and private land, appropriate attention will be given to producing fodder and maintaining herbs and shrubs.
- The government will encourage people to plant in the premises of public institutions such as union council offices, schools, *idgahs*, mosques, *maktabs*, temples, orphanages, *madarshas* and the areas around them. Technical and other assistance will be provided.
- The government will undertake afforestation with the participation of the people and with assistance from NGOs.
- To ensure that pollution in cities is controlled, the government shall take up special afforestation activities in all the municipal areas of the country. To achieve this goal, the municipalities, town development authorities and other related autonomous bodies shall help the government in the implementation of the programmes by way of zoning and allotting land for tree plantation. The town planning authorities must make provisions for tree planting in their development plans by setting aside specific sites for the purpose.

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- In the hill districts of Banderban, Rangamati and Khagrachari, massive afforestation programmes will be undertaken in the USF by public and private agencies. The agency exercising the rights of the land ministry will execute the programme.
 - In order to preserve the soil, water and biodiversity, the natural forests of the hilly areas and the catchments of the rivers within the country shall be declared as protected areas (game sanctuaries and national parks). The government will endeavour to notify 10% of the national forests as protected areas by the year 2015.
 - An integrated management plan will be prepared for the Sundarbans that incorporates management of forests, water and wildlife.
 - State-owned hill and sal forests will be managed as production forests, except those declared as protected areas for preserving the soil, water and biodiversity. The production forests will be managed on a commercial basis with due consideration to the environment.
 - Critical areas such as steep hill slopes, vulnerable watersheds and wetlands will be designated as forests and will be managed as protected areas.
 - Denuded and encroached government forest lands will be identified and brought under afforestation programmes with the participation of the people with a benefit-sharing approach, preferably under agro-forestry, in which NGOs may be associated.
 - Modern and appropriate technologies will be introduced to minimize the losses at all steps of collection and processing of forest produce.
 - Modernization of forest-based industries will be emphasized to maximize the utilization of raw materials derived from forestry.
 - Steps will be taken to bring in competitive and profit-oriented management to the state-owned, forest-based, industries in accordance with an open market economy.
 - Labour-intensive small and cottage industries based on forest products will be encouraged in the rural areas.
 - The forest transit rules will be made simpler to meet present day needs.
 - Since there is a deficit of wood, the ban on export of logs will continue. Processed wood products can, however, be exported. The import of wood and wood products will be liberalized, but reasonable import duties will be levied on forest products that are abundant in the country.
 - Due to the shortage of forest area in the country, no forest land will be allowed to be used for any purpose other than afforestation without the permission of the head of the government.
 - In the absence of clearly defined land ownership, the tribal people living close to forests in some parts of the country cultivate anywhere in the forest land. Clearly delineated forest land will be set aside for them through forest settlement operations, and the rest will be brought under permanent forest management.

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- Training, technical assistance and financial support will be enhanced towards private afforestation and tree-based rural development programmes from the funds received as international grants from donors.
 - Women folk will be encouraged more in programmes such as homestead afforestation, rural tree farming and participatory forestry.
 - Eco-tourism will be encouraged, keeping in mind the carrying capacity of the forests and nature.
 - To create widespread awareness about afforestation and protection and utilization of forests and forest products, mass media campaigns shall be taken up through both government and non-government channels.
 - Planting of fruit trees under forestry programmes in habitations shall be encouraged in addition to planting of timber, fodder and fuelwood and NTFP yielding trees.
 - Steps will be taken to modernize the methodology of extraction of forest products to minimize losses and increase the efficiency.
 - The Bangladesh Forest Department (BFD) will be strengthened to achieve the objectives and goals of the policy, and a new social forestry department will be established.
 - Research, education and training institutions related to forestry will be strengthened to achieve the policy, targets and their roles will be enhanced and integrated. In the light of the aims, objectives and targets outlined in this forest policy, the related acts and rules shall be modified, amended and, if necessary, formulated afresh.

The 1994 Forest Policy was reasonably elaborate, and it incorporated and advocated the participatory forestry concept in clear terms. This has opened up an avenue of co-operation between NGOs and government agencies in social forestry. However, it did not address the issue of the impact of climate change and did not furnish policy directives on how to address it. Moreover, many new issues and challenges, such as an extensive loss of forest cover, administrative anomalies, an acute shortage of manpower, very poor capacity and an extremely unsatisfactory state of forestry research and education have cropped up in the recent past. In order to address all the important new and emerging issues, a new forest policy draft has been prepared as a part of the FMP development exercise.

The newly proposed National Forestry Policy 2016 (draft) is briefly reviewed in the following.

The new forestry policy draft has been prepared after an extended process of consultations with all relevant stakeholders and expert reviews. The revision was necessitated by the emergence of new environmental and socio-economic changes in the context of climate change and the extensive loss of forest cover in the country in the last two decades. The salient features of the draft forest policy of 2016 are the following:

- The principal aim of the policy is to 'to manage all existing forest, wildlife and other forestry resources, adhering to the principles of sustainable management and climate resilience; enrich degraded forest areas; and enhance land areas under forest/tree cover; to produce a wide array of goods and ecosystem services for the benefit of Bangladesh's current and future generations.'

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- In pursuance of this overall goal, the policy lists 16 objectives, of which the most important is 'To arrest deforestation, and degradation of forest resources, enrich and extend areas under tree cover, through appropriate programs and projects, to ensure that at least 20% of the country comes under tree cover by 2035, with at least a canopy density of 50%.' This objective is an improvement over a similar objective in the previous policy, which did not say anything about the canopy density.
 - The principal policy statements are listed here.
 - Given the acute shortage of forest land, henceforth no forest land will be released for any non-forestry activities without the prior approval of the Honourable Prime Minister with a vetting from the cabinet. In cases involving priority national interest, where it becomes necessary to transfer lands for any other purpose of national interest, an equal area will be handed over to the Forest Department, with the required funds for compensatory afforestation. Necessary rules will be formulated to that effect;
 - Traditional rights of various ethnic-communities, living in and around state forest areas, will be recognized and maintained with due respect to their forest-related cultural values and religious beliefs. Conservation initiatives related to forest, wildlife and biodiversity taken up by indigenous communities will be encouraged;
 - Undertake a credible valuation of the ecosystem services that the forestry sector provides in Bangladesh and demonstrate it as an additional contribution from the forestry sector to the gross domestic product of the country;
 - To ensure protection of the Sundarbans Reserve Forest from pollution and oil spills, navigational routes inside the Sundarbans will be strictly restricted. Access to any waterway inside the RF, except the recognised routes between Mongla Port and the sea, will be subject to prior permission from the forest authorities.
 - Encourage the flow of corporate and institutional financial resources into reforestation activities and plough back all forest revenues into reforestation programmes;
 - Ensure that forest management plans are formulated and implemented in all Forest Divisions and all silvicultural prescriptions therein are strictly implemented;
 - Ensure that all newly accreted land (*char*) is handed over to the Forest Department for extensive coastal plantation establishment with climate-resilient species;
 - Continue the existing moratorium on exploitation of natural forests without restricting the scope for silvicultural interventions.
 - Complete effective mapping and clear demarcation of all notified forest areas using modern tools and technologies, and update and maintain a record of rights, accordingly;
 - Strengthen extension activities and expand participatory forestry activities through the establishment of forest extension units in all *upazilas* with adequate resources and manpower to handle an effective advisory and support programme;

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- Develop a network of market places for promoting competitive trade in timber produced by private growers;
 - Ensure the implementation of the provisions laid out in the Bangladesh Wildlife Master Plan 2015-2036 and the Bangladesh Forestry Master Plan (FMP) 2017-2036 through appropriate mechanisms;
 - Expand the area under protected areas (PAs) to 30% of the state forest land;
 - Empower communities, allowing them to have rights and responsibilities and devolved authority, to participate in forestry activities for socio-economic and environmental benefits, and increased forestry production;
 - Encourage all wood-based industries to engage in a 'contract farming approach' to obtain their desired raw material supply;
 - Ensure entry level training for all new recruits in the Forest Department and upgrade and modernize curricula for basic training for entry level officials at Forester and Assistant Conservator levels. In the case of foresters, as there is no longer any intake at the Forest Ranger level, upgrade the curriculum so that it prepares the new recruits for the eventual responsibility of administering and managing forest ranges;
 - The Forest Department will liaise and co-ordinate with universities providing forestry education so that the graduates of these institutions have adequate knowledge of core forestry subjects and could be inducted into the forest service after administrative and field level training.
 - Maintain [the] maximum area possible under tree cover and ensure through proper actions that deforestation is totally arrested;
 - Create a massive carbon sink for carbon sequestration by bringing more areas under tree cover;
 - Develop and implement awareness raising strategies and capacity development programmes on the opportunities for adaptation and mitigation measures as per the climate change action plan;
 - Create a 'coastal green belt' of thick mangroves and other suitable climate resilient species to reduce the vulnerability of coastal communities to the impact of climate change induced disasters;
 - Commitments made at the Paris Climate Change Meeting through Intended Nationally Determined Commitments regarding land use, land change and forestry shall guide the future forestry action in the country;
 - Enhancement of forestry carbon stocks and generation of benefits through mechanisms such as Clean Development Mechanism and Reduced Emission from Deforestation and Degradation Plus (REDD+) shall be one of the main objectives of future forestry programmes;
 - Formulate a climate financing mechanism that will help the country take advantage of new and emerging climate change funds such as REDD+, Forest-Carbon Partner Facility, Green Climate Fund, and other available sources and also, include innovative ways to fund climate change actions domestically

through accessing Bangladesh Climate Change Resilience Fund and support from other governmental allocations and other local sources;

- Transform Bangladesh Forest Research Institute into an autonomous body with a major mandate to undertake forestry related applied research;
- Review, update and rationalize the Forest Research Institute to ensure the induction of staff with appropriate educational backgrounds, and facilities for further education and research should be made available to ensure [the] development of appropriate capacity and know-how;
- Strengthen Bangladesh National Herbarium and encourage and facilitate taxonomic research;
- Strengthen Bangladesh Forest Industries Development Corporation to spearhead the development of forest product industries and ensure a proper policy environment for the growth and modernisation of the sector;
- Help establish non-timber forest product (NTFP)-based cottage industries so that they can add value to the processing and marketing of NTFPs for an enhanced income to the producers;
- The forest service will be considered a technical/professional service, and similar to all other such civil service cadres, only forestry graduates will be eligible for entry;
- Formulate a 10-year recruitment plan on the basis of the foreseen needs, and the induction into the service will be made on a regular annual basis;
- Review the current administrative structure of the Forest Department and assigned roles and responsibilities after conducting 'needs and workload analysis' to create a more efficient administrative structure;
- Establish third-party monitoring and evaluation of forestry programmes;
- Provide risk/difficulty allowances to forest staff posted in inhospitable and non-family stations.

3.2 Review of other relevant national policies

Other national policies that are relevant for implementing the National Forest Policy are described in the following sections.

National Environment Policy, 1992

The primary objectives of the National Environment Policy, 1992 are:

- To maintain the ecological balance and ensure overall progress and development of the country through protection and improvement of the environment
- To ensure the environment-friendly development of all sectors
- To ensure the protection of the country against all natural disasters
- To ensure long-term and environment-friendly utilization of all national resources on a sustainable basis
- To identify and regulate all kinds of activities that pollute and degrade the environment and

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- To be an active participant in all environment-related international endeavours.

Environmental impact assessment (EIA) is the major tool for analysing possible impacts of development projects. EIA guidelines have been issued for nearly 15 sectors. Forestry subjects such as afforestation, biodiversity and wildlife have been mentioned in the policy document. The National Environmental Conservation Act, 1995 has been formulated under this policy and lately has been revised and updated. The Department of Environment (DoE) of the Ministry of Environment and Forest is the implementing authority of this policy. According to the Environment Policy, a large number of activities extending over a very large arena need to be looked after by the DoE. Shortage of manpower coupled with the placement of administrative personnel, in place of personnel educated on environment is a serious issue for the DoE. Full implementation of the Environmental Policy, 1992 is yet to be seen. This policy made recommendations on subjects such as raising pure plantations, degradation of natural forests, the conservation process and soil erosion. The BFD has to be technically prepared to co-ordinate their programmes with DoE on these matters.

This policy is already undergoing a revision, and a comprehensive draft has already been finalized and is awaiting approval. While the objectives of the policy do not differ much from those of the 1994 policy, the draft policy places a special emphasis on ensuring that all development initiatives are based on environment-friendly participatory approaches and sustainable utilization of all national resources, with the active involvement of people dependent on harvesting natural resources for living. The main features of this draft policy that are relevant to the forestry sector are controlling population growth to reduce the pressure on nature and its resources; harvesting all natural resources on a scientific basis; considering the risks to, and impacts on, the environment when harvesting natural resources; including the value and contributions of ecosystem goods and services (EGS) when calculating the contribution of the forestry sector to the national economy; and ensuring the sustainable use of all EGS.

National Agricultural Extension Policy, 1997

The main features of the National Agricultural Extension Policy, 1997 are:

- Extension of cost-effective and efficient support to all categories of farmers
- Decentralization of extension services to ensure that situation-specific, field-level support can be extended
- In a demand-led situation, farmers' problems, needs and demands will set the extension agenda.
- Working with groups will be promoted because this will ensure sharing of limited extension resources, exchange of knowledge and experience and creation of an environment for participatory decision making.
- Strengthening of linkages between extension and research to ensure delivery of effective services to farmers
- Proper training will be provided to all extension agents for the task they will undertake. This training programme should include familiarization with different strategies and approaches suitable for agricultural extension activities.
- Advice and information provided to farmers must adopt an integrated farming systems perspective.
- Co-ordination of agricultural extension services with other similar services provided by other agencies
- Promotion of sustainable and environmentally friendly agricultural practices.

As the Department of Agricultural Extension has staff presence even at the union level, this policy is being implemented successfully. The farmers are getting aware of new technologies related to farming practices, agricultural inputs, seeds and seed crops, manure and fertilizers, pests and pesticides, etc. This policy also advocates the promotion of agro-forestry and inter-cropping.

National Agriculture Policy, 2013

The objectives of the National Agriculture Policy, 2013 relevant to the forestry sector include the following:

- Ensure an environment-friendly, profitable and sustainable agricultural production system.
- Preserve and develop productivity of the land.
- Take necessary steps to ensure environmental protection as well as environment-friendly sustainable agriculture through increased use of organic manure and strengthening of the integrated pest management programme.
- Establish agriculture as a diversified and sustainable income-generating sector through strengthening of farming system-based agricultural production and agro-forestry programmes.
- Inclusion of agro-forestry in the agricultural policy opens the window for developing synergy with the forestry sector. The policy also provides that 'maximum utilization of land will be ensured through promotion of inter-cropping with the main crops', which creates potential for another link with the forestry sector through inter-cropping with forestry species. This policy has no contradiction with the forest policy. However, at times conflicts may arise in fixing the priority between forestry and agriculture, with respect to fallow lands.

National Land Use Policy, 2001

The salient features of the National Land Use Policy are listed here.

- It emphasizes the protection of the declining cultivable lands of the country.
- It provides for promotion of intensive agriculture and expansion of fisheries. At the same time, it has enunciated that forestry can play a significant role in alleviation of poverty.
- It lays ample emphasis on zoning and has suggested the formulation of 'Zoning Laws'.
- It expresses concern over the engulfment of cultivable land by rural housing and suggests planning of housing at the rural level.
- It emphasizes the importance of 'austerity in land use' with a specific suggestion of bringing minimal land under buildings.
- It expresses concern over misuse of acquired lands.
- It recommends rehabilitation of the landless poor on new *chars*, stating that forestry can combat pollution, and recommends afforestation and preservation of existing forest areas.
- While recommending the use of coastal areas for agriculture and rehabilitation, it recommends the maintenance of a 'functional green belt' along the coast.
- It advocates controlling the fragmentation of land to the limit of a 'logical unit'.

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- To release the pressure on land, it recommends that flood prevention dams be used as roads and highways. Expressing concern over the illegal occupation of government land, it recommends a 'Certificate of Land Ownership Scheme', and it identifies the awareness of people awareness is mandatory for successful implementation of the policy.

Though this policy has several progressive features, it has failed to address these two important forestry-related issues:

- The proportion of land to be kept under forests to preserve the balance
- Minimization of the conversion of forest land to other uses

Coastal Zone Policy, 2005

The coastal zone of the country is highly vulnerable to natural disasters and the impacts of climate change. The following are the main features of the policy:

- Effective measures will be taken to achieve the objectives of poverty reduction through enhancing economic growth in the coastal zone.
- To meet the basic needs of the coastal people and enhance livelihood opportunities, the government policy will support poverty alleviation, education, safe drinking water and *khas* land distribution programmes for the landless.
- Sustainable management of marine and shrimp fisheries and inland fisheries, mangrove and other forests, land, livestock, salt, minerals, sources of renewable energy such as the tide, wind and solar energy resources of the coastal region
- Reduction of vulnerabilities through implementation of appropriate interventions
- Efforts for equitable access to resources, particularly for the poor and disadvantaged groups
- Empowering communities through mainstreaming of the coastal people by enhancing their safety and capacity
- Promotion of women's development and gender equity through adaptation of appropriate measures
- Conservation and enhancement of critical ecosystems through implementation of measures to conserve and develop aquatic and terrestrial ecosystems.

Although the Coastal Zone Policy was adopted in 2005, it has failed to address many of the important issues and challenges. The Coastal Zone Policy, 2005 covers 19 districts⁸ of the coastal zone and involves many sectors without indicating the linkage of their sectoral policies.

The policy has not been effectively implemented yet because no specific ministry has been identified for the responsibility of implementing the Coastal Zone Policy, 2005. It has been stated in the policy document that the respective ministries and agencies will have the responsibility of implementation; while 'Co-ordination, Monitoring & Evaluation' will be the responsibility of the Water Resources Planning Organisation (WARPO) of the Ministry of Water Resources. It needs to be mentioned here that the Coastal Zone Policy, 2005 has incorporated items that are of interest to many sectors operating in the coastal areas. Any process of

⁸ The districts are Bagerhat, Barguna, Barisal, Bhola, Chandpur, Chittagong, Cox's Bazar, Feni, Gopalganj, Jessore, Jhalkati, Khulna, Lakshmipur, Barisal, Noakhali, Patuakhali, Pirojpur, Satkhira and Shariatpur.

implementation of this policy essentially requires good co-operation between many of the ministries of the government, which is often difficult to achieve.

National Food Policy, 2006

The goal of the National Food Policy of 2006 is to ensure a dependable food security system for all the people of the country, at all times. It has the following objectives:

- To ensure an adequate and stable supply of safe and nutritious food
- To ensure the purchasing power of the people for increased food accessibility
- To ensure adequate nutrition for all, especially women and children.

Forests play an important role in providing supplementary food and income to the poor people. However, the policy does not make any reference to this contribution of the forests as a source of food.

National Water Policy, 1997

The objective of the National Water Policy, 1997 is to take cognizance of the existing situation, to propose a framework for creating a system of laws and institutions and to develop a plan of action with a unified national perspective. The main features of the policy are the following:

- To address issues related to the harnessing and development of all forms of surface water and ground water and to manage these resources in an efficient and equitable manner
- To ensure the availability of water to all sections of society including the poor and the underprivileged and to take into account the particular needs of women and children
- To accelerate the development of sustainable public and private water delivery systems with appropriate legal and financial measures, including delineation of water rights and water pricing
- To bring about institutional changes that will help decentralize the management of water resources and enhance the role of women in water management
- To develop a legal and regulatory environment that will help the process of decentralization and sound environmental management and will improve the investment climate for the private sector in water development and management
- To develop a state of knowledge and capacity that will enable the country to design future water resource management plans by itself with economic efficiency, gender equity, social justice and environmental awareness to facilitate the achievement of the water management objectives through broad public participation.

The policy did not identify vital water-forest interactions, although many other connections, including the water-fisheries-wildlife and water-environment connections, have been discussed. Afforestation is suggested in areas with declining water tables. Similarly, the policy states that the development and management of the nation's water resources should include protection, restoration and preservation of the environment and its biodiversity, including wetlands, mangroves and other national forests, endangered species and the water quality. Accordingly, EIA is recommended when development projects are to be taken up in order to avoid or reduce environmental damage. Climate change has, over time, emerged as an important socio-environmental concern that needs to be integrated keeping in view strong climate-water interactions.

National Fisheries Policy, 1992

While fishery resources are the main source of protein for the people of Bangladesh and a source of employment for a significant section of its population, the sector is faced with many problems. To address these, the National Fishery Policy was put in place by the government in 1992. The main features of the policy are:

- Enhancement of the production of the fisheries
- Poverty alleviation through self-employment and improvement of the socio-economic conditions of the fishers
- Fulfilment of the demand for animal protein
- Achieving economic growth by earning foreign currency through the export of fish and fisheries products
- Maintaining the ecological balance, conserving biodiversity, ensuring public health and providing recreational facilities

As many species of wildlife, such as crocodiles, turtles and dolphins, share a habitat with fish, their conservation depends upon proper management of aquatic habitats. As 'fish' is also defined as wildlife in the Wildlife (Conservation and Security) Act, 2012, there is good scope for interaction, co-operation or conflict between the fisheries and forestry agencies. As the Sundarbans has a significant role in keeping the national fisheries healthy and productive, it should have found a conspicuous mention in the policy.

3.3 Conflicts among and compatibility of the various national policies

The various sectoral policies focus primarily on specific sectors, and as a result, the needs of other sectors are not reflected in these documents. All these policies have a sectoral bias. They are often not compatible and in some cases contradictory to the policy statements of other government agencies. This has resulted from unilateral formulation of sectoral policies without any consultations with other agencies, which may have caused the formulation of contradictory policy statements. As all these policies have the approval of the government, these have the same official backing and footing. However, there are policies that are supportive of and complement each other.

Here are a few of examples:

The agricultural policy is compatible with the forestry policy. Similarly, the environment policy is also compatible with forestry policy. The National Water Policy, by emphasizing erosion control and afforestation, has fortified the Forest Policy. In the policies that contradict each other, the points of conflict need to be removed through mutual consultation so that these become complementary and supportive of each other so that an enabling environment is created for their fruitful implementation.

3.4 Gaps and constraints in forest laws

The conservation and management of forests and wildlife in Bangladesh is based primarily on the provisions of two acts, namely the Forest Act, 1927 and the Wildlife (Conservation and Security) Act, 2012. The rules framed under these two acts are the basic tools for the BFD to operate in the field. Besides these two acts, the East Pakistan Private Forest Ordinance, 1959 and the East Bengal State Acquisition and Tenancy Act, 1950 were used to consolidate the

forest estates. From the point of view of field operation, these are no longer of much significance.

Forest Act, 1927

Though this act was promulgated on 22 September 1927, it was revised from time to time to meet the changing needs. This act has the details of the process to be employed for creating 'Reserved Forests and Protected Forests'. This act also makes provisions for dealing with forest offences. This is the act that provides the basis on which various rules such as Transit Rules and Drift Timber Rules have been formulated from time to time. By introducing Section 28A in this act, social forestry received a firm footing, which led to the formulation of various social forestry rules in 2004.

The current forest transit rules were promulgated in 2011. Before that there were similar but different transit rules for different districts, with one General Transit Rules. The 2011 transit rules superseded the previous rules in this regard. The Forest Transit Rules, 2011 are, however, not applicable in the CHT and the Sundarbans RF. Under the provisions of these rules, wood produced on private land will need a free permit from the BFD for transportation, except for seven species, namely mango, jackfruit, black berry, *taal*, coconut, *shupari*, *khajur* and *shimul*. In the CHT, permissions to cut and transport wood from private lands are given as 'jot permits', issued by the Deputy Commissioner of the district on the basis of recommendations from local Divisional Forest Offices (BFD). It is a common belief that pilferage of huge quantities of wood from the state forest occurs under the cover of these *jot* permits.

The basic objective of the forest transit rules is to provide protection to state forests against illegal felling and extraction of forest produce. Although these rules have not been able to stop the destruction of the state forests, these are now seen as a serious hindrance to the growth of private forestry due to the scope they provide for harassment and corruption.

The Sundarbans has a number of 'standing orders' for day-to-day control relating to its forestry products. In 2012, rules were formulated for sawmills. According to these rules, every sawmill will require a license from the BFD to operate. Besides these, the BFD has a two-volume Forest Manual (Part I and Part II) describing the actions to be taken on different issues, powers of forestry officials, etc.

The act is fairly comprehensive, but many of the notifications, issued under the act long ago, have become outdated and are in need of urgent revision. For example, notifications issued in 1959 to empower forest officials to exercise powers under Section 72 have become anachronistic due to the addition of many new designations to the forest staff. Fresh notifications relating to the designations to be treated as 'Forest Officers' under the act need to be issued to include new designations. Similarly, the definition of 'forest produce' needs to be reviewed to include the wildlife living outside state forests. As forest offence-related cases often take a long time to be settled in the courts of law, provisions for the creation of separate 'forest courts' under the Forest Act will help have these cases disposed of quickly.

Wildlife (Conservation and Security) Act, 2012

A wildlife ordinance was promulgated in 1973 for the first time. The Wildlife Act, 2012 has replaced that ordinance. The Wildlife Act, 2012 provides a comprehensive framework for the creation of protected areas for wildlife conservation and regulation of the possession, trading in and transportation of live wildlife, skins and other body parts. This act also prohibits the possession, trading in or transportation of any wildlife item without the permission of the BFD.

Violation of the provisions of this act may lead to 12 years of imprisonment. Besides these, the act also makes provisions for all export and import of wildlife items to be handled under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) framework. The law has five schedules of species to be protected, which include a list of plants as well. This law has the provision for establishing 12 different kinds of protected areas for wildlife and nature conservation, including community conservation areas on private lands. It makes provisions for formulating various rules, such as rules for

- empowering various designated personnel,
- handling perishable goods that are seized,
- implementation of CITES,
- issuing various kinds of permits,
- issuing permits for propagation and breeding and
- handling venom collection.
- Though this act is very comprehensive, it suffers from some serious flaws such as
- a lack of powers to arrest suspects,
- a lack of power to ensure the presence of witnesses,
- limited power and no procedure to compound offences and
- a provision for only 'co-management' of wildlife sanctuaries.

This act is yet to be implemented. It is reasonably elaborate, but its benefits will accrue to the nation only after the formulation of various rules thereunder, authorization of various officers to exercise powers under the act and deploying qualified BFD personnel for implementing them.

4 Forestry Institutions and Capacity building

4.1 State forestry institutions

The Bangladesh forestry sector, which is under the Ministry of Environment and Forests (MoEF), consists of four major institutions, namely, the Bangladesh Forest Department (BFD), Bangladesh Forest Research Institute (BFRI), Bangladesh Forest Industries Development Corporation (BFIDC) and Bangladesh National Herbarium (BNH). In addition, some public universities offer undergraduate and postgraduate forestry education and generate information through research carried out by both the faculty and students.

4.1.1 Bangladesh Forest Department

The BFD has been responsible for managing the country's forests for more than 150 years. The administrative head of the BFD is the Chief Conservator of Forests. The BFD is divided into four wings—Forest Management, Development Planning, Education and Training, and Social Forestry—and each of those wings is administered by a Deputy Chief Conservator of Forests. There are nine forest circles, including five forest management circles, three social forestry circles and one wildlife and nature conservation circle, each of which is headed by a Conservator of Forests. There are 24 forest management divisions, 13 social forestry divisions, seven wildlife management and nature conservation divisions and three management plan divisions, each of which is headed by a Divisional Forest Officer (DFO).

Issues and constraints

Despite being an important organization within the government, the BFD suffers from various serious systemic issues and constraints, which need to be urgently addressed while devising the road map for the future of the organization. The most important constraints and issues faced by the organization in discharging its mandate successfully are briefly discussed in the following.

Shortage of manpower

The current sanctioned strength of the BFD is 10,224 across four categories of staff, but the actual current on-the-job strength is less than 8000! As can be seen from Table 4-1, overall, 24.66% of the staff positions in the department are vacant, and the vacancies at the senior two levels are very high, 44.1% in the case of Class 1 officers, including cadre officials, and 55% in the case of Class 2 officers, including Forest Rangers. The all-important management personnel in the department belong to these two categories, and these people are responsible for the planning, management and implementation of all forest management interventions. The acute shortage of personnel has reached an alarming situation in both these categories of officials.

Table 4-1: BFD staff position*

Grade	Approved	Existing	Vacant	Vacancy (%)
1-9	295	164	131	44.1
10	416	191	225	54.08
11-17	5344	3943	1392	26.05
18-20	4169	3317	737	17.68
Total	10,224	7615	2485	24.30

*Figures as of 10 April 2017; source—ACCF Establishment, BFD. The numbers vary in different reports, depending on when these were prepared.

This acute shortage of officers has resulted because of continued unplanned and intermittent recruitments, with no recruitment of cadre-service officials between 1987 and 2002 and only 40 officers recruited between 2003 and 2016,. As of today, there are only 67 cadre-service officers working in the department against around 114 sanctioned posts. Another 83 Class 1 posts are occupied by non-cadre ACFs who were recruited between 1990 and 2001. Currently, out of a total of 50 sanctioned posts of cadre ACFs, 40 are vacant. In the case of non-cadre ACFs, out of a sanctioned strength of 107, 26 positions are vacant. There is no plan to recruit non-cadre ACFs in the future, and the recruitment of 24 ACFs through the Public Service Commission is being processed now. The above scenario clearly illustrates how short of staff the department is!

In addition to an acute shortage of cadre-service personnel, a huge seniority gap in the cadre has also been created. When the last member of the 1986 batch, the batch to which the current Chief Conservator and all the Deputy Chief Conservators belong, retires in the next couple of years, going by the existing service rules, there will not be any cadre officials available to take up their positions because they would not have served the prescribed length of time needed to be eligible for promotion to positions. There will also be a huge shortage of manpower required to fill the vacant positions lower down the ranks. The situation is not any better at the technical and subordinate levels, where a large number of vacancies exists. Out of the 403 sanctioned positions, 179 are currently filled, and most of these officials will retire before 2020! After 1995, no direct recruitment of Forest Rangers has taken place, and all posts are filled through promotion of serving Deputy Rangers. While there are 454 sanctioned positions of Deputy Rangers, only eight posts are filled, and an enormous number of 446 posts is lying vacant! The next lower level in the official hierarchy where recruitments are done is that of Foresters. While in the past, Foresters were trained in forestry disciplines after recruitment, the system has been changed, and now only those who graduate through a 4-year Diploma in Forestry Programme from the Forest Science and Technology Institute, Chittagong are eligible to apply. Currently 200 positions of Foresters are lying vacant. While the yearly turnout from the institution is adequate to fill vacant positions under a normal situation, it will not be possible for these institutions to turn out adequate qualified candidates to fill up the large number of vacant positions that has been created because of the issues associated with recruitment and the increase in staff strength under consideration now. While 211 posts of Forest Guards and another 161 posts of Plantation Malis (gardeners) are currently vacant, filling up these positions is a much lesser problem.

The other problem is that, in spite of the positions remaining vacant, the eligible candidates have not been promoted to the next level. This has happened particularly in the cases of Conservators and Deputy Chief Conservators. While a number of qualified candidates were allowed to officiate in these positions, their promotions to the next rank have not been finalized. An officer needs to serve a number of qualifying years before he/she becomes eligible for substantive promotion to the next rank. A number of officers who retired recently have retired with the substantive rank of Conservator even though they were eligible for such promotions. A number of officers retired recently as officiating DCCF because their promotion to the next position was not processed! As mentioned previously, 446 posts of Deputy Ranger are currently lying vacant, because there was a plan to abolish this rank, which has been abandoned in the new proposal. The above scenario illustrates a clear manifestation of a very poor personnel management system.

Another major problem is that between 1990 and 2001 ad hoc recruitment of a large number of ACFs was carried out by the department for different development projects without following the prescribed processes. However, the services of the ACFs were not terminated, and they were not inducted into the cadre when these projects ended. Eighty of these ACFs are still working in the department. While these officers were transferred to the revenue budget in 2000, they have so far not been encadred. This group consist of officers with extensive experience, and they are also professionally highly qualified. The majority, in addition to having an academic background in forestry, have obtained higher education and training mostly abroad. Their qualifications include doctorates (Ph.D.s.), master's degrees and postgraduate diplomas and degrees in forestry, wildlife and even business management from reputed institutions. Interestingly, most of these officers have undergone training with scholarships arranged by the department! Although many of them have been allowed to discharge duties of higher positions, after working in the BFD for more than two decades, they still officially hold the positions of ACFs. It may be mentioned here that more than 20 of these officers are currently holding the positions of DFOs and some others are holding equally important positions. This situation, retention of these recruits without inducting them into the cadre of the largest group of professionals in the department, has created a serious problem. These officials who did not take the departmental examinations, which is a pre-requisite for promotion to the posts of Deputy Conservator and above, are not eligible for any promotion until they are included in the Bangladesh Civil Service (Forest) cadre. While efforts have been made in the past to absorb these officers into the cadre, nothing has so far come out of these efforts. There are instances of similar recruitments in the case of sub-professional/technical staff members as well. Such out-of-turn recruitments have caused serious discontent and led to the institution of several court cases, which are interfering with the normal HR functions of the department, including routine promotion of staff members. It is very important in the interest of the BFD to solve this issue urgently.

Human resource development and capacity building programmes are very poor. Training or capacity building activities are only ad hoc, and there is no arrangement for planned replenishment of manpower capacity in the BFD. In addition, many specialized positions such as those in training institutions, GIS, management planning and other similar assignments are filled by officials who may not have the required skill sets and background. To meet the need for additional staff members to implement the Forestry Master Plan, the Wildlife Master Plan and Management Plans as well as routine and new activities, the department has requested the government to sanction a large number of new posts. Table 4-2 shows the post-wise position of the current staffing and the proposed increase in number of posts.

Table 4-2: Proposal for additional staff members

Sl. No.	Designation	Grade	Current Pay Scales	Current staff strength	Additional staff proposed in 2015	Total staff proposed in 2015	Additional staff proposed in 2017	Total staff proposed in 2017
1.	Chief Forest Conservator	1	78,000	1	-	1	-	1
2.	Additional Chief Conservator of Forests	2	66,000-76,490	-	6	6	6	6
3.	Conservator of Forests (Conservator of Forests / Director)	3	56,500-74,400	11	11	22	16	27
4.	Deputy Conservator of Forests (Divisional Forest Officer / Deputy Conservator of Forests/ Director / Additional Director)	5	43,000-69,850	68	10	78	42	110
5.	Chief Instructor	5	43,000-69,850	1	-	1	4	5
6.	Senior Instructor	6	35,500-67,010	4	-	4	6	10
7.	Computer programmer	6	35,500-67,010	1	-	1	-	1
8.	Maintenance Engineer	6	35,500-67,010	-	1	1	1	1
9.	Senior Assistant Conservator of Forests (Additional Divisional Forest Officer / Senior Assistant Conservator of Forests / Deputy Director)	6	35,500-67,010	-	95	95	120	120
10.	Senior Research Officer	6	35,500-67,010	2	3	5	3	5
11.	Senior Veterinary Surgeon	6	35,500-67,010	-	3	3	6	6
12.	Senior Botanist	6	35,500-67,010	-	1	1	1	1
13.	Senior Wildlife Conservation Officer	6	35,500-67,010	-	4	4	5	5
14.	Senior Accounts Officer	6	35,500-67,010	-	2	2	2	2
15.	Senior Mass Communication Officer	6	35,500-67,010	-	-	-	1	1
16.	Senior Sociologist	6	35,500-67,010	-	-	-	1	1
17.	Law Officer	6	35,500-67,010	1	-	1	-	1
18.	Assistant Conservator of Forests (Assistant Conservator of Forests)	9	22,000-53,060	159	1	160	11	170

Sl. No.	Designation	Grade	Current Pay Scales	Current staff strength	Additional staff proposed in 2015	Total staff proposed in 2015	Additional staff proposed in 2017	Total staff proposed in 2017
	/Assistant Director)							
19.	Research Officer (Memology/Ornithology/Harpetology/Ep idimolgy/Fishery/Ecology/taxonomy/wil dlife)	9	22,000-53,060	-	6	6	8	8
20.	Research Officer (Planning)	9	22,000-53,060	11	1	12	1	12
21.	Wildlife Conservation Officer	9	22,000-53,060		16	16	27	27
22.	Instructor	9	22,000-53,060	12	3	15	8	20
23.	Budget officer	9	22,000-53,060	1	-	1	-	1
24.	Accounts Officer	9	22,000-53,060	1	5	6	5	6
25.	Assistant Computer Programmer	9	22,000-53,060	3	-	3	2	5
26.	MIS Officer	9	22,000-53,060	-	1	1	1	1
27.	GIS / Remote Sensing Officer	9	22,000-53,060	-	1	1	2	2
28.	Assistant Maintenance Engineer	9	22,000-53,060	-	2	2	2	2
29.	Veterinary Surgeon	9	22,000-53,060	1	5	6	19	20
30.	Assistant Engineer	9	22,000-53,060	-	3	3	3	3
31.	Assistant Law Officer	9	22,000-53,060	-	2	2	2	2
32.	Librarian	9	22,000-53,060	2	1	3	1	3
33.	Curator	9	22,000-53,060	1	-	1	-	1
34.	Botanist	9	22,000-53,060	2	-	2	1	3
35.	Mass Communication Officer	9	22,000-53,060	1	1	2	1	2
36.	Estate Officer	9	22,000-53,060	-	4	4	8	8
37.	Sociologist	9	22,000-53,060	1	-	1	1	2
38.	Cameraman	10	16,000-38,640	-	2	2	2	2
39.	Physical Instructor	10	16,000-38,640	4	1	5	1	5
40.	Demonstrator	10	16,000-38,640	4	-	4	1	5

Sl. No.	Designation	Grade	Current Pay Scales	Current staff strength	Additional staff proposed in 2015	Total staff proposed in 2015	Additional staff proposed in 2017	Total staff proposed in 2017
41.	Administrative Officer	10	16,000-38,640	2	5	7	5	7
42.	Forest Ranger	10	16,000-38,640	403	363	766	274	677
43.	Wildlife Inspector	10	16,000-38,640	-	20	20	21	21
44.	Data Control Supervisor	10	16,000-38,640	-	3	3	3	3
45.	Sub Assistant Engineer (Civil / Mechanical / Electrical / Marine)	10	16,000-38,640	-	15	15	22	22
46.	Field Investigator (Fisheries)	10	16,000-38,640	-	3	3	3	3
47.	Draftsman (diploma)	10	16,000-38,640	5	-	5	3	8
48.	GIS Analyst	10	16,000-38,640	-	1	1	3	3
49.	MIS Analyst	10	16,000-38,640	-	1	1	1	1
50.	Remote Sensing Analyst	10	16,000-38,640	-	1	1	1	1
51.	IT Analyst	10	16,000-38,640	-	1	1	1	1
52.	Computer Operator	11	12,500-30,230	17	28	45	33	50
53.	Deputy Ranger	11	12,500-30,230	454	(454)		146	600
54.	Foreman / Mechanic / Mechanical Supervisor	11	12,500-30,230	8	-	8	2	10
55.	Lab Assistant	11	12,500-30,230	-	4	4	4	4
56.	Forester	11	12,500-30,230	1,342	320	1,662	218	1,560
57.	Engine Driver / Engineman	11	12,500-30,230	38	-	38	-	38
58.	Audio Visual Operator	11	12,500-30,230	1	-	1	-	1
59.	Sureng	12	11,300-27,300	23	-	23	-	23
60.	Head Assistant	13	11,000-26,590	46	30	76	40	86
61.	Steno Grapher-Cum-Computer Operator	13	11,000-26,590	12	-	12	-	12
62.	Assistant Librarian	13	11,000-26,590	1	6	7	7	8
63.	Imam	13	11,000-26,590	-	14	14	14	14

Sl. No.	Designation	Grade	Current Pay Scales	Current staff strength	Additional staff proposed in 2015	Total staff proposed in 2015	Additional staff proposed in 2017	Total staff proposed in 2017
64.	Accountant / Cashier	14	10,200-24,680	90	12	102	22	112
65.	Radio Operator / Wireless Operator	14	10,200-24,680	22	-	22	-	22
66.	Steno Typist-Cum-Computer Operator	14	10,200-24,680	48	16	64	34	82
67.	Electrician / Cable Car Operator	14	10,200-24,680	8	10	18	17	25
68.	U.D. Assistant	14	10,200-24,680	55	101	156	363	418
69.	Draftsman	15	9,700-23,490	13	-	13	-	13
70.	Surveyor	15	9,700-23,490	17	27	44	37	54
71.	Assistant Forester	15	9,700-23,490		-		1,850	1,850
72.	Animal Pathologist / Lab Technician	15	9,700-23,490	-	6	6	7	7
73.	Store Keeper	16	9,300-22,490	2	18	20	18	20
74.	Store assistant	16	9,300-22,490	1	-	1	-	1
75.	Library Assistant	16	9,300-22,490	4	-	4	-	4
76.	Data Entry Operator	16	9,300-22,490	32	20	52	25	57
77.	Office Assistant Cum Computer Operator	16	9,300-22,490	285	160	445	425	710
78.	Electric Generator Driver / Deep Tubewell Operator / Pump Operator	16	9,300-22,490	20	10	30	22	42
79.	Turner	16	9,300-22,490	2	2	4	4	6
80.	Feeter	16	9,300-22,490	1	1	2	3	4
81.	Driver	16	9,300-22,490	138	160	298	178	316
82.	Trawler / Speedboat Driver	16	9,300-22,490	91	9	100	21	112
83.	Carpenter	16	9,300-22,490	3	-	3	1	4
84.	Compounder	16	9,300-22,490	1	4	5	9	10
85.	Cash Sarkar	17	9,000-21,800	32	-	32	2	34
86.	Plumber	17	9,000-21,800	3	6	9	8	11

Sl. No.	Designation	Grade	Current Pay Scales	Current staff strength	Additional staff proposed in 2015	Total staff proposed in 2015	Additional staff proposed in 2017	Total staff proposed in 2017
87.	Forest Guard	17	9,000-21,800	2,487	1,659	4,146	1,638	4,125
88.	Taxidermist	17	9,000-21,800	-	5	5	5	5
89.	Photocopy Operator	18	8,800-21,310	10	-	10	-	10
90.	Welder	18	8,800-21,310	1	-	1	-	1
91.	Cook	18	8,800-21,310	14	58	72	74	88
92.	Sukani	18	8,800-21,310	13	-	13	-	13
93.	Record Supplier	18	8,800-21,310	3	-	3	-	3
94.	Dispatch Rider	19	8,500-20,570	35	-	35	2	37
95.	Watcher / Petrol Guard	19	8,500-20,570	100	25	125	29	129
96.	Security Guard / Gate Man	19	8,500-20,570	15	133	148	185	200
97.	Wildlife Keeper / Animal Keeper / Animal Trapper	19	8,500-20,570	9	31	40	51	60
98.	Wildlife Scout	19	8,500-20,570	9	87	96	95	104
99.	Lift Operator	19	8,500-20,570	1	5	6	8	9
100.	Bungalow Chowkider / Bungalow attendant / Cottage Keeper	20	8,250-20,010	83	-	83	17	100
101.	Office Sahayok	20	8,250-20,010	484	76	560	608	1,092
102.	Night Guard	20	8,250-20,010	83	89	172	127	210
103.	Cleaner	20	8,250-20,010	99	81	180	101	200
104.	Mali	20	8,250-20,010	1,762	238	2,000	298	2,060
105.	Boat Man	20	8250-20,010	1,312	-	1,312	-	1,312
106.	Laskar / Khalasi	20	8250-20,010	95	-	95	-	95
107.	Laboratory / Library Bearer / Laboratory Attendant	20	8250-20,010	5	9	14	9	14
108.	Grass cutter	20	8250-20,010	5	-	5	10	15
109.	Mahut	20	8250-20,010	5	9	14	11	16

Sl. No.	Designation	Grade	Current Pay Scales	Current staff strength	Additional staff proposed in 2015	Total staff proposed in 2015	Additional staff proposed in 2017	Total staff proposed in 2017
110.	Dresser	20	8250-20,010	1	3	4	3	4
111.	Helper	20	8250-20,010	5	-	5	-	5
112.	Water Carrier / Water Carrier Helper	20	8250-20,010	6	-	6	-	6
113.	Tendal	20	8250-20,010	10	-	10	-	10
114.	Greezer / Fire Greezer / Oilman	20	8250-20,010	22	-	22	-	22
115.	Engine Room Cassob / Deck Cassob	20	8250-20,010	10	-	10	-	10
116.	Electric Stoker / Tendal Stoker	20	8250-20,010	4	-	4	-	4
Total Post				10,200	3,622	13,822	7,444	17,644
Abolished Post								
	Deputy Chief Conservator of Forests	3		4			-	
	Sub-Divisional Forests Officer	7		7			-	
	Diploma Engineer	10		4			-	
	Assistant Veterinary Surgeon	10		1			-	
	Wildlife Warden	11		2			-	
	Supervisor	14		2			-	
	Track Helper	16		1			-	
	Black Smith/Karmoker	16		2			-	
	Security Inspector	16		1			-	
Total Abolished				24				
Total Post				10,224	3,622	13,822	7,444	17,644

4.1.1.1 Forestry education and capacity building

Traditionally, the induction of new recruits and in-service training of staff members have been conducted at different training facilities established by the BFD. These training programmes were conducted initially for newly recruited Assistant Conservators, Forest Rangers and Foresters. Induction training for Forest Guards were started later on. The BFD maintains the following training institutions:

The **Forest Academy** was established in Chittagong in 1963. Initially the facility was used for conducting the induction training of Forest Rangers. However, subsequently some ACFs were also trained at the facility. The academy became affiliated with the University of Chittagong and started conducting 2-year Master of Science, 1-year Master of Forestry and 3-year Bachelor (Pass) of Forestry programmes to the induction trainees. In addition, before the affiliation, the academy conferred a Diploma in Forestry and over the years conducted capacity training programmes for another 2371, mostly serving, forestry officials.

Table 4-3: Graduates from the Forest Academy

Serial Number	Programme	Number of Graduates
1	M.Sc. in Forestry	28
2	Master of Forestry	30
3	B.Sc. (Pass) in Forestry	1190
4	Diploma in Forestry	76
5	Short capacity building courses	2471
Total		3795

As no major recruitments have taken place at the ACF and Forest Ranger levels for a long time, these programmes are now not being offered. This may be mentioned here that, as B.Sc. (pass) degrees are no longer offered by the University of Chittagong, before offering this course in the future affiliation from the National University, which is authorized to offer such programmes, will have to be obtained. At present, the academy organizes short refresher courses for DCFs, ACFs and Forest Rangers. It also organizes seminars and workshops on forestry- and wildlife-related topics.

The institute has in place the facilities needed for such an institution, but maintenance has not been possible because of a shortage of funds. Some needed repairs and expansion of existing facilities are currently being carried out under a project funded by the Government of Bangladesh (GoB), but unfortunately the funds available under the current phase are not adequate for completing all the needed works.

The academy has a sanctioned staff strength of 47 persons. Out of these, 16 positions, including those of four senior instructors, have remained vacant for a long time.

The oldest facility for training Foresters and Forest Guards is located in Sylhet. It was originally established as the East Pakistan Forest School in 1948, exclusively for training newly recruited foresters. A training programme for Forest Guards was introduced in 1966. The school was renamed the **Forestry Science and Technology Institute** (FSTI). In the past this institute has

conducted 1-year certificate course for Foresters, 3- and 4-month induction training courses for Forest Guards and other short courses for Foresters, Office Assistants, Plantation Assistants, staff members of non-governmental organizations (NGOs) and Malis. The main programme at the institute is a 2-years, 4-semester certificate course for in-service Foresters, for whom obtaining the certificate is a requirement for eligibility for promotion to the position of Forest Ranger. The Bangladesh Technical Education Board is responsible for preparing the curriculum, conducting examinations and awarding certificates. Thirty Foresters complete the course at this institution every year. Table 4-4 lists the different courses offered by the institute and the number of people who have successfully completed them.

Table 4-4: Training programmes at the FSTI, Sylhet*

Serial Number	Programme	Years	Number of Graduates
1	One-Year Certificate Course for Foresters	1948-1985	1182
2	Three-Month Training Course for Forest Guards	1966-1986	701
3	Four-Month Training Course for Forest Guards	1980-1986	414
4	Two-Year Certificate Course for Foresters	1985-2016	590
5	Three-Month Certificate Course for Foresters	1997-1998	55
6	Training Course for Office Assistants	1999	19
7	Ten-Day Course for Foresters/Plantation Assistants/Staff Members of NGOs	1999-2002	306
8	Eleven-Day Social Forestry Training Course for Malis	2001-2004	485
Total			3752

*Source: Forest Department, 2017

The institute is located on a large piece of land (14.6 ha) and has the required facilities. However, due to a non-availability of adequate funds, the facilities are falling apart and need urgent restoration. It may be mentioned here that some of the buildings and other infrastructure and facilities are in such a bad condition that it will not be possible to repair these. Out of 40 sanctioned positions, 13 are currently vacant. In addition, the institute suffers from an acute shortage of trained teaching staff. Given its location in a quiet site and the large size compared with other BFD training institutes in the country, it could be developed into a much larger training facility that could play a major role in meeting the demand for much more trained staff.

The second forestry school in Bangladesh, focusing on providing training in the social forestry sector, was established at Rajshahi in 1985. It was renamed the **Forestry Science and Technology Institute (FSTI), Rajshahi** in 2009. The institute has been offering a 2-year certificate programme for in-service Foresters. Thirty Foresters complete this course every year.

In addition, the institute has conducted different short courses for Foresters, Plantation Assistants and staff members of NGOs and the Social F (Table 4-5).

Table 4-5: Training Programmes at the FSTI, Rajshahi*

Serial Number	Programme	Year	Number of Graduates
1	Two-Year Certificate Course for Foresters	1985-2016	434
2	Ten-Day Training Programme for Foresters, Plantation Assistants and Staff Members of NGOs	1999-2005	394
3	Social Forestry Training for Plantation Malis	2001-2003	439
Total			1267

*Source: Forest Department, 2017

The land on which the institute is built is too small (less than 1.5 ha) for the deployment of a full-fledged institute with all required facilities. The institute also suffers from a shortage of adequately trained teaching staff, required facilities and amenities. Currently, the institute is undergoing renovation, repairs and expansion under a GoB-funded project. There are 33 sanctioned staff positions at the institute, out of which six are currently vacant.

Originally established in 1994 as the Forest School, near the Forest Academy in **Chittagong**, for training Foresters, the subsequently renamed **Forestry Science and Technology Institute** is currently running a 4-year diploma programme in forestry for the general public. The programme is recognized by the Bangladesh Technical Education Board. The Diploma in Forestry is the only qualifying educational requirement for Foresters, and this institute is the only institution that offers this programme in Bangladesh. The course is fully subsidized, and on completion, students become eligible to apply for the position of Forester. The institute admits 50 students every year, and so far 558 students have graduated from it. As the recruitment of Foresters is not regular, these candidates generally look for employment elsewhere, particularly with various development NGOs. The institution suffers from an acute shortage of qualified teachers, and this is reflected in the quality of the students who are currently graduating. Senior teaching positions are lying vacant for a long time, while some other instructors are working continuously at certain positions, with no promotion for long periods (up to 15 years or even more).

With the support of the Swedish International Development Cooperation (Sida) the **Forestry Development and Training Centre (FDTC), Kaptai** was set up in 1976 with the objective of developing capacity in forestry, including the technological aspects, for the BFD, BFIDC, Bangladesh Chemical Industries Corporation (BCCI), staff members of NGOs, people of the Chittagong Hill Tracts (CHT) and timber merchants. The main focus of the programme was on forest extension, logging, plantation establishment, forestry education and saw doctoring. In addition, it has the most elaborate training facilities (lecture rooms, laboratories, accommodation for trainees and staff) among all the forestry training institutions in the country. A total of 10,680 persons have been trained at this centre, mainly in forest extension, basic logging, saw doctoring and saw milling. Some other supplementary courses have also been conducted. Unfortunately, after the completion of donor funded projects, in 2004, the centre has become inactive. Without the needed maintenance, it is falling apart. Most of the machinery in the centre

is no longer in working condition. This centre is supposed to train Forest Guards. However, even though 449 Forest Guards have been recently recruited, they have been posted to the field without any training at this institution.

The Wildlife Centre was set up in Gazipur recently. The civil work at this World Bank-funded project was completed in December 2016. The centre will be headed by a Conservator of Forests, and the creation of a total of 83 technical and support staff posts has been approved by the GoB. It is planned to develop the Wildlife Centre as a regional centre of excellence for training and research on wildlife. The strategic plan for operation of the centre and 11 training modules and two curricula for short courses have been developed. Ten MoUs have been signed with other institutions for collaboration and exchange programmes. Three short training courses were conducted up to December 2016. Donor funding is currently not available for the centre, and there is no money available to carry out routine and development activities. A proposal to request bridging funds before new donor funding can be arranged has been submitted to the government.

As can be seen from the foregoing discussions, the BFD has a large establishment for training and capacity building. However, all the training institutions are suffering from similar problems. These include a lack of funds for regular activities, acute shortage of trained staff, poor conditions of some facilities and lack of modern teaching tools. It is high time the problems faced by these important institutions are addressed, considering that the BFD needs now, more than ever, to train large numbers of staff members to meet its large demand.

With the changes in the recruitment policies, as a result of which diploma holders are inducted as Foresters and all ACFs may also be forestry graduates soon, the mandate and roles of the institutions need to be reviewed and adjusted to meet the current needs. There has been a shift in the management from age-old practices to new technology-based ones, and forestry officials need to be prepared to handle the issues and challenges of a technology based system of management.

4.1.1.2 Induction of new recruits and in-service training programmes

The BFD recruits its staff at three levels: Forest Guards, Foresters and ACFs. Earlier, recruitment was done at the level of Forest Ranger as well. However, this has since been discontinued. The management process for recruitment of staff members has not been satisfactory for quite some time. Instead of recruiting regularly, the BFD, recruited only twice in very large batches between 1984 and 2004. In addition to the problems in cadre management, this practice of recruitment in large batches resulted in a serious scarcity of officers when a large number of senior officers retired within a short period of time. The recruitment practice has continued, and only three ACF was recruited between 2004 and 2015. In 2016, another seven more ACFs were recruited. In addition, a large number of field staff and non-cadre ACFs were recruited for project activities. This has created a major problem, which has been discussed previously.

4.1.1.3 Induction training

The primary purpose of various training institutions was to provide induction training, immediately after recruitment, to all new recruits, but this system is no longer in practice. Although there are induction training curricula for Forest Guards, Foresters and ACFs, these courses are not currently offered, primarily because there is no regular intake and the institutes

do not get trainees on a regular basis. These induction training programmes are very important because here those subjects and issues are taught that are not a part of an academic curriculum and prepare the fresh inductees better for the responsibility they are planning to shoulder. In the past, this used to be followed by a probationary period for on-the-job learning. This is also not strictly followed any longer. Even if all recruits at the level of Forester and ACF are forestry graduates from FSTI and universities as proposed, officials need to undergo field-oriented training related to administrative issues and practical aspects of forestry.

4.1.1.4 In-service training

All the institutes of the BFD provide in-service training. Apart from the 2-year courses run by the FSTIs at Rajshahi and Sylhet, all the other courses are specialized refresher courses supported by various development projects. The nature and content of these courses vary with the focus of the sponsoring project. As all these institutes are being run on skeleton staff, most of the teaching is done with the help of external resource persons.

The BFD is currently planning to raise its staff strength to 16,000 by 2020 and to 20,000 by 2025. These figures are based on the staff requirement estimated for implementing the programmes and projects planned in the near future. This will mean a recruitment of almost 8000 staff members at all levels in the next 3 years and another 4000 during the following 5 years. Meeting these targets will be a very challenging task particularly for the technical and sub-professional positions. Such a large number of eligible candidates may not be available, and the BFD does not have the capacity in place to provide basic post-recruitment training to these recruits. To complicate the situation further, under the current recruitment rules, any science degree holder can be recruited. In the case of recruits with non-forestry backgrounds, extensive training will have to be arranged in order to provide the forestry knowledge needed to cover the functions of a forestry official. If the process is started even today, such candidates will not be available for forestry jobs by 2020! For the recruitment of Foresters, the educational requirement is a diploma in forestry. The facilities that provide diplomas in forestry can turn out only a small number of students every year. These facilities will need time to build up capacities to educate a much larger number of students.

4.1.1.5 Improper field-structure

Traditionally, the BFD has had a single-tier field structure in which territorial DFOs perform all the management, enforcement and administrative functions. These units suffer from shortages of funds, adequate manpower and the tools and equipment required for discharging their duties. The same small staff of a beat, the basic field management unit in a forest division, is responsible for raising nurseries, establishing plantations, protecting the forests and performing many other routine functions. Forest Extension Divisions are responsible for forest extension services and are mostly located in districts where forests do not exist. They are tasked with promoting and planting trees outside state forests. However, there is usually no budget for extension work until there is an externally aided project. Like the others, these units suffer from an acute shortage of funds, facilities and the necessary tools. In the past, when the Extension Divisions were funded for different projects, they were active and showed visible results.

The BFD has also created seven wildlife and nature conservation divisions since 2001, but these divisions have also not been given any clear mandate. While many of them hold no territory (protected area) at all that they are mandated to manage, their official job is just to

advise other DFOs when they are dealing with wildlife matters. They have no special qualification or capacity to render this service due to the lack of training, staff, equipment, etc. Their law enforcement activities, related to wildlife crime, are also not exactly legal as the Wildlife Act is still not operational. Due to the lack of proper notifications and rules, they virtually have no powers to enforce the law. The territorial divisions have virtually stopped enforcing the wildlife law because the wildlife divisions have been given overlapping jurisdiction in this matter.

In the absence of empowerment, given the lack of clear mandates and the shortage of staff, equipment and the funds required for discharging their duties, these units are unable to perform the assigned duties satisfactorily. These divisions, especially the four created under the Strengthening Regional Cooperation for Wildlife Protection (SRCWP) project, were never really functional, and they have now been virtually wound up due to the closure of the projects that sustained them.

This shortage of funds for routine work extends to payment of travel allowances and other reimbursable costs to staff members, which greatly hinders the discharge of routine duties and upkeep of tools and equipment, including vehicles and vessels, and basic amenities, including housing for field-level officials. There is also no special allowance for those posted in remote and non-family stations.

Most activities are undertaken with funds from different projects and are discontinued once the project funding ends. This results in the loss of the progress made, and the infrastructure and other facilities created often do not remain serviceable. For the sake of continuity of development, all initiatives should be taken on the basis of long-term availability of funds.

4.1.1.6 Irregular recruitments at all levels

Any large organization has to plan its staffing needs keeping in view upcoming retirements, creation of new positions needed and possible attrition. However, the BFD has been recruiting its staff members very irregularly, generally only when the number of vacancies becomes too large. As a result, serious cadre management problems have been created. For example, whereas a large number of vacancies reduces the efficiency, bulk recruitments lead to dissatisfied cadres due to the government's inability to ensure equal promotion opportunities to all members of large batches. As one of the worst examples, quite recently, members of the same/close batches hold positions of DCF, CF, DCCF and CCF. As direct recruitment at the Forest Ranger level has been discontinued after 1995, it is going to be a major challenge to fill up all these vacant positions, more than 200, with competent promotees. The situation at the Forester and Forest Guard levels has improved somewhat after large-scale recruitments in the last few years. But these recruitments have not been done in a planned manner. Seventy-three Foresters were recruited in 2014, none since. The process of recruiting another 114 Foresters has been blocked by a court order. After several years in which no recruitment was done, 449 Forest Guards were recruited in 2017. These moves are welcome but will entail another cycle of stagnation as these Forest Guards will mature and retire at the same time.

Currently, the officers of the 1986 batch are placed in the top management of the forest administration. The last officer of the 1986 batch is scheduled to retire in December 2019. Thereafter, the officers of the 2003 batch will occupy the senior positions in the department with only 16 years of experience. Under the existing service rules, promotion to the position of CCF requires 20 years of service in the BCS Cadre because the post of CCF has been elevated to Grade 1 of government service. The incumbent also needs to work in the concerned service,

including 3 years as a Deputy Chief Conservator of Forests and another 2 years as a Conservator of Forests. As none in the 2003 batch has yet been promoted to the position of a Conservator (although many of them are officiating as Conservators), these officers will not meet the current eligibility criteria. This is the result of irregular recruitment of officers in the BCS (Forest) Cadre. A regular intake of officers is the only possible means of maintaining professionalism in the department.

As mentioned previously, the situations in most other ranks are similar. As there has been no recruitment of Forest Rangers since 1995 and all the current Rangers are promotees from the lower ranks, most of them have neither the educational background nor the technological skills necessary for working in a modern system. Most of the Rangers are also past their prime and are incapable of hard physical work. Nearly all of them will retire by 2020. The decline in the condition of the forests in the last few decades may be attributed, at least partly, to the loss of vigour and efficiency amongst the Forest Rangers in the department.

Again, it is important that the BFD have a proper recruitment plan that ensures that trained replacements for potential retirements are available in time.

4.1.1.7 Ad-hoc recruitments

Over the years the BFD has recruited new staff members for implementing donor-funded projects, without following the standard prescribed procedures. These ad-hoc appointees at both professional and technical/subordinate levels have been retained even after the end of the tasks for which such recruitments were made, and this has created many kinds of serious administrative problems. A large number of ACFs were recruited, bypassing the normal recruitment procedures, under different development projects since 1990. While some of these recruits have left the department, most of them are still working. Most of the currently serving officers belong to this group, and the number of the cadre officers is shrinking steadily due to the retirement of senior officers. Thus the functioning of the BFD is heavily dependent on this group of officers. A large number of the retained ACFs are still working in the same rank where they were recruited although some of them are in higher positions, due to the shortage of cadre officers.

Dissatisfaction prevails among these trained and long-experienced non-cadre officers due to their stagnant position in the department and their loss of seniority to very newly recruited BCS (Cadre) officers. This anomaly has led to the institution of several court cases, which have become a serious problem for the administration of the BFD. This group is currently the single largest among the professional-level forestry officials. While the resolution of this problem is not going to be easy because of the multiple litigations, a way needs to be found to resolve the issue and extricate the BFD from this messy situation.

Similarly, a large number of staff members at various levels, including from Wildlife Scouts, Wildlife Rangers, Biodiversity Conservation Officers and Veterinary Officers, have been recruited under the ongoing SRCWP project, and their fate is also uncertain. Only a few of them are likely to be transferred to the revenue budget, and these lucky few will face the same situation that the ACFs are currently facing. Moreover, as these newly created designations have not been included yet in the list of forest officers, under the prevailing rules and regulations, they have not been empowered to exercise any legal or financial powers. Therefore, they are unable to work at full efficiency.

4.1.1.8 Lack of human resource development and management policy

The BFD has a training and education wing, but there is no coherent training policy or currently ongoing training programmes either for new recruits or for building the capacity of serving officials. As mentioned previously, there is no plan to carry out phased-out recruitments at different levels to meet the new and emerging needs as well as to fill in vacancies arising from retirements. The tradition of providing induction training, immediately after recruitment, even at lower ranks has been discontinued. As a result, people are posted in field jobs without knowing the procedures and field craft needed for their jobs. As explained previously, due to irregular recruitments, and the consequent non-availability of trainees, the training institutions are in a state of decay. Many of them have only skeletal staff and inadequate facilities, which remain mostly unused. All the current training programmes are project-driven, short-term and ad hoc events that may have no relevance to the current job of a trainee. The only regular in-service training programme is the 2-year diploma programme run by the Rajshahi and Sylhet FSTIs for Foresters. This course is now a qualifying requirement for promotion to the level of Forest Ranger. Although it is good that all Rangers have this qualification, it shows that all Foresters go through most of their service without any professional training. Those officials who obtain specialized training abroad are not necessarily posted to positions where their acquired skills will be applied. Those holding teaching positions at the different training institutions also do not have any specialization in teaching. In Resource Information Management Systems (RIMS), there is a requirement of computer-literate specialists, which cannot be filled because the remuneration package and career progression prospects are not attractive for individuals with such educational backgrounds. This problem has made the smooth functioning of RIMS difficult.

4.1.1.9 Weak ICT infrastructure

The Internet and computing capabilities are the backbone of any modern organization. In the BFD, the computing facilities are, in general, limited to the typing and e-mail level. While ICT plays a very important function in the day-to-day operations of many organizations and organizations are trying to make their operations paperless currently, the operations remain extensively paper-based at the BFD and other sector organizations. In all sector organizations, access to ICT facilities is restricted to major offices and does not include field offices, which mostly use personal e-mail addresses because the official e-mail addresses are often unusable. There is no computer networking even at the headquarters. There are no databases, mobile apps or any other tools to improve efficiency. A limited GIS facility is available at RIMS alone, but no other office uses or demands GIS support. It is virtually impossible for the BFD to implement any modern programme efficiently because all such programmes need reasonable levels of computer and communications support across the enterprise.

4.1.1.10 Weak monitoring and evaluation systems

The BFD raises plantations over large areas every year. In addition, it undertakes a number of cost-intensive activities. However, there is no appropriate mechanism in place for monitoring effectively the success or failure of any activity. The large-scale failures of plantations could not be detected in time because of the absence of a comprehensive monitoring and evaluation programme. In practice, there is no system in place to check whether a task has been completed successfully except the submission of a report by the officer who executes the task. Under the current arrangements, the offices of the three DFOs of the Working Plan Divisions are supposed to carry out monitoring of the primary stages of establishment of different plantations and submit their reports to the DCF, Monitoring and Evaluation, who in turn is

supposed to analyse and compile such reports after spot verification. However, the Working Plan Divisions are grossly understaffed, and the resources needed to carry out the task diligently are not available to them. At present, monitoring of plantation establishments is restricted to assessment of the established seedlings once in the first year and again in the third year. This operation does not include monitoring tending operations and other related activities. There is no system for monitoring the status of natural forests and older established plantations. As a result, by the time the disappearance of trees from these plantations and natural forests is discovered, there is no scope for any action to reverse the process! While certifications of successful establishment of plantations are issued, in reality such certificates do not reflect the situation on the ground. The office of the DCF, Monitoring and Evaluation, is also understaffed. As all these reports are on paper, they are difficult to track, and any analysis or synthesis of the information is a very difficult task involving entering the huge volume of data into computers. As forest cash books have traditionally been the storehouse of all management information, digitization of range and divisional cash books can be extremely helpful in collecting management data. Incidentally, there is no system of annual reports nowadays, at any level. Therefore, nobody feels the need to compile all the reports, and any compiling and analysis are now done only on the basis of sporadic demands for information from higher offices.

4.1.1.11 Weak RIMS

RIMS is the unit in the BFD responsible for generating, managing and disseminating resource-related information. However, due to the lack of the necessary equipment, appropriately trained manpower and other resources, it has not been possible for the unit, which could play a major role in forest management, to function satisfactorily. This unit, which is supposed to undertake highly specialized functions, is treated like any other unit within the BFD, and it is extremely difficult to hire staff members for some positions that require special skills because of the low salaries and incentives associated with them. In addition, RIMS also suffers from a shortage of funds and is only active when it becomes a part of an externally funded project.

The scope of activities at RIMS is enormous. A survey of the forest resources of the country is currently under way. It will be important for RIMS to be able to manage the information that this survey will generate and to periodically update this information. In addition, it could manage all other information that will be helpful in taking forest management decisions. It can also act as a depository of all digitized records, maps and other important documents.

4.1.1.12 Lack of forest management planning

Bangladesh had a long tradition of forest management planning in the form of 10-year or longer-term working plans. Detailed surveys, enumeration of forest stock and collection of relevant information were undertaken before these plans were prepared. However, this system was abandoned in the late 1980s, and at present the only planning being done is for the preparation and implementation of occasional projects. Field interventions are based on recommendations made in these project documents, which in the best of circumstances is a very undesirable practice. In the past, the management plans, which were known as working plans, were prepared after carrying out extensive field work and performing a field-level assessment of different forest stands, the needs of the forests and the supporting activities necessary for implementing the plan. Detailed site-specific management prescriptions for tending and harvest operations were incorporated in the plans, and all field activities were carried out on the basis of the prescriptions in the plan. So, the current implementation of field operations through project-based interventions is ad hoc at best. There are three Forest Management Plan Divisions,

based in Dhaka, Khulna and Chittagong. However, it appears that these divisions have no role to play in the formulation of management prescriptions. The decline of forests in the country as a result of project-based management interventions in different natural forests and plantations in the last few decades may be linked, to some extent, to this passivity in forest management planning.

It is pertinent to mention here that almost no silvicultural operations are carried out in the forests after the first year after the establishment of a plantation. These activities include vacancy filling, thinning and other associated operations. This practice results in the forest not reaching its full production potential, in terms of maximizing both volume of growth and financial returns.

4.1.1.13 Legal issues

The BFD is responsible for enforcing the Forest Act, 1927 and the Wildlife (Conservation and Security) Act, 2012. While the Wildlife Act has completely replaced the Wildlife Ordinance, 1973, the Forest Act has also been amended many times to bring it in line with the demands of the changing times. One major amendment of the Forest Act was the institutionalization of social forestry. Several other amendments aimed at effective enforcement have been carried out from time to time.

However, the notifications issued by the government to implement various provisions of the Forest Act have not been reviewed for a long time, and many of them have become obsolete or are no longer implementable due to the changes in the organizational structure of the BFD over time. For example, the three notifications numbered 2404, 2405 and 2406 dated 26 December 1959, which empower only gazetted officers to exercise powers invested in forest officers under Section 72 of the Act, need to be amended urgently as all actions against criminals are actually taken by the subordinate staff, not by gazetted officers. Moreover, many new designations in the department, such as Wildlife Scout and Wildlife Ranger, do not fall within the definition of a 'forest officer' as defined by Notification No. 2396 dated 26 December 2016, and, as a result, these staff members have no powers to enforce the act. In fact, some courts have started refusing to accept forest cases on the ground that the complainant officers (Foresters) are not authorized to file cases in the courts.

Similarly, the three sets of transit rules prevailing in the country need to be reviewed to create unified regulations that govern the whole of the country. In fact, these rules continue to be seen as obstructive to the growth of tree cultivation in the country as their only use at present is to harass the public. The provisions of the current transit rules are also not friendly to those people who are growing trees on private land and have become a major issue associated with the harvest of trees outside forests. In fact, these rules have lost their relevance with the virtual disappearance of sal and hill forests, for the protection of which these rules were framed. There are allegations of misuse of the transit rules by staff members for monetary gains, and the process of issuance of a transit pass even for tree species that no longer grow in the forest may take weeks or even months.

Although the Wildlife Act was promulgated in 2012, it has still not been fully operationalized as the necessary rules for enforcing it have not been promulgated yet and the empowering notifications have not been issued. Moreover, the law has some serious shortcomings, which need to be urgently addressed. For example, forest officers have no power to arrest wildlife criminals or to file cases in courts under this act.

There can be many more such law-related issues that may need urgent attention. It is, therefore, necessary to conduct a comprehensive review of the current forestry- and wildlife-related legal framework of the country in order to make it effective in meeting the current and emerging challenges faced by the forestry sector.

4.1.1.14 Lack of research support

Modern forestry is highly research-dependent as the availability of modern tools and techniques makes it possible to go deep into questions that had no answers a few decades ago. In the past, enhanced activities at the BFRI were driven by external support from donors, and such activities tapered off once the funding support ended. The appearance of new challenges such as climate change, biodiversity conservation, introduction of recurring income-generating forestry practices and valuation of ecosystem services as well as the changed focus of forest management, etc. makes it imperative for forest managers to have access to researched information and knowledge for correct and efficient forest management decision-making. Due to its poor state, the BFRI is unable to generate information that will be useful to other sector organizations. The country needs to find out, for example, the overall impact of climate change on the forestry sector in the country and identify climate-resilient tree species suited to different habitats, varieties/clones suitable for rubber plantations, new fast-growing species for meeting the growing demands for timber and other products, demands and markets for forest products, silvicultural and financial rotation schemes for homestead trees, which contribute the bulk of the timber to the nation's markets, new combinations for agroforestry, means of *ex situ* conservation of species of non-timber forest product (NTFP) and medicinal value and so on. Forest industries also have no access to research facilities for information related to modern technologies, efficient operations and wood substitutes. The BFRI and a few universities are involved in limited forestry research in the country, but not much applied research has been carried out in the country so far. A demand-driven research programme that will benefit other sector organizations needs to be undertaken under a clear research plan prepared in consultation with other sector organizations. The country has to take stock of the situation, address the reasons behind the current state of affairs and create an enabling environment for conducting research to support the growth of the forestry sector. The BNH, which has a primary mandate of conducting surveys and carrying out research on plant species, also suffers from an acute shortage of manpower and funds and from problems similar to those of the BFRI.

4.1.1.15 Financial constraints

Bangladesh has lost most of its sal and hill forests, and the pace of this loss has accelerated in the last few decades. The country has made ambitious plans and policies for preserving its forest wealth in the past but has not been successful in this endeavour. The lack of adequate manpower, equipment and tools for better management and protection of the forest resources of the country is partially to be blamed for the current situation. Apart from the shortage of development funding to take up new capital works, the sector faces an acute shortage of funds for undertaking obligatory routine activities, such as those involved in protecting and managing forests. In addition, most of the field offices and staff housing are inadequate and often in poor condition because of a lack of funds for building new staff quarters or maintaining the existing ones. Finally, project-driven activities that cannot be continued after project funding ends are not a desirable option either! This situation does not create an enabling working environment.

4.1.1.16 Inadequacy of field infrastructure and logistics

As indicated previously, there is a tremendous shortage of field infrastructure, particularly in remote areas such as the Sundarbans and the CHT. The staff accommodation is often not available or is of very poor quality. Transportation is often not available, and if it is available, there is hardly any money for fuel and other maintenance costs. Travel bills are rarely reimbursed. Staff members working in remote areas have to maintain double or triple establishments in order to look after their families and aged parents. There is no provision for an allowance to cover these costs. In addition, staff members working in remote areas do not have access to electricity, safe drinking water, medical facilities and satisfactory schooling for their children. There are also no facilities to keep government records safe and secured. Most agencies working under such circumstances, such as the police and BGB, are paid special allowances to compensate for their difficulties. However, forest subordinates are paid nothing despite the fact that the facilities they get in the field are much worse than what other agencies get. It is important to note here that the risk allowance along with other incentives are impetative for the staffs who are working in the remote and risky areas.

4.1.2 Bangladesh Forest Research Institute

The BFRI is a national institute under the administration of the MoEF as well as a component of the National Agricultural Research System. It is the only national organization that has a mandate to conduct forest management and forest product utilization research. The BFRI maintains the largest forestry library and documentation facilities in the country. It has published more than 1360 research papers and 160 technical bulletins and has trained more than 10,000 individuals in using the technologies that have been developed by the institute's research scientists.

The BFRI currently has two research wings—the Forest Products Wing, with six research divisions, and the Forest Management Wing, with 11 research divisions. There are also two service divisions. The BFRI has established 21 research stations and sub-stations under five field divisions that cover forest types that spread over eight ecological regions of the country.

Issues and constraints

Like other institutions, the BFRI is also suffering from an acute shortage of manpower, especially at the senior level. The latest available status of manpower is shown in Table 4-6.

Table 4-6: Staff position at BFRI⁹

Class	Approved	Existing	Vacant
1	103	56	47
2	43	23	20
3	433	310	123
4	213	136	77
Total	792	525	267

⁹ Annual Report of MoEF 2014–2015.

It is disheartening to note that 33% of the approved positions in the institute are vacant at present, while the vacancies at the senior level (scientist level) are as high as 45% of the sanctioned positions. During discussions, the staff members came across as highly aggrieved and demotivated due to the problems they are facing at the institute.

The primary constraints that restrict the research activities of the BFRI are the following:

- No new divisions have been created for a long time to address important current and emerging issues, and the original structure continues despite new challenges and areas of interest/concern, e.g., climate change, social forestry, forest restoration and promotion of cash-generating products from the forests.
- A shortage of manpower due to retirements, a lack of new recruitments and the recruitment process being very slow (it takes 2-3 years to fill a vacancy). Most recruits leave due to the lack of career advancement opportunities.
- The recruitment rules are grossly outdated (1985 vintage), and their revision has been proposed several times but not been carried out. While this is the only mandated forestry research organization in the country, forestry is not included among the qualifying disciplines for recruitment for research jobs in the institute!
- Because of the limited and very slow prospects of career progression and inadequate opportunities for conducting research, the institute is unable to attract bright and qualified scientists.
- A proposal to modernize the institute and upgrade its research and other facilities has been submitted to the MoEF. Implementation of this project will create facilities and the required support for an enabling environment for conducting research.
- There is no facility at the BFRI for carrying out research on current and emerging disciplines such as climate change, genetic engineering, social forestry, restoration forestry, remote sensing and GIS, biotechnology, monitoring and evaluation, capacity building and technology transfer.
- The infrastructure is in bad shape at the BFRI and BNH, and it is even worse at the 20+ field stations of the BFRI. No modern equipment has been procured for a long time, except a few computers. The IT infrastructure is poor and is not available to a large section of the staff.
- Almost entirely dependent on the government's regular budget. Has very limited access to external project funding or any opportunity for conducting research for industries and other entities.
- The Bangladesh Journal of Forest Science, which is published by the BFRI, does not come out regularly because of a shortage of funds and suitable contributions from authors. Only two issues have come out in the last 8 years.
- Funds are not available for acquiring new books and journals. The library has no digitization facilities or library management software.
- No incentive is available to the scientists to excel in research as promotions are slow and there are very few other career progression opportunities.

- The scope for higher training and capacity building of the young scientists is very limited. There is also no arrangement for exchange of scientists with other reputable forestry research organizations.
- Separate funds have never been allocated for undertaking research for the BFD or FIDC. Opportunities for carrying out research for private sector industries have never been explored.
- None of the recommendations made about the BFRI in the previous Forestry Master Plan has been implemented.
- There is no comprehensive long-term planning for conducting research, and the institute does not have a planning outfit also.

4.1.3 Bangladesh National Herbarium

The BNH, which is also under the MoEF, is the national organization for plant taxonomic research and a depository for taxonomic specimens. It is involved in the exploration, collection, identification and preservation of the country's plant resources. During explorations, its scientists collect plant specimens, as well as relevant information on locations, local names, collection dates, phenology, diversity, abundance, distribution, local uses and risks. These endeavours have not only enriched the herbarium with recent collections but also contributed to the knowledge. Among the publications of the BNH are the Flora of Bangladesh, the Red List Data Book of Vascular Plants of Bangladesh and checklists of the national flora. The BNH currently has a collection of more than 100,000 plant specimens with species and family names, accession numbers, collection dates, names of collectors, collection numbers, ecological details and important notes regarding the plants. These specimens are used as the basis of plant identification and plant diversity assessments throughout the country. They will be bequeathed to posterity and will continue to be used as reference materials in plant taxonomic research and conservation of biodiversity and the environment.

Issues and constraints

The herbarium is suffering from the same problems as the other sectoral institutions, namely a shortage of staff, funds and capacity-building initiatives. The latest available staff position at the BNH is presented in Table 4-7.

Table 4-7: Staff strength of BNH¹⁰

Class	Approved	Existing	Vacant
1	19	9	10
2	3	3	0
3	18	14	4
4	12	11	1
Total	52	37	15

¹⁰ Annual Report of MoEF 2014–2015.

More than half of the senior scientist-level positions, including the position of the Director, are currently vacant. The current service rules are inadequate and in need of revision. There is a serious shortage of funds, equipment, logistics and other necessities for running a smooth operation. The IT and computer facilities are inadequate, and there are no facilities available yet for digitizing the taxonomic data collected.

The herbarium works in complete isolation without any linkages/networking with other similar reputable institutions elsewhere.

Because of the shortage of funds, the herbarium is unable to carry out its core activities and has never received any outside funding or any other development funds for conducting new surveys except last year, when it received Tk.1 crore for a new survey and specimen collection project.

4.1.4 Bangladesh Forest Industries Development Corporation

The government of the then East Pakistan established this autonomous body under the name 'East Pakistan Forest Industries Development Corporation' in 1959. The name of the corporation was changed to Bangladesh Forest Industries Development Corporation, with its headquarters at Dhaka, after the country became Bangladesh.

The corporation is functioning on a commercial basis. The Board of Directors exercises all powers and conducts all the activities of the corporation under the guidance of the ministry.

Functions and responsibilities

Currently, the BFIDC's functions are confined to:

- Procurement of timber and other forest produce from forest land
- Establishment of industries/factories for commercial use of forest produces
- Treatment and seasoning of timber;
- Manufacture of furniture and various wooden items for supply to government offices
- Raising rubber plantations and rubber production
- Promotion of rubber cultivation in Bangladesh through the private sector/multinational companies.

Organizational structure

The general direction and administration of the corporation are vested in a board consisting of the Chairman and three directors, namely, Director (Finance), Director (Planning and Development) and Director (Production and Commercial), and the Secretary, in charge of the Secretariat Division.

The responsibilities of many of the positions are vested with officers of lower rank due to a lack of sanctioned manpower for those positions.

Human resources

The staff strength and vacancies in the BFIDC structure are given in Table 4-8.

Table 4-8: BFIDC staff position¹¹

Class	Approved	Existing	Vacant
1	228	84	144
2	13	4	9
3	519	237	282
4	551	404	147
Labour	5277	4340	937
Total	6588	5069	1519

As can be seen in the table, 63% of the senior posts and 44% of the total staff positions are vacant. This is a very serious disability.

The corporation has proposed a reorganization and strengthening plan to the government that will give it a total permanent staff strength of 2215.

The BFIDC's human resource management activities are almost negligible. Occasionally, some training in field operations is provided to the field staff. Overseas training for the senior staff is almost non-existent.

The functions of the BFIDC can be divided into two sectors, namely, the industrial sector and the rubber sector. A brief description of these two sectors follows.

Industrial sector

Nineteen industries were established by the BFIDC. Most of these have been sold or are being sold.

Seven industrial units are currently running under the BFIDC: (i) Cabinet Manufacturing Plant (CMP), Dhaka; (ii) Eastern Wood Works (EWW), Dhaka; (iii) Sangu-Matamuhuri Timber Extraction Unit, Chittagong; (iv) Wood Treating Plants (WTP), Chittagong; (v) Cabinet Manufacturing Plant (CMP), Chittagong; (vi) FIDCO Furniture Complex, Chittagong; and (vii) Lumber Processing Complex (LPC), Kaptai, Rangamati.

Shortage of wood is one of the constraints faced by the industry sector. There is a moratorium on felling of trees in natural forests, and the seized wood procured from the BFD does not meet the full requirement of the BFIDC.

Rubber sector

The corporation has at its disposal 65,155 acres (25,652 ha) of forest land in the Greater Sylhet, Chittagong and Mymensingh regions for establishing rubber plantations. It has so far established 16 rubber plantations over 57,335 acres of land using Malaysian clones. There are eight rubber gardens in Chittagong, four in Sylhet and five in the Tangail and Sherpur areas.

¹¹ MoEF Annual Report 2014–2015.

Two million rubber trees in the BFIDC's plantations are now under production. Many of the plantations have become old and underproductive and are continuously being replaced with new plantations. The area of the plantations in existence is lower than the area planted up. A total of 4204.392 metric tonnes of rubber was produced during the 2015-2016 fiscal year. The low level of production is attributed to older trees, a lack of cutting edge expertise and knowledge about rubber tree farming, which has become less productive, use of old, low-yielding clones for planting, an absence of the required tending and fertilization operations, etc. A total area of 85 ha of new plantations was established in the 2015-2016 fiscal year, and there is a plan to raise another 220 ha of plantations during the current fiscal year. It is interesting to note that in spite of the huge gap between the demand and the local production and close to 90% of the requirement of raw rubber in the country being met through imports, the BFIDC exported 3215 metric tonnes of rubber to India in the 2015-2016 fiscal year! The BFIDC incurred a loss of Tk.20.1 million in 2015-2016. The loss from rubber production was actually much higher. However, the industrial sector made good profits, reducing the overall loss.

As an apex body, the BFIDC has been promoting rubber cultivation in the private sector. A total of 32,550 acres (13,172 ha) of hilly land was allotted to 1302 individuals (25 acres/person) for raising rubber gardens in the private sector. Out of this, 13,000 acres (5261 ha) of rubber plantations is under the Chittagong Hill Tract Development Board. Tea gardens and other organizations have also raised about 20,800 acres (8418 ha) of rubber plantations. The private sector produces about 5500 metric tonnes of rubber annually.

The production levels at both the BFIDC and the private sector plantations are quite low compared with the levels in countries such as Thailand, Indonesia and Malaysia. It is reported that all the rubber producers in the country have been using planting stock of a low-yielding variety that was brought in from Malaysia when the first rubber garden was established in Bangladesh in 1961. For higher yields, rubber requires more intensive management than that practiced in Bangladesh. Some of the BFIDC rubber plantations are old and have reached a stage where the latex yield has greatly diminished. It may be mentioned here that while the private plantations have higher yields and are making some profits in spite of the slump in rubber prices globally, from the sale of rubber sheets, the BFIDC is incurring mounting losses over the last few years. The reasons for this are its older trees, poorer management and large number of permanent workers. The older trees are harvested and taken to the BFIDC furniture manufacturing plants. According to BFIDC records, between 2011 and 2016, BFIDC furniture units utilized a total of 31,446 m³ of different varieties of timber, of which 17,780 m³ (55%) was rubber, which came from the harvest of old rubber trees. As the private rubber growers in Bangladesh, depending on the quality of the product, are selling a kilo of rubber for Tk.125-140, and their production costs vary between Tk.80 and Tk.90, it is necessary to review the situation at the rubber plantations in the BFIDC and identify the reasons for such losses and what interventions will ensure a return to profit making.

While for various genuine reasons the rubber yields in Bangladesh are not comparable with those of the rubber-producing countries like Malaysia and Thailand, given the continued strong demand for rubber in the country, which is currently met largely through imports, the prospects of rubber in Bangladesh are still good. It is expected that with improved planting stocks, proper management and processing of latex, provision for bank loans at low interest rates, tax holidays and ensuring that the growers get the appropriate price for their produce, the profit margin will

continue to be good. In addition, the current rubber price is less than half of what it used to be in 2010. This is primarily because of the low cost of production of artificial rubber using petroleum products as the raw material. As and when the price of petroleum fuel increases in the future and producing artificial rubber becomes more expensive, the price of natural rubber is bound to increase. While there is lot of interest in the private sector, the main limiting factors are the scarcity of land available for rubber plantations, non-availability of high yielding varieties of planting stock and know-how and the absence of any support from the government.

The less-than 10 ha (25 acres) allocated to private sector entrepreneurs in the CHT for establishing rubber plantations is too small a parcel of land to be a viable unit of management. Consideration should be given to raising the sizes of such allocation to 100 ha or even more, providing technical supports and doing away with some of the problems associated with waiting for 7 years after making investments to see the returns starting to accrue. As mentioned previously, the reasons why the BFIDC is incurring losses, when others involved in rubber production are making profits need to be identified and addressed. Unfortunately, the BFIDC does not have the needed expertise and skills, which they could share with the private sector tree farmers. Some progress has been made to institutionalize rubber farming. The government has set up a rubber board with its gazette notification No. 19 of 2013. This notification has laid out the detailed procedures for setting up the board, its membership and functions. The board comprises the representatives of the relevant government agencies as well as representatives of other stakeholders. However, while the notification establishing the board is already in place, it is not functional in the true sense yet. The rubber plantation owners have also formed their own association. Bangladesh is also in the process of applying for membership of the Association of Natural Rubber Producing Countries, an association of all major rubber-producing countries. This will allow Bangladesh to access authentic technical and management information about the rubber industry, including that related to the development of high-yielding clones of rubber. In addition, Bangladesh will become a member of the network of major rubber producing countries.

Through research, high yielding varieties of cloned rubber plants could be developed in Bangladesh. However, very little research on rubber is currently being carried out in the country. BFRI has recently initiated some research. However, this is more because of the personal interest of a scientist in it.

Financial resources

The BFIDC is a self-financed organization. The corporation pays Tk.5.0-10.0 million to the government from its profits annually. The state of its finances varies from year to year, depending on the market conditions and the performance of its various units. It earned a profit of Tk.403.97 lakh in the year 2014-2015, mainly on the strength of its manufacturing operations, while the rubber business suffered a loss of Tk.875 lakh. The corporation consumed 31,4456 m³ of timber in its manufacturing operations in that year, out of which 17,380 m³ came from old rubber trees harvested from the BFIDC rubber plantations.

The corporation is reported to be suffering from over-centralization of its financial decision making, and decentralization efforts have not been successful so far. The corporation has very limited IT infrastructure, and its field units have no Internet access, in general. There is scope for improving the website of the BFIDC.

Issues and constraints

- As indicated previously, the BFIDC faces the following challenges in performing its mandate efficiently:
- Shortage of staff, skill and expertise
- Lack of experts with required relevant specialization
- Shortage of quality timber for manufacturing wooden furniture, cabinets, doors and windows
- Lack of resources and absence of financial and administrative freedom
- Low-yielding planting stock and old and obsolete technology in rubber processing
- Aging rubber plantations and poor clones of rubber trees.

Looking at the overall plantation-based and industrial nature of its operations, it is surprising to note that there is no expert from the relevant disciplines in its top management. Although the corporation has been instrumental in spreading rubber cultivation to the private sector, it has no role in promoting the development of forest industries in the country beyond running its own businesses. As the forest product-based industries and occupations are among the biggest employment generators in the country, the country needs a body to spearhead their growth and development. It will be fitting for the BFIDC to take up this role.

4.1.5 Forestry education

Three universities, i.e., Chittagong University, Khulna University and Shahjalal University of Science and Technology, run different courses for graduate, postgraduate and doctoral degrees in forestry in Bangladesh. A brief overview of the forestry institutes or departments follows:

- **Institute of Forestry and Environmental Sciences, Chittagong University, Chittagong**

The Institute of Forestry in Chittagong University, established in 1976, was the pioneer in university-level forestry education. Later, it offered additional courses in environmental sciences and was renamed the Institute of Forestry and Environmental Sciences (IFESCU) in 1996. Besides offering the B.Sc. (Honours) in Forestry degree since 1978-1979, the institute has been offering the M.Sc. in Forestry degree since 1996, in-service training (Master of Forestry) to newly recruited ACFs under the BFD since 1977-1978, the B.Sc. (Honours) in Environmental Science since 2000-2001 and the M.Sc. in Environmental Science since 2004. The institute awarded the M.Sc. in Forestry to two batches (during 1977-1978 and 1985-1986) to 38 ACFs recruited by PSC and the Master of Forestry to one batch (2003-2004) of 30 ACF recruits of the BFD. Along with these, the 4-year professional B.Sc. (Honours) in Forestry programme was also started. So far IFESCU has offered the professional B.Sc. (Honours) degree to 1055 students, M.Sc. in Forestry to 608 students and Ph.D. to nine students. Thirty-two foreign students also pursued forestry education at this institution. IFESCU has 32 qualified faculty members, who have expertise in the diverse arena of forestry and the environment, including agro-forestry, biodiversity conservation, carbon measurement, climate change, GIS, community forestry, forest and environmental economics, genetics, mangrove forestry, resource management, restoration ecology and tree improvement. The institute has courses in advanced areas of research in forestry and the environment such as sustainable forest management (SFM), climate change, protected area management, biodiversity conservation, ecosystem analysis and community forestry. in its curriculum. A survey of IFESCU graduates revealed that they were employed in the BFD, BFRI, BFIDC, DoE, SPARRSO, KU, SUST, MoEF, BTRI, IFESCU, Bangladesh Academy for Rural Development, training and educational institutions, Hill

Tracts Development Board, tea and rubber gardens, forest-based industries, Bangladesh Civil Services, banks, NGOs and research institutions (BCAS, IUCN, CEGIS, Arannayk Foundation and international organizations such as FAO, UNDP, ADB and Winrock International).

IFESCU maintains its own seminar library with adequate books, journals, references and other reading material covering forestry, environmental science and related fields. The institute also has physical, chemical, biological, GIS, computer, climate change, watershed and tree propagation laboratories, with a permanent nursery covering an area of about 2 ha, which is used by the teachers and students for research work and for raising quality seedlings. A plantation programme was initiated in 1982, and till date an area of about 650 acres (out of 800 acres of hills and valley land in the university campus, where the institute is located) has been planted successfully with different timber, wood fuel, medicinal, rare and endangered species. At present IFESCU has plantations of 110 different tree species in the campus. All students of IFESCU get physical training and rifle training and are compulsorily enrolled in the Bangladesh National Cadet Corps (BNCC).

- **Forestry and Wood Technology Discipline (FWTD), Khulna University, Khulna**

FWTD was established in 1992 with a 4-year professional B.Sc. (Honours) in Forestry programme broadly in line with the curricula and courses developed at the Institute of Forestry at the Chittagong University but with greater emphasis on wood technology and computer literacy. Special emphasis is also given to the Sundarbans mangrove forest and social forestry programmes. FWTD also runs M.Sc. and Ph.D. programmes in forestry. So far FWTD has produced 600 B.Sc. (Honours) and 595 M.Sc. graduates from this discipline. The graduates are working for the BFD, DoE and other governmental and semi-governmental departments, academic institutions and wood-based industrial, non-governmental and corporate sectors in Bangladesh. It must be mentioned here that a number of the graduates of FWTD have pursued higher studies abroad and are currently engaged in research, teaching and other activities, both in Bangladesh and abroad. FWTD has 23 faculty members including 16 Professors, 3 Associate Professors and 4 Assistant Professors, and has extensive expertise in diverse areas of forestry, including agro-forestry, biodiversity, forest ecology, ecophysiology, environmental science, forest genetics, forest management, forest nutrient dynamics, forest pathology, forest policy, forest product technology, genetics and tree improvement, mangrove ecology, social forestry, tourism, wildlife, wood microbiology and wood science. Since its inception, the faculty members have been conducting research in various fields of forestry and wood science, and this work has already earned recognition and fame both nationally and internationally. FWTD has facilities to carry out advanced research in the areas of mangrove ecology, wood science, social forestry and tree improvement. FWTD possesses sophisticated equipment in its Nutrition Dynamics Laboratory, Wood Science Laboratory, Tissue Culture Laboratory, Nano Biomaterial Laboratory and Eco-Physiology Laboratory. Besides, research funds for various projects have been obtained from Khulna University Research Cell; University Grants Commission; Ministry of Information, Science and Technology; Ministry of Education; Bangladesh Agricultural Research Council; Bangladesh Academy of Science; GIZ (German Cooperation); US Department of Agriculture (USDA); World Bank; Nagao Natural Environment Foundation; The World Academy of Science; Japan Society for the Promotion of Science (JSPS); Asian Development Bank; and the BFD.

Linkages have been established with various forestry organizations such as the BFD, BFRI, BFIDC and different wood-based industries in Bangladesh. Besides, the university has also

established collaborations through exchange programmes such as EXPERTS (Exchange by Promoting Quality Education, Research and Training in South and South-East Asia), funded by the European Commission. The projects provide scholarship opportunities for faculty members and students to study and conduct research in seven European universities. Every year, a good number of faculty members and graduates get scholarships for pursuing M.Sc. and Ph.D. programmes and postdoctoral studies. They also get academic staff fellowships.

- **Department of Forestry and Environmental Science, Shahjalal University of Science and Technology (SUST), Sylhet**

The Department of Forestry was started in 1998 with a 4-year professional B.Sc. (Honours) in Forestry programme, broadly in line with the curricula and courses developed in the Institute of Forestry at Chittagong University. Subsequently, the Department of Forestry was upgraded to the Department of Forestry and Environmental Science (DFES) in 2007. So far, the DFES has awarded the professional B.Sc. (Honours) in Forestry to 308 students and the M.Sc. to 184 students. Graduates in this discipline are engaged with the BFD, DoE and other governmental and semi-governmental departments, academic institutions, wood-based industries, NGOs, corporate houses and the banking sector in Bangladesh.

The DFES has 22 faculty members (five Professors, 6 Associate Professor, 11 Assistant Professors) who have expertise in the diverse fields of forestry, including climate change, ecology, environmental law, governance and community-based natural resource management, environmental science, forest ecology, forest tree improvement and genetics, GIS and remote sensing, non-wood forest products, natural resource management, resource economics and wood science. Six of the faculty members have doctorate degrees from reputed universities abroad; eight others are pursuing doctoral studies in different universities in the UK, Germany, Canada and Malaysia; and eight other faculty members are enrolled in different M.Sc. programmes abroad. Many graduates are currently working in the BFD, other government agencies, NGOs and corporate institutions. The department is contributing significantly in the broader context of forest management by producing professional forestry graduates. Furthermore, the DFES is rendering services to the BFD as and when required.

The ongoing activities of the DFES include offering undergraduate and postgraduate courses in forestry to produce trained forestry graduates for Bangladesh; conducting research on multidimensional attributes of forests and the environment, particularly climate change, forest ecology, environmental law, GIS, tree improvement and forest resource economics; supporting the FSTI in providing teaching support to the Foresters' course; and providing human resource support to the DoE, BFRI and other related organizations during training programmes, workshops and seminars. The DFES has signed an MoU with the BFD for collaboration on research, education and training for the Wildlife Centre. It is also in the process of signing an LoA to conduct a national forest inventory in association of the BFD.

Put together, these three forestry programmes have the capacity to provide the forestry graduates and postgraduates required by the BCS (Forests) Cadre and the qualified forestry educated staff essential for other needs.

4.2 Monitoring and evaluation system and information management

The BFD has a very basic and limited monitoring and evaluation system. Monitoring the forest resources is the responsibility of the Resource Information and Management System (RIMS) Unit, while monitoring management activities is the responsibility of the Monitoring and Evaluation Unit.

4.2.1 The Resource Information Management System Unit

RIMS was established in the mid-1980s with the objective of establishing a computer-based resource information management system. Its design was based on a similar system in use in Sri Lanka. The emphasis was on forest inventory and mapping to provide decision-making information to the Management Plan Divisions. Initially, maps with forest formations and drainage patterns were prepared from aerial images using digitizing boards. Gradually, more advanced surveying and mapping techniques were introduced, largely through externally funded projects.

Staff

RIMS has the following approved staff resources:

DCF (1), ACF (3), Research Officer (1), Assistant Computer Programmer (1), Draftsman (2), Office Assistant (2), Data Entry Operator (1), Computer Operator (1), Driver (1), MLSS (4)

Out of the 12 positions (other than that of the driver and the peons (MLSS)), six positions are currently vacant, including four technical positions. RIMS, therefore, lacks the capacity to undertake any significant IT tasks such as server and network management.

Facilities

Hardware

RIMS operates a GIS/RS laboratory at the BFD Headquarters. The main GIS laboratory has 13 basic computers connected in a local network.¹² There is only one professional workstation, with dual large-screen monitors, which is being used for image analysis. There are also large-format plotters, printers and an uninterrupted power supply. The workstations can share GIS data sets, but there is no server computer to control data access and version control. For field work there are two laptop computers and a collection of GPS devices. Many of the projects that RIMS implements set up separate labs for GIS or RS work.

Software

RIMS has three licences for GIS analysis (ESRI ArcInfo, up-to-date versions) and three licences for satellite image analysis (2x Erdas Imagine, 1x PCI Geomatica). In addition, there are some licences for older versions of the same packages, but these have limited usability due to a lack of functionality and compatibility with current operating systems.

¹² The workstations are relatively recent commercial-grade PCs with 19" screens, without any specific hardware additions to support GIS or RS analysis. The workstations were acquired in 2012 under the FIGNS project.

Facilities management

RIMS does not have adequate budget allocations for maintaining the facilities. While hardware prices continue to fall, the requirements of new software are requiring ever more capable—and thus expensive—hardware. Software licenses from commercial vendors are prohibitively expensive, making RIMS dependent on external support for maintaining the GIS and RS capability operational.

Current RIMS activities

Remote sensing capability and products

RIMS currently has limited capacity to undertake large-scale satellite image analysis and mapping work. Such mapping is typically undertaken with external support, using one of the following two modalities:

1. RIMS operates in the capacity of a project co-ordination unit for activities undertaken through external support, the role of the RIMS staff being limited to specific tasks such as procurement of imagery.
2. The image analysis is outsourced to another organization in Bangladesh, such as SPARSSO or CEGIS.

MIS/GIS database management

RIMS currently does not have any databases for MIS or GIS data¹³. Neither is there any appropriate infrastructure (server computers, networking, etc.) to support the operation of databases for concurrent access.

Currently, GIS data are not available to offices in the BFD outside the RIMS unit due to the lack of basic infrastructure (such as a modern office network capable of supporting intranet applications) and applications for use by the BFD staff.

Additional tasks

RIMS is undertaking many activities in the BFD in addition to its primary task of resource information management:

- Hosting the BFD website and maintaining the email system
- Maintaining the CCF's and departmental information and email accounts
- Maintaining the Internet connection of the department
- Maintenance of generic business databases (e.g., human resources)
- Maintaining equipment and infrastructure inventories
- General ICT activities and reporting, troubleshooting of computers, LAN and Internet
- Preserving and supplying forest-related photos; supplying information and photographs for the National Tree Fair since 2005.

Under the CRPARP project a package was defined to undertake a 'Technical Study to Strengthen Forest Resources Monitoring and Assessment (FRMA) System and Forest Resources Management Information System (FRMIS) in Bangladesh Forest Department'

¹³ The available GIS data are managed in the form of individual shape files on regular computers, and the data are not integrated into a single platform for concurrent multi-user access.

(package BFD/S4). A new business plan has also been prepared for this unit under this package. The business plan lists the products that the RIMS unit intends to produce in the next 10 years, with an indicative time line against each.

4.2.2 Monitoring and evaluation

The main function of the Monitoring and Evaluation Unit (M&E Unit), headed by a Deputy Conservator of Forests (DCFM&E), is to monitor the success of establishment of forest plantations and the production and distribution of seedlings raised under the department's social forestry programme and compile reports for the department. The collected data are compiled into reports such as the Plantation Survey & Monitoring Report.

The activities of the M&E unit are confined to assessing the survival of seedlings in the 1- and 3-year plantations and monitoring the raising and distribution of seedlings to the public under the social forestry programme. Other aspects of forestry management and development are not currently monitored. As a result, the status of the natural forests and plantations is only available when a forest inventory is taken up, which happens once in more than a decade!

The Planning Unit of the BFD collects forest resource and industry data that are sent on to FAO for inclusion in the National Reports for the Forest Resources Assessment every 5 years.

In conclusion it may be inferred from the foregoing discussions in this chapter on the forestry institutions that the forestry institutions in Bangladesh, particularly the BFD and BFRI, need major overhauls, resourcing, restructuring and upgrading. The staff strength needs to be increased, and each organization, both at the management level and the field level, needs to be restructured. A medium-term staff recruitment and development plan needs to be put in place, and the technical capacity of the staff and of the various specialized units needs to be upgraded. The field infrastructure needs to be significantly improved. It should be ensured that the organizations have adequate funds for their core functions. A strong GIS and MIS capacity coupled with functional Web-based databases needs to be integrated into the working of the department. Internet-based working, the hallmark of a modern organization, needs to penetrate deeper.

4.3 Non-state institutions

Apart from the government organizations, the forestry sector comprises numerous non-state stakeholders such as forest based industries, craftsmen, sawmills and development NGOs.

There are more than 80 paper and pulp mills in the country although these are not entirely dependent on local raw materials. Only one of them, the Karnaphuli Paper Mills, produces its own pulp from local raw materials, bamboo and pulpwood. However, this public sector enterprise is currently functioning at about half its production capacity because of the shortage of raw materials. It has always been dependent on the BFD for its raw material and has not tried to develop alternative sources. All the others are dependent on recycled fibres and imported pulp. There are nearly 71,000 furniture manufacturers, nearly 15,880 sawmills and lakhs of small artisans and craftsmen producing handicrafts and various items of domestic and commercial use. BBS lists 33 different professions/industries that are dependent on wood, bamboo or other forestry-related raw materials. Apart from industries, there are many big and small NGOs, such as BRAC, DRDS and PROSHIKA, which are engaged in promoting social forestry or agro-forestry. There are no formal training institutions for the workers employed in these organizations. The industrial workers can get their basic training in the technical training

institutions, but most of their learning has to be done on the job. Some industrial houses have started their own training centres. For example, Akhter Furniture has started its own furniture training school in Dhaka. Among the factors limiting the growth of forest product-based industries in the country are a shortage of skilled workers, difficulty in securing financing and inability to market products at appropriate prices. There is a dire need to create training facilities for industrial workers in view of the fast-changing technological scene.

5 Impacts of Climate Change

The impacts of changes in climatic components, such as temperature, rainfall, humidity and wind velocity, need to be assessed in order to prepare the country to deal with them. Different parts of the country have different climatic vulnerabilities and associated impacts. The magnitude of the impacts will also vary across the region, depending on the socio-economic and physiographic conditions. The coastal area of the country is prone to salinity intrusion and tropical cyclones; the floodplains in the central areas are prone to floods; the north-western region of the country is prone to drought; the north-eastern part of the country is prone to flash floods; and the hilly regions of the country are prone to erosion and landslides (NAPA 2009).

The Bangladesh Climate Change Country Study has made an attempt to analyse qualitatively the impacts of climate change on the forest resources of Bangladesh. It was found that increased rainfall during the monsoon would cause increased runoff since the forest floor will not have the capacity to let all the rain water percolate into the soil (Ahmad et. al. 1999). As a result there would be enhanced soil erosion. The erosion problem would be more pronounced in degraded hill forest areas (Ahmad et al. 1999).

5.1 Climate change projections for Bangladesh

Climate change projections for Bangladesh based on the latest IPCC-AR5 GCMs protocol (CMIP5) and CORDEX ensemble, using Representative Concentration Pathways (RCPs) 4.2 and 8.5, with 38 GCMs coupled with about 105 model runs, in conjunction with other relevant studies, are presented hereunder.

5.1.1 Temperature

The temperature regimes across Bangladesh are similar, with the highest temperatures being recorded in the month of June-July (average of 25°C) and the lowest in December-January (average of 12.5°C). The maximum temperature ranges from 25°C in winter (November-February), with a peak of 33.5°C in summer (June-September). Past trends indicate that the mean temperature has already increased by about 0.65°C during the period from 1950 to 2015. The increase in the minimum temperature is more than that of the maximum, in all seasons.

The projections indicate that the temperature in Bangladesh will continue to rise. This rise will affect all seasons, but winter will warm up more than will summer. RCP8.5 clearly indicates that the mean summer temperature will increase by 1°C in the 2030s and winters will be warmer by slightly more than 1°C. The same RCP8.5 indicates that in the 2050s the mean summer temperature will increase by 1.5-2°C and winter temperature will increase by 2.5-3°C, which will particularly affect the south-west region (Sundarbans area) of Bangladesh. The rise in the maximum temperature in winter is projected to be considerably higher than that in summer, in both the 2030s and the 2050s. This rise in temperature will affect the central and northern parts of Bangladesh, especially the Rangpur, Rajshahi, Dhaka and Sylhet regions. These areas will experience warmer winters in the future.

5.1.2 Rainfall

The seasonal distribution shows that most of the rainfall, about 72% of the total, occurs during the monsoon season (June-September). The pre-monsoon season receives about 17% and the post-monsoon season receives about 9% of the annual rainfall. The current rainfall shows

increasing trends all over Bangladesh with the exception of Srimangal. The south-eastern hill station, Rangamati, shows an increasing trend of around 11 mm/year; while the south-western coastal zone exhibits a moderate increasing trend of about 7 mm/year. Central and northern to north-eastern Bangladesh show increasing trends of 4-8 mm/year. North-western Bangladesh shows increasing trend of 6.5-16.5 mm/year.

Future rainfall projections show an increasing trend during the monsoon, especially in July and August. The south-eastern part of the country is expected to experience increased rainfall, about 5-10%, during the 2030s. While there will be significant countrywide changes in the rainfall by the 2030s, an increase of about 10-15% of the prevailing total rainfall is predicted all over Bangladesh by the 2050s. The highest increase, about 20%, is predicted over the south-eastern hilly region of Bangladesh by the 2050s. Districts such as Chittagong, Rangamati and Cox's Bazar will, therefore, receive more rainfall in the future.

This indicates that the rainfall will be increasing countrywide in the future.

5.1.3 Floods

The intensity, duration and geographic extent of floods in Bangladesh mostly depend on the combined influence of three river systems, the Ganges, Brahmaputra and Meghna. By the 2030s, the annual runoff is projected to increase by 11.3%, 6.7% and 19.1% in the Ganges, Brahmaputra and Meghna basins, respectively. The wet season will be wetter in the future. Amongst the three basins, the Meghna shows the highest increase in runoff, indicating a higher possibility of flood occurrence. The south-west region will be more vulnerable than the other regions.

Thus, countrywide, there will be more floods in the future, especially in the Meghna basin.

5.1.4 Sea level rise

The likely range of the global mean sea level rise (SLR) is 0.5-1.5 m at different RCPs. The SLR in Bangladesh has been predicted to be slightly higher, about 5-10% more than the global mean. This means that by 2050, the SLR in Bangladesh could be up to 4 cm higher than the global mean and up to 10 cm higher by the end of the century. The likely inundation ranges show that 0.5 m, 1.0 m and 1.5 m rises will inundate 2000 km² (1.3%), 3930 km² (2.5%) and 5300 km² (3.5%) of the country.

Globally the sea level will be higher in the future, and in the case of Bangladesh it will be about 5-10% higher than the global mean.

5.1.5 Tropical cyclones

The incidence of major cyclones has drastically increased in recent decades. During the period from 1978 to 2016, a total of 131 tropical cyclones formed in the Bay of Bengal, showing an annual mean occurrence of 3.6 events. Bangladesh was hit by 33 tropical cyclones, which represent about 25% of the total number of cyclones formed during that period.

Global warming and increasing sea surface temperatures (about 1.5°C by 2050 in the Bay of Bengal) will cause the wind speed of the tropical cyclones to intensify further. It is predicted that the tropical cyclones originating in the Bay of Bengal in the future will be 2-11% stronger though their frequency may decline. The stronger these tropical cyclones are, the more likely they are to be more devastating, especially to the forests and forestry of the country.

Stronger tropical cyclones, but at a lower frequency, will form in the future.

5.1.6 Lightning

As the planet warms, it may spark more lightning strikes, which in turn can ignite wildfires. Just a 1°C rise in temperature, which is highly probable by the 2030s, will cause about 30% more lightning strikes. The forests in Bangladesh are particularly vulnerable, with more than 50 strikes/km² annually.

The number of lightning strikes will increase.

5.1.7 Climate change projections for Sundarbans

Coastal regions such as the Sundarbans, which include the vast mangrove forest, will face the adverse effects of the rising temperatures and rising sea level in the near future. Based on the RCM RCP8.5 projection, it is evident that this area will face a 3°C rise in temperature by the 2050s. The projected SLR by the 2050s is 0.5 m, which would inundate approximately 491 km², about 8% of the Bangladesh part of the Sundarbans. By the end of the century, the projected 1-1.5 m rise would inundate approximately 43-61% of the Sundarbans. In addition, the El Niño event will cause more forest fires, and a La Niña event will cause more inundation due to the higher sea level. The species composition will also change. The proportions of species such as *gewa* and *goran* will increase.

A flow of freshwater, either rainwater or from water from rivers, is critical to the stability of the mangrove forests. The freshwater flows from the rivers and the tidal ingress result in a gradient of three salinity zones, namely (1) less saline (salinity <2dS/m), (2) moderately saline (2-4 dS/m) and (3) strongly saline (>4dS/m) zones. The salinity decreases from west to east, and these three zones correspond to the technical classification of oligohaline, mesohaline and polyhaline zones, respectively (Siddiqi 2001). Variations in the salinity, as well as physical factors such as the topography, soil condition and tidal variation, have implications for the floristic composition, forest type, growth habits, etc. At present, considering the geomorphology, there are roughly six ecological niches where species find their habitats: (1) mudflats, (2) ridges or levees, (3) back swamps or basins, (4) river channels, (5) tidal creeks and (6) bays or sandy shores. The *sundari* (*Heritiera fomes*) dominates the less saline and elevated back swamps or basins. The combined impact of the reduced freshwater flow due to the loss of the connection with the Ganges due to the Farakka Barrage, the Halifax Cut and the Mangla-Gashiakhali Cut and the projected rise in the sea level will alter the salinity regime and may reduce the extent of the habitat of the *sundari* (International Union for the Conservation of Nature 2014).

5.2 Threats and impacts of climate change on forests and biodiversity

Bangladesh has about 17% of its geographic area under tree cover. The country has not been successful in preserving much of its forest wealth outside of the Sundarbans due to the rapid population growth and increasing pressures from different quarters. The forests in Bangladesh are generally concentrated in the coastal mangroves, central sal forests and eastern hill forests. An analysis based on satellite estimates of the Normalized Differential Vegetation Index (NDVI) and net primary productivity (NPP) values over the period from 2000 to 2015 suggests that the inland sal forests and eastern Hill forests have suffered heavily from large-scale degradation in the last 15 years compared with the mangrove forests (Figure 5-1). The NDVI is generally considered an indicator of vegetation health. Degradation of the vegetation in an ecosystem, or a decrease in the 'greenness', is reflected in a decrease in the NDVI value. Similarly, a negative

value of the NPP means forest degradation and forest loss, while a positive NPP value indicates a healthy and growing forest ecosystem. However, field-based analysis and assessment are required to identify the processes and drivers of the degradation of the forests in these areas.

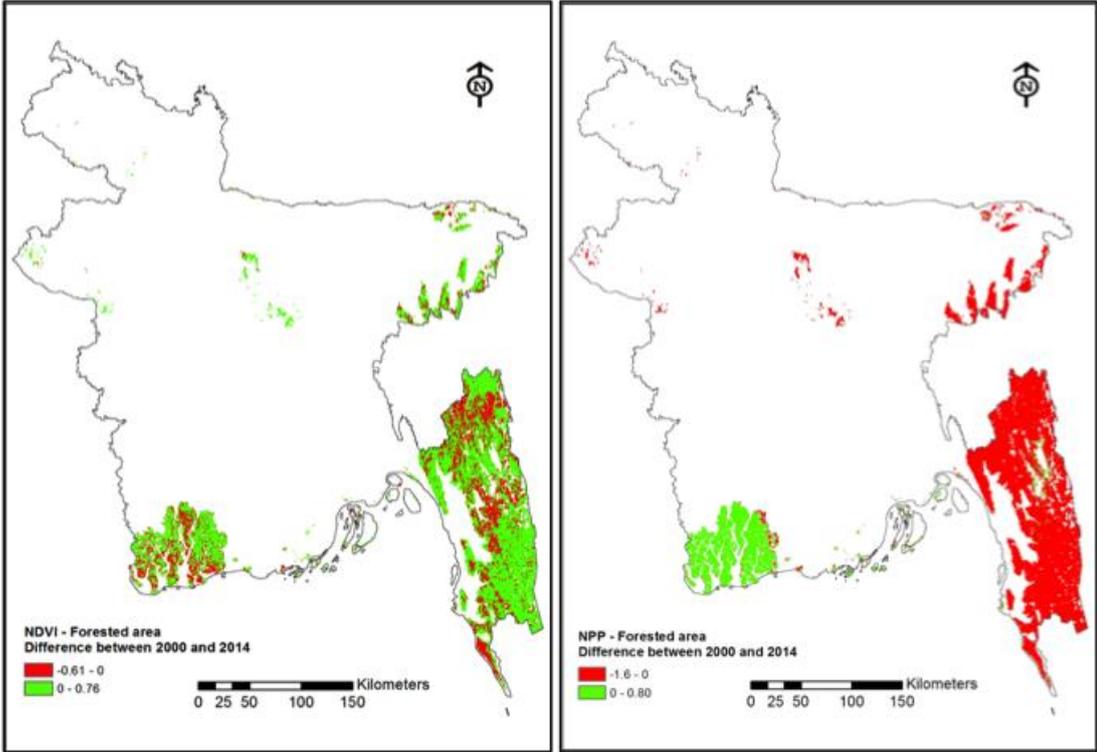


Figure 5-1: Observed changes in NDVI and NPP in Bangladesh forests from 2000 to 2014 (Source: IISc analysis based on MODIS satellite data)

The Sundarbans forests, however, face a different set of challenges, in the form of increased salinity, a rising sea level and damage due to frequent cyclones. For example, in 2007, Cyclone SIDR completely damaged 30,000 ha of mangrove forest and partially damaged another 80,000 ha. While there is no consensus, some researchers link the ‘top drying’ of *sundari* trees in the Sundarbans to the increase in salinity over a long period of time, especially due to the construction of the Farraka Barrage.

Forests are dependent on the climate system for their vital physiological processes. Hence it is important to understand how the projected changes in the climate could potentially impact the distribution of forests and forest carbon stocks in Bangladesh. A number of approaches are available to assess the impact of climate change on forest ecosystems. The Fourth Assessment Report of the IPCC suggests that dynamic vegetation models (DVMs) are among the most advanced tools for estimating the impact of climate change on vegetation dynamics. In this study, the Lund-Postdam-Jena (LPJ) model, one of the most actively used DVMs, was used to project the impact of climate change on the forest ecosystems in Bangladesh. The model was first run for the baseline scenario, i.e., the current climate, and then for climate change scenarios in the future, i.e., RCP4.5 and RCP8.5. Climatology data from the Climate Research Unit of the University of East Anglia (CRU) were used to drive the historical simulations. The simulations of the vegetation distribution in this study match well with the current vegetation

distribution reported by the Bangladesh Forest Department (BFD), which is based on a combination of satellite and ground-based observations. This provides confidence in the model's ability to project future impacts on the forests of Bangladesh. Climatology projections from 17 CMIP5 GCMs and the CORDEX RCM (SMHI) were used to drive simulations of climate change impacts in the short-term (2030s) and long-term (2080s) for RCP4.5 and RCP8.5¹⁴.

The impact of climate change on the vegetation distribution, forest productivity (NPP) distribution and biomass and soil carbon (SOC) distribution over Bangladesh was assessed on the basis of the LPJ projections. While the LPJ model is capable of simulating the impact of changes on climatic factors, such as temperature and precipitation, it is not capable of simulating the impact of a rise in the sea level or an increase in the salinity on the forests in the coastal areas, e.g., mangroves. In this report the impact of a rise in the sea level and increased salinity on the mangrove forests is explored outside the LPJ modelling framework. The study found that the forests in the eastern and hilly parts of the country are particularly vulnerable to the impacts of climate change. It suggests that many of the forested grids in the eastern and hilly parts of the country will experience vegetation shifts as these forests may not remain suitable for the existing vegetation types in the future in a climate change situation.

¹⁴ CMIP5 GCMs stands for 'Global Climate Models from Coupled Model Inter-comparison Project 5', while CORDEX RCM (SMHI) stands for 'Regional Climate Model from the Swedish Meteorological and Hydrological Institute', which was provided to the research community under the Co-ordinated Regional Downscaling Experiment of World Climate Research Programme.

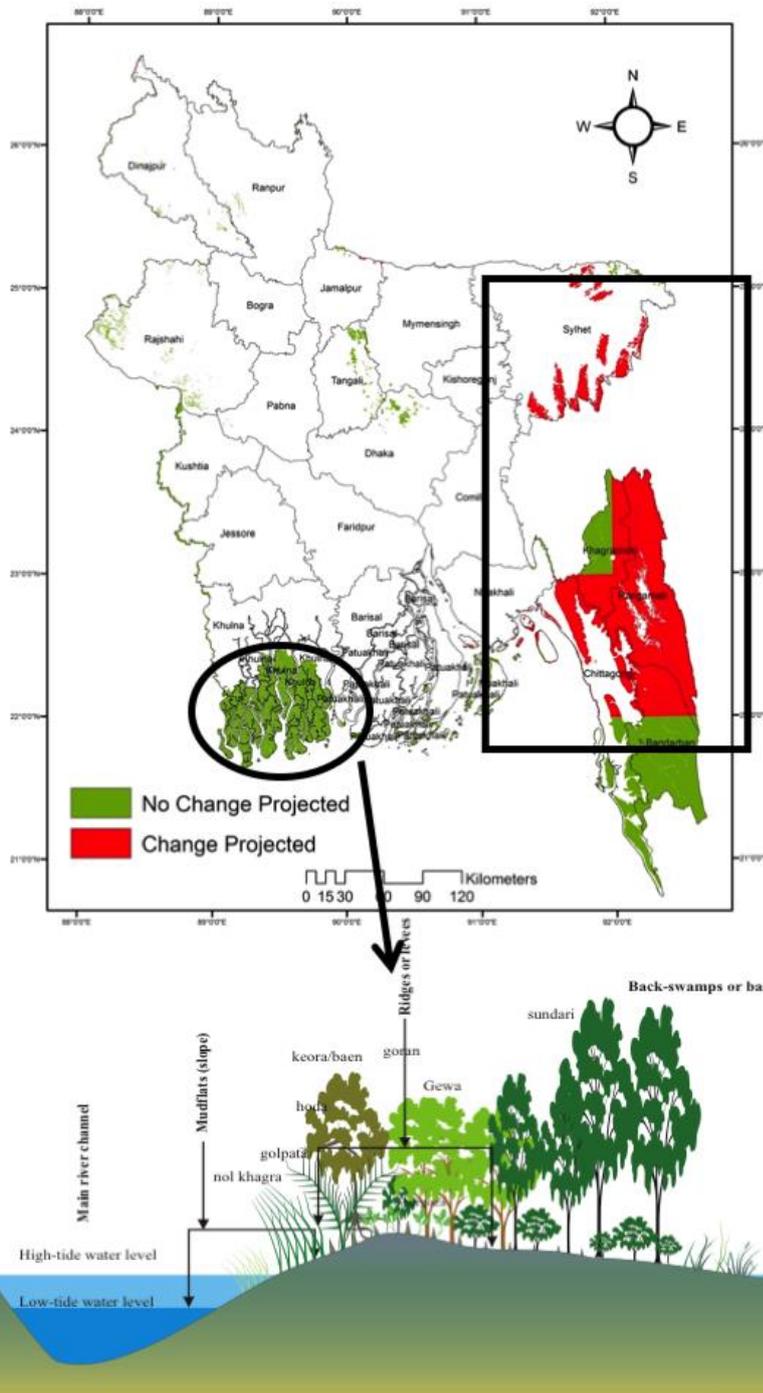


Figure 5-2: Changes in the distribution of vegetation in the forests of Bangladesh in the 2080s under RCP8.5 (Source: IISc)

While the mangrove forests of Sundarbans are not particularly threatened by the projected temperature increase and changes in rainfall patterns, these forests are particularly vulnerable to the impacts of the rising sea level, increased salinity and increased risk of climatic extreme events, such as cyclones. According to global SLR models, under the Business as Usual (BAU) emission scenarios (RCP6.0-RCP8.5), the global sea level is expected to rise by 80-100 cm (with a rapid SLR expected in the second half of the century). It is estimated that about 40% of the Sundarbans will get inundated at an SLR of 100 cm. Studies available in the literature suggest that at an SLR of 88 cm, the area suitable for *sundari* forests will decrease by approximately 50%, the proportion of well diversified forests in the Sundarbans will decline by

approximately 50%, and moderately diversified forests will decline by approximately 25%. Low-salinity-preferring species assemblages such as *sundari* forests are particularly vulnerable, while moderate-salinity-preferring species such as *gewa* are expected to remain stable. Figure 5-3 shows the projected changes in the areas of mangrove vegetation assemblages due to a rising sea level and increasing salinity in the future.

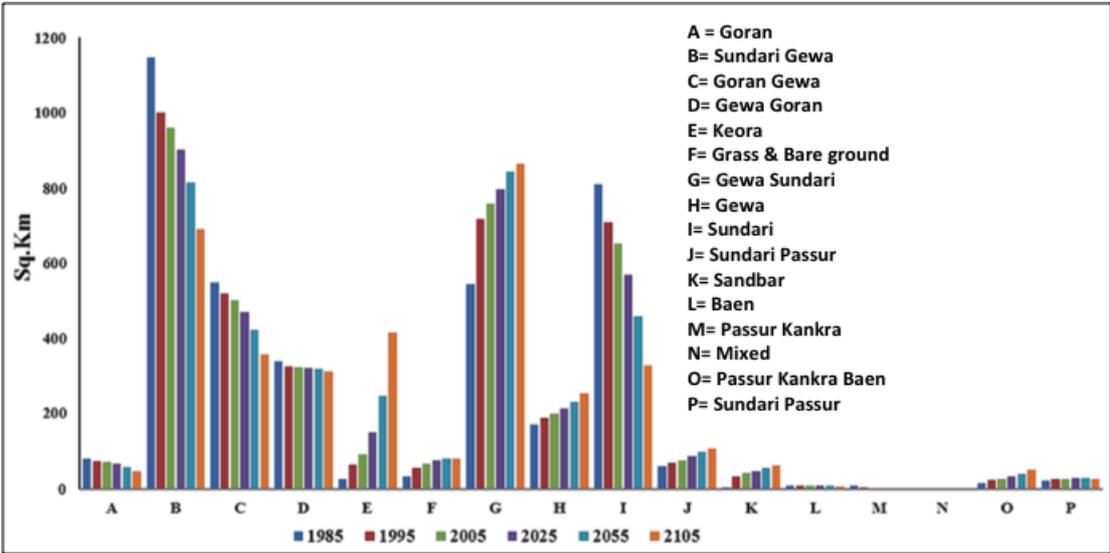


Figure 5-3: Projected changes in the area of mangrove vegetation assemblages in the forests of the Sundarbans (source: Mukhopadhyay et al. 2015)

The NPP is an indicator of forest health, and the SOC is an indicator of the productivity of the soil. NPP and SOC estimates for Bangladesh forests suggest that generally the NPP and SOC will increase due to the CO₂ fertilization effect. However, some areas in the north-eastern parts of the country will experience a slow growth in the NPP or decline in SOC.

Viewed together, the projections of the vegetation shift and NPP increase suggest that climate change presents both an opportunity and a threat to the forests of Bangladesh. The opportunity arises from the projections of increased NPP, biomass and SOC in some parts of the country. However the threat comes from the projections of shifting vegetation boundaries, especially in the eastern hill forests. Shifting vegetation boundaries in themselves may not be a big problem. However, in combination with the lack of biodiversity, and disturbed and fragmented habitats, it poses serious threats to forest ecosystems. The fragmented and isolated forests in low-biodiversity areas are especially vulnerable to the impacts of climate change, which in turn could hamper the dispersal and migration of species. Hence, it is necessary to carry out afforestation and forest restoration activities, keeping in mind the need to build corridors to link fragmented and isolated forests. While building these corridors, a mix of native and fast-growing species should be used. Such corridors will not only be useful for building up the resilience of the forest ecosystems but will also provide crucial points for the movement of the fauna apart from being useful in avoiding human-animal conflicts.

The growth of different species will have different response patterns against the changing climate, especially temperature. In experiments with tropical tree seedlings in the controlled environment of a plant growth chamber, elevated temperatures (30°C, 32°C and 34°C)

enhanced the growth of *Swietenia macrophylla* seedlings, increasing their height. But their collar diameter and leaf number mostly remain unaffected (Rahman *et al.*, 2013). *Lagerstroemia speciosa* showed tolerance to high temperatures when grown in controlled growth chamber conditions, and better growth was found in *Albizia procera* exposed to moderately high and high temperatures (Ullah, 2008). Ahmed (2007) similarly found a positive response to elevated temperatures between 31.58°C and 39.6°C for germination and the initial growth of *Shorea robusta*. Ullah and Al-Amin (2008) found *Cassia fistula* grew better at 34.58°C compared with 32.78°C.

There are some negative responses as well. In the case of *Artocarpus chaplasha* it was found that seedlings were stunted and suffered from higher mortality at elevated temperatures (Al-Amin, 2009; Rahman *et al.*, 2012). The combined effect of elevated temperatures and salinity on seedlings of *Artocarpus chaplasha* was to stunt growth compared with rearing at the outdoor temperature regular irrigation with freshwater (Rahman *et al.*, 2012). Species such as *Swietenia macrophylla* and *Gmelina arborea* may also benefit from elevated temperatures, with better shoot growth performances (Rahman *et al.*, 2012) where there is no increase in salinity.

Prolonged floods would severely affect the growth of many tree species, while it would cause a high incidence of mortality for *Artocarpus* species (Ahmad *et al.* 1999). In contrast, enhanced evapo-transpiration in winter would cause increased moisture stress, especially in the Madhupur area, which will affect the sal forest ecosystem (Ahmad *et al.* 1999). The tea plantations in the north-east would also suffer due to moisture stress. It was found that the Sundarbans mangrove forest would be most severely affected by climate change. Due to a combination of high evapo-transpiration and a lowered flow rate in winter, the salinity of the soil would increase. As a result, the growth of freshwater-loving species would be severely affected (Ahmad *et al.* 1999). Eventually the species offering a dense canopy cover would be replaced by non-woody shrubs and bushes, while the overall forest productivity would decline significantly. The degradation of forest quality might cause a gradual depletion of the rich diversity of the forest flora and fauna of the Sundarbans ecosystem (Ahmad *et al.*, 1999).

Through a species composition and regeneration status study conducted in the natural hill forest of Shitalpur, Chittagong North Forest Division, Nur *et al.* (2016) found that 17 out of 47 species, i.e., only 36% of the tree species, are regenerating in their study area, which means that a majority of the tree species, i.e., 64%, are not getting favourable conditions to regenerate. This study (Nur *et al.* 2016) attributed the poor regeneration status to an absence of mature trees of these species. Over-exploitation or illicit felling by the local people has caused this situation. The tree density at Shitalpur was found to be 1425 stems/ha (Nur *et al.* 2016), which was better than the density of 381 stems/ha in Sitapahar Reserve Forest, Chittagong Hill Tracts (CHT), South Forest Division (Nath *et al.* 1998). At Chunati Wildlife Sanctuary, the tree density was found to be 459 stems/ha (Rahman and Hossain 2003). In the Ukhiya natural forests of Cox's Bazar Forest Division, the density was found to be 257 stems/ha (Ahmed and Haque 1993). In Bamu Reserve Forest, Cox's Bazar North Forest Division, the density was found to be 369 stems/ha (Hossain *et al.*, 1996). The density in a *Dipterocarpus* forest in Bangladesh was reported to be 384 stems/ha (Biswas and Misbahuzzaman 2008). Though the age and species are not similar, the number of stems per hectare varies from 257 to 15,425, which is very wide and fairly low. This is indicative of the fact that these areas are subjected to heavy illicit felling. If such anthropogenic pressures cannot be reduced, no forestry programme will be able to reduce the vulnerability of a given forest ecosystem to climate change impacts.

Al-Amin and Rahman (2011) compared the current (2011) and projected (year 2100) habitat suitability of 18 important forest tree species using geographic information system (GIS) tools on the basis of future climatic parameters. The suitability projection indicates a decrease for 13 species and increase for five species. These authors found that the geographical distribution of species such as *Heritiera fomes* and *Terminalia bellirica* will decrease by 100%, followed by *Melocanna baccifera* and *Artocarpus chaplasha*, which will decrease by 68%, *Albizia lebbbeck* by 39% and *Lagerstroemia speciosa* and *Cassia fistula*, both by 31% (Al-Amin and Rahman 2011). On the other hand, the habitat suitability will increase for *Sonneratia apetala* by 110%, for *Leucaena leucocephala* by 45%, for *Shorea robusta* by 34% and for *Terminalia arjuna* by 25% (Al-Amin and Rahman 2011). The studies cited here provide indications of how the habitats of species will be affected by climate change.

In the face of the rapid degradation of the government forests of the country, the homestead forests are considered a major supplier of forest products. It has been reported that over 20 million homestead forests of Bangladesh meet more than 80% of the country's demand for timber and 70% of the demand for bamboo (FMP 1992; Salam et al. 2000).

5.3 Vulnerability assessment

Vulnerability is defined as 'the propensity or predisposition, of a system, to be adversely affected. It includes sensitivity or susceptibility to harm and lack of capacity to cope and adapt' (IPCC, 2014). Thus, the vulnerability of a forest is the degree to which a forest ecosystem is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of

- (i) the character, magnitude and rate of climate change and variation to which a forest ecosystem is exposed,
- (ii) its sensitivity and
- (iii) its adaptive capacity.

Vulnerability can be due to bio-physical hazards, such as cyclones and a rising sea level, but also due to socio-economic, policy and institutional factors, such as poor governance, which can result in mangrove forests being cut down, leaving coastal areas more prone to sea surges and winds during a cyclone. Vulnerability can be situation-specific, interacting with a hazard event to generate risk. For example, a community may be vulnerable to cyclones but not to landslides or floods. While vulnerability is generally hazard-specific, certain factors can aggravate or affect vulnerability levels, regardless of the type of hazard, e.g., poverty or a lack of social networks.

5.3.1 Vulnerability of forests

Forest degradation (decline in the status of biodiversity, species composition and structure) and fragmentation, predominantly due to socio-economic pressures in the case of Bangladesh, result in forests being more vulnerable to current climate risks and long-term climate change, compared with a healthy, well-stocked forest. By assessing the current or inherent vulnerability of forests to the risks of current climate change, adaptation strategies can be designed to tackle the sources of vulnerability in order to reduce the vulnerability of forests to future climate change. By identifying and prioritizing the most vulnerable forests, policy makers and forest

managers can prioritize and develop adaptation interventions that will enhance the resilience of forests to climate change by restoring their health and productivity.

Assessing the vulnerability of a forest ecosystem is challenging since the mechanisms that determine vulnerability cannot be observed directly. Assessment of inherent vulnerability enables identification of the underlying mechanisms, such as different species regenerating at lower densities due to over-grazing, which in turn affects the biodiversity, which has implications for the adaptive capacity and vulnerability. By selecting indicators that represent the underlying mechanisms, the focus is placed on the identification and treatment of the causes of vulnerability rather than on the impacts.

Forest vulnerability index

A vulnerability index is a measure of the exposure of a population to a hazard. The index is usually a composite of multiple quantitative indicators, which when applied to a formula, produces a single numerical result. Such an index allows 'diverse issues [to] be combined into a standardised framework ... making comparisons possible' (Wikipedia).

A forest vulnerability index was developed for the forest lands of Bangladesh to identify which forests are most vulnerable to climate change/variability. A quantitative approach was used to assess the vulnerability of the forests by developing a vulnerability index (ranging from 1 to 4) that can be used to assess the current climatic conditions as well as future projected climatic conditions. When constructing a vulnerability index, individual measures are weighted according to their relative importance. A cumulative score is then generated, typically by adding the weighted values. Vulnerability assessments are often influenced by data availability, data reliability, scale, rating methods used for vulnerability indicators, and interpretation of the results.

Assessment of inherent vulnerability is important for identifying the underlying causes and mechanisms that have implications for designing and implementing suitable adaptation measures for addressing vulnerabilities for building forest ecosystem resilience, thereby enhancing the capacity of the ecosystem to adapt. Forest ecosystem vulnerability is addressed better by identification of its underlying causes and resolving them rather than by dealing with its impact. But many causal processes are not directly observable and measurable, and so proxy indicators identified on the basis of an analysis of the factors that cause vulnerability are often needed.

Methodology used to develop regional forest type-wise vulnerability profiles

The vulnerability of forests under the 'current climate' scenario, also referred to as the 'inherent vulnerability', was assessed using an indicator-based approach, pair-wise comparison method for assigning weights, based on the work by Sharma et al. (2015).

Thirteen vulnerability variables/indicators were selected on the basis of the literature and local expert opinion (refer to Table 5-1) and analysed at a 1 km × 1 km resolution. The vulnerability indicators were broadly classified as satellite imagery-based product (NDVI,¹⁵ which indicates

¹⁵The Normalized Differential Vegetation Index (NDVI) is a measurement of the balance between the energy received and energy emitted by objects on Earth. When applied to plant communities, this index establishes a value for the 'greenness', i.e., how green the area is, the quantity of vegetation present in a given area and its state of health or vigour of growth. Since the NDVI is a dimensionless index, its values range from -1 to +1. Generally, values that are less than 0.1 correspond

current land cover, e.g., forest/plantation, agriculture, settlement, water body, open barren land, canopy cover/forest density); topographical (elevation, slope/gradient and flood prone); climatological (mean maximum temperature, mean maximum rainfall, mean minimum rainfall and storm/cyclone affected); soil (soil salinity and topsoil texture); and demographic (population density and illicit timber seized) features.

Studies on characterization of the inherent vulnerability of forested landscapes have used several significant indicators such as biological richness, disturbance indices and fragmentation. In the absence of these significant indicators, the choice of vulnerability indicators was narrowed down by invoking expert judgment to quantifiable variables pertaining to the physical structure of the forests, the plausible factors of disturbance and the constraints with respect to availability of data on the indicators and/or access to maps. Often, the lack of data became the deciding factor in the selection of the vulnerability indicators. While the focus is on the current climate conditions, the indicator data used in this analysis were sourced from as early as 1988, up to 2016. For example, the topsoil texture map was obtained from a map that was generated during 1988, while the NDVI map was prepared in 2016. Similarly, the data for storm/cyclone-affected areas were based on an analysis of 1600 storms that occurred from 1980 to 2000.

Table 5-1: Indicators used for the vulnerability analysis, along with range and source

Indicator Category	Input Indicators	Source (year)
Satellite imagery-based products	NDVI	MODIS—MYD13Q1 (2016)
	Canopy cover density	Forest Resource Assessment (FRA), FAO—Geonetwork (based on 2001 data, published in 2010)
Topography	Elevation	GTOPO30 (1997)
	Slope gradient	GTOPO30 (1997)
	Flood-prone area	Bangladesh Agricultural Research Council (2000)—modified on the basis of expert knowledge
Climatological	Mean maximum temperature	Bangladesh Meteorological Department, Government of Bangladesh (GoB)(based on data from 1950 to 2015)
	Mean maximum rainfall	Bangladesh Meteorological Department, GoB (based on data from 1950 to 2015)
	Mean minimum rainfall	Bangladesh Meteorological Department, GoB (based on data from 1950 to 2015)
	Storm/cyclone-affected area	Socioeconomic Data and Applications Center (SEDAC)—World Bank—modified on the basis of expert knowledge (based on 1600 storms from 1980 to 2000, published in 2005)
Demographic	Population density	Bangladesh population and housing census 2011, Bangladesh Bureau of Statistics—modified on the basis of expert knowledge (2011)
	Illicit felling	BFD records
Soil	Soil	Bangladesh Agricultural Research Council—modified
	Topsoil	Bangladesh Agricultural Research Council—modified

to bodies of water and bare ground, while higher values are indicators of high photosynthetic activity linked to forest lands and agricultural activity. The NDVI is generally considered an indicator of vegetation health, as degradation of ecosystem vegetation, or a decrease in greenness, is reflected in a decrease in the NDVI value (Tovar, 2011).

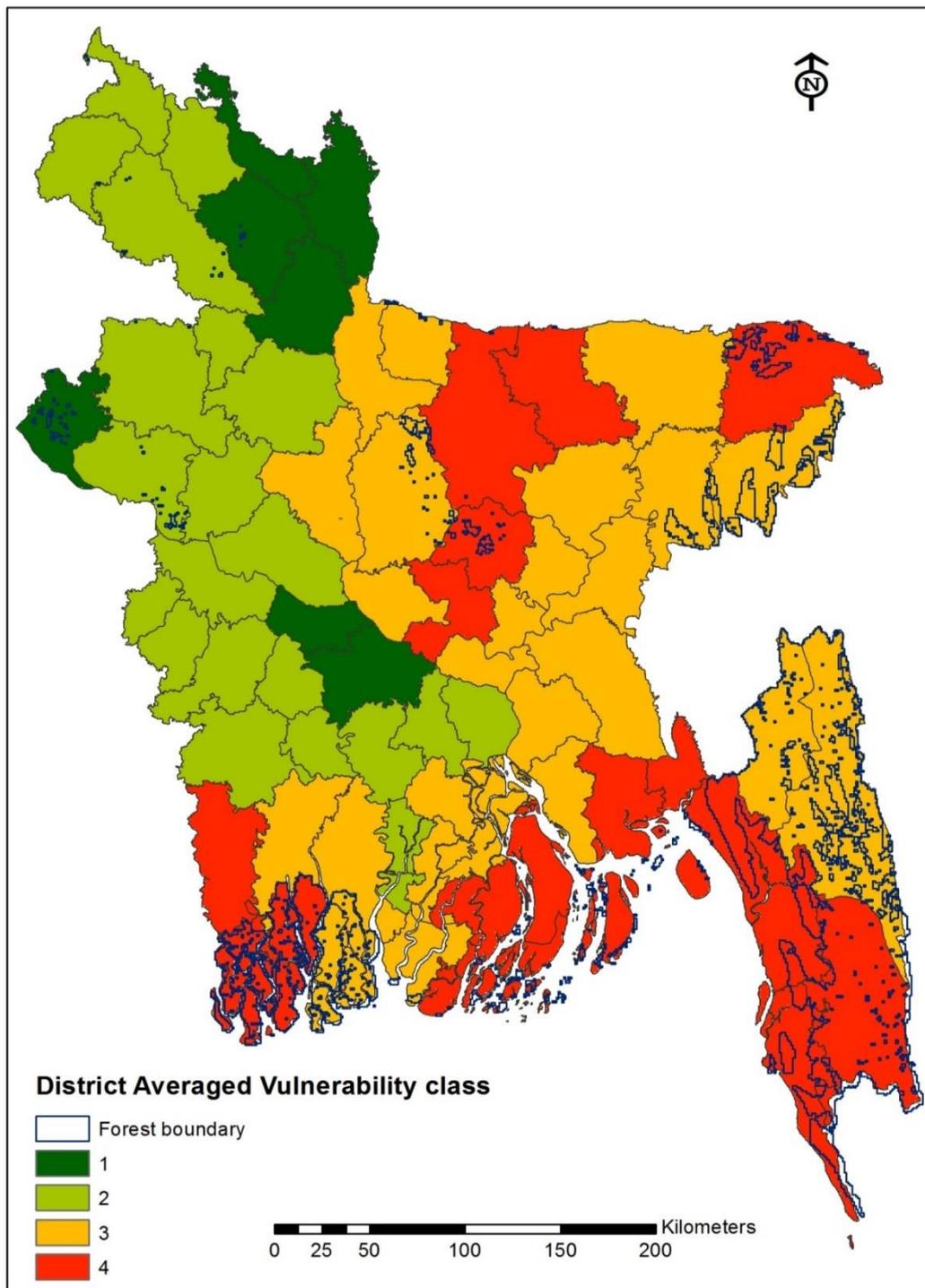
Box 5-1 provides a brief description of the methodology used to analyse the forest vulnerability.

Box 5-1: Methodology used for analysis of forest vulnerability

1. The first step involved identification of inherent vulnerability indicators specific to the region of study on basis of local knowledge and expertise.
2. The second step involved compilation of the indicator data (in the form of maps, tables, graphs).
3. The third step was the preparation of indicator maps to work in a GIS environment.
4. The fourth step was the gathering of expert knowledge on the ranges for each vulnerability class for all the indicators on the basis of published data and verification by a local expert's knowledge.
5. The fifth step was to re-classify the indicator maps on the basis of the ranges to obtain a vulnerability class map (1=least/no vulnerability, 2=low, 3=medium, 4=high) (tables 1 to 5). These vulnerability class maps were reviewed by senior forestry staff members to verify that the maps reflected the reality on the ground. As a result of this review, it was realized that additional indicators needed to be added (flooding, elevation, illicit timber seized).
6. The sixth step was to rank the indicators on the basis of a pairwise comparison chart (PCC) by rating the indicators on a relative scale of importance that indicates the degree of importance of each indicator with respect to the other indicators (from the most important indicator to less important indicators). The comparison was made by senior forestry staff members on the basis of the reality on the ground.
7. The seventh step was to assign normalized weights (W) for each indicator (table 6) on the basis of the relative ranking created from the PCC, to obtain the vulnerability due to an indicator ($VC_{ij} \times W_i$), where VC_{ij} is the vulnerability class value for the i th indicator in the j th grid cell and W_i is the weight of the i th indicator.
8. The eighth step was the calculation of the vulnerability value (VV_j) at that grid cell level by adding the values for all the indicators in a grid cell ($VV_j = \sum_{i=1}^{13} VC_{ij} \times W_i$). It is the vulnerability value of the i th indicator of the j th grid cell.

Results of the regional forest type-wise vulnerability assessment

Map 5-1 shows the vulnerability of the forest lands in Bangladesh. Rather than showing the vulnerability classes of only the forest land under the control of the BFD, vulnerability classes are also shown for all of Bangladesh in order to capture the homestead/village forests.



Map 5-1: District-averaged vulnerability classes with forest distribution

Analysis of the forest vulnerability index

Table 5-2 shows the extent of forested land in each vulnerability class managed by the BFD, and Map 5-1 shows the forested land within the entire country (including homestead forests). A major part (65.8%) of the GoB forest land falls within vulnerability classes 3 and 4—moderately vulnerable (37.2%) and very vulnerable (28.6%)—while only 13.4% falls within the no/little vulnerability class and 20.8% falls within the low-vulnerability class. In comparison, 52.1% of all the forested land within the country falls within vulnerability class 3 (26.2%) or 4 (25.9%).

Table 5-2: Area by vulnerability class within GoB forested areas and forested land within the entire country

Vulnerability Class	Area Within GoB Forested Land		Area of Forested Land Within the Entire Country	
	Km ²	%	Km ²	%
1	2184	13.4	11,148	24.1
2	3400	20.8	11,029	23.8
3	6061	37.2	12,165	26.2
4	4664	28.6	12,027	25.9
All classes	16,309	100.0	46,369	100.0

Note: The area of forested land will differ from the figures in the Forestry Master Plan (FMP) due to the limitations in using grid cells of size 1 km × 1 km.

The most vulnerable (vulnerability index (VI)=3 or 4) forests are found to be:

- Along the coast (western half and coastal portion of the Sundarbans, and all the coastal plantations);
- Hill forests located in the south-east corner of the country, including Chittagong and Cox's Bazar districts, as well as most of the CHT, except for the northern most portion of Rangamati District;
- Sal forest from Dhaka District north through Gazipur, Tangail, Mymensingh and Netrokona districts;
- Hill forests in Sylhet District; and
- Freshwater swamp forests in Sylhet District.

The least vulnerable (VI=1 or 2) forests include:

- The north-east portion of the Sundarbans (mangrove forest);
- The northern portion of the CHTs, i.e., north-east corner of Khagrachari District and northern part of Rangamati District (hill forests);
- The hill forests in the north-east corner of the country, close to the boundary with India, in Habigonj and Moulvibazar districts; and
- Small pockets of sal forest found in north-western Bangladesh in Dinajpur, Rangpur, Nawabganj and Rajshahi districts.

Each forest type faces a different combination of vulnerabilities, on the basis of the 13 indicators. Table 5-3 highlights which indicators represent the greatest vulnerability (VI=3 or 4) for each forest type and location.

Table 5-3: Indicators representing moderate to high vulnerability for each forest type and location

Forest Type and Location	Population Density	Illicit Timber Seized	Forest Canopy Density	Cyclone	Elevation	Soil Salinity	NDVI	Soil Texture	Maximum Rainfall	Maximum Temperature	Slope	Minimum Rainfall	Flood-prone	District-averaged, VI predominantly 3	District-averaged, VI predominantly 4
Sundarbans—west half, coast		x			x	x							x		x
Sundarbans—north-east		x				x			x				x	x	
Coastal plantations			x	x	x	x			x			x	x		x
Hill forests, CHT in south-east (excluding northern Rangamati District)		x						x	x	x	x	x		x	x
Hill forests, CHT, northern Rangamati District and north-east corner of Khagrachari District		x						x		x		x		x	
Hill forests, Chittagong and Cox's Bazar districts	x	xx	xx	xx	xx	xx	xx		xx			x	xx		xx
Sal forests—central part of country	x	x	x				x			x				x	x
Sal forests—north-west corner			x				x			x		x			
Hill forests—north-east (Habigonj and Moulvibazar districts)		x						x	x					x	
Freshwater swamp forest and hill forest—Sylhet		x	x		x		x	x	x				x		x

As seen from the table and the map, the most vulnerable (VI=4) forests are located along the coast (Sundarbans Reserve Forest, coastal plantations), in Chittagong and Cox's Bazar Districts (hill forests), in the southern half of CHT (hill forests), through the central part of the country north of Dhaka (sal forest) and in Sylhet District (hill forests and freshwater swamp forest). Although each forest type and location has its own combination of indicators that represent high vulnerability, indicators with a high vulnerability class (VI=3 or 4) that are common to the highly vulnerable (VI=4) forest types include illicit timber harvesting, forest canopy density, elevation, maximum rainfall and susceptibility to floods.

While forest staff members ranked population density as the most critical factor/indicator affecting the health and resilience of a forest, this indicator did not prove to be directly strongly correlated with a forest's vulnerability. While both the Sundarbans and the CHTs have low population densities (VI=1), the forests face heavy pressures from illicit timber felling, as well as extraction of non-timber forest products (NTFPs) (legally and illegally), because this is where the large areas of forest are situated. In the case of the coastal plantations, the population density is low, but there is strong pressure to convert the plantations to agricultural land due to a

hunger for land. On the other hand, the sal forest is under tremendous pressure because of the large population living adjacent to, or within, the forest. When this vulnerability index is recalculated in the future, it is recommended that population density not be included as an indicator or, if it is included, that it be given a low weight.

A forest climate vulnerability index based on 13 indicators was developed. The most vulnerable (VI=4) forests are situated along the coast (Sundarbans Reserve Forest and coastal plantations), in Chittagong and Cox's Bazar districts (hill forests), in the southern half of the CHT (hill forests), through the central part of the country from north of Dhaka District (sal forest) and in Sylhet District (hill forests and freshwater swamp forest).

Given that up-to-date data were not available for two of the most critical indicators, i.e., forest canopy and cyclone-affected areas, it is recommended that the forest vulnerability index be recalculated in 5 years' time using recent data.

5.3.2 Community vulnerability

Livelihoods vulnerability index

By assessing the vulnerability of forest-dependent communities to climate change and climate variability, it is possible to prioritize policy interventions and/or to develop and monitor adaptation plans for specific vulnerable groups and areas. Including climate change/variability issues in policies and plans will increase their effectiveness and help build socio-ecological resilience among the affected communities, ensuring that resource allocations are needs-based. In 2015, UNDP-Bangladesh developed a climate and disaster vulnerability index (CDVI) to assess the vulnerability of communities in six Bangladeshi landscapes or 'hotspots' that are known to be prone to major hazards. The CDVI can be used as a baseline vulnerability profile and a tool to help prioritize where development programmes are implemented in order to reduce the vulnerability and sensitivity of the most vulnerable communities and improve their adaptive capacity. The climatic and disaster vulnerability was quantified at the national, district and *upazila* levels.

The six hydro-meteorological hazard zones or hotspots selected, which are expected to be affected due to climate change and climate variability, correspond very closely with the different forest types of the country and thus correspond to where forest-dependent communities are situated. The hazards evaluated included the following: drought in the Barind area in the north-west (sal forest found in this hazard zone); river flooding and erosion along the Brahmaputra-Jamuna-Ganges river system (sal forest found in this zone); flash flooding affecting the deeply flooded *haor* basin in the north-east (freshwater swamp forest found in this zone); coastal zone with high levels of salinity, high exposure to cyclones and waterlogging (Sundarbans mangrove forest and buffer zone found in this zone); coastal zone with high exposure to cyclones and moderate salinity (mangrove forest (non-Sundarbans) and coastal plantations found in this zone); and, landslides and flash floods in hilly areas (tropical evergreen and semi-evergreen hill forests found in this zone).

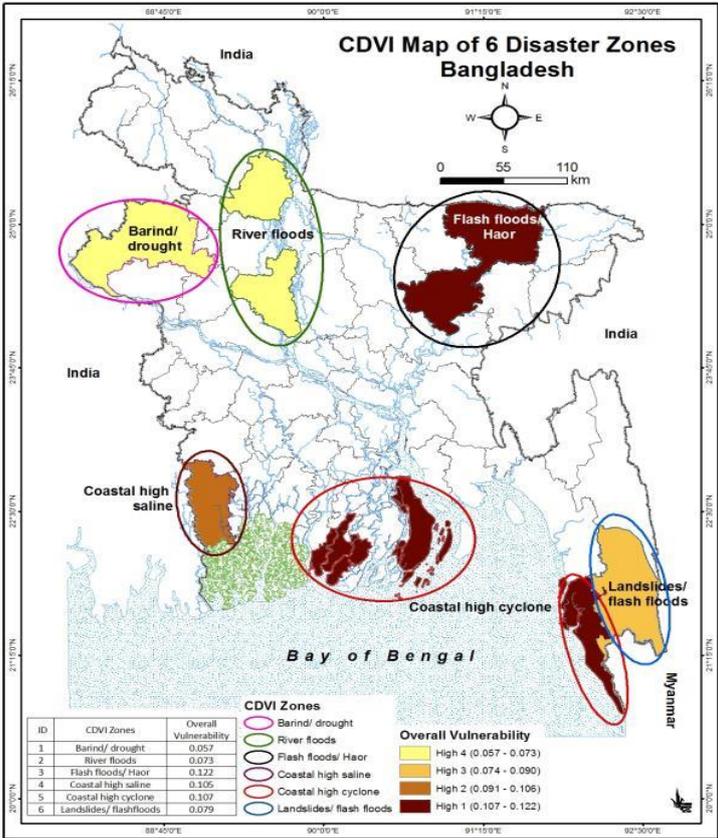
Forty-six indicators were used to assess the current extent of exposure, sensitivity and adaptive capacity—the three factors that contribute to vulnerability. The indicators were grouped under eight major components in three groups: (1) adaptive capacity—Socio-demographic Profile, Livelihood Strategies and Assets, Institutional Functions and Social Networks/Social Capital, (2) sensitivity—Health Services, Food Security and Water Security, (3) exposure—Natural Disasters and Climate Variability.

An analysis of the data is presented, broken down by exposure, sensitivity and adaptive capacity, which together result in overall vulnerability. The *haor* zone in the north-east (corresponding to freshwater swamp forest) is ranked the most vulnerable hotspot due to relatively high levels of exposure and sensitivity to disasters (highest among the six hotspots) combined with the weakest adaptive capacity. The coastal zone, with high exposure to cyclones and moderate salinity (corresponding to non-Sundarbans mangrove forest and coastal plantations), and the coastal zone, with high salinity, exposure to cyclones and waterlogging (corresponding to Sundarbans mangroves and buffer zone), ranked virtually equally in terms of vulnerability, just behind the *haor* zone. While both the coastal zones have the highest levels of exposure, they have relatively low sensitivity and higher adaptive capacities, which led to a lower overall vulnerability compared with the *haor* zone. The coastal zone with high salinity (corresponding to the Sundarbans mangroves and buffer zone) is more sensitive than the coastal zone with high exposure to cyclones (corresponding to non-Sundarbans mangrove forest and coastal plantations), due to its being affected severely by saline water intrusion, which in turn affects the availability of potable water.

The remaining three hazard zones are much less vulnerable: the landslide zone (corresponding to hill forests) was ranked fourth; the river flooding zone (corresponding to sal forest) was ranked fifth; and the drought-prone Barind Tract (sal forest) was ranked sixth. These three zones had a moderate level of adaptive capacity, which lowered their level of vulnerability.

The zones with water-induced vulnerability (coastal zones, flash-flood prone *haor*/freshwater swamp forest, river flood/sal forest) had higher levels of exposure compared with the drought-prone Barind Tract/sal forest and landslide/hilly zones.

Map 5-2: Map of overall vulnerability by disaster/hotspot zones



Source: UNDP, 2015

5.4 Mitigation and adaptation policies and practices for Bangladesh

In view of the foregoing description of climate change projections, potential impact on forests and the vulnerabilities of various forest types and forest-dependent communities, the following interventions are proposed for enhancing the resilience of the forest ecosystems and communities.

5.4.1 Mitigation and adaptation policies and practices for forest ecosystems

The forest ecosystems of Bangladesh can be divided into two broad categories:

Natural forests: sal forest, hill forests and mangroves

Plantations: coastal green belt, short-rotation plantations and long-rotation plantations.

The mitigation and adaptation policies and practices for each of these ecosystems have to be different in view of the threats they face and the level of inherent resilience of their constituent biota.

Mitigation and adaptation policies and practices for natural forests primarily aim at maintaining and enhancing their diversity and integrity by controlling the biotic pressures from the neighbouring communities as well as by minimizing the degradation and fragmentation caused by infrastructure projects of national importance. Fragmented forests and/or forests low in diversity are more vulnerable to the impacts of climate change than are intact and diverse forests. The steps that can enhance the resilience of natural forests against the impacts of climate change include controlling illicit felling, encroachments, over-grazing and fires. Enrichment plantations, assisted natural regeneration (ANR) and silvicultural operations such as thinning over-crowded crops and soil and water conservation can go a long way in imparting climate resilience to natural forests. As the anthropogenic impacts mentioned are often the result of prevailing socio-economic conditions in the surrounds of the forests, these factors cannot be controlled without working with the communities and providing them viable economic alternatives.

As native species are likely to be naturally adapted to the local conditions, both climate-induced and otherwise, preserving native species in a natural forest is very important. Thus, continuation of the moratorium on the extraction of timber from natural forests, stringent control of diversion of forest land for non-forestry purposes, weaning people away from shifting cultivation, provision of firewood-saving devices and technologies, ecotourism and co-management in protected areas (PAs), strengthening the trees-outside-forests sector to offset pressure on natural forests, demarcation and mapping of forest boundaries and controlling invasive alien species are the kinds of policies and practices that need to be continued and reinforced to improve the climate resilience of natural forests.

Plantations, especially young plantations, are more vulnerable to climate change and biotic pressures due to their monoculture nature (often) and the inherently higher vulnerability of young seedlings and saplings to traumatic events, such as droughts, floods and storms. Monocultures are very vulnerable to diseases and pests. Young plantations are also more vulnerable to the impacts of grazing, trampling, fires etc. Vulnerability of plants to one category of risk also enhances their vulnerability to other risks.

Mitigation and adaptation practices for plantations, in the case of afforestation and reforestation programmes, need to target both categories of risks (anthropogenic and climatic) to make them

truly resilient. While law enforcement, along with generating community support, is the best bet against destruction of plantations due to human activities, sound silvicultural practices, such as hardening the plants in nurseries, avoiding monocultures and selecting climate-resilient native, species known to be adapted to the edaphic conditions and microclimate of a site can vastly improve their climate resilience. The use of quality planting material is critical for the success of plantations. Timely weeding and thinning can improve plant vigour and reduce moisture and mineral stress caused by competition. Strengthening the coastal green belt will provide safety to inland people and infrastructure. Maintaining a strip of natural vegetation between plantations can improve their resilience. Selection-based harvesting can protect a site against desiccation and erosion. Planting up gaps and corridors can enhance the resilience of isolated patches and can facilitate the movement of wildlife.

Conservation of forests, including afforestation, reforestation and forest restoration, in the context of climate change requires strong research support. Identification of climate-resilient species and development of appropriate nursery and silvicultural practices to improve the resilience of forests and plantations are some of the many important areas in which research is required.

Monitoring the forest condition is critical to the success of any development effort. The BFD needs to develop adequate capacity to monitor the condition of forests as well as the factors that influence their health, growth and survivability. Sound systems, both scientific and social, need to be developed to produce, capture, transmit, store and analyse data on various parameters related to forests, plantations and communities. Investments in the development of strong monitoring capability can go a long way in preventing unknown and unrecognized losses of natural resources.

5.4.2 Adaptation policies and practices for communities

The more robust a forest (or other natural resource) is, the more resilient it will be in coping with future climatic stressors, such as rising temperatures and changes in rainfall patterns and amounts. Given the intense pressure exerted on forests by poor rural households to help them meet their livelihood needs (both to consume and to sell) there is a need to reduce the reliance of local communities on forests. In a populous and poor country like Bangladesh, effective forest protection is not possible without the partnership of local communities. Management is needed to enhance the capacity of both forest ecosystems and local communities to adapt together and be resilient to changes and disturbances. A proven means of reducing this reliance on forests is increasing the people's awareness of the multiple services that forests provide and increasing the resilience of the local communities by diversifying their livelihoods through promotion of alternative income-generating activities (AIGAs), promotion of community savings, providing access to credit and strengthening social capital.

Several initiatives, aimed at building partnerships between conservation agencies and local communities and at reducing the dependence of communities on forests, have been going on in Bangladesh. A number of strategies that have/will strengthen the resilience of forest-dependent communities so that the communities are less reliant upon forest products to meet their needs are reviewed in the following. All the projects reviewed aimed to reduce degradation of the natural resource base and restore the natural resources; to reduce the dependency of local people on natural resources by providing alternative income-generating options; and to ensure the engagement of local people so that they feel ownership and are protective of the natural

resources. These strategies need to be continued, and strengthened, in order to improve the resilience of the communities to the impacts of climate change.

Laying the groundwork

The BCCSAP provides for 'comprehensive and participatory planning and investment for climate resilience against erosion in income, employment and human health in coastal, *char*, hilly and wetland regions'. This tenet is the foundation of any approach for amelioration of the impacts of climate change on communities. Identification and selection of project beneficiaries in a fair and transparent manner is fundamental to any climate change adaptation programme. Conduct a community risk and vulnerability assessment (CRVA) involving the entire forest-dependent community. The community identifies the risks and vulnerabilities it faces. The CRVA helps identify beneficiaries who need help with building secure livelihoods to cope with climate change.

Select beneficiaries in an open and transparent process, and form community groups. Since the aim of livelihood diversification is to reduce dependence on the forest, care needs to be taken during the participant selection process to ensure that the participants selected are in fact dependent on forest resources. The landless and/or female-headed households should be the target for participatory forest management since they tend to be more vulnerable compared with households with land.

Conduct a baseline survey to verify the types and quantity of timber, firewood and NTFPs being extracted from the forest by males and by females.

Provide a start-up activity to project beneficiaries, e.g., distribution of vegetable seeds and quick growing fruit seedlings, poultry and ducks, to provide a quick source of cash/income to generate interest/provide income while waiting for yields from longer-term investments such as tree plantations.

Formation of community/forest-dependent groups and federations

Since the poorer households tend to be more heavily reliant upon extraction of NTFPs and tend to be the most vulnerable to the impacts of climate change due to their low adaptive capacity, these households should be targeted to be members of the community group (known as the forest-dependent group in some projects).

Each forest-dependent community group should be part of a federation at the union level. In accordance with the Law on Union Parishad, union-level forest conservation forums (UCFs) are under the leadership of the respective union parishad chairpersons. The institutionalization of the federation at the union level, as well as being registered as a cooperative, provides access to the local government for voicing concerns and interests of poor forest users in policy and decision making and provides perceived legitimacy to the federation.

Co-management structure

According to the co-management model used in protected areas, there are two management bodies for each PA: (1) The co-management council, which includes 55 members (minimum of 10 female members) from various categories of stakeholder. The council functions as the general body of the management structure. (2) The co-management committee, which acts as an executive body, consisting of 19 members (of whom one-fifth should be female).

In theory, it is desirable to have representatives from the various stakeholders as members of the co-management council, i.e., representatives from the local administration, local government, land owners, brickfield owners, sawmill owners and the poor and ethnic communities. However, the weaker members (i.e., the poor and ethnic representatives) find it difficult to have their voices heard. In addition to sensitizing the co-management council to the need to listen respectfully to all members of the CMC, it is recommended that the number of female members and representatives of the poor be increased, with a corresponding decrease in the number of representatives from the local land owners, brickfield owners and sawmill owners. It is also recommended that each person serve a three-year term on a co-management council, with one-third of the membership replaced each year, in order to minimize the opportunities for personal profiteering and to enable a wider cross-section of persons to sit as members.

Strengthening linkages between forest-dependent communities and various service providers

Establish and strengthen linkages with various organizations for technical expertise in natural resources and agricultural production, e.g., the BFD, Agricultural Extension, Department of Environment, Department of Fisheries and Bangladesh Water Development Board and with non-governmental organizations (NGOs) for their expertise in community mobilization and revolving loan funds (RLFs). Since climate change/variability will also affect agricultural production, there is a strong possibility that a decrease in agricultural production will result in greater pressure on the natural forests for NTFPs that can be used to meet household subsistence needs or be sold. Therefore, it is important that the BFD and the Agricultural Extension staff support each other.

Work with NGOs who are already established and working within the targeted *upazila*/district. These NGOs will know the area, the communities and their strengths and weaknesses, reducing the amount of time required to gain the trust of the beneficiaries and to get a new project/programme up and running.

Forest-dependent community groups should be linked with the local government at the union and *upazila* levels and local authorities such as the district administration, in addition to the Department of Forestry. Strengthening the social capital of community groups improves their ability to cope with external shocks to their livelihoods since the groups will have established a relationship with these stakeholders and will be more confident about approaching them in times of need. Linking forest-dependent communities and their union-level federations with their union *parishads* will ensure that participants have better access to support of various kinds, e.g., the social safety net provided by the GoB and implemented through the union *parishads* to the poor and very poor people.

Link community groups with local providers, e.g., the Union Disaster Management Committee or Upazila Disaster Management Committee, to avoid duplication, ensure transparency, and increase their input to the development of climate-resilient and pro-poor Union Development Plans (WB, 2015).

Awareness creation about impacts of climate change/variability

Increase awareness about the protective value of forests and about how forests are/will be impacted by climate change/variability. Awareness creation needs to target not only forest-dependent communities but also the general public and government officials. A number of communication techniques have been used successfully within Bangladesh to raise awareness

among the people about climate change issues, including radio programmes, newspaper articles, the school curriculum (including training for teachers), pop songs/traditional theatre, flip charts and posters. Any of these proven techniques can be modified to increase the focus on the impacts of climate change on forests.

Revolving savings and loan funds

Establish an RLF component (also referred to as a micro capital grant or mutual rotating savings and loan fund in some projects) with the union federations of forest-dependent groups to provide loan support for AIGAs to forest-dependent group (FDG) members. The RLF provides a sustainable 'access to capital' (AF, 2011). Each member contributes a monthly amount (usually Tk.100). In Arannayk Foundation (AF)-supported projects, the loan varies from Tk.5000 to Tk.15,000, with an average of Tk.10,286. The RLF approach is very effective in promoting AIGAs among forest-dependent poor people and in reducing their dependence on the extraction or collection of forest resources. Extra awareness-raising efforts may be required with indigenous communities in the CHT in order to promote participatory savings programmes among them (AF, 2011).

Given that the targeted group members in most cases will be extremely poor, they may have limited experience with banks and formal savings. Each community group receives intensive training on how to manage an RLF. Guidelines on how to manage the RLF are established by each community group. A grant or loan is provided by the implementing agency (usually a donor) to each community group, which acts as a catalyst to jump start savings. The amounts of grants/loans given out by various projects have varied from Tk.100,000 to Tk.300,000. In addition to receiving a loan or grant from the implementing agency, members have a monthly savings scheme (projects to date have had members saving Tk.20 to Tk.100/member/month) and an annual share scheme (where part of the savings from a joint account are shared on an annual basis with each member). Service charges for members borrowing money tend to be around 10%, which is less than what banks or most other micro credit loan schemes charge.

Community groups lend money to individual group members, with the maximum amount set in the guidelines developed by the group. The high repayment rates on past projects, which have been over 90% and often as high as 100%, are attributed to the following: (1) The borrower is one of the owners (lenders) of the RLF money and feels obligated to comply with the group's policy. (2) Regular participation in group meetings. (3) Pressure from other group members who are waiting to get approval for new loans upon the repayment of existing loans. (4) Timely repayment of a loan creates the possibility of obtaining a second, larger loan.

Once the community group is well organized and holding regular meetings, with a savings and loans programme in place and membership contributions collected on a regular basis, the group should be registered with the Department of Cooperatives. The group is audited by the Department of Cooperatives at least once a year.

An endowment fund is an investment fund, specifically for not-for-profit organizations, in which regular withdrawals from the invested capital are used to pay for ongoing operations. In order to ensure the long-term viability of the community groups and their apex associations, they need a source of working capital—which an endowment fund can provide.

AIGAs

Provide alternative sources of livelihoods (AIGAs) at both the household level and the community level that are climate-resilient to reduce the reliance of the people on forest products.

Box 5-2: Participants invest in AIGAs

In a study conducted in 2010, in 18 projects funded by the AF with AIGAs, 43 different AIGAs were practiced. The choice of AIGAs was related to the agro-ecological characteristics of the area, marketing opportunities, input availability and access to extension services. Vegetable cultivation was the most widely adopted AIGA (23% of all participants), followed by fruit gardening (22%), small-scale businesses (8.3%) and rice cultivation (7.6%, usually on leased land). In terms of distribution across the projects (locations), small businesses (retail selling of vegetables, banana, dry fish, betel leaf, goat, fish fry, green coconut, grocery, stationery, wood) was the most widely adopted AIGA, practiced in 12 out of 18 projects (75%), followed by vegetable cultivation (69%), poultry rearing (63%), maintaining nurseries (63%), goat rearing (56%), cow rearing or beef fattening (56%), fish cultivation (50%) and fruit gardening (50%).

Investments by participants in the AIGAs ranged from Tk.4000 to Tk.10,000 on average. According to estimates made by project staff, the gross returns of the AIGAs ranged from 1.2 to 3.1 times the value of the investment, with small-scale businesses being most profitable. (AF, 2010).

It is important to note that simply providing money to participants to start an AIGA is not enough. Hands-on training in the proposed AIGA is important, as is follow-up training/support and monitoring, in order to improve the chance of the AIGA being successful. This was evident in the Sunderbans Environment and Livelihoods Project (SEALS), where NGOs contracted by the project to promote AIGAs provided funds ranging from Tk.6800 to Tk.16,000 per beneficiary, with only a limited number of beneficiaries successfully managing and growing their AIGA (SEALS, 2015). Rather than attempting to reach huge numbers of beneficiaries, it is advisable to focus on a smaller number and provide excellent and ongoing support to them.

Projects that promoted AIGAs but limited their efforts to providing training for development of skills and/or promotion of marketing linkages did not succeed since the poor project beneficiaries could not take advantage of alternative livelihood opportunities due to a lack of capital, e.g., the Integrated Protected Area Co-management (IPAC) Project.

Box 5-3: Impact of AIGAs on extraction of NTFPs

The AF monitored the impact of its alternative livelihood development support to forest-dependent communities by tracking the extraction or collection of NTFPs. Forest entry points were identified. Monitoring was done twice a month—once on a market day and once on a non-market day. A local market survey was conducted once a month in at least three adjacent markets to record the prices and quantities of the forest products (the NTFPs collected). Data were collected from six co-management project sites (three national parks, one wildlife sanctuary and two reserve forests (RFs)). Over 4 years, the illegal extraction of forest resources was reduced by 47%.

The amount of seed money provided for AIGAs, by past projects, has varied widely. Research is needed on how large a grant is required to be effective in improving the livelihood of a household in the long term so that the household no longer needs to extract NTFPs from the forest in order to meet basic needs.

Box 5-4: *A valuation of the forest conservation impact of AIGAs*

'In the AF-funded Homestead Agroforestry Project of CODEC in Patiya and Chandanaish sub-districts of Chittagong, 142 forest dependent households are now engaged in AIGAs and have stopped cutting trees and bamboos from the forest. Previously, at least one person from each of these households used to go to the nearby forests and cut at least three sapling- to pole-sized trees per week, or 12 trees per month. Therefore, not going to the forest, each of those households saved an estimated 144 trees in a year. Thus the 142 households saved at least 20,448 trees. Each of these trees, yielding at least 20 kg of dry fuelwood, has a market value of BDT150 at the minimum. Thus, the value of the saved trees (avoided being felled) accounted for the 142 households stands at BDT3,067,200 per year.' (AF, 2011).

Some of the AIGAs promoted at the household level are growing saline-tolerant rice, growing drought-tolerant rice, growing quick-maturing rice (varieties such as BRRI-28 and BRRI-29) and wheat, vegetable cultivation, aquaculture (crab fattening, shrimp rearing, raising tilapia, maintaining fish nurseries), raising poultry, duck rearing, goat and cow rearing (grazing land or fodder must be available outside forest lands), tailoring/sewing, rickshaw pulling, running grocery/tea stalls. At the community level, eco-tourism, making energy-efficient cooking stoves

and running agricultural farms were promoted. Skills training, and follow-up refresher training, is required in each of the AIGAs.

In the above example, an investment of BTK288,000 support from the project and Tk.549,000 participatory savings of the participants resulted in savings of over Tk.3.0 million, in the form of trees saved from being felled in one year. The return on investment was more than 1:3.6.

Having at least three different occupations or sources of income within a household increases the likelihood that one or more of the income sources will survive a climate event, thus reducing the possibility of households being forced to turn to the forest to meet their need for income. To date, a number of projects have promoted alternate livelihood options, but the livelihood options have usually been limited to one or two per household, which has minimal impact on increasing adaptive capacity. At least three AIGAs per household should be promoted to enhance the adaptive capacity of a household.

Demonstration plots are an effective method of promoting and sharing information to promote alternative technologies, such as the cultivation of salt-tolerant rice varieties and short-duration rice varieties, integrated pest management and crop diversification. Although participants may express a preference for a particular AIGA, market analysis should be conducted to determine if there is a demand for that product and to determine what type of profit can be expected. Provide training programmes (including at least one refresher training programme for each AIGA) using the technical expertise of local persons as trainers, e.g., Upazila Livestock Officers, Upazila Agriculture Officers and veterinary surgeons. Additional informal needs-based training can be included as part of the regular monthly meetings of the community-based organization (CBO). Assessing the impact of alternative livelihood interventions on reducing forest dependence and forest degradation and assessing the impact on resilience of afforestation/reforestation activities and AIGAs are required.

Promoting climate-smart farming systems

Since the majority of forest-dependent communities rely on agriculture to supplement their incomes and provide food, climate-smart technologies should be encouraged and supported, with the support coordinated between the BFD and Ministry of Agriculture. If agricultural production suffers, households will be forced to rely more heavily on NTFPs, fuel-wood, etc. from the forest. Examples of climate-smart technologies include cultivation of drought-tolerant rice and wheat varieties, saline-tolerant rice and rice varieties that are tolerant of inundation. In areas protected by coastal mangrove forests but outside embankments, the Triple F model can be used. Since the entire model is raised, it is protected from tidal surges and storms. The Triple F model consists of building mounds and ditches, with fruit and timber trees grown on the mounds. High-yielding vegetables are grown on top of the mounds and along the banks of the ditches, and fish and ducks are reared in the ditches¹⁶.

Market linkages and market value chains

Communities benefit when a significant number of persons organize production around a single product line, with co-operative sales and marketing. The Nishorgo Project found that it was wise

¹⁶A new land use model: forest fruit fish. UNDP Bangladesh, 2011.

to focus on one product, such as bamboo, from the beginning of a project, as a strategy to avoid time lost while the FD, NGO or donor debates a wide range of opportunities (BFD, 2007).

Mobilize groups to purchase/produce/sell collectively. Form producers-and-collector groups. Collective production and sales helps avoid middlemen and allows producers to retain more profits.

Link community groups with local providers and develop market linkage and value chains to get the products to the market. A rapid value chain assessment can determine which livelihood activities have the potential to have value added, the latest technology, prices that can be charged and what products can be successfully marketed due to an unfulfilled demand.

Community-level value chain activities, e.g., co-operative marketing of local products, community-based eco-tourism and manufacturing improved cooking stoves (ICS), need to include training in small-business management, product quality control, market expansion/scaling up and access to banking. There is a need to ensure the institutional and financial sustainability of established groups. A risk with many projects is sustainability of the interventions and assets created, after the closure of the project (as projects are usually of only 3-5 years' duration).

Value chain development activities should include the following:

- An orientation meeting with community groups to agree upon the selection of value chains for value-adding economic activities, using matrix-scoring techniques, with extensive stakeholder interviews and FDG

- The community selecting lead farmers (respected, experienced in the activity being promoted/considered)

- Validation workshops on the value chain—establish linkages with all value chain actors, including FDG members, suppliers, producers, output traders, private companies and GoB line departments

- Hold a needs analysis meeting with lead farmers to determine the needs of lead farmers as they will take the lead in promoting the business and improved technologies/practices among other producers. Provide advanced training for lead farmers as needed.

Conduct a promotional campaign at the village level to promote awareness about the activity. Provide incentives as appropriate, e.g., feed, medicines, vaccines, houses, cages and hatching pots for chicken growers.

- Arrange for training as required, e.g., a 3-day vaccination training programme for community-level vaccinators, with a certificate and tool kits distributed to participants at the end of the training.

- Hold an inception meeting with participants from the community, value chain actors and local elite to promote and expand awareness about the value chain.

- Facilitate a production and sales planning workshop at the village level, for producers cum sellers, service providers, poultry producers and output traders. At the workshop, all the participants will produce production and sales plans based on mutual demands. The result of this planning exercise will be that inputs and services will be readily available in the villages.

Improved cooking stoves

The use of improved cooking stoves decreases fuelwood usage by 40-45%. A study conducted by AF showed that a forest-dependent person who used to go to the forest five or six times a week to collect fuelwood now goes only one or two times a week (Arannayk Foundation Newsletter, Vol. 2, Issue 4). The average fuelwood saving per household is approximately 1.45 kg, cooking time is reduced by 44 minutes per day, and production of ash is reduced by 338 g per day. Since the majority of very poor and poor households cannot afford to purchase an improved cooking stove, this is an input that should be provided to project/programme beneficiaries.

Capacity building

Provide capacity training to the community group leaders and members on natural resource conservation, organizational management and livelihood enhancement. Build the capacity of the community groups and their apex associations. For example, in Component 2 of CRPARP, the 200 FDGs were federated into 55 federations at the union level (FDG Federations). In accordance with the Law on Union Parishad, 55 UCFs (including members of the FDGs) were formed under the leadership of the respective Union Parishad Chairpersons and were registered with the Department of Cooperatives. The sustainability of the FDG, FEG Federations and UCFs depends upon their funding capacity and locally perceived legitimacy. The institutionalization of the UCFs provides an opportunity for poor forest users to have a voice and lobby in policy and decision making. An additional advantage of establishing UCFs is that at the monthly meetings, local conservation issues are discussed, including measures that can be taken to protect plantations and forests.

The establishment of CPGs, FDG Federations and UCFs has proven to be effective in engaging communities and local governments in environmental protection, sustainable forest management and enhancing climate change resilience during the life of the project. The sustainability of the CPGs can be enhanced with their own source of income (possibly via small grants received as part of the exit strategy to be used to establish an RLF for AIGAs) and by ensuring that the UCFs participate in the development of Union Development Plans. The CPGs should be formally recognized through a government gazette notification. For the UCFs to remain sustainable once the project funding ends, they will require an ongoing income source—perhaps an RLF through which the UCFs retain the interest paid.

The membership in apex associations/federations should change every 2 years to reduce the possibility of corruption/intimidation of the BFD and other group members.

Capacity building of community groups is a long-term process. Some projects have worked with the same groups for nearly 10 years before the groups became capable of functioning on their own.

As is often the case, strong, effective leadership is critical at the community group level.

Cross-visits/exposure trips

Cross-visits can be cost-effective and very helpful in improving awareness about and understanding of new technologies that are being promoted and new management structures, e.g., Co-management Councils and Co-management Committees. Exposure trips to other countries can be useful for viewing new practices. For example, the AF sponsored 11 government and NGO officers to visit Nepal, where they learned about bio-briquette production,

solar driers and stall feeding of goats (along with several other practices), which help improve resilience to the impacts of climate change.

Forest protection

Organize the communities to protect the forest against unsustainable extraction of NTFPs and timber harvesting by forming community patrolling groups¹⁷ (CPGs). CPGs are sub-groups of FDGs and receive uniforms and minimal pay for helping forest guards protect new and old plantations and the natural forest. CPGs have proven to be effective in protecting the forest and reducing deforestation. The sustainability of the CPGs after the project funding ends can be enhanced through the provision of a grant (AF provided USD 4000-5000 per CPG) to establish an RLF for AIGAs.

Reduce fuelwood consumption by promoting improved cooking stoves and solar energy devices. A study carried out by a partner NGO of AF found that a household using an improved cooking stove reduced its fuelwood consumption by 1.45 kg/day, a 50% reduction in fuelwood usage. Cooking time was also reduced by 44 minutes/day, ash production was reduced by 338 g/day, and less smoke was created and inhaled by the family. A case study was conducted of four indigenous communities living close to or within Lavachara National Park, in north-east Bangladesh. The villagers claimed that using improved cooking stoves reduced their fuelwood usage by 50-70% (Rahman and Alam, 2016).

Exit strategy

Develop an exit strategy. Identify what sustainability measures need to be included in ongoing project activities and who will implement them once the project ends. Develop a strategy and budget. Ideally, once a project/support ends, the participants should be empowered to continue collaborating with relevant government agencies and to have the necessary skills, knowledge and financial resources to plan and implement local development activities on their own. The collection of membership fees and interest earned from an RLF could provide the CBOs with ongoing operational funds after a project/support ends.

To help ensure the long-term sustainability of the community groups, and to strengthen their voices, community groups need to be linked to an umbrella group at the union, *upazila* and district levels. The president of each community group within a given *upazila* is a member of the *upazila* management committee. The Upazila Nirbahi Officer (UNO) chairs the committee, and a member of the implementing agency (i.e., donor or BFD staff) is usually the secretary. This management committee provides guidance to the community groups and helps resolve issues.

As previously mentioned, the provision of a grant to each Community Patrol Group after project funding ends (AF provided \$4000-5000 per CPG) to establish an RLF for AIGAs would enhance its sustainability.

¹⁷Each CPG consists of 21 members selected from among the FDG members. On a rotational basis, three members of a CPG will patrol, together with Forest Guards of the local Forest Beat Office.

5.5 Synergy between mitigation and adaptation as well as between different conventions

It is well known that global temperatures are going to continue to rise due to the quantum of greenhouse gases (GHGs) already accumulated in the atmosphere. The efforts to reduce the rate of emission in the future are going to make an impact slowly, and in the meanwhile more gases will enter the atmosphere. Therefore, while we continue to reduce the emissions and increase sequestration of accumulated gases, it is necessary to be prepared for the inevitable climate events that we will have to face in the future. Adaptation to climate change means reducing human vulnerability to the impacts of climate change on aspects such as livelihoods, food security and the impact of increased floods, storms and cyclones. It is obvious that both mitigation and adaptation approaches have to go hand in hand. While mitigation aims to slow climate change and keep its extremes within the limits of human coping capacities, adaptation measures enhance human resilience in the face of climate-induced difficulties and disasters. In the absence of effective mitigation action, the cost and effort of adaptation may be beyond human capacity. Adaptation alone cannot save the world if the global temperatures continue to rise and destroy the very ecosystems on which human existence depends. Thus, there has to be a strong synergy between mitigation and adaptation efforts in dealing with climate change.

Various international conventions and multilateral environmental agreements, such as the Convention on Biodiversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), UN Convention to Combat Desertification (UNCCD) and the Ramsar convention on wetlands of international importance, have a common goal of preserving the environment and biodiversity against human impacts, which include climate change. While they collectively address the environment holistically, individually they have their own specific areas of focus, as their names suggest. Whereas lack of action in one focal area can undermine the achievements of others, their achievements can strengthen each other's effectiveness. It is, therefore, important that all these conventions and Multilateral Environmental Agreements (MEAs) get equal importance from the reporting and implementing agencies. Moreover, their data requirements are common to some extent (e.g., forest area, PAs, population, biomass production), and a common database can reduce the workload involved in reporting. Therefore, a synergistic and unified approach to all the MEAs is good for both the reporting agencies and the MEAs themselves. Reporting on all the MEAs should ideally be the responsibility of a single agency so that it can plan the data collection and collation keeping the requirements of all the MEAs in mind.

5.6 Deforestation, REDD+, CDM and LULUCF

5.6.1 Deforestation

Deforestation and forest degradation in the country have accelerated as a result of rapid population growth, poverty, expanding cultivation, infrastructure growth and industrialization. Inadequate forestry investment and inadequate institutional capacity have been the other principal reasons behind the lack of sustainable forest management and biodiversity conservation. Since Bangladesh is a delta with good rainfall and fertile soils in plains, most of the forest areas in the country are suitable for agriculture as an alternative land use in a land-scarce, agrarian economy. Therefore, the pressure for converting forest lands to agriculture is very great.

The principal drivers of deforestation and forest degradation in Bangladesh include various combinations of the following factors:

- High dependence of a large rural population on natural forests for fuelwood, construction timber, fodder and various NTFPs;
- Encroachment of forest land for agriculture or habitation by poor people living in and around forests, as well as by migrants;
- 'Land grabbing' by influential people for various commercial purposes;
- Conversion of forest land to non-forest uses by the government for infrastructure or industrial development;
- Commercial timber felling and smuggling of valuable timber trees by criminals; and
- Weak institutional capacity to enforce forest laws.

These factors are aggravated by an extremely high population density, poverty and a lack of good governance. The lack of clear demarcation of forest blocks on the ground makes encroachment by neighbours both easy and defensible in courts. The intensity and combination of factors driving deforestation vary from area to area. The sal forests are more prone to agricultural encroachments because of the suitability of the land in the plains for agriculture. The hill forests of the CHT suffer from progressively decreasing cycles of traditional shifting cultivation (shifting) practiced by the indigenous people. The dependence of local people on neighbouring forests for fuelwood, fodder and small timber requirements is prevalent throughout the country. Frontier areas of the Sundarbans are degrading under the pressure for fuelwood and small timber exerted by the people living on the periphery of the forest.

Although it is difficult to estimate the extent of encroachment in a vast landscape with any degree of accuracy without a proper survey, especially when many encroachments are converted into social forestry plantations, approximately 104,154.43 ha of forest land was estimated to be under various kinds of encroachment in 2016. In addition, 125,626 ha of forest land has been officially converted to other land uses and transferred to other agencies. According to the latest assessment, only 15% (17,490 ha) of the remaining sal forests have more than 10% canopy density, while only 11% (79161ha) of the remaining hill forests have more than 10% canopy density.

A major driver of deforestation/degradation in Bangladesh is the widespread poverty and scarcity of land. This results in over-exploitation and encroachment of easily accessible public natural resources such as forests and wetlands. This nexus can be broken by gainfully involving the rural poor in the protection, sustainable use and management of government forests. Both climate change mitigation issues (avoided deforestation and forest degradation) and adaptation issues (reducing the vulnerability of communities by involving them gainfully in forest protection and sustainable co-management) can be addressed within the framework of the National Climate Change Strategy and Action Plan, formulated in conformity with the national development goals of Bangladesh. It is important to identify conservation options that will result in the restoration and maintenance of forests and will simultaneously be beneficial to local communities for the sake of sustainability. The Reducing Emissions from Deforestation and Forest Degradation (REDD+) programme of the UN offers excellent scope for such actions, and Bangladesh has been quite active in this area.

5.6.2 REDD+

The REDD+ mechanism was proposed in 2005 to enable the incorporation of reduction of GHG emission from natural forests in non-Annex I countries in mitigation programmes. The REDD+ mechanism is still under negotiation as of June 2016 although most elements of the mechanism have been defined in a series of decisions taken by the Conference of the Parties to the UNFCCC.

The REDD+ mechanism has five eligible activities:

- Reducing emissions from deforestation
- Reducing emissions from forest degradation
- Conservation of forest carbon stocks
- Sustainable management of forests
- Enhancement of forest carbon stocks

If Bangladesh opts for the REDD+ mechanism, then all the Forest Land¹⁸ in Bangladesh will have to be included in the National REDD+ Programme. The only exceptions will be made for forests included in other climate finance agreements, such as the Clean Development Mechanism (CDM), Forest Carbon Partnership Facility (FCPF) and Forest Investment Programme (FIP).

Decision 1/CP.16 defines the four required elements of a National REDD+ Programme:

- A national strategy or action plan
- A national forest reference emission level and/or forest reference level, in accordance with national circumstances
- A robust and transparent national forest monitoring system for monitoring and reporting eligible activities, in accordance with national circumstances
- A system for providing information on how the safeguards are being addressed and respected throughout the implementation of the eligible activities

In effect, the safeguards require Bangladesh to have full and effective engagement of all local stakeholders, specifically indigenous peoples and local communities, in all relevant aspects of any activities implemented under the National REDD+ Programme. Bangladesh has to prepare a Technical Annex to the National Communication with full details of the REDD+ Programme and activities. This Technical Annex will be assessed through the International Consultation and Analysis process organized by the UNFCCC Secretariat. If the Technical Annex is found to be compliant with UNFCCC decisions, then Bangladesh can apply for 'results-based finance' to the Green Climate Fund. The current (June 2016) price of REDD+ GHG emission reductions is approximately USD 5-5.50 per ton of CO₂. Any amounts awarded would accrue directly to Bangladesh and are expected to be applied towards the operation of the National REDD+ Programme and otherwise be distributed to the stakeholders of the REDD+ activities in a form deemed appropriate by the government. Once the system is properly set up, it is rather straightforward, and many current programmes and activities could be brought under the National REDD+ Programme with limited additional work, such as the social forestry

¹⁸'Forest Land' is a land use category under the IPCC Guidelines. In principle it includes all land that is currently forested, but it should also include land that is designated as forest even though it is not currently forested, such as degraded RF land and land accretion in RF areas.

programme. However, establishing the reference (emission) levels and the national forest monitoring system are complex undertakings, and a system has to be set up and maintained for continuous forest resource assessment. Bangladesh is actively participating in various REDD+ initiatives, and a project is currently being implemented with support from the UN-REDD Programme.

The Bangladesh Climate Change Strategy and Action Plan is built on six pillars including mitigation and low carbon development. Under the USAID-funded IPAC project (IPAC, 2008-2013) a Clean Development Mechanism and two REDD+ proposals were prepared for Chunoti Wildlife Sanctuary, the Sundarbans Reserved Forests (SRF) and six PAs, respectively. Bangladesh became a partner country of the UN-REDD in August 2010 and a National REDD+ Steering Committee was formed in July 2011. The REDD+ MRV Action Plan, REDD+ Readiness Roadmap and REDD+ Readiness Preparation Proposal were prepared in 2011-2012. The Roadmap was endorsed by the National REDD+ Steering Committee in December 2012. Bangladesh is now a member of the UN-REDD. In 2015 the UN-REDD Bangladesh National Program was approved with funding from UNDP and USAID. In the same year, Bangladesh was identified as a pilot country of the FIP under the World Bank's Climate Investment Fund.

By following a verified carbon standard (VCS) methodology, a concept document for REDD+ IFM (Improved Forests Management), called 'Collaborative REDD+IFM Sundarbans Project (CRISP)' was developed by the BFD in 2011. A similar concept paper was prepared for six PAs by following a VCS methodology for REDD+ Assisted Natural Regeneration (referred to as Bangladesh REDD+ANR Protected Area Project or BRAPAP). The documents were developed by following the approved VCS methodology VM0006 (Methodology for Carbon Accounting in Project Activities that Reduce Emissions from Mosaic Deforestation and Degradation).

The overall aims of CRISP and BRAPAP are (1) enhancing carbon sequestration with improvement in community livelihoods; (2) community participation in forestry activities for better forest governance; and (3) conservation of the flora and fauna.

5.6.3 CDM

The CDM of the Kyoto Protocol has an objective of reducing GHG emissions through the provision of financial and technical assistance from Annex I countries to non-Annex I countries in the establishment of projects. Under CDM Scope 14 are afforestation and reforestation.

CDM has fairly elaborate administrative, reporting and validation requirements, as a result of which the overhead costs erode the financial viability of the projects. Hence there are not many afforestation and reforestation projects. As a result, small-scale activities were allowed, with reduced administrative requirements and hence lower overhead costs. More interestingly, a Programme of Activities (PoA) can be defined that acts as an umbrella for multiple small projects in a country, with its concomitant benefits of scale. For instance, a PoA for social forestry could include all new plantations on degraded RF land throughout the country and then be registered as a single CDM project.

For afforestation projects, only that land can be included which did not support actual forests in the past 50 years.

For reforestation projects, only that land can be included which did not support actual forests since 1 January 1990.

The minimum area would be several tens of thousands of hectares¹⁹ for a project to be financially viable.

Bangladesh needs to formally submit a CDM proposal to the UNFCCC. Local stakeholders need to be consulted and detailed assessments need to be made of additionality, persistence and leakage.

CDM projects always need a donor country that provides the technology and financing of the project. Any Certified Emission Reduction (CER) certificates that are issued will be assigned to the donor countries to offset their domestic GHG emissions with the reductions achieved in Bangladesh.

Individual afforestation and reforestation projects are not likely to be financially viable, but bundling them into a PoA is a more tenable option.

Nishorgo developed a CDM project for Chunoti Wildlife Sanctuary in 2007, but this has not been submitted to the UNFCCC. A field inventory design, formats and methods were established in accordance with the guidelines of the Intergovernmental Panel on Climate Change (IPCC) and the GOFCL (Good Practices for AFOLU—Agriculture, Forestry and Other Land Use). The nature of the carbon pools, including above-ground biomass, below-ground biomass, on-ground necromass, and SOC, was assessed according to the carbon inventory manual developed by the BFD.

5.6.4 LULUCF

The land use, land use change and forestry (LULUCF) sector is an important land-based sector that mitigates climate change, strengthens terrestrial ecosystems and builds resilience among communities. The conservation and growth of forests can ensure substantial sequestration and storage of carbon dioxide, in addition to numerous socio-economic and environmental co-benefits. Global warming is adversely affecting Bangladesh's climate, with serious consequences for natural resources, including the water, soil, forests and air. Forests provide low-cost mitigation opportunities to combat climate change by removing GHGs from the atmosphere as carbon sinks and by reducing GHG emissions through avoided deforestation and forest degradation. By conserving the country's forests and establishing climate-resilient plantations in unused public and private lands, biodiversity and water will be conserved *in-situ*, and community biomass needs can be met. Besides, sustainable forest management has significant potential to attract investments and technology and to upgrade the institutional capacity of the BFD and local community organizations for biodiversity conservation, forest restoration and meeting their energy needs.

Avoiding deforestation and forest degradation is in line with the Poverty Reduction Strategy of the GoB. In accordance with the measures envisaged in the Partnerships for the Global Environment, it supports the Sustainable Development Goals by ensuring environmental sustainability and by addressing rural poverty alleviation. Climate-resilient afforestation and reforestation on unused public and private lands, in partnership with local communities, will offer

¹⁹A regular CDM project should have a minimum projected annual emission reduction of 16 ktCO₂e/yr (decision 9/CMP.3), and for a small-scale CDM project the amount is less. Given the administrative overhead and low price of Certified Emission Reduction certificates, projects tend not to be financially viable unless much higher annual emission reductions are achieved.

excellent opportunities for achieving national environmental goals. It will mitigate GHG emissions while conserving biodiversity and alleviating rural poverty. Greening the country through community conservation activities will result in empowerment of local communities, thereby contributing to improved forest governance.

Due to her favourable climate, Bangladesh is a good case for forest restoration and conservation in partnership with forest-dependent communities. Forests that act as both sinks and sources of GHGs are indeed in need of restoration and sustainable management. Bangladesh is a low-carbon-emitting country mainly due to her low level of industrialization. Carbon dioxide emissions are derived mainly from the energy sector, with some contributions from the LULUCF sector. The protection and sustainable management of existing forests and enhancement of carbon stocks through afforestation and reforestation will improve their ability to sequester and store carbon.

Activities in the LULUCF sector can provide a relatively cost-effective way of offsetting emissions, either by increasing the removal of GHGs from the atmosphere (e.g., by planting trees or preserving forests) or by reducing emissions (e.g., by curbing deforestation). However, there are drawbacks as it may often be difficult to estimate the GHG removal and emissions resulting from LULUCF activities. In addition, GHGs may be released unintentionally into the atmosphere if a sink is damaged or destroyed through a forest fire or disease.

Forest carbon sinks benefit the country's forest-dependent communities through enhanced incomes and a better quality of life. Forest ecosystems enhance the resilience of poor people against climate change by providing economic safety nets in a disaster-prone economy. Forest and wetland ecosystems contribute to the mitigation of climate change by sequestering and holding CO₂, which depends on their growth and conservation.

5.7 Carbon stocks and inventory

Forest carbon inventories are becoming increasingly important because of the expanded global emphasis on afforestation/reforestation, CDM and REDD+ activities. The development of national forest inventory institutions and processes for objectively assessing baseline scenarios and reference emission levels is essential for developing proposals to receive the carbon payments available under these programmes.

A seminal effort in Bangladesh was initiated in Chunoti Wildlife Sanctuary in 2007, when the BFD conducted a carbon inventory for developing a CDM reforestation proposal under the Nishorgo Support Project. A field inventory design, formats and methods were established in accordance with the guidelines of the Intergovernmental Panel on Climate Change (IPCC) and the GOFCC. The nature of the carbon pools, including the above-ground biomass, below-ground biomass, on-ground necromass and SOC, was assessed according to the carbon inventory manual developed by the BFD. The carbon stock changes over a project activity area of 5000 ha were estimated to be 2.78 M ton of CO₂ over a maturity period of 40 years.

The carbon inventory programme conducted in Chunoti Wildlife Sanctuary provided the means for planning and conducting a mangrove carbon assessment in the state RF for developing a REDD+ proposal under the USAID-supported IPAC project. CRISP is an AFOLU activity with an emphasis on REDD+ and Improved Forest Management (IFM) in the project area through avoiding unplanned frontier deforestation and degradation and through conversion of logged forests to protected forests, including protection of currently logged or degraded forests from

further logging. A manual on carbon inventory methods was developed for the mangrove forests on the basis of the experience of the Chunoti project. The project forest area of 412,000 ha was estimated to generate an average of 213,115 tons of CO₂ annually over a 30-year project period for total project enhanced removals of 6.4 MtCO₂e (an average of 15.52 tons of CO₂/ha, excluding the SOC).

This effort was succeeded by another REDD+ proposal developed by the BFD, the USAID-supported BRAPAP, for which a forest carbon inventory was conducted in six protected areas. It is calculated that the proposed project will generate annual net GHG emission reductions through reduction of deforestation and carbon stock enhancement amounting to 103.7 M tons of CO₂ for 40 years over a mere 33,344 ha, or an annual average of 3110 tons of CO₂. This estimate is very obviously impossible and is indeed due to methodological errors,²⁰ and this proposal is therefore not further considered. In 2014, under the USAID-supported Climate Resilient Ecosystems and Livelihoods (CREL) project, a forest carbon inventory was also completed by the BFD in 17 protected areas, including the six protected areas covered under BRAPAP. The carbon stocks varied from 146 to 381 MtCO₂e/ha. Unlike CRISP and BRAPAP, however, no REDD+ proposal was developed under this initiative.

AF has estimated carbon stocks in the community conserved forests managed by the indigenous communities of the Chittagong Hill Tract. CREL estimated the carbon stocks in the country's 15 protected areas in 2015.

Various activities are in progress, striving to produce forest resource information and carbon densities and dynamics, at the national level. The National Forest Inventory (NFI) project is preparing a national land cover classification and will sample all land cover classes in such a way that carbon densities will be established and the National REDD+ Programme will establish a national forest monitoring system that should envelop all the sources of forest resource information in a unified format.

Apart from the generation of forest information through internationally funded programmes, the BFD has no in-house system or policy of data collection, storage, retrieval and analysis. The data related to forestry activities such as afforestation, reforestation and extraction are not collected systematically, and information is generally collected from field offices on an *ad hoc* basis. Even though there are standard formats for submitting periodic performance reports from field offices, the information is prepared and transmitted manually, and it is virtually impossible to compile or access this information at the central level. The BFD will have to review not only its resource inventory systems but also establish an effective, operational database on forest management activities. The BFD is in the process of creating a Web-based database on wildlife crime management, and similar information management systems are urgently required for managing data related to forest crimes and for managing forest resources.

²⁰The main methodological issues are two. First, the reduced emissions from reduced deforestation and forest degradation are calculated over the entire area of the protected areas for each of the 40 years. This clearly violates the principle of permanence: deforestation and forest degradation are avoided only once the forest is considered to be protected from further threats. Effectively, the emission reductions are over-estimated by a factor of 40. In addition, the project implementation period has to be considered (not all forests are protected right from the beginning). Second, the ANR uses a rather high MAI of 4.95 m³/ha/yr over the 40-year span of the project. Such a high MAI can be attained in a plantation where trees are optimally spaced, but in a natural forest crowding reduces the MAI, while the natural growth rate of forests over a 40-year period gradually declines to 0.

6 Issues and Challenges

This chapter underlines the key issues and challenges that thwart the progress of the sector in general and cause serious impediments to the smooth functioning and discharge of the mandated duties and roles of the forestry sector institutions. In what follows, selected major issues and associated challenges are flagged and discussed in some detail. Under each theme, the contextual realities are summarized first, followed by identification and discussion of the relevant major challenges. Wherever appropriate, some suggestive tips for improvement of the situation are also furnished.

6.1 Conservation of remaining natural forests

The context

Over the years, the natural forests of the country have seriously been depleted and degraded. During the Second World War, the accessible hill forests in the eastern part of the country were heavily exploited to meet the demand of the war in Burma and elsewhere. After 1947, when the supply of timber from Assam, in India, ceased, these forests came under heavy exploitation. Due to the inaccessibility of the Chittagong Hill Tracts (CHT), the forests there continued to remain in a good natural condition until the Kaptai dam was built and the area became easily accessible by water. In addition to the felling in the areas submerged by the lake created, large-scale exploitation of forests started taking place in the Raingkheong and Kassalong valleys. The decimation of forests in the Sangoo-Matamuhuri reserves is more recent. In addition, clearing for shifting cultivation by local communities, which has been going on all along, became a major cause of destruction of forests in the CHT. The situation further deteriorated when Bengalis from the plains districts were settled in the hills. This opened the door for a further influx, including those who settled there illegally, who cleared forests. According to the latest information available, 85% of the forests in Chittagong, Cox's Bazar and the CHT have a canopy cover of less than 10%. A clear picture of the actual status of the forests in the hills and elsewhere will emerge when the ongoing inventory of forests is completed. However, by all available accounts, the situation in the other forested areas, except the Sundarbans, is no better.

Out of the total notified hill forest area of 722,716 ha, only 79,161 ha is currently under a minimum acceptable level of tree cover (FIGNSP, 2013). This estimate is based on a projection following some trends and may not reflect a true picture. The present situation has resulted from over-exploitation of tree resources, encroachment of forest land, clearing of forest land for shifting cultivation, transfer of land for non-forestry purposes and large-scale illicit removal of trees from the hill forests.

The semi-deciduous forests of the plains were already very fragmented and depleted when these were vested with the Bangladesh Forest Department (BFD) in 1950. The trees of sal (*Shorea robusta*), the main species in these forests, were of poor quality, mostly small shoots of coppice origin. The initial transfer from private ownership was done only on paper, and the actual reservation of the transferred land under the Forest Act has not been completed today, even after 65 years have lapsed since. Out of the area of 125,767 ha transferred at the time of vesting, barely 15% is reported to be under tree cover still. There are several reasons for this. These include ownership conflicts, the slow process of reservation, encroachment of forest land, over-exploitation of tree resources, mainly for fuelwood and poles, and transfer of large

chunks of land for non-forestry purposes. The quality of the remaining forest is poor because of its inability to regenerate through seeds. Seedlings do not survive because of overgrazing and frequent, fires ignited by neighbouring communities to ensure the growth of grass for their cattle in the rainy season.

There was serious deterioration in the quality of the forest cover in the Sundarbans, a contiguous patch of 601,000 ha of forest, due to the removal of large numbers of trees beyond silviculturally permissible limits and because of 'top-dying' of large numbers of *Sundari* trees, which are of the commercially most important species in the forest. Three successive inventories of the tree resources in the Sundarbans between 1959 and 1996 revealed a serious decrease in the number of *Sundari* and *Gewa* trees. However, an assessment carried out by the Integrated Protected Area Co-management Project (IPAC) revealed a significant recovery of all the major species, except *keora*. This improvement in condition of the crop has resulted from the imposition of a total moratorium on the extraction of timber from the Sundarbans and other natural forests.

Over-exploitation of some commercially important forest resources together with large-scale destruction of forests in the hill and lowland forests has diminished the quantum of ecosystem services offered by the forests in Bangladesh. Apart from a loss of biodiversity and reduction in the production of timber, fuelwood, various non-timber forest products (NTFPs) and raw materials for cottage industries, the regulation of flow of water into the streams, *haors* and aquifers has been seriously affected, resulting in frequent floods and depletion of the water table. With the loss of forests, the carbon footprint of the country has increased, and it will require some serious efforts on the part of the government to sequester the greenhouse gases released into the atmosphere as a result of deforestation and forest degradation. With the loss of forests, the country also lost many populations of pollinating insects and birds, leading to a loss in agricultural production. In addition, the loss of forests has already affected the livelihoods of millions of forest-dependent people. Although the growth of the trees-outside-forests (TOF) sector has compensated the country for the loss of forest cover, to some extent, Bangladesh has no alternative but to regenerate her forests, whatever the cost.

Although the current crop of trees in the Sundarbans is of a small size, because of its resilience, the forest has recovered quickly from the destruction it suffered and is providing its full share of ecosystem services to the country in the form of livelihoods and protection against cyclones and storms.

Restoring the ecosystem services means recovery of the lost forest areas. This will require rehabilitation of forests, protection of watersheds, re-introduction of economically important species, etc.

Issues and challenges

1. Over-exploitation of the resources of the hill and plains forests and a failure to restock the area through establishment of plantations have resulted in a serious reduction in the area under tree cover. This has also very adversely affected the capacity of the forests to offer ecosystem services. The challenge will be to reforest these areas as early as possible. The current political and law-and-order situation in the CHT, where most of the reforestable area is situated, is not favourable for undertaking such an exercise using the age-old system that the BFD has been following. An option agreeable to all involved parties will have to be devised to ensure reforestation of the forests of the CHT. A

shortage of manpower and other resources needed are also major constraints in achieving this goal.

2. Large-scale illicit removal of trees from the forests is a major cause of depletion of tree resources. While this is not possible, to a great extent, without the active connivance of those assigned to protect the forests, the legal and other tools, resources and protection machinery available are grossly inadequate for affording effective protection to the forests. In addition, the large-scale felling of trees in the hill forests has not been caused just by clearing forests for shifting cultivation. It has been possible only because somehow the timber reaches the timber markets in the plains districts. This, together with the issuance of *jot* permits for large quantities of timber in the CHT without due verification and large-scale removal of trees in other hill forests, will have to be reviewed in detail, and the reasons for this situation will have to be identified and addressed permanently.
3. It may be mentioned here that very large-scale timber removal has taken place from the area under the Chittagong and Rangamati forest circles, where most of the terrestrial forests of the country are located, over the last few decades, under the cover of *jot* permits. Between 2009-2010 and 2015-2016 a total of more than 1 million m³ of timber has been removed from the forests of these two circles (Table 6-1)! As this practice has been continuing since the 1980s, it is not difficult to assess how many cubic metres of timber may have left the area during the period. In fact, the misuse of the *jot* permits issued for extraction of timber from private holdings may lead to the devastation of hill forests, particularly in the CHT districts. Figure 6-1 clearly shows that the timber extraction in the name of *jot* permits is increasing every year. This would not be possible if this had been coming only from private holdings, where extraction has been going on for decades now. The procedure for issuance of *jot* permits may be reviewed particularly in the areas under the Rangamati Circle.

Table 6-1: Year-wise details of timber removed under *jot* permits from different circles (m3)

Forest Circle	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Chittagong	28,410.33	32,949.26	35,295.06	43,111.38	48,738.19	53,266.77	56,432.39
Rangamati	71,246.88	77,870.93	107,131.26	139,171.60	115,545.74	139,898.01	138,736.91
Dhaka	4834.87	5601.14	4332.03	3722.92	3261.57	2340.62	2089.60
Total	104,492.08	116,421.33	146,758.35	186,005.89	167,545.50	195,505.39	197,258.90

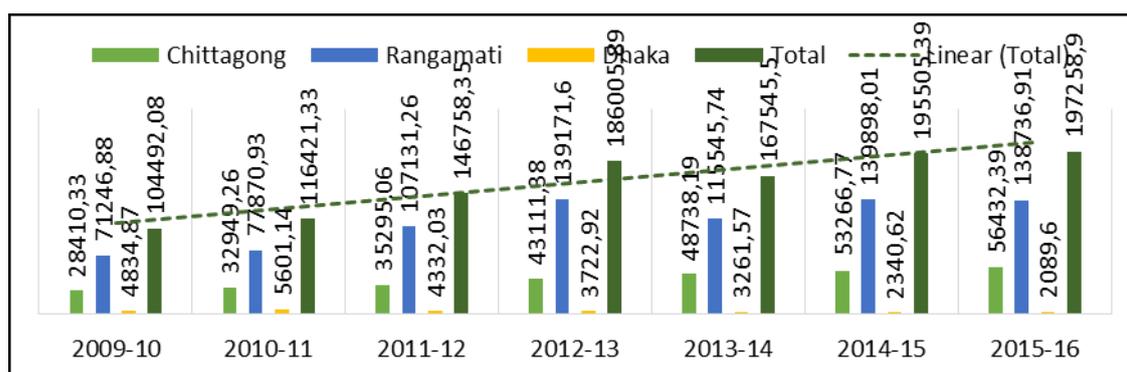


Figure 6-1: Trends in the production of logs through 'jot' permits (m3)

4. With the drastic reduction of the rotation and fallow periods (from 10-12 years to the 2-3 years of the present), the practice of slashing and burning large areas in the hill districts for traditional cultivation has contributed to the destruction of forests there. This has been a practice followed by the locals for ages, and it will be an uphill task to convince them to refrain from this practice unless financially more rewarding practices, acceptable to them, can be implemented instead. To ensure conservation of hill forests, it is crucial to work with the local communities to explore possibilities of reducing the need to resort to shifting cultivation and tap into settled agriculture and other off-forest sources of livelihood.
5. The encroachment of forest land elsewhere for agriculture and other purposes in the absence of deterrents is also a major concern. In addition to the failure to protect the forest areas, forest boundaries are not demarcated, court cases take too long to be resolved and the BFD is unable to pursue these cases properly due to a lack of adequate and trained manpower. The fact that forest boundaries are not clearly demarcated anywhere does not help! The main challenges are to delineate the boundaries with visible pillars and recording of GPS co-ordinates, protect the forests better from encroachment and make arrangements for ensuring quick disposal of forest cases by courts.
6. The management of forests has been relegated to just nominal overseeing of the forest estates. There is no management plan in operation in any of the forests, and currently there are very few silvicultural operations in practice to manipulate and improve the quality of the forest. Systematic information on growth and yield is non-existent. Deploying trained manpower in adequate numbers for intensive management of forests is among the main challenges, together with generation of silvicultural and biometric information on the forests.
7. In the absence of alternative fuels for cooking, communities living in areas close to forests depend almost entirely on fuelwood from the forests. In addition to large-scale illicit felling, which has taken place over the years, the timber needs of these communities have also been met from the forests. The challenge here will be to decrease the demand placed on the forests by these communities and gradually encourage them to build up alternative sources.
8. The depletion of tree resources also has adverse effects on the catchment areas of many rivers, particularly in eastern Bangladesh, in the CHT, Sylhet Division and districts of Chittagong, Cox's Bazar, Habiganj and Moulvibazar districts. This has diminished the downstream flow of water in the dry season and has increased erosion in the hills, resulting in siltation of rivers and lakes, including Kaptai Lake. The challenge will be to identify, demarcate and reforest the critical catchment areas and bring these under full and effective permanent protection.
9. The loss of tree cover has adversely affected the large array of ecosystem services that these forests provided. Apart from loss of biodiversity and habitats, the production of timber, fuelwood and various NTFPs and the flow of water into the streams, *haors* and aquifers have been seriously affected, resulting in frequent floods and depletion of the

water table. With the loss of forests, the carbon footprint of the country has increased. In order to restore the levels of the aforementioned services provided by the forest ecosystems, a major drive for restoration of the forests will have to be taken up.

10. The BFD seriously lacks resources needed for protection and management of the forests. While the sanctioned staff of the department is insufficient, a significant number of the positions are already vacant, and the situation will further worsen after a large-scale retirement of the BCS cadre and Forest Ranger-level officials in the immediate future. The sizes of such operational management units as beats and ranges are too great for the small number of officials deputed to manage and protect them. The same three- or four-person units are responsible for both managing and protecting the large area of a beat. The field-level training of staff members is inadequate, and the financial and physical resources provided to them are inadequate for their tasks.
11. The financial resources available for management of forest resources are often inadequate for the tasks involved. Unless there is funding from an external source through a project, the allocations from the Government of Bangladesh (GoB) for the management and protection of forest resources are small compared with the needs. These project-funded endeavours also lose steam when a project ends and there are no funds available to continue the good work. In addition, rehabilitation of a denuded forest is a very costly task, which the BFD finds difficult to cope with even with external funding. So additional sources of funding, including from the private sector, will have to be identified and accessed.
12. Forest-related cases, instituted in the courts of law, are tried under the Forest Act, 1927 (with subsequent amendments). These cases take an unreasonably long time to be resolved and often are not effective as deterrents to forest crimes. The BFD also does not have adequate manpower with adequate training in legal matters to follow up effectively the cases that have been filed.
13. Despite several innovative steps having been taken, such as designation of special courts, having advocates on a retainer basis and appointment of Forest Case Conducting Officers (FCCOs) for efficient and effective prosecution of cases, court cases take very long to mature, and the backlog is piling up. A strong mechanism of co-ordination between the BFD officials and the judiciary is required to improve the situation.
14. The BFD does not have the manpower and resources required to carry out its stated mandate. The help available from the other law-enforcing agencies is inadequate and not spontaneous because they (the other agencies) consider the protection of forests and their resources as solely the responsibility and task of the BFD. In addition, the involvement of local communities in forest protection is limited. Protection of the forests needs to be seen as a responsibility of all citizens of the country.
15. In order to restore the capacity of the forests to provide enhanced levels of ecosystem services, forest rehabilitation programmes should include conservation of watersheds and other sensitive areas and re-introduction of economically important species. As this has not been done consciously in the past, the challenge will be to develop a mechanism for achieving this objective.

6.2 Conservation of wildlife and biodiversity

The context

For its small size and large population, Bangladesh has rich floral and faunal resources. However, loss of habitats in both hills and plains, including seasonally inundated areas (*haors*), is a major cause of depletion of faunal biodiversity. According to the country's Red Listing Exercise, carried out by the International Union for the Conservation of Nature (IUCN) in 2015, out of the 1619 animal species occurring in Bangladesh, 31 are Regionally Extinct, 56 are Critically Endangered and 181 are Endangered. Another 243 species are classified as Vulnerable or Near Threatened. The population of the royal Bengal tiger has shrunk to a lowly 106, and it is confined to the Sundarbans. The habitat and the food chain of the tiger in the Sundarbans are satisfactory, and the decrease in the tiger population can be attributed very largely to poaching, impelled by the high value of tiger skins and body parts in the clandestine international market. Given the resources and facilities at the disposal of the poachers, the BFD would require well trained additional manpower, modern tools, equipment and other amenities to control the poaching.

With the loss of sal and hill forests, the biodiversity of these areas has taken a serious blow due to loss of habitats. Nearly 15% of the forest area in the country is notified as protected areas (PAs), but most of these PAs are not well protected due to a shortage of staff and resources. While PAs should be free from human interference, most of the PAs in Bangladesh have people living right inside or close to them who are exploiting the remaining forests in the PAs. While the existing PAs should be managed for the purpose for which they have been declared PAs, more areas should be brought under the PA network so that the size of wildlife habitats is increased and watersheds and other sensitive functions are well protected.

The total number of tree species has not been assessed recently. But the floral species diversity in Bangladesh is rich, with more than 5700 species of vascular plant (Khan, 1977) reported to occur in the hill and plains forests alone. Over-exploitation of selected species has made these species very rare or non-existent in the hill forests. According to a new study, there are 528 species of vascular plant occurring in the Sundarbans (M. Sayedur Rahman et al, 2015).

Issues and challenges

1. In order to restore a respectable wildlife habitat in the forests and PAs of the country, a massive forest restoration programme will have to be taken up. Manpower, capacity and financial and logistic resources will be required to ensure conservation of the biodiversity, which the BFD does not currently have at its command.
2. The protection of all wildlife habitats, including those outside the forest areas, will have to be strengthened. In addition, measures for providing protection against poaching of flagship wildlife species will have to be ensured through appropriate actions. In this regard, the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), ratified by the GoB and run under the authority of the BFD, in Bangladesh must be strengthened.
3. The existing PAs are not appropriately managed, and as there has been significant habitat loss, these will have to be restored. In addition, the area under PAs will have to be increased keeping in view the fact that they represent all types of wildlife habitats, including watersheds and other sensitive areas.

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4. Although the new National Forestry Policy (draft) provides for expanding the PA network to 30% of the notified area, from the existing 15%, the country does not have any more intact forests, outside the Sundarbans. Therefore, finding new areas, with intact biodiversity and habitat values, for protection will be a serious challenge.
 5. The adequate trained manpower, financial, logistic and other necessities, capacity and legal backing needed for biodiversity conservation is seriously lacking in the BFD. These need to be upgraded immediately.
 6. While the recently concluded Red Listing of Species Exercise has furnished detailed information on the status of various animal species, no such current knowledge is available on the flora of the country. In addition to this lack of knowledge about the status of different species, there is no effort to conserve these, either *in situ* or *ex situ*. The BFD will need to take the necessary measures to restore habitats for the conservation of all wildlife species.
 7. In addition to the loss of habitats, the remaining habitats have become very fragmented in many situations, interspersed with habitations and agricultural lands. Efforts need to be made to create natural or planted corridors among these fragmented habitats at least to ensure the safe passage of animals from one habitat to another.
 8. The shortage of fodder for elephants and food for tigers, particularly older tigers, results in their seeking food in neighbouring villages. These create wildlife-human conflicts. In some cases, they involve wildlife coming across borders from neighbouring countries. This issue needs to be addressed together with the provision of food for wildlife.
 9. Special efforts need to be made to ensure the protection and proliferation of Vulnerable, Threatened and Endangered species. This will require special research into the lives and habitats of the species. In addition, assessment of the feasibility of re-introduction of some of the extinct species needs to be made. However, trained manpower, technical know-how, the required facilities and other necessary resources are not available currently.
 10. Despite strong penalties being provided in the Wildlife Act, 2012, the conviction rate of wildlife poaching and trafficking cases is very low and cases take very long time to mature. Outside Khulna Circle, virtually no convictions have been recorded in the last many years, except in the cases registered by mobile courts. The Wildlife Act has serious flaws regarding the powers of forest officers and police officers to handle offence cases. Forest officers cannot even arrest criminals involved in wildlife offences. Strong support from the judiciary is required to improve the situation.
 11. The creation of the seven wildlife divisions had created the erroneous impression that enforcement of the wildlife law was no longer the job of the territorial forest officers. With the conclusion of the Strengthening Regional Cooperation for Wildlife Protection (SRCWP) project, four of the wildlife divisions created under that project have been virtually closed and exist only in name now. Revival of these divisions with adequate resources, along with clarity about their mandates, is extremely important for the conservation of wildlife in the country.
 12. Conservation of wildlife and biodiversity requires strong co-ordination between the BFD, law enforcement agencies, research institutions and conservation organizations such as the IUCN and WWF. Although wildlife focal points have been created in all law

enforcement agencies, this system is not being used effectively. The supposedly multidisciplinary Wildlife Crime Control Unit (WCCU) has no staff members from other law enforcement agencies. The BFD has no co-ordination mechanism to influence the wildlife and biodiversity research being carried out by universities. As biodiversity conservation is formally a domain of the Department of Environment (DoE), a strong mechanism of co-ordination with the DoE is also required.

6.3 Establishment and maintenance of plantations

The context

While the plantation programmes in the forests of the country were initiated about 150 years ago, in the early days, small areas of plantations were established by clearing natural forests. These plantations were properly managed under rigorously designed silvicultural regimes. The rest of the forests were worked under a selection system. The management system was subsequently changed in the 1930s, and larger areas of forests were clear felled and replanted, mostly with teak. Large areas of accessible forests were exploited during the Second World War to meet the demand for timber. As little funding was available for non-war activities at that time, these high-grade forests were left to nature for recuperation.

After 1947, when the supply of timber from the rest of India ceased, the forests came under large-scale exploitation to meet the local demand and some of the demand from West Pakistan. At this stage, more areas were clear felled to meet the demand and were replanted, mainly with teak and other selected species. From the mid-1960s, plantations were established in the coastal mudflats with mangrove species and the creation of coastal embankments with *Acacia arabica* (*babul*) was initiated as a measure of protection against storms from the sea. These practices gained steam in the 1970s and still continue to be a major component of the plantation programme in the country. Plantations of rubber (*Hevea brasiliensis*) and agar (*Aquilaria malaccensis*) have also been established successfully, in both the public and private sectors.

According to the draft NBSAP (2016), the total area of plantations established since liberation, in 1971, is 474,372 ha. This area includes plantations on forest and unclassed state forest (USF) land, coastal *char* land, roadsides, sides of railway tracks and plantations with rubber and agar. The extent of the plantations currently in existence in the denuded hills and plains forest lands under the BFD is reported to be only 75,872 ha. This figure also includes some plantations that were established before 1971. Likewise, around 200,000 ha of mangrove plantations has been raised since, mostly after 1971.

According to the available information, out of the total area of 722,716 ha of notified forests in the hill districts, only 79,161 ha barely qualifies to be called forests according to international norms and is under an acceptable level of natural tree coverage. Only 15,029 ha of natural bamboo forests survives now. Nearly 54,000 ha of the hill forest is under plantations although some plantations have become indistinguishable from the surrounding forests. Out of the notified sal forests of approximately 125,767 ha, only about 17,495 ha has more than 10% canopy cover, while the extent of the plantations in the sal zone is approximately 21,433 ha only. The remaining area is either degraded or has been diverted to other uses, legally or illegally. This situation clearly demonstrates large-scale failure to successfully establish or retain a major portion of the plantations. The reasons for this, in the cases of the hill and plains forests, include failure to establish and maintain plantations properly, an inability to implement silvicultural operations following planting of an area, inadequate care, inability to protect

plantations from damage, the return of some coastal land to the Revenue Department, grazing and illicit removal of plants, even when these are young. In the case of the mangrove plantations of *char* lands, the main causes of failure are human interference, grazing, trawling for fish, tidal waves during the monsoon and deposition of silt/sand in plantation areas.

Issues and challenges

1. The main issue is the failure to raise plantations properly, followed by maintenance in the early years, undertaking desired silvicultural operations and providing adequate protections. The main challenge will be to improve the overall planning and management of nurseries so that good-quality planting stock is available for establishment of plantations and planting activities are carried out with provisions for sufficient adequately trained manpower, know-how and resources, backed by regularly implemented silvicultural prescriptions, ensuring that the plantations are protected from all adversities. In addition, attracting resources and participation from the private sector and other unconventional sources for establishing plantations will be a major challenge.
2. Shortage of adequate properly trained manpower, poor quality of planting stock and nominal supervision are among of the major constraints in raising plantations. The capacity of the entire BFD needs to be enhanced greatly in terms of manpower, and up-to-date knowledge about nursery and plantation establishment practices needs to be provided. Given the current situation of an acute shortage of manpower and other resources, the BFD will have to implement innovative models involving communities, the private sector and other entities to re-green the forests of the country.
3. The choice of species for plantation is often based on what has grown in the past and is limited to only a few species. Given the new challenges arising from climate change-related issues and the acute shortage of timber and other forestry products, these plantation establishment programmes need to be better planned, ensuring that climate-resilient species are planted that have the potential to meet the future demand for timber in the country. Research and field trials need to be conducted to generate the necessary information to help choose species that will not only increase the forest cover but also provide ecosystems services in terms of climate change adaptation strategies. Due to the removal of the cover, exposure and desiccation of the soil may have led to a change in the edaphic conditions of the forests. Research and field trials are needed before large-scale plantation programmes are taken up to assess the suitability of different species to the changed habitat conditions. It may be necessary to adopt a two-step process in which short-rotation, soil-enriching trees are planted first to enrich the soil before plantations with selected species are established.
4. Protection against outside interference detrimental to the establishment of plantations needs to be strengthened. However, the current administrative structure, manpower strength and available resources are very inadequate for the task. The involvement of communities and/or entering into a public-private partnership (PPP) in protecting plantations is one valid option, provided the BFD is ready to share the benefits with such beneficiaries / participants.
5. Desired silvicultural operations, to ensure good growth and vigour, are often not carried out. This often causes failure of plantations or at least does not allow these to attain a satisfactory level of growth. Inadequate funding and a lack of both accountability and

know-how are among the main reasons for this. Limited availability of funds, appropriate silvicultural prescriptions and know-how for carrying out these operations are the main limiting factors.

6. A huge area of land suitable for establishing plantations is available in the hills. This area is too large for the BFD to carry out plantation programmes single-handedly. In addition, given the current situation in most of the areas in the CHT districts, the BFD is unable to undertake plantation establishment programmes in a significantly large area. Alternative models of plantation establishment, including involving important parties and stakeholders in the Hill Districts, need to be formulated and implemented.
7. Rubber plantations have been successfully established by private entrepreneurs in the CHT on land leased to them by the government. While the Bangladesh Forest Industries Development Corporation (BFIDC) is incurring mounting losses, the private entrepreneurs are, even at this time of lower prices of rubber in the international markets, are making a significant profit. In order to bring more areas under tree cover and increase the production of rubber in the country, more areas can be allotted to interested private parties. However, the current size of plots, less than 10 ha, is too small for them to be viable units. Larger-sized plots will have to be allocated, and, in addition, the necessary technical backstopping and other incentives will have to be provided.
8. The causes of the large-scale failure of the BFD to successfully establish plantations need to be reviewed, and the identified problems need to be removed. There is also a case of clear lack of accountability for the chronic failures over the years, which needs to be addressed.
9. The involvement of communities, civil society organizations and credible NGOs in plantation activities needs to be promoted and facilitated.
10. Although the survival of plantations is believed to be good in the social forestry plantations, the survival in other plantations is quite unimpressive. For example, the mean survival of 22 plantation sites (total area 211 ha), involving long-rotation teak, bamboo and cane plantations, established in 2012-2013, in Chittagong South Division, dropped from 83.69% in 2014 to 41.22% in 2016²¹. This makes a very strong case for participation of communities and other entities in the establishment of plantations and subsequent protection. Establishment of a strict monitoring regime and protocol for plantations established by the BFD is extremely important.

6.4 Consolidating and expanding participatory forestry in TOF areas

The context

TOF are the main source of the timber and firewood consumed in the country. Virtually no area is without trees in Bangladesh, and an area of nearly 1.7 million ha outside the state forests is under tree cover, producing nearly 7 million m³ of timber at present. The role of TOF in meeting the demand for timber, fuelwood and other products is extremely significant. Given the current status of the forests and the moratorium on extraction from state forests, the only available

²¹ CCF's letter no. 54, dated 19 March 2017.

source for meeting almost of the demand is the TOF sector, which will continue to play a very important role in meeting the demand for tree products in the country for the foreseeable future.

Because of the aforementioned reason, it is extremely important that all help be extended to promoting tree husbandry practices outside forests. This will involve good advice and imparting know-how regarding selection of the right species, ensuring access to good quality planting stock, caring for the planted trees, arranging incentives, both financial and/or otherwise, and providing access to markets where the tree farmers get appropriate prices for their products. In addition to fruit and timber trees, a significant market has evolved in the country for medicinal plants, rubber and aromatic plants such as agarwood.

Given the great importance of TOF in Bangladesh, all-out support needs to be extended to ensure that the areas under TOF continue to grow. Massive support will require to be extended to ensure that this sector continues to flourish. Though the BFD has significantly contributed to the establishment of the culture of tree growing in the past, through several projects, this sector is now being sustained mostly by individuals and NGOs. Corporate and individual entrepreneurs are also making contributions to the growth of TOF. While individuals need technical advice and easily available quality planting material, they also need convenient marketing facilities to get competitive and remunerative prices. As there is a shortage of land for planting trees, the productivity of the existing planted area has to be improved in order to meet the demand in the future. Intensive counselling of the beneficiaries and supply of quality inputs will be required for this. So far the growth of TOF has been restricted mostly to non-government land. However, in any country where land is precious, no land can be left barren. State-owned *khas* and USF lands that are currently not being used productively need to be brought under tree cover. In addition, any barren land in the government offices and establishments, including the military establishments all over the country, provides ample scope for extending the area under tree cover. Given that individuals, communities, enterprises and NGOs are leading the tree planting programmes, the BFD should review and ease the provisions under the Forest Transit Rules to ensure that a grower does not face any hassles in harvesting and disposing of trees grown by this sector. In addition, the BFD needs to take up the roles of capacity builder, facilitator and co-ordinator among the players, including NGOs, in order to improve the coverage. As most of the funding projects are generally focused on coastal and mangrove areas, in view of their importance for mitigating climate change impacts, finding enough resources to intensify efforts to boost the homestead and TOF sector is going to be a serious challenge for the country.

Issues and challenges

1. The BFD needs to play an important role in ensuring that the areas under TOF continue to grow. However, it does not have the required manpower, resources and technical capacity to support this movement. So far, the BFD has been active in forestry extension work only when such activities have been funded by external sources through projects. These activities fold up as soon as the funds are exhausted. The BFD needs to make forest extension services a component of its core programmes, supported from its normal budget.
2. For ensuring proper support to participatory activities all over the country, the BFD needs to maintain its operational staff in all *upazilas* with officials at an equivalent status as those of other relevant government agencies. This will require a large increase in qualified manpower and other resources. As externally funded projects are not the answer to providing support to this sector sustainably, ways and means are to be

evolved to fund these activities sustainably. The main challenges will include creating a well-trained structure within the BFD, spread all over the country, which has the capacity, resources and mentality to promote and support participatory forestry activities. The BFD needs to convert the social forestry programme into a major continuous campaign.

3. Large areas outside government forests that are suitable for establishment of plantations are available in the CHT, where the BFD is facing problems (concerning access, credibility and political sensitivity) in undertaking activities. Developing and implementing innovative plantation models, involving parties acceptable to all concerned, for undertaking massive plantation programmes, under a participatory approach in the CHT will be a big challenge of the future.
4. While the Social Forestry Rules have established the rights of the collaborating participants, there are reported instances where all rights are not allowed to accrue; this undermines the spirit of participatory forestry. In addition, there are objections from some potential collaborators about the provisions of the Social Forestry Rules. These need to be reviewed and made 'participant-friendly'.
5. The use of fuelwood for cooking is still very prevalent in rural areas. This results in consumption of a significant portion of the wood produced, making less wood available for other purposes. The BFD needs to have a good programme encouraging the use of alternative fuels for cooking so that tree products are available for more productive use. Likewise, while there is a law against the use of fuelwood in brick kilns, in practice, it is used extensively in brick manufacture. The promulgation of the law has not fully borne the desired results because of ineffective implementation.
6. When the objective is to increase the area under tree cover in the country, the approach needs to facilitate the farming of trees of any type as long as they have uses. Rubber plantations have been established successfully in the country for almost six decades. While the public sector plantations are incurring losses, those in the private sector are still making reasonably good profits, even when prices has fallen due to the availability of cheap substitutes made from petroleum products and due to the age of the low-yielding variety that is being used in the country from the time the first rubber plantation was set up, in 1961. In addition, studies from Sri Lanka, Brazil and Thailand clearly indicates the high carbon-sequestration potential of rubber plants (Maggiotto et al, 2014; Charoenjit et al., 2013; Rodrigo and Munasinghe, 2011). With treatment, the wood of the rubber plant becomes durable furniture timber and is in extensive use in different countries, including Bangladesh. Likewise, agar tree farming, already taken up in both the private and public sectors, needs to be promoted. Agar oil and agarwood are high-value products for which there is a great demand in Asian countries and China. Bangladesh imports millions of US dollars' worth of medicinal plants every year. Many of these, with guidance and support, can be grown in Bangladesh. Farming of cash crops such as medicinal plants, rubber and agarwood needs to be promoted through implementation of necessary measures, research and extension support and facilitation.
7. At present there are no timber markets where the producers and consumers/traders of timber can interact and determine a fair and competitive price. All timber marketing at present is opportunistic, and there is a chance of one party being cheated by the other. This situation is also true for other tree products. Developing a sound marketing system

is a primary requirement for the growth of this sector. However, it will be a challenging task as it will require developing a huge infrastructure and motivating sellers and buyers to participate in this endeavour.

8. Credible NGOs, which are good at motivating communities, can play a major role in participatory forestry endeavours. Further, brainstorming may be required to explore and design an appropriate modality through which NGOs can play a more significant role in participatory forestry programmes, especially in bonding the government agencies (including the BFD) with local communities. Many NGOs have already raised large participatory plantations in accordance with the benefit-sharing norms of the BFD under the Social Forestry Rules. Most of these NGOs are dependent on external funding. Providing sustained capital to NGOs to take up social forestry projects is a challenge. Rather than depending upon external funding, national channels for financing NGO programmes need to be identified/strengthened.
9. Involvement of a potent and viable private sector, which is making valuable contributions to the economy of the country, in tree farming can be a game changer in the future. This will require the creation of an enabling environment through provisions for support and incentives. This will require the forestry sector to move out of its comfort zone and agree to work in partnership with the private sector and/or arrange the incentive and supports needed to promote the involvement of the sector in the development of an enhanced tree cover in the country in the future.
10. Most of the private plantations source their planting stock from private nurseries. Although there are more than 10,000 private nurseries in the country, there is no quality assurance system for their planting stock. The quality of the planting stock primarily depends on the source of the seeds, which often is in the forest areas. Production of sufficiently high-quality seeds of popular species and creating a supply network across the country will require a big effort from the BFD and the Bangladesh Forest Research Institute (BFRI).
11. In most countries, agroforestry is the backbone of the TOF sector. However, in Bangladesh, agroforestry is limited to encroached forest lands. As agricultural land holdings in Bangladesh are very small, it is important that suitable agroforestry models involving mixtures of agricultural crops and tree crops suited to various climatic zones be developed and popularized. Such models can give better returns compared with agricultural crops alone. In addition, an integrated farming system that ensures generation of financial benefits early on, involving timber, fruit and other plant products, has been successfully tested in the Hill districts, and it needs to be scaled up and promoted.
12. The Forest Transit Rules are reported to be an important hindrance to the popularization of private plantations as people need permission from the government for cutting and transporting timber and other tree products even though these originate outside forest land. There are rampant allegations of harassment, corruption and delays in the issuance of transit passes. Rationalizing the transit rules is a major issue as foresters are reluctant to dilute them any further, despite the fact that most of the natural forests which were meant to be protected with the help of these rules have already been devastated.

6.5 Meeting the growing demand for wood and non-wood forest products

The context

Due to the moratorium that has been imposed and large-scale destruction of tree resources in the forests of the country, the current need for forestry products, except for some imports is met entirely from local sources of trees outside state forests. Although no reliable data on the subject are available, the best estimates indicate that the current annual consumption of timber in the country is nearly 8.57 million m³, of which approximately 1.57 million m³ is imported timber. If the rate of consumption persists at the current level, the demand is likely to reach 9.77 million m³ and 10.62 million m³ in 2030 and 2050, respectively.

However, the consumption of fuelwood is likely to decline from the current level, primarily due to the decline in the proportion of the population using firewood as a cooking fuel. Pulpwood is another item in short supply. The Karnafully Paper Mill, in Rangamati District, the largest paper mill in the country is unable to produce at full capacity because of non-availability of the required quantities of bamboo and pulpwood, its raw materials. The large private sector paper industry depends largely on imported pulp to meet its needs. Bangladesh imports a major portion of the rubber it needs for its domestic consumption. Honey, beeswax, medicinal plants, *golpata* (*Nypa fruticans*), *murta* (*Schumannianthus dichotomus*) and a variety of bamboos are the major NTFPs produced in the country. While the demands for some of these have decreased, the demands for bamboo, rubber, pulpwood, medicinal plants and honey will continue to rise. Medicinal plants have tremendous potential. They are available in the forests and can be grown in agroforestry plantations and/or as monocultures, depending upon the species of interest. However, as the status of most medicinal species in the wild is unknown. Any plans for conserving or exploiting them can be prepared only after a proper assessment of their status in the wild.

Issues and challenges

1. The demands for timber, industrial wood and rubber will continue to increase steadily. Given the limited land available for growing TOF, it will not be possible to meet the demand for tree products indefinitely from TOF. An assessment needs to be done to find out ways and means to meet the future demands.
2. In the absence of a correct assessment of the actual demand and supply of timber in the country, it will not be easy to figure out and plan how this demand can be met. All land suitable for afforestation/reforestation in private and public institutions should be brought under tree cover using both conventional and new and innovative approaches.
3. Brick kilns, mostly using the banned, outdated and energy-guzzling fixed chimney kiln (FCK) technology, are very significant but illegal, consumers of firewood. Nearly 4000 brick kilns were estimated to be using nearly 2.00 million m³ of firewood annually in 2004 (Hossain and Abdullah 2012), this mostly coming from TOF. The demand has grown exponentially as the current number of brick kilns is estimated to be close to 8000. Quoting local foresters, *The Daily Star* (5 June 2012) mentions a consumption of 12 crore cubic feet (approximately 3.4 million m³) of firewood by brick kilns in the country. Despite the ban on the use of firewood in brick making, and the ban on FCKs, which are most energy-intensive and polluting kilns, almost 33% of the fuel used in the brick

industry is estimated to be firewood. There is a ban on the establishment/continuation of kilns within a 2 km radius of public forests, but kilns continue to function in prohibited territory. Forest Officers have been empowered by the Brick Manufacturing and Brick Kilns Establishment (Control) Act, 2013 to inspect brick kilns, but this power is not very effective in curbing this practice, essentially due to the cost of alternative fuels, conversion to new technologies or shifting to new locations.

4. At present, there is a moratorium on the exploitation of the tree resources of the state forests of the entire country. Moreover, given the current degraded condition of the forests, they are not likely to contribute much to meeting the demand for wood products, even if there was no moratorium. Efforts should be made to restock and enrich these forests so that these become productive.
5. While TOF are the main sources of tree products in the country, there are no comprehensive plans for extending the backup necessary to ensure that the sector grows in the right direction. Help and the required facilities need to be provided.
6. In the absence of any promotion, incentives and extension of the necessary facilities, there is very limited commercial involvement of the private sector in tree farming. Some arrangements should be made to provide incentives for involving the private sector in tree farming activities. Many business houses are interested in taking up captive plantations in partnership with the government but are unable to do so in the absence of a suitable policy framework. Examples of support can be drawn from our neighbouring countries.
7. Land suitable for plantation establishment is available in both private and public sector institutions and enterprises. There is no effort to bring these lands under tree cover.
8. While NTFPs have a significant demand in the country, they has not been developed into an organized sector. Steps need to be taken to institutionalize the production of commercially viable NTFPs after identifying and assessing the market size correctly.
9. Given that the demand for tree products cannot be met locally currently, there is hardly any significant effort to incentivize and promote the development and marketing of wood substitutes. Attempts need to be made to promote the production of wood substitutes at reasonable/affordable prices to meet partially the demand for wood products.

6.6 Arresting the loss of forest land

The context

Loss of forest land is a major problem faced by the BFD. There are two major reasons for the loss of forest land. These are encroachment and transfer of land to other organizations. BFD records show that 104,151 ha of forest land has been encroached upon. Large areas in the CHT are reported to be encroached upon and converted into human habitations and in all probability, because of the current law-and-order situation in the hills, it has not been possible to make an estimate of the loss of land. So, it is very likely that this quoted figure is significantly lower than the actual area under encroachment. According to BFD records, a total area of 125,626 ha of forest land has been transferred to other agencies, with a major chunk transferred to defence and law enforcement agencies. This is unlikely to be reflecting the actual situation. No forest land in the entire country has been demarcated on the ground, and there is no information available on whether the records and maps maintained by the BFD showing the

forest land in the country match the records maintained by the Department of Land Records. Sixty-six percent of the transferred land has been transferred to institutions that will use the land for non-forestry/non-plantation purposes, while the area transferred to the BFIDC is being used to raise rubber plantations.

Issues and challenges

1. The absence of boundary lines and pillars delineating the forest boundaries, or any other means of readily recognizing forest boundaries, makes encroachment easier along the periphery of forest estates. In addition, detailed maps and descriptive land records are not available. Demarcation of forest boundaries, fixing boundary pillars, recording the GPS co-ordinates of each pillar and creating and regularly upgrading records are among the steps to be taken immediately. The land records maintained by the BFD need to be tallied against the records maintained by the Department of Land Records. The current level of resource availability and the lack of manpower to undertake the specialized task are major challenges in this regard.
2. A shortage of staff and the other facilities needed to carry out regular patrolling of forest lands, weak protection of forest lands, lax punitive measures and the long time taken at the courts of law are among the main reasons for the encroachments. The current strength of the field-level staff at the forest beat level, together with the tools at their disposal, is highly inadequate for the protection of these tracts. In addition, the long time taken to complete the process of reservation of the Dhaka-Mymensingh sal forest area has led to the dispossession of a large chunk of forest in the region. Improvement of the protection measures, quick disposal of court cases and involving local communities are among the major challenges.
3. As the extent of encroached forest areas is large, special measures need to be initiated, if necessary through promulgation of new legislation, for swift disposal of court cases and quick eviction of encroachers. In the past, forest officers were authorized to evict encroachers. This is not the practice any longer. The current practice, where a magistrate conducts an inquiry before an eviction is carried out, is time consuming and allows the encroacher to consolidate his position on the land. However, arrangements need to be made for quick eviction of encroachers. In addition, measures need to be taken to ensure that the encroachers do not return to the encroached land after the eviction. However, the question is whether the BFD or the Ministry of Environment and Forests (MoEF) can muster the support needed to be able to pursue this option.
4. Forest cases lodged in the courts of law are often not properly formulated and documented. The witnesses often do not turn up or are unable to provide a credible account of the offence. The Case Conducting Officers who represent the BFD are also not trained to handle court cases. Although there is a system of engaging advocates on a retainer basis, in most cases in various courts, no lawyer represents the BFD! It is important that the staff members who file cases be adequately trained and a lawyer be at hand to represent the BFD in the courts.
5. Forest land has been transferred to other agencies on several occasions. Normally the area of the land is large. Given the fact that the country has limited area under forest cover, transfer of land for non-forestry purposes should be discontinued immediately.

However, given the need for land development projects, dealing with this pressure is going to be a major challenge for the forestry sector.

6. The currently available legal tools are inadequate to handle encroachments and transfer of land for non-forestry purposes. The currently enforced legal tools need to be reviewed and updated so that these can act as deterrents against encroachment and also make transfer of land, even legal, for any non-forestry purposes difficult.

6.7 Combating impacts of climate change on forests

The context

Among the countries, Bangladesh is most vulnerable to the impacts of climate change. The changes in the temperature regime, patterns of seasonal rainfall and intensity and duration of floods, rising sea level in the Bay of Bengal and frequent extreme events in Bangladesh offer a set of diverse and complex challenges to its forest ecosystems and forest-dependent communities. Owing to its geographical diversity extent, the challenges faced by different forest ecosystems will vary. Since the exposure and sensitivity of particular forests to different climatic stressors (temperature, rainfall, sea level rise (SLR), etc.) is different, the challenges faced by the various forests will be unique in terms of spatial and temporal dimensions. For example, the set of challenges and their level in the south-eastern hill forests of Chittagong might be different from those of the the south-western mangroves in the Sundarbans.

While climate change and its impacts are real, it is often difficult to assess the timing, intensity of impact, etc. until the last minute. It is also extremely difficult to assess the magnitudes of the various impacts of climate change. As a result, the options of direct measures to minimize these impacts are very limited. In addition, the causes of these climate change-related impacts do not arise within the boundaries of countries such as Bangladesh. Indirect measures, mostly mitigative and adaptive in nature, need to be taken to ensure that the impacts of climate change are minimized.

The forests, particularly the Sundarbans, face severe adverse impacts of climate change. Any significant rise in the sea level will permanently inundate a section of the forest, making it unsuitable for mangrove trees, which cannot grow in stagnant water. The extent of the submersion will depend on the actual sea level rise (SLR). The plantations on the coastal mudflats will also face a similar fate. While the rise in temperature may improve the productivity of forest ecosystems, different species will be impacted differently, depending on their inherent capacity for tolerance and resilience to this disturbance, and this may influence their flowering and fruiting. Similarly, erratic rainfall patterns, together with the changes in temperature regimes, may change the biological rhythms of different species, causing disruption of normal flowering and fruiting. The SLR, together with an ever-increasing withdrawal of fresh water from different rivers upstream, will cause a significant increase in salinity intrusion further upstream and an overall increase in the salinity of river waters, which is expected to change habitat conditions, resulting in habitats becoming unsuitable for some species, particularly the less tolerant *sundari*. This will lead to a change in the species composition, with more salinity-tolerant species such as the *gewa* being dominant. The destruction of hill forests has resulted in changes in the edaphic conditions, with soils becoming drier and desiccated and the topsoil getting eroded in many places. This condition may not be suitable for the original crop of trees the site supported. This situation has further been aggravated by the changes in the rainfall and temperature regimes, which are pronounced in some forested areas. The denudation of forests

has resulted in a significant shrinkage in the size of the carbon sink, which, however, has to an extent been compensated by the increase in the area under TOF.

Nath et al. (2014) studied earnings from homestead forests in the Cox's Bazar-Teknaf Peninsula and found that due to repeated inundation by tidal surges, the mortality of betel nut trees is on the rise and homesteads are earning less compared with non-affected areas. Such a situation is also very likely to change the homestead vegetation composition in coastal areas, where tidal surges are regularly experienced and the rainfall is not able to flush away the salinity of the soil.

Trees play a proven role in mitigating the impacts of climate change. The objective, in this case, will be to bring as much land as possible under tree cover, regardless of species, in the country.

Issues and challenges

1. While climate change is a stark reality and its impacts are expected to be disastrous, the forestry sector in Bangladesh has not been able to address the issue at the level of seriousness it warrants. It has very little capacity, understanding and know-how regarding handling this steadily emerging threat. Further, it has also not deployed adequate resources, developed capacity or established institutions for implementation of the relevant components of the Bangladesh Climate Change Strategy and Action Plan, 2009 and has so far been dependent on the intermittently available funds from external sources. This need to change and address the impacts of climate change on the forestry sector needs to become a top priority.
2. Very little is known about the various impacts of climate change on species, forests and ecosystem services in Bangladesh. At present, most of the assessments are based on certain assumptions. In order to gain a better understanding of these impacts, so that proper actions can be taken to ensure protection against the impacts of climate change, considerable research work and networking and exchange of information and experiences with countries in similar situations need to be undertaken. Informed interventions can be formulated and implemented then.
3. As it is not possible to assess correctly the magnitudes of the impacts of climate change and combat them, necessary mitigating and adaptive measures need to be taken to minimize or, if possible, neutralize these impacts. This will require correct identification of possible impacts and will require research, assessment and studies, for which adequate capacities do not exist in the country. There is no research facility capable of handling research on various aspects of climate change and what needs to be done to minimize the impacts of climate change. The necessary measures need to be taken in this respect. This will require trained manpower and resources that are not available at this time.
4. Preparedness to face impacts of climate change will include establishment of a physical barrier comprising trees, in the form of a shelter belt, all along the coast of the country, with climate-resilient species. A study on the creation of a green belt all along the coast of Bangladesh was carried out by CEGIS under the Climate Resilient Afforestation and Reforestation project. This study covered 37 coastal *upazillas* of nine coastal districts and proposes to establish 126,748 ha of plantations and establish a continuous belt of trees as a protective measure against storms from the sea as well as to support aquaculture and production of fruits, vegetables and spices. The estimated cost of the

project is Tk.20.9 billion or \$261.4 million over a period of 7 years. This estimate costs do not include the cost of land acquisition, which will be needed if a continuous belt of trees is to be established along the coast. This is a massive, costly task. At this point of time the BFD does not have the capacity to implement such a project. Among the major issues is availability of land where coastal accretions are not available. Acquisition of private land is not going to be easy. There is no legal framework in place for providing legal coverage to the undertaking. In addition, the coastal plantations, which will form a part of the shelter belt, are not permanently vested with the BFD. The necessary resources, legal coverage and other tools need to be made available to ensure the success of the establishment of this important protective measure against storms from the sea.

5. Research on the possible impacts of climate change and how best these can be addressed needs to be carried out. In addition, physical indicators need to be identified and monitored to evaluate the changes in the biodiversity and other components of sensitive forest ecosystems. The capacity for carrying out this task is barely in existence.
6. As enhancing the tree cover is important as a measure, it is important to bring as much available land as possible under tree cover with any tree species. This will require bringing all the denuded forests together, along with all other available and suitable land, under tree cover. This is a massive and challenging undertaking, which is beyond the BFD's current capacity to handle. In addition, because of the situation prevailing in the CHT, innovative models acceptable to all parties will have to be implemented.
7. It is apparent from the past experience that protecting the existing plantations is a serious problem. Poor plantation practices, inadequate protective measures and a lack of accountability are among the main causes of this problem. Accountability must be imposed, and appropriate legal tools, manpower and logistic support will have to be made available to ensure the protection of the plantations. The BFD currently does not have the manpower and resources.
8. As the area under tree cover is larger outside forests than that in state forests, it is important to promote the practice of tree planting outside forests so that the area under tree cover outside forests continues to grow steadily. This will warrant the establishment of extension facilities all over the country, encouraging NGOs, the private sector and civil society organizations to join the programme, and will make the rules and regulations covering the TOF more tree grower-friendly. Manpower and resources, neither of which is available with the BFD at the present time, will be intensively required.
9. Deforestation and degradation of the ecosystems are causing loss of biodiversity, food insecurity and poverty. In practice, forest management is focused on forestry operations only. In fact, an integrated approach towards landscape management that increases synergies among multiple land-use objectives is required. Better coordination among the players, building their capacity, adequate funding and above all, the interests of all stakeholders in both protecting and raising new trees are vital.
10. The capacity of the forest sector to respond to climate change is low in general. Practitioners and decision makers are not always equipped with the information and tools, or have access to the information and resources, to enable the most effective

responses to a changing climate. Therefore, capacity building at the national and local levels will be a key issue as well as a challenge for the sector.

11. The resilience of forest ecosystems to the impacts of climate change can be enhanced by minimizing the fragmentation of forests and maintaining connectivity among ecosystems. But this is easier said than done. Given the priority of development, the balance between development and conservation will remain a challenge even in the face of climate change.
12. A large part of the hill forests lies in the CHT districts. For any forestry programme to become effective, this area needs to be brought under tree cover, with support from and the participation of all the stakeholders. Both afforestation and reforestation in the CHT are very important to face the adversities of climate change.
13. Funding opportunities for climate change research in relation to the forestry sector are very limited. An intensive effort is necessary to identify research priorities and funding mechanisms and to effect institutional co-ordination, to facilitate research and to integrate knowledge into practices.
14. The forest-dependent communities need to be motivated and enabled to diversify their livelihoods. This will enhance their climate resilience aspect.
15. To ensure an efficient and coherent policy approach to forests and climate change, policy makers need to integrate climate change strategies and plans with the National Forest Policy framework and the sectors that affect forests. Equally importantly, there is a need for institutional reforms to strengthen their structures, operations and capacities. At the current level of capacity, the BFD cannot support regular forestry operations, let alone take on the burden of combating climate change.
16. Climate change being a multidimensional phenomenon, strong co-ordination and close co-operation between various state organizations, research institutions and universities are required in order to develop a comprehensive response based on complementarities and pooling of strengths and resources. The fact that the Bangladesh Climate Trust Fund has not funded any significant forestry programme so far, despite forestry being the principal mitigating tool, is a sad example of the lack of co-ordination between various players.

6.8 Revitalizing forestry institutions

The context

All the major forestry sector institutions are suffering from a whole variety of human resource-related and other institutional problems. These include shortage of manpower, inadequate capacity building, inadequate facilities, insufficient funds and a number of other malaises. This situation is making it impossible for these institutions to discharge their respective mandates properly.

As discussed in Chapter 4, nearly all the institutions in the forestry sector are reeling under a huge number of vacancies in their ranks. While the BFD has 24% of all posts vacant, the vacancies in the BFRI, BFIDC and BNH are 33%, 44% and 30%, respectively. Despite the glaring shortage of officers, the BFD has recruited only eight officers after the 2003 intake. The situation is equally bad in the case of other lower-level positions. Currently, out of 403 positions,

224 are vacant. Most of the currently serving Forest Rangers are retiring in the next 2 or 3 years, and so a huge number of vacant positions will be created. To complicate things further, the BFD has stopped direct recruitment of Forest Rangers after 1995! While there are 454 sanctioned positions of Deputy Rangers, 446 are lying vacant! The situation is better in the case of Foresters and Forest Guards. The recruitment policy has been badly revised without taking into account its long-term adverse consequences! Recruitments have essentially been done without proper planning! As regular recruitment of staff members at different levels has not taken place regularly over the years, the five training facilities run by the BFD have remained idle.

Ad hoc recruitment of officials for projects and their retention after the end of the projects have created a different kind of problem. These officials, who did not undergo the basic probationary training and did not sit for the qualifying departmental examinations, which are essential for holding certain positions, have been entrusted with important responsibilities as they have crossed the age limits for these examinations. Whereas these officers have gained years of valuable experience, performing diligently the duties assigned to them, with many of them having acquired advanced qualifications including Ph.D. and master's degrees and advanced post-graduate diplomas in the relevant disciplines, they cannot be promoted to the senior positions, which is a huge demotivating factor for them. This group of 80 well-trained officers currently forms the most experienced group of professionals in the BFD, and it is more in the interest of the BFD that the issues involving their recruitment be resolved soon. These and other out-of-turn recruitments, in the lower-level positions of the BFD, have led to serious discontent and institution of court cases, which are interfering with the normal human resource management functions of the BFD.

The abolition of direct recruitment of Forest Rangers has not been prudent. The position of Forest Ranger is the most important field position, and with the management of forests becoming more technical, it is important that this position be mostly assigned to people who have the kind of background needed. Doing away with the age-old practice of training for the positions after recruitment, the current rule allows only recruitment of Diploma in Forestry holders for the positions of Foresters. The diploma is offered by only one institute in Chittagong, which is run by the BFD. It is reported that because of a shortage of adequately trained instructors and the required facilities, the quality of the graduates of this institution is often not what is desired. The Forest Academy, which is supposed to train newly recruited ACFs, has not run this course after 2004 because of a lack of availability of trainees. Likewise, the Forestry Development and Training Centre (FDTC), which was running with donor support from the beginning, has not been active since 2004, when funding ceased! The new Wildlife Centre for training wildlife officials has been established in Gazipur with World Bank funding. This brand new outfit is unable to fulfil its mandate because the donor funding has ended and there is no money available for covering the costs of basic maintenance. All the older training facilities are in urgent need of repairs and restoration, which have not been undertaken for a long time because of a shortage of funds.

Proper training to make a person qualified for field-level forestry jobs cannot be carried out through academic programmes at educational institutes. Some part of the very important training and capacity building can only be done through professional training schools like the ones run by the BFD. It is essential that all new recruits undergo a few months of training at relevant BFD-run training facilities. In addition, in-service and capacity building training programmes should be arranged regularly.

All the training institutions are in poor physical condition because of a lack of proper maintenance. They need restoration and, in some cases, reconstruction. The FSTI in Sylhet is in the worst condition, with most of the buildings falling apart and no longer repairable. This institute, with almost 15 ha of land and located in a quiet suburb of Sylhet is ideal for development into a more comprehensive training facility. Some other training facilities need additional buildings or extension of the existing facilities. None of the training institutions have any dormitory for training female staff members. Such a facility is a necessary component of capacity development because female staff members have been joining forestry jobs down to the Forester level. There is no suitable vehicle available for transporting trainees during their frequent field study trips.

The single-tier field-level set-up of the BFD at the forest division level, which is supposed to handle conservation, management, protection and plantation establishment, is inadequate for meeting the emerging and existing challenges. Although a number of new units have been created under the Social Forestry and Wildlife wings, they are not empowered and do not have the necessary resources. Out of the seven wildlife divisions, four are virtually defunct as the SRCWP project, under which these divisions were created, has ended and most of the staff have been retrenched. They do not have even DFOs now.

The human resources situation at the Bangladesh Forest Research institute (BFRI) and Bangladesh National Herbarium (BNH) is no better. Almost half of the positions of senior-level research scientists and an overall 33% of the posts in the BFRI are vacant. The recruitment rules of the BFRI have not been revised after 1985. Though it is a facility for forestry research, forestry graduates are not eligible to apply for employment at the BFRI! The scientists have very limited access to the Internet, and the library does not have current issues of relevant journals and other research publications. There is very little opportunity for career progression or any other incentive to work at the BFRI. Likewise, at the BNH, half of the senior positions and almost a third of all the positions are lying vacant! These research entities are run like other government agencies with no local autonomy. Every recruitment initiative requires to be processed through a lengthy, bureaucratic, time-consuming process. These institutes also lack the incentives necessary to attract researchers.

The human resources situation at the BFIDC is even worse. Only 64.5% of the management positions are currently filled. There is an acute shortage of skilled manpower among both the management and field levels. For example, while raw rubber production is one of the two main components of the BFIDC's activities, there is not a single expert on rubber on the corporation's payroll! Many of the top decision-making positions, including that of the Chairperson, are filled up by officials on deputation, who necessarily do not have the required experience, skill, ownership and motivation needed to run such a commercial entity. The BFIDC has not been a profitable organization and will continue to remain so unless there is a major overhaul and manpower and other resources are made available.

A major weakness of all these institutions is related to the nearly complete lack of human resource management, including career planning, recruitment, capacity building and human resource development. The management activities in these organizations are run on an ad hoc basis. This has precipitated a situation where there is a huge shortage of manpower and capacity in all the forestry sector institutions, which is greatly hampering the discharge of their mandates. In addition, in the case of the BFD, the shortage of manpower is so acute and has so badly been compounded by administrative issues, litigations and other complexities, that the

current staff strength is inadequate for overseeing the routine activities, let alone implementing the ambitious recommendations this master plan revision exercise is going to make.

Issues and challenges

1. The large numbers of vacancies in all the organizations need to be filled quickly but in a planned manner. Recruitment of large batches will create cadre management problems later, while keeping the vacancies lingering will prolong the problems.
2. In the case of the BFD, there is no quick fix solution available to fix the current mess. While a solution has to be found to fill the vacancies at the top, a viable solution to the shortage of officers in the cadre has also to be found, without creating long-term problems. The problem can be resolved only by undertaking a planned, time-bound induction so that this situation can be resolved in the next 10 years. The organization also needs to re-organize itself, update recruitment policies and rules and make sure that it has the appropriately qualified personnel available for all positions.
3. The BFD is unable to play a more significant role in the promotion of TOF as it does not have many staff members on the ground. The demand for having an ACF office in each *upazila* has been under consideration for quite a long time. The BFD badly needs to expand and reorganize its structure in order to cope with its growing responsibilities. The BFD has proposed a total staff strength of nearly 14,000, while the current strength is less than 8000. The MoEF is reported to have agreed, in discussions, to consider the case for a new set-up of 13,992 members. In the new proposal, the *upazila*-level office is headed by a Forest Ranger, not by an ACF.
4. To shorten the induction period, it is advisable to temporarily recruit only forestry graduates in the BCS (Forests) Cadre, who will not require any academic training in forestry or wildlife, and thus the time taken by them after selection will be at least a year and a half less than that of those coming from other unrelated disciplines. This will require a revision of the recruitment rules. Whether the huge number of forestry graduates will be available for recruitment is another issue to be considered.
5. Recruitment at the Forest Ranger's level was discontinued after 1995. This position is very crucial in the field administration of the BFD. Given the gradual modernization of management practices, incumbents at the Forest Ranger's level will require higher levels of education and capabilities, including computer literacy, which the current lot of Deputy Rangers, whose entry-level required qualification was the higher secondary when they joined as Foresters, will find difficult to handle. The matter needs to be reviewed, and fresh recruitment at Forest Ranger's level needs to be initiated for at least 66% of the Forest Rangers' positions. As the Forest Ranger is a class-II position, the required academic qualification can be a university degree in forestry. However, given that the forces that have been responsible for the current ill-advised recruitment policy will continue to be active, it will be a major challenge to implement such decisions.
6. The current pattern of recruitment, particularly in the BFD, does not follow any norms or plan and is done on an ad hoc and unplanned manner. In order to avoid recurrence of the current situation, the BFD needs to formulate and implement a long-/medium-term recruitment plan for all levels of officials taking into consideration the expected vacancies resulting from retirements and newly created positions. Again, the implementation of such a plan hinges upon the resolution of the human resource-related problems and

issues. Because of the change in the recruitment policy (switching over to forestry graduates only), basic forestry training may not be required to be imparted, and the roles and responsibilities of the different academic and training institutes under the BFD need to be reviewed and refocused. The current staffing arrangements at these institutions also need to be reviewed, and, given the dearth of qualified officers from the department, the possibility of recruitment of qualified teachers and instructors from outside should be explored. In the event that this proposition is pursued, a clear career advancement plan for such recruits (specialists) will have to be put in place. An incentive system to attract quality faculty members to these institutions needs to be put in place.

7. At present there is no system of induction training. Officers are sent for university degrees whenever an opportunity arises, while there is no system of induction training for new Forest Guards and Foresters (Rangers are not recruited directly). Imparting proper induction training for all the newly recruited officers and subordinate/technical staff members must be ensured. No official should be given charge of a substantive position before such training is completed. None should be given the charge of a forest division until and unless he or she successfully completes the departmental examinations and a forestry degree.
8. Various anomalies, discords and litigations created by out-of-turn recruitment are adversely affecting the smooth functioning of the BFD. Rangers have gone to court against the recruitment of non-cadre ACFs. The Foresters' recruitment rules have been struck down by the High Court because they were framed during the dictatorship period. These issues need to be resolved immediately through whatever means it takes. There are many possible options. However, as no solution can satisfy one and all, it is advisable to constitute a high-powered commission to look into the issues and make binding recommendations, which all the involved parties will have to accept. This will require an intervention at the highest level in the government.
9. The current bureaucratic procedures associated with recruitments at the BFRI and BNH are making recruitments difficult. The recruitment rules of the BFRI are grossly inadequate and out of sync with present-day reality. Nearly all the recruitment/cadre rules need to be amended to fix the problems faced by the BFD at present. Career progression at the BFRI is very slow, and there is very little or no incentive for researchers. The 30+ year old recruitment rules of the BFRI need to be urgently revised to bring them in line with the current time and needs. Fixing all these issues will be a serious challenge for the sector as the procedures are long and complex.
10. The training institutions of the BFD are in a state of continuous decay and decline. Although most of them have good infrastructure and facilities, they are extremely short of trainers and money for operating expenses. In fact, all of them are, almost, without any teachers. There are no regular training programmes in the Forest Academy although the FSTIs are busy running diploma courses for Foresters. Although most of the training is done through guest faculty members, there are no funds for paying honorarium to the guest teachers, in FSTIs, for teaching the Foresters' courses. Nearly all their training (other than the diploma programme) activities are linked with projects.
11. Apart from administrative issues, the most serious problem for the BFD is the shortage of funds for operating expenses, for routine activities such as staff travel, prosecution of criminals, patrolling of forest areas, maintenance of buildings, vehicles and equipment,

etc. It is really shocking to hear that field staff members, below the DFOs, have virtually never got any travel expenses. Because they keep travelling, it is evident that travel expenses are eked out from somewhere else, creating scope for corruption. The BFD is able to support these functions only in areas where some internationally funded project is under implementation.

12. Without taking care of these core activities of the BFD, it is futile to expect any quality performance from the BFD.
13. The forest and wildlife laws in Bangladesh are out of sync with the times and current realities. For example, the field staff of the BFD, below the Forest Rangers' level, is not empowered to take action against criminals under the Forest Act, although the staff members have been taking action erroneously, all along. Field staff members have been recruited under several new designations (Wildlife Rangers, Wildlife Inspectors, Wildlife Scouts, etc.) that have not been notified as 'forest officers' under the Forest Act and cannot exercise any powers vested in forest officers under any law. Forest officers have no power to arrest a wildlife poacher due to a defect in the Wildlife Act. Wildlife outside forest areas is not forest produce and thus cannot be protected under the Forest Act as the Wildlife Act is not yet operational. No rules have so far been framed to implement the Wildlife Act, and no notifications have been issued to empower any authorities to exercise powers under the Wildlife Act. The Forest Transit Rules are a hurdle to the growth of TOF.
14. As mentioned previously, the BFIDC is experiencing a huge shortage of staff, particularly at the senior level, as well as an acute shortage of experienced staff. The top positions are mostly occupied by civil servants and other officials who are posted there temporarily. Under this practice, there is little opportunity for building expertise and developing a sense of ownership. There is an urgent need for rationalizing the staffing so that costs can be minimized without sacrificing quality. As a technical and professional institution, the BFIDC needs to develop its own professional capability.
15. Capacity-building opportunities should be given to research scientists by providing opportunities for pursuing advanced-level research programmes in Bangladesh and abroad. The opportunities for promotions at the two research institutions are limited. Often a scientist spends long years in a particular position and at a particular pay scale. In the absence of any clear career progression, incentives in the form of time scales can be introduced under clearly spelled out conditions.

6.9 Strengthening data and information management, monitoring and evaluation capacity

The context

The general state of information and data management within the BFD is dismal. There is hardly any systematic effort towards data collection, documentation or cataloguing and storage of reports, publications, forest maps and official records, including the land records of the department. The library is in a very poor condition, and in the absence of any cataloguing, it is extremely difficult to locate a document, even if it is available.

Very little information on the growth and yield of important species and forest stands has ever been generated. This information is fundamental to preparing forest management plans.

Prescriptions in connection with the natural forest, plantations, protected areas, etc. cannot be formulated without basic forestry data. These data are neither generated nor stored properly.

The BFD has a Resource Information Management System (RIMS) unit, which is supposed to act as a depository of all forestry information and monitor the changes in the forest cover. In addition, another dedicated office (DCF Monitoring and Evaluation (M&E)) is officially responsible for the monitoring forestry activities carried out by the BFD. The RIMS unit is grossly under-staffed and under-resourced and is entirely funded by donors. Under the current salary structure, some of the positions can possibly never be filled. However, the current task of this unit is only to monitor the seedling survival in plantations in the first and third years after their establishment using the staff of the Forest Management Divisions and to raise and distribute seedlings to the public under social forestry programmes. Actually the main function of the M&E unit is to compile the reports received, conduct some cursory field checks and submit them to higher officials. This function of the M&E unit is grossly inadequate, as indicated by the large-scale loss of natural forests. Plantations could possibly have been more successfully established, and measures for protecting them instituted, if there had been a robust monitoring system in place. There is no system in place in the BFD for digitizing personnel, institutional or technical reports, and it is often impossible to retrieve any document that is printed on paper. The library has the physical facilities, but in the absence of proper cataloguing, locating a document is a time-consuming task. The ICT infrastructure at the field level is either non-existent or very poor. Even the headquarters do not have their own set-up, and most officers use public domain email addresses such as Gmail and Hotmail.

None of the other sectoral institutions have any system of modern information management or effective monitoring.

In a situation where there is large-scale loss of forests and failure of plantations, a sound monitoring system for keeping track of the status of natural forests, as well as the condition and status of existing plantations, both newly established and old ones, is particularly important. Other sector organizations also need to upgrade their data management capabilities and put in place an effective M&E system to enhance the efficiency with which different tasks are carried out.

Issues and challenges

1. There is no depository for management information and for the safekeeping of important documents such as land deeds and maps of different forests. When documents are needed, it is extremely difficult to locate them. Creation of a depository with branches down to the range level is extremely important. Modern technologies make it easy to store and retrieve such documents and maps. However, creating such a facility at the BFD will not be easy because of the lack of know-how and resources and the inability of officials to handle any modern systems. Other sector organizations also need to set up similar facilities.
2. Over the years, the BFD and BFRI have generated a lot of information in the form of working plans, project-based documents and research publications. The BFD, in particular, has not been able to retain many of these documents. In many cases, not even a single copy is available. The library maintained at the BFD headquarters is totally disorganized, with no cataloguing, and finding a specific document requires checking the titles of all the documents one by one. The FRI and BNH also need to upgrade their

libraries. Securing funds for upgrading the libraries and building capacity to manage modern libraries is seen as a challenge.

3. There is no facility for management of the generated data and other important information in any of the sector organizations. Easy retrievability of data is a fundamental prerequisite for any modern management and administration regime. The rudimentary facility in the BFD needs to be upgraded in terms of manpower, the required facilities and resources.
4. To be able to put in place such a system, a strong ICT infrastructure and trained manpower are required. Development of the ICT infrastructure down to the beat level in the BFD and up to the field level in BFIDC and the establishment of the necessary data collection and analysis protocols will be a big challenge for a resource-starved organization. A lack of adequate ICT infrastructure and manpower is a major hurdle in data management, regular communication and building adequate monitoring capabilities. As most of the development work in the forestry sector organizations is supported by short-term donor-funded projects, creating an environment for such qualitative development has been difficult so far. Trained manpower for data management is lacking in all the sector organizations. In addition to procuring the necessary expertise for data management, extensive training programmes will have to be undertaken to familiarize the staff of a sector organization so that they are capable of participating effectively in this effort. The government systems traditionally depend on career civil servants who settle for a secure career for a lifetime. However, modern technologies, which are the backbone of modern enterprises, need a proper hiring and firing policy to attract and encourage quality staff and to get rid of any deadwood. Without such an approach, it will be difficult to establish a functional and useful information management unit in any organization. However, making the top management understand this need, obtaining resources and attracting experts on government salary scales are major challenges.
5. Determining how to allow RIMS the independence and flexibility to become an efficient technology hub for the BFD is going to be a huge challenge.
6. The quality and efficiency of a monitoring system depends on the quality of the data collection and generation systems. As the number of people involved in capturing, pooling and transmitting data for the monitoring network is huge, the quality of this data is often uneven and questionable. In any new M&E initiative, training and motivating the field staff to produce quality data at assigned frequencies is a challenge. It has to be a regular exercise due to the continuous retirement, transfer and recruitment of new staff members. Monitoring and data management are considered routine tasks like the others in the BFD. This perception needs to change, and these should be accorded the attention and support they need.

6.10 Upgrading the capacity of forestry research institutions

The context

Forestry research in Bangladesh is carried out by the BFRI, the BNH and three universities where forestry is taught as a part of the academic curriculum. While the universities carry out mostly academic research, the BFRI is the prime institution formally mandated to carry out

need-based operational research to support the BFD and other stakeholders. With some exceptions, however, the quality of the products, resources, infrastructure and operational funds at the BFRI have generally remained less than satisfactory, almost since the inception.

The research facilities and equipment at the BFRI have become outdated, and the logistics and resources necessary for conducting research are grossly inadequate. In addition, the library and Internet support are very poor. The recruitment rules at the BFRI are very outdated and do not cater to the needs of the present time. A large number of senior research positions at the BFRI are vacant, and in the absence of a clear career advancement opportunity or any other incentives, the BFRI is not seen as an attractive place to work in by many qualified scientists. There is also a lack of opportunities for higher studies. The recruitment process is also very bureaucratic and time consuming. As a result, only minimal research is going on at the BFRI at present, and very little of that is of practical use. Whatever technologies are developed cannot be transferred to users because of the absence of an extension division. Revitalizing forestry research, in partnership with the universities and international research institutions, is a big challenge for the future. The research areas that need immediate attention include identification of climate-resilient species and silvicultural practices, production, consumption and demand of forest products, assessment of ecosystem goods and services and conservation of biodiversity and NTFPs.

Issues and challenges

1. Attracting and retaining high-quality researchers at the BFRI is one of the biggest challenges as the service conditions, career prospects and research facilities are far from satisfactory.
2. Research institutions all over the world prosper only if they are free from the usual bureaucratic control but still have enough government support to carry out their mandate. Creating an autonomous institution with adequate government support is a challenge for the immediate future.
3. There is no routine collaboration between the BFRI and the BFD, as well as the BFIDC. The research conducted at the BFRI often does not reflect the needs of other organizations in the sector. There is no long-term research planning process, and neither the BFD nor the BFIDC is known to have sought help from the BFRI for resolving issues that need inputs from research. The BFRI has a strong wood technology research set-up that can service the wood industry and help resolve some of their problems. However, the linkage between the BFIDC and forest product-based industries is poor.
4. Research on important and current issues such as genetic improvement of tree species, including rubber, on the impact of climate change on forests is inadequate.
5. The BFRI and BNH get limited annual research grants from the government. Whatever little research funds are provided are project based, and approval takes years. What is required is a regular research budget for these institutions out of which projects can be sanctioned by a research advisory body locally.
6. It is important for any research organization to ensure that its staff has access to cutting edge knowledge. This access is not available at these institutions. The BFRI and BNH do not have any regular staff development programmes. Finding resources and opportunities for faculty development programmes is an issue that needs immediate attention.

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7. The very limited access to IT infrastructure and Internet connectivity is a major hindrance for the research community.
 8. The condition of the library at the BFRI is extremely poor. Building a modern library and linking it with the global library network must be seriously pursued.
 9. The BFRI needs to be immediately restructured to focus its attention and limited resources on topical issues. Any structural changes needing government approvals and creation or renaming of existing posts is a difficult task in the government. Simplifying such procedures in order to allow the BFRI the flexibility to form and re-form staff units according to the need of the hour or emerging challenges and opportunities is another challenge for the sector.
 10. A research institute is only as good as the clients it serves. Therefore, the BFRI's clients need to become research conscious and must demand research support from the BFRI according to their needs. Creating a live link between the BFRI and its clients, i.e., the BFD, forest industries, development NGOs and forestry farmers, remains a challenge.
 11. The BFRI and the various universities involved in forestry research need to co-ordinate their programmes in order to avoid duplications and gaps. This can be done either by providing research grants from a common pool or by having a co-ordinating committee that reviews all the research programmes and suggests realignments where necessary.

6.11 Development of forest resource-based industries

The context

The industries in Bangladesh that are dependent on plants or the forest for raw material include sawmills, wood-processing plants, furniture and other wood-based product manufacturing units, pulp and paper mills, pharmaceutical industries manufacturing allopathic, Unani and other traditional medicines and manufacturers of perfumes made from agar oil. These industries exist in both the public and private sectors and include small-scale cottage industries as well as large industries.

The BFIDC, as mentioned earlier, is currently engaged in furniture manufacture and raw rubber production. For various reasons, its performance is not satisfactory, and in recent years its balance sheet has been in the red. The main reason for this, in the case of furniture division, is old equipment, a lack of a skilled workforce, a shortage of staff, large overhead and a shortage of funds and appropriate technical backstopping! In the case of rubber, the reasons are low-yielding trees, old trees with low yields, a large staff and a lack of proper management and accountability for individual and collective performance. While the furniture industry in the private sector is booming, the BFIDC is unable to compete and is almost entirely dependent on supplying furniture to public sector offices! In the case of raw rubber production, while the BFIC is incurring huge losses, the private sector is making reasonable profits in spite of the price of raw rubber dipping in the last few years.

All rubber plantations in Bangladesh use planting stock of a very low-yielding variety that was brought into the country in 1961. No efforts have been made to develop new varieties or import varieties from countries such as Malaysia, Indonesia, Thailand and India, where such research has led to the development of many higher-yielding clones, which have yields up to three or four times that the yield of the variety in Bangladesh. In addition, the management system is not intensive, and no intervention in the form of applying fertilizers/manure and other measures that

help enhance latex production are followed. The reason for the better performance of the private sector plantations is their more intensive management and supervision. However, the private sector suffers from resource constraints, scarcity of land, access to current know-how and higher-yielding planting stock and, unlike other countries in the region, an absence of any incentives from the state's end. There is no research on either improving the planting stock or on scientific management in the country! The local sources are not adequate to meet the demand for raw rubber in the country, and large quantities are imported from abroad.

The pulp and paper industry depends on forests as a source of pulping material. However, the only paper mill in the country that depends on raw materials from forests is the Karnafully Paper Mill, which is currently running at half-capacity mainly because of the shortage of raw materials. All private sector paper mills, which now are the main source of paper in the country, import their requirement of pulp from abroad.

The name 'BFIDC' indicates that it should be promoting the development of forest industries in the country. However, it does not have any programme devoted to this, except in the case of rubber, where it played a major role in the early establishment of plantations. The following are the issues and constraints faced by the sector:

1. The capacity of the BFIDC needs to be strengthened so that the overall performance of the institution improves. As it is no longer a leading player in the sector it is involved in and has become a losing concern, unless its performance can be improved, its future will be at stake.
2. Further development of the industry in the private sector needs to become a priority. With the strides it has so far made, with appropriate incentives and other support, it could really flourish.
3. While the BFIDC reports the loss it incurs from its raw rubber enterprises, there is nothing to show that efforts have been made to correct the situation by undertaking appropriate interventions and actions. There is no record of any major intervention that was initiated to correct the situation!
4. As private entrepreneurs have been successful at establishing plantations and making profits from the endeavour, it is advisable that establishment of large-scale rubber plantations in the private sector is promoted. However, as the available land suitable for rubber is under government ownership, provisions will have to be made for allocation of land and for making available other incentives.
5. In the major rubber-producing countries, a major portion of the raw rubber produced comes from small landholdings. According to information obtained from Malaysian Rubber, out of a grand total of 1,074,530 ha of rubber plantations in the country, 996,910 ha is in small holdings. In Bangladesh, private sector plantations, particularly in the non-corporate sector, are small holdings. However, high-yielding varieties of planting material, access to knowledge regarding good rubber tree husbandry, incentives and/or financial support, which are accorded to rubber tree farmers in other countries, are not available. In addition, there is no tax relief for this sector. Resolution of these issues and the creation of an enabling environment will be a major challenge.
6. The current average production of rubber per hectare in Bangladesh is almost a third of or even less than that in other major rubber-producing countries. This high yield of rubber has been achieved through continuous development of new high-yielding

varieties of clones and improvement of management regimes. Bangladesh has no facility for conducting genetic research on rubber. Bangladesh still uses the rubber planting materials that were imported from Malaysia in 1961! The management practised is also of an equally old vintage!

7. The BFD has been supplying raw materials for pulping in the form of pulpwood and bamboo. However, the supply has diminished. The private sector paper mills are entirely dependent on imports for fulfilling their requirements. It is possible to increase the supply of raw materials for pulping by bringing new areas under plantation of suitable species in both the private and public sectors. Again, the limiting factors are availability of land and resources and an enabling environment for undertaking this endeavour.

6.12 Addressing the acute shortage of funds and capacity for field operations

The context

Bangladesh has limited resources, and there is extreme competition between various sectors for the limited funds available with the government. Most of the available funds go to the sectors considered more critical than forestry, such as health, education and security. As a result, the forestry sector has been surviving mostly on donor funding. As donor interest in the sector cannot be guaranteed, many programmes fail because of a lack of financial sustainability. Forestry Master Plan 1995 received only 38% of the minimum investment. If the net present value (NPV) is considered, the allocation to the BFD in 2015-2016 was even lower than that in 2004-2005! Although donor support, especially from climate change-related sources such as the Forest Investment Program (FIP) of the World Bank and Global Climate Fund (GCF) of the IPCC, is likely to increase in the future due to the recognition of Bangladesh as the most vulnerable country in the world, unless the GoB increases allocations for the core functions of the BFD and other sectoral organizations, efficient utilization of the donor support will continue to be difficult. Training and other capacity-building activities are also linked to various donor-supported projects, and the training institutions are often without work if there are no projects to support trainees.

In view of the chronic shortage of funds, the BFD and other forestry sector institutions need to look elsewhere for funding. While the BFD should evaluate the scope for PPP models for afforestation/reforestation programmes and other possible sources of funding. The BFRI and the BNH, who will find it difficult to harness funds from non-traditional sources, need to seek the government's commitment to enhanced budget allocations, seek funds from external donors and, perhaps, explore the corporate social responsibility (CSR) sector of industry to garner some funds.

Issues and challenges

1. The most important challenge of the forestry sector is to convince the GoB of the importance of forestry as a multidimensional tool, such as a shield against climate change impacts, creator of jobs and businesses, provider of critically required goods such as timber and fuelwood and protector of soil and watersheds and as the backbone of agricultural productivity, maintaining healthy populations of pollinating agents. For this a comprehensive assessment of all the ecosystem services provided by forests and trees is required. These services must be accounted for in national wealth accounting.

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2. The BFD needs to tone up its anti-corruption and accountability systems as an efficient use of available resources is as important as getting additional resources. As many systemic shortcomings, such as a lack of travel funds and a lack of funds to deal with crimes and criminals, induce and encourage corruption, the lack of efficient monitoring, evaluation and supervision of field operations makes it difficult to detect corruption, which is a serious drain on scarce resources.
 3. Although climate change mechanisms do promise a lot of funds, the country, especially the implementing agencies, lack the expertise required to access these resources. The country has to depend on external consultants to prepare projects for tapping into climate change funds, which again is dependence on external assistance. Development of in-house capacity to develop projects for international funding remains a serious challenge for the BFD and other agencies.
 4. Although the GCF, REDD+, CDM and other climate change-related mechanisms promise significant result-based returns to the country, achieving results in combating deforestation and forest degradation is the most serious challenge in this regard. Even if the country is able to develop the expertise and mechanisms such as forest assessment, baseline emissions and methods of measurement, reporting and verification, achieving results on the ground will be extremely difficult unless the forest governance is strengthened and the livelihoods of the forest-dependent communities are made sustainable. This is perhaps the biggest challenge to the forestry sector as results will be possible only over the long term, in tandem with the socio-economic development of the country.
 5. Even if the GoB is able to tap all the traditional sources to support the forestry sector, the growing demand for afforestation and reforestation cannot be fully met. Therefore, the country will have to look at some novel options such as PPPs, institutional finance and CSR activity to finance big-ticket projects like reforesting the denuded hill forests. Although the country is already going ahead with the idea of using PPPs to finance core sector projects, forestry is not one of those sectors. As forestry is not a high-yielding business, particularly in money terms, developing profitable PPP investment projects will be a big challenge. Moreover, due to the prevailing land tenure issues in most forest areas, particularly the CHT, and the direct stakes of local communities in state forests, in the form of grazing livestock, collecting fuelwood and small timber, shifting cultivation, etc., PPP projects in forestry will be more challenging than the usual infrastructure projects that are financed by PPP.

Apart from afforestation and reforestation, PPP models can also be explored in the area of processing and marketing of forest products such as NTFPs, medicinal plants and handicrafts. The biggest challenge for the sector will be to start thinking out of the box, beyond the government coffers, for financing forestry projects. Development of the necessary systems, processes and projects will be a lesser task, though not very easy, once the mind-set is ready.

6.13 Compliance with international conventions, commitments and reporting requirements

The context

Bangladesh is a signatory to almost all the international conventions and multilateral environmental agreements (MEAs). These agreements commit the country to certain actions that help preserve the forests and environment. These MEAs have extensive reporting requirements that need intensive data collection and collation capacity. The agreements in which the BFD has a direct or indirect reporting role include the following:

- United Nations Framework Convention on Climate Change (UNFCCC)—This convention requires ‘national communication’ (NC) every four years and biennial update reports (BURs) every 2 years.
- Nationally Appropriate Mitigation Actions (NAMA)—Optional activity.
- Intended Nationally Determined Contributions (INDC)—Once every 5 years.
- National Adaptation Plan of Action (NAPA)—Optional. Bangladesh has proposed coastal afforestation with community participation as a priority activity under NAPA in 2005.
- Convention on Biological Diversity (CBD)—National report, once every 5 years.
- National Biodiversity Strategy and Action Plan (NBSAP)—Once.
- Programme of Work on Protected Areas (POWPA)—Once.
- Ramsar Convention—National report for every COP.
- United Nations Convention to Combat Desertification (UNCCD)—National report on every COP. National Action Programme (NAP) once.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)—Biennial reports
- Forest Resources Assessment (FRA)—Once every 5 years.
- United Nations Forum on Forests (UNFF)—Voluntary
- Sustainable Development Goals (SDG)—Schedule not yet established.

In view of the large number of international agreements, fulfilling the reporting requirements is quite an involved process. However, there are many generic elements that are common to most reports, and a common database of those elements can help make the process of reporting simpler. Although the BFD is not the reporting authority for most of the MEAs, except CITES, it still has a significant role in preparing the reports.

Issues and challenges

1. The most important challenge regarding all the MEAs is that they require actions for which the country does not have enough financial and technical resources. Although all these MEAs require virtually the same programmes, aimed at conservation of forests, wildlife and biodiversity, which the country should in any case be pursuing, the shortage of funds and technology are major challenges in conforming to the obligations.
2. There is no established set-up for collecting and collating the necessary data for preparing the reports for all the MEAs. As every convention has a different reporting frequency and format, although the data elements may be common to some extent, data have to be collected afresh every time a report has to be prepared. As the staff are generally overworked and the reports have to be prepared at short notice, quite often the data collection is done hurriedly, without enough thought for quality. A common online

database, at least on the basic elements of the reports, which is updated by the data-generating agencies/offices as a matter of routine, in real time, can be a big help in preparing the reports.

3. Preparation of many of these reports requires technical knowledge and experience, which sometimes are not available in the country. In such cases, either faulty reports are prepared or reports are just not submitted or are delayed. With the retirement of senior officers in the near future, this problem is likely to be more aggravated. International agencies need to train the national staff frequently in order to keep their skills and knowledge up-to-date. The country often has to engage international consultants to prepare national reports, and finding funds for such engagements is often not easy.

A separate office with full-time responsibility for handling MEA-related obligations, equipped with the necessary capacity and staff, needs to be set up. Shortages of adequately trained manpower and resources are the main constraints.

7 Aims and Objectives

The current National Forestry Policy of Bangladesh was enunciated in 1994 in tandem with the bringing into effect the Forestry Master Plan (FMP). The expiry of the old master plan and the emergence of new challenges such as climate change, rampant deforestation, a rising demand for forestry products and a need for increasing the tree cover in the country called for a revision of both the National Forestry Policy and the current FMP.

Against this background, a draft National Forestry Policy document was prepared after consultations with relevant stakeholders at local, regional and national levels and submitted to the Ministry of Environment and Forest (MoEF) for facilitating its approval by the Government of Bangladesh.

7.1 Aim of the National Forestry Policy

The aim of the National Forestry Policy, 2016 is stated in the draft policy document:

'The main aim of the policy is to manage all existing forest, wildlife and other forestry resources, adhering to the principles of sustainable management and climate resilience; enrich degraded forest areas; and enhance land areas under forest/tree cover; to produce a wide array of goods and ecosystem services for the benefit of Bangladesh's present and future generations.'

The policy statements are divided into 13 groups, namely: General statements, Enrich and extend forest cover, Protection of forests, Trees outside forests, Biodiversity and wildlife conservation, Participatory forestry, National parks and recreational areas, Forestry education and capacity building, Climate change, Forestry research, Forest industries, Non-timber forest products, Forestry administration. The Bangladesh Forest Department, under the MoEF, is the body responsible for ensuring the proper implementation of these policy statements to achieve the aims and underlying objectives.

This policy sets an ambitious goal for rehabilitating the forestry sector. The policy emphasizes the need for all forestry sector institutions to strive to manage all natural resources according to the principles of sustainable forest management (SFM) and climate resilience. It also aims to rebuild forestry sector institutions, restore degraded forests, enhance the tree cover both within and outside state forests and enhance the protection against various effects of climate change. The aim of producing a 'wide array of goods and ecosystem services' is a very comprehensive goal that flows from the success with the foregoing aims, i.e., sustainable management, enhancement of the overall tree cover in the country and enrichment of its forests.

7.2 Objectives of the National Forestry Policy

- a. To arrest deforestation and degradation of forest resources and enrich and extend areas under tree cover, through appropriate programmes and projects, to ensure that at least 20% of the country comes under tree cover by 2035, with a canopy density of at least 50%
- b. To ensure strict conservation, growth and sustainable management of state forests and to increase the range of ecosystem services and to introduce forest certification as a tool to improve forest management through market influences

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- c. To significantly increase the tree cover outside the state forest, through appropriate mechanisms, in both public and private lands, including urban areas
 - d. To encourage all types of participatory forestry activities and creation of off-forest job opportunities to reduce the dependence of forest-dependent communities on forests
 - e. To improve wildlife management and conservation practices in protected areas (PAs) and other habitats
 - f. To incorporate measures to deal with the impacts of climate change on forest ecosystems
 - g. To delineate the catchments of rivers, lakes and other wetlands and designate them as strict nature reserves
 - h. To ensure enhanced recharging of ground water and perennial flows in streams by extending the coverage of PAs to 30% of notified forest land
 - i. To strengthen research and education and to build capacity in state-of-the-art forest ecosystem management practices to cope with existing and emerging challenges including the impacts of climate change, population pressure and urbanization
 - j. To include valuation and payment for ecosystem services in planning and management of forest ecosystems
 - k. To ensure effective implementation of the relevant programmes identified by the Bangladesh Climate Change Strategy and Action Plan, 2009
 - l. To ensure that the policies prescribed herein and the formulated programmes under them are properly implemented and to establish a strong information management, monitoring and evaluation set-up.
 - m. To facilitate the establishment of efficient wood- and wood substitute-based industries, together with building the capacities of rural communities and entrepreneurs to enable them to set up wood-based production facilities, small and large
 - n. To ensure the fulfilment of the country's commitments under different multilateral environmental agreements (MEAs) such as CITES, CBD, UNCED and Ramsar
 - o. To encourage community involvement, particularly, involvement of women, in forestry activities, wherever feasible
 - p. To make plans for converting the policies outlined herein into actions by developing appropriate plans backed by commensurate financial provisions and proper accountability.

These objectives can be broken up and the overall goal of the forestry sector elaborated into various specific, measurable, achievable, realistic and time-bound (SMART) elements. The action areas that emerge out of this list are the following:

- The policy emphasizes the need to use all available forest land for forestry purposes alone, manage forests at the ecosystem level according to the principles of sustainable management, complete all pending forest land reservation processes, recognize the traditional rights of various ethnic communities, carry out a valuation of the ecosystem services provided by forests and protect the Sundarbans from pollution.

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- Enrichment and extension of the tree cover to 20% of the geographical area, with a minimum canopy density of 50%. The current area under tree cover, including state forests, is approximately 2.49 million ha. This means that an additional extent of approximately 460,000 ha will have to be brought under tree cover to reach the 20% level. As the estimate of the area under tree cover is not based on a detailed assessment, the actual area needing reforestation/restoration is expected to be much higher. However, the ongoing National Forest Inventory Project will be able to furnish this information.
 - The policy promotes the participation of the people in forestry, and inclusion of women in forestry activities has been specially emphasized. The country has already made significant progress in social forestry, both in the state forests and outside them. The expansion of tree cover outside the state forests is a clear indication of the interest and involvement of the people in growing trees. Social forestry plantations on state forests have been instrumental in bringing encroached forest lands under significant tree cover and in alleviating poverty. Non-governmental organizations have played a very important role in this development. Innovative approaches acceptable to all parties will be employed to establish plantations in areas of the Chittagong Hill Tracts where the current situation has made it difficult for the BFD to work.
 - The policy emphasizes the need to strengthen the measures taken to protect the forests by developing the needed capacity, seeking support from other relevant agencies, involving communities in the process, revising regulatory tools where needed, ensuring quick disposal of court cases and completing the surveying and permanent demarcation of the boundaries of all forests.
 - The policy directs the forestry sector institutions to improve the conservation of biodiversity and wildlife through implementation of the Bangladesh Wildlife Master Plan, 2015-2035 and the Bangladesh Forestry Master Plan, 2017-2035.
 - The extent of land notified as PAs under the Wildlife (Conservation and Security) Act, 2012 is to be enhanced to 30% of the notified state forest area from the existing 15%. However, as the only sizeable, intact natural forests outside PAs are now available in the Sundarbans, most of the expansion of PAs will have to be done in the Sundarbans. In addition, PAs will have to be established that cover sensitive catchment areas, where the ground water storage and recharging take place, and this category of PA will include areas in the hill forests in the east and sal forests in central Bangladesh.
 - The policy emphasizes rebuilding of all the forestry sector institutions, which have been suffering from an acute shortage of manpower, dilapidated facilities and a lack of technical/professional capacities. The rebuilding will involve assessment of the immediate and future capacity needs and formulation and implementation of a manpower recruitment and development plan, followed by arrangements for capacity building, to make recruits ready for different forestry assignments within institutions from different sectors.
 - The policy mentions research and education as a priority area. Forestry-related research is being carried out by the Bangladesh Forest Research Institute and some universities of the country, while forestry education is being imparted by the BFD's own training institutes and the universities of Chittagong, Khulna and Sylhet. In addition, some

universities, such as Jahangir Nagar, Dhaka, Rajshahi and Khulna run programmes in wildlife biology and other relevant disciplines. The BFD has just established the Wildlife Centre, which has a mandate to provide training, conduct research and be a depository of all wildlife-related information and documents. The FMP will review the status and condition of these institutions and will make specific recommendations regarding the upgrading needed, curriculum development and raising teaching capacity.

- The policy mentions that the ecosystem goods and services (EGS) provided by the forest ecosystems of the country shall be evaluated and that the valuation shall be given due weightage in the national planning and financial accounting processes. Inclusion of EGS will reflect an improved contribution of the sector to the nation's GDP. The value will improve further with the improvement and spread of the tree cover and the resulting increase in goods and services. This increase in contribution to the nation's GDP will help negotiate for higher allocations for the sector.
- The new policy lays a strong emphasis on dealing with the impacts of climate change and implementation of the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). BCCSAP is an overarching policy of the government, and all the sectoral policies of the country need to internalize BCCSAP in developing future programmes. Forests have a major role in mitigating climate change and its impacts. For achieving progress in this field, the sectoral institutions will have to develop a strong capacity to develop projects under REDD+, CDM, NAMA, NAPA, INDCs, etc., which will not only help improve the forest and tree cover in the country, with all the co-benefits, but will also bring in additional resources for the sector. The emphasis on building strong management and programme implementation capacities, including monitoring and evaluation, are critical for making progress towards minimizing the impact of climate change on the country, and the policy specifically gives directions in this regard.
- The objectives of the policy include development of forest product-based industries. This will not only improve employment in industrial units but will also help develop forestry initiatives in the private sector. At present, nearly all the timber and fuelwood in the country are being produced by the private sector. With an increase in demand from industry, tree-growing activity will get a boost. Furniture exports have recently started growing at a rate of almost 104% per annum, bringing in much needed foreign exchange. The demand for SFM-certified timber is going to grow with growing exports. If the country can meet the certification requirements of international organizations, as demanded by trade, the rural economy will get a tremendous boost.
- The new policy also commits the country to strengthening compliance with various international conventions and MEAs. Thus the policy indicates that the systems and procedures required for dealing with the monitoring and reporting requirements of these instruments be internalized by the sectoral institutions in order to improve compliance. Compliance with these conventions is in the country's own interest as it helps focus energy and resources on the critical areas on which reporting to MEAs is required.

Although the aforementioned objectives of the National Forestry Policy are quite comprehensive, it could have emphasized more strongly the need to conserve the Sundarbans, the source of livelihood for thousands of people, and the creation of a coastal shelter belt in order to deal with the impacts of climate change. As the Sundarbans is a multifaceted ecosystem, and the only one that is reasonably intact today, its preservation deserves a specific

mention in the objectives of every important policy document of the country. Similarly, the creation of a coastal green belt is a recognized national priority for protecting the communities against cyclones and storms, but there is no mention of this in the set of objectives of the National Forestry Policy. Despite this omission, the FMP will emphasize the importance of the mangroves and a coastal shelter belt to the country and will propose appropriate programmes for conserving/developing them.

The strategies and programmes proposed under the FMP aim to achieve the vision and objectives of the National Forestry Policy. Most of the proposals have cross-cutting effects as they contribute to progress in the pursuit of multiple objectives. For example, an afforestation programme will increase the tree cover, improve the delivery of EGS, provide raw materials for industry, sequester carbon to mitigate climate change and create jobs at multiple locations.

The policy aims to follow SFM principles as enunciated by various international organizations, in pursuit of its objectives. The objectives listed in the foregoing are in conformity with the international SFM criteria. They propose to enhance the forest area, improve the productive and protective functions of the forests, conserve biodiversity and promote the participation of communities in boosting the forestry sector. The country will need to make a serious effort to plant trees outside forests (TOF), arrest the degradation of the forests and promote and facilitate restoration of the forests so that the health of the tree cover is regained.

The following long-term, short term objectives and the broad aim of the Forestry Master Plan have been formulated taking into consideration provisions made in the Draft National Forestry Policy (2016), finding of the background studies carried out under the Forestry Master Plan exercise, one to one consultations with relevant experts and synthesis of workshops proceedings organised under the master plan exercise.

Long-term objectives of the FMP

1. To increase the forest and tree cover in the country to at least 20% of the geographical area, with a minimum canopy density of 50%
2. To re-designate 30% of all the forests as PAs
3. To re-establish the capacity of the sectoral institutions through recruitment and capacity building of staff members, updating facilities and equipment and institution of incentives, where necessary
4. To restore and conserve all the natural forests, including the Sundarbans
5. To manage the state forests in accordance with the principles of sustainable forest management (SFM)
6. To improve the management, research and technical capacities and to make provisions for developing the additional manpower and facilities necessary for implementing the FMP
7. To encourage the participation of the people, particularly women, in all aspects of forestry activities
8. To enhance the resilience of the forests against climate change and to ensure that the forests are able to mitigate the effects of climate change
9. To facilitate the development of forest-based industries

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10. To develop a competitive market for the produce of homesteads and other private forests
 11. To reduce the dependence of rural communities on state forests for fuelwood, timber and livestock grazing with the help of viable alternatives
 12. To encourage public–private partnerships (PPP) in reforesting degraded forest areas, to complement government efforts
 13. To review and revise legal and regulatory tools to ensure that these are capable of addressing current needs and issues
 14. To develop the institutional capacities for achieving the long-term objectives of the forestry sector.

Short-term objectives of the FMP

1. To stop degradation of forests and deforestation, particularly in the remaining hill forests and sal forests
2. To use a participatory approach in forestry activities wherever feasible and ensure the accrual of legitimate benefits to participating individuals/groups
3. To step up the process of protection of natural forests and plantations
4. To take special measures to ensure the conservation of the Sundarbans
5. To facilitate the use of forests for mitigating the impacts of climate change. In addition, to create a continuous green belt of trees all along the coast as a buffer against sea storms and cyclones
6. To restore the degraded hill forests through the establishment of plantations as well as assisted natural regeneration. To employ innovative approaches to extend the area under tree cover successfully
7. To maximize the production of timber, fuelwood and industrial raw materials through social forestry and plantation of trees outside forests
8. To strengthen the BFD and other forestry sector institutions to enable them to discharge their responsibilities successfully.

Broad aim

The main aim of the policy is to manage all existing forest, wildlife and other forestry resources, adhering to the principles of sustainable management and climate resilience; enrich degraded forest areas; enhance land areas under forest/tree cover; and to produce a wide array of goods and ecosystem services for the benefit of Bangladesh's present and future generations. This approach will also include upgrading and rehabilitating as necessary all forestry sector institutions.

8 Programmes and Strategies

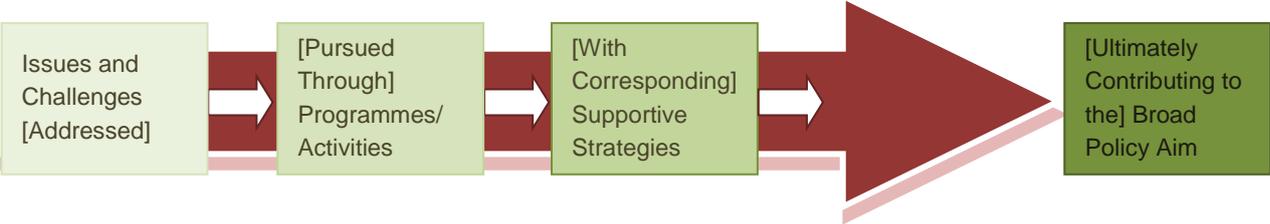
On the basis of the aims and objectives of the forestry sector enshrined in the proposed forestry policy, and an analysis of the state of the forestry sector as performed in the previous chapters, a menu of programmes and strategies for the management of forests in the future is proposed in this chapter.

The proposals in this master plan follow an action logic model and consist of such complementary elements as the broad aim of the national policy, objectives, programmes and supportive strategies.

The following discussion is organized in three sections. The first section outlines the action logic on the basis of which the proposals are formulated and furnished. The second section elaborates the proposed programmes, providing a description of the context and rationale, together with the suggested interventions and associated actions. In the third section, the proposed strategies are elucidated in the same vein.

8.1 Outlining the action logic

The attainment of the aim of the policy is contingent upon the production of three logic phases concerning the linkages between key challenges and issues of the sector through programmatic interventions to achieve the aim of the national policy. The action logic of the programme is as follows:



Issues and challenges: A recapitulation

The major challenges and issues of the sector have already been identified and analysed in a preceding chapter (Chapter 6). Suffice it to recapitulate briefly here the key challenges as the basis for recommending the programmes, strategies and associated activities.

The principal challenges that the programmes and strategies of the Forestry Master Plan (FMP) need to address include the rampant deforestation and degradation of sal and hill forests, impacts of climate change on various forest types and forest-dependent communities, growing demand for biomass, loss of biodiversity and wildlife, conservation of the Sundarbans and coastal afforestation, support required by the growing homestead forests and trees outside forests (TOF), weak research, monitoring and evaluation systems, shifting cultivation and difficult law-and-order situation in the Chittagong Hill Tracts (CHT), forest encroachments, weak institutional capacity and governance, acute shortage of staff and shortage of sustenance and operational funds. The nexus and functional linkages between these issues and challenges and the proposed strategies and programmes are explained further in Table 8-1.

Table 8-1: The challenge-programme-strategy nexus: A summary

Strategies/Programs to Meet Challenges	Environmental and socio-economic challenges												
	Meeting biomass demands	Arresting loss of natural forests	Arresting loss of biodiversity, wildlife and ecosystem services	Conservation of mangroves and need for a coastal green belt	REDD+ and CDM strategy and climate-resilient REDD+ and CDM projects	Forest and community resilience enhancement	Weak institutions and governance	Shifting cultivation and forest encroachments and illicit felling	Shortage of financial resources	Weak research, monitoring and evaluation systems	Support to ToF	Support to forest industries	Strengthening compliance with MEAs
Reinstitution of forest management plans	Green	Green	Green	Green	Light Green	Green	Light Green	Green	Green	Light Green	Green	Light Green	Light Green
Conservation of remaining natural sal, bamboo, hill and mangrove forests	Green	Green	Green	Green	Green	Green	Light Green	Green	Light Green	Light Green	Light Green	Light Green	Green
Reforestation of 3,000,000 ha of degraded forests, mostly in hill areas	Green	Green	Green	Light Green	Green	Green	Light Green	Green	Green	Light Green	Light Green	Green	Green
Afforestation outside state forests including USF (extension of support to private tree growers)	Green	Green	Green	Light Green	Green	Green	Light Green	Light Green	Light Green	Light Green	Green	Green	Green
Coastal afforestation including creation of a coastal shelter belt	Green	Light Green	Light Green	Green	Green	Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Green
Management of protected areas and protection of wildlife	Light Green	Green	Green	Green	Green	Green	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green	Green
NTFP plantations and related enterprises	Green	Green	Green	Green	Green	Green	Light Green	Green	Light Green	Light Green	Green	Green	Green
Climate change-related programmes (REDD+ and others)	Green	Green	Green	Green	Green	Green	Light Green	Green	Green	Green	Green	Green	Green
Forest-based industries	Green	Light Green	Green	Light Green	Light Green	Green	Light Green	Light Green	Light Green	Light Green	Light Green	Green	Light Green
Reforming institutions and capacity building	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Light Green	Light Green	Light Green

Strategies/Programs to Meet Challenges	Environmental and socio-economic challenges												
	Meeting biomass demands	Arresting loss of natural forests	Arresting loss of biodiversity, wildlife and ecosystem services	Conservation of mangroves and need for a coastal green belt	REDD+ and CDM strategy and climate-resilient REDD+ and CDM projects	Forest and community resilience enhancement	Weak institutions and governance	Shifting cultivation and forest encroachments and illicit felling	Shortage of financial resources	Weak research, monitoring and evaluation systems	Support to ToF	Support to forest industries	Strengthening compliance with MEAs
Forestry research and knowledge management													
Livelihood support to forest-dependent communities													
Promotion of fuelwood-saving devices and technologies													
Control on forest encroachments													
Maintenance and protection of existing plantations													
Public-private partnerships in forestry													
Consolidating and expanding community participation													
Strengthening of monitoring, evaluation and database facilities													
Ensuring basic amenities and logistic support													

Programmes and strategies

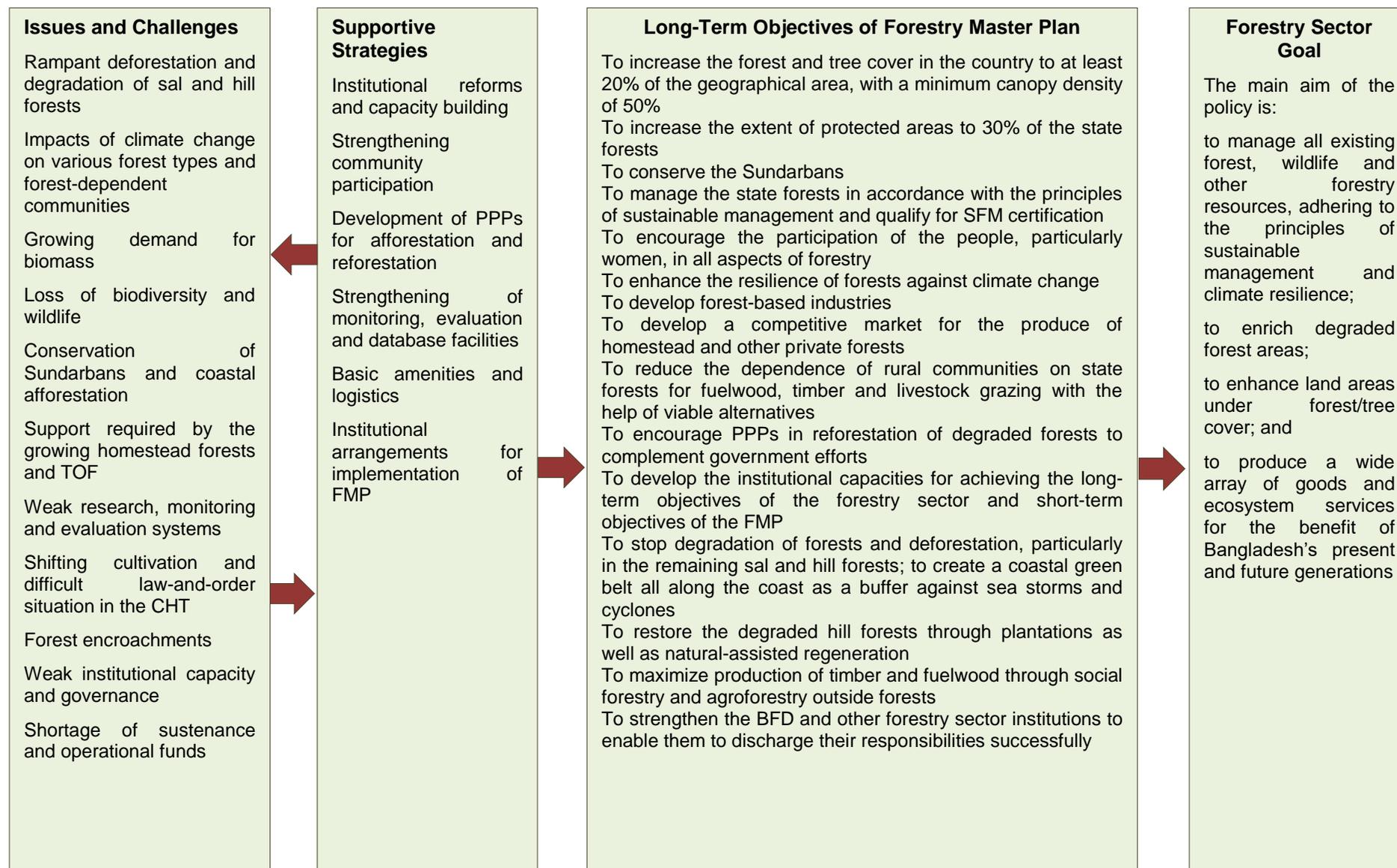
For the purpose of this plan, programmes are groups of concrete physical interventions that will happen on the ground and will affect forest expansion, composition, production or protection directly, while supportive strategies are the overarching systemic actions that, although not directly related to forests, are crucial for the success of the programmes aimed at improving the condition of the forests.

Most programmes will have a cross-cutting relationship and inter-sectoral incursions with multiple objectives of the forestry sector and will help deal with multiple challenges and the proposed strategies will improve the effectiveness of multiple programmes. For example, both afforestation and reforestation programmes will help meet the demand for forest products, enhance carbon sequestration, increase community resilience against climate change, help watershed protection and so on. A list of various programmes and corresponding strategies proposed is presented in Table 8-2. Each of these programmes and supportive strategies is further discussed and rationalized in subsequent sections (2 and 3).

As noted previously, the proposed programmes, activities and strategies are anchored on a carefully crafted 'action logic'. The logic consists of three inter-related elements: a) an analysis of the key challenges, b) the broad aim (of NFP/FMP), short- and long-term objectives, which have been provided in the previous chapter and c) programmatic and strategic interventions.

In what follows, the menu of programmes and strategies is elaborated.

Table 8-2: A Menu of the proposed programmes and corresponding strategies



8.2 The proposed programme portfolio

8.2.1 Preparation of management plans for state forests and TOF for climate resilience

The context and rationale

Except Sundarbans Reserved Forests until some years back, forests in Bangladesh had traditionally been managed through implementation of 'working plan' prescriptions, typically formulated for a period of 10 years at a time. These prescriptions were formulated with a view to achieving a set of pre-agreed management objectives. However, the system of forest working plans was discontinued some years ago, and all desired forestry interventions are now included in development project documents and implemented through these projects, depending upon the availability of funds. These projects are usually prepared in accordance with the priorities of the donors or development partners rather than on the basis of strategic planning. The Sundarbans Reserved Forest is managed under Integrated Resource Management Plan (IRMP) for a period of 2010-2020. Management plan of many protected areas have been formulated under different development projects.

However, the management scenario has become more complex as the pressure on the forests by the increasing population has increased and the impact of climate change on forests has become a reality. In view of the vulnerability of forests to the impact of climate change and associated hazards, it is all the more important that the vulnerability of each forest unit be assessed in detail, including consultations with local stakeholders and preparation of suitable adaptation and mitigation plans. A broad vulnerability assessment of various forest ecosystems, based on NFA 2005-2007 forest maps, was undertaken during the preparation of the FMP. However, this assessment needs to be updated and refined at the forest division level, and necessary adaptation measures such as reforestation, afforestation and rehabilitation of partially degraded forests, subsidiary silvicultural operations, soil and water conservation measures, enrichment planting, livelihoods planning for forest-dependent communities, etc. need to be taken to ensure that forestry practices are climate-resilient.

Moreover, with the recognition of TOF as a significant factor in sequestering carbon and the main source of various ecosystem goods and services, it is necessary to review and analyse the status of this sub-sector periodically and plan the interventions required to give it a desirable direction and impetus. This may involve the promotion of certain species, silvicultural practices, use of innovative approaches to establish plantations, improvement of marketing conditions, induction of new techniques and inputs, review and revision of relevant legal tools, a change in focus of awareness campaigns, etc.

The proposition and actions

It is, therefore, proposed to reinstitute the practice of using forest management plans, incorporating interventions for addressing emerging challenges in addition to routine silvicultural prescriptions. All forest divisions shall be managed under 10-year management plans.

As TOF have become the main source of forestry products, given the size of the area under tree cover and their being an important carbon sink, it is imperative to ensure that this sector continues to grow steadily. This can only be done through implementation of properly formulated management plans backed by required tools and resources.

8.2.2 Conservation of the remaining natural forests

The context and rationale

Out of the total area of approximately 1.53 million ha under the control of the BFD, only about 700,000 ha (FD mapping 2013) is recorded as natural forest. While nearly 601,700 ha of the natural forest lies in the Sundarbans (including rivers and water bodies), 94,200 ha (FD mapping 2013) lies in the hills, mostly in the CHT districts. The sal zone has only 17,495 ha (FD mapping 2013) of natural forest remaining, while the rest has been mostly encroached. It is pertinent to mention here that while at one time large tracts of natural forest existed in the greater Chittagong and Sylhet regions, a mere 5075 ha (FD mapping 2013) of natural forests remains today! In the case of the CHT, the current area under natural forests is a very small percentage of the forest that existed, say, 50 years ago. The forest inventory, the result of which is expected in 2018, may reveal that the area of the natural forests is even less. This reflects the gravity of the current situation.

Except the Sundarbans, most of these areas are too small and fragmented to be ecologically significant now from the perspective of a larger landscape. However, they are of extreme symbolic and heritage value as Bangladesh will lose an important part of its natural identity forever if they are lost. The Sundarbans, on the other hand, is of extreme economic, ecological and environmental value for the country.

The proposition and actions

With this backdrop, the remaining natural forests deserve special attention and must be protected with utmost seriousness. Accordingly, the following actions are proposed under this programme:

- Demarcation and mapping of forest boundaries, fixing boundary pillars and recording the GPS co-ordinates of forest boundary in collaboration with the Department of Land Records (DLR) so that the records and maps maintained by the BFD tally with those of the DLR
- A mechanism should be developed for Bio-Diversity assessment and its periodic review of the natural forests.
- Formulation of forest management plans for all forest divisions and forest estates and management following the interventions prescribed in these plans
- Enhancement of the capacities of the forest management divisions with the necessary tools, manpower and resources. These forest management divisions, in collaboration with monitoring and evaluation (M&E) and Resource Information Management System (RIMS) units, will be responsible for monitoring the implementation of the prescriptions of the management plans.
- Strengthening of forest protection measures through increased patrolling, enhanced accountability of staff members and collaboration of communities and other law-enforcing agencies; to ensure 'safe' passage of timber and other forest products to markets; promotion of a proper mechanism for the participation of communities and other interested parties with clearly defined and agreed roles, responsibilities and benefit sharing

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- Improvement of field infrastructure, such as secured field offices, staff residences, access to safe drinking water and transport facilities. Where feasible, Internet facilities will have to be provided to such offices.
 - Provision of ration and risk allowances should be ensured for staffs working in the remote areas.
 - Strengthening of institutional support in investigation, filing of criminal complaints and prosecution of offences. This will involve proper filing of cases, availability of funds for hiring lawyers to defend forest cases, a system for monitoring the progress of court cases, reviewing and revision of relevant laws and regulations, creation of 'forest courts' to ensure quick disposal of forest cases and adoption of a process for quick eviction of forest encroachers.
 - Building the capacity of the BFD field personnel to enhance their skills and competence in effectively protecting forests and conserving biodiversity. This will involve recruitment of the required staff, proper training and making provisions for transport, a two-way communication system, funds and the other facilities needed for effective forest protection personnel. The possibility of separating the forest management and protection functions will be seriously reviewed, and an appropriate decision will be taken.
 - Establishment of a properly staffed and equipped data and information management, monitoring and evaluation unit for generating and assessing information. The M&E Unit will have direct two-way communication with the field offices. A modern system for regular monitoring of the forest resources of the country will be put in place and used where possible for detection of forest crimes.
 - The sizes and staff structures of forest ranges/beats shall be reviewed on the basis of the need for strengthening the protection of the surviving natural forests. If need be, beats shall be made smaller and the staff strength shall be improved to make the protection more effective.
 - Extension, enhancement and strengthening of information, education and communication (IEC) campaigns will be undertaken all over the country for making the people aware of the values and functions of forests so that they become favourably disposed and participate in the conservation of forests.
 - The results of the ongoing forest inventory to identify the status of forests in different locations will be utilized and necessary measures for restoration/rehabilitation of forests, where necessary, will be taken through adequate protection, intensification of enrichment planting, assisted natural regeneration (ANR) and other silvicultural operations. Necessary provisions will be made for reforestation of denuded forest land with suitable species using appropriate models of plantation. In addition, the impact of the moratorium on all forest exploitation activities will be reviewed and silvicultural measures to improve forest stands, where necessary, will be implemented.
 - Efforts will be made to rehabilitate degraded old plantations, particularly in the hill districts, with the active collaboration of the local communities under a clearly defined and implemented benefit-sharing mechanism. These collaborating communities will be allowed to grow suitable 'cash crops' as long as such practices are not detrimental to the rehabilitation process.

- From now on, forest land will be used only for forestry activities. No forest land will be relinquished for any other purpose unless it has to be done or in the national interest. When this is done, an equal area of land will be made available with the necessary funds for establishing tree cover.
- Protection and management of the Sundarbans, a global heritage and the largest forest formation of its kind, through necessary legal and programme interventions will be undertaken. The larger part of the forest will be declared protected areas (PAs), classified into different categories according to the globally accepted classification of the International Union for the Conservation of Nature (IUCN), and the provisions associated with each category will be implemented. Access to the Sundarbans will be further regulated, and only ecotourism will be permitted. Restrictions will be imposed gradually on access to all sensitive wildlife habitats. The BFD will be provided with all the necessary tools, equipment and manpower for management and protection of the forest.
- Forest certification as a tool to improve forest protection and management through market influences will be introduced as and when the moratorium on forest exploitation is withdrawn.
- Navigational routes within the Sundarbans, other than the recognised route to Mongla Port, will be strictly regulated and controlled to ensure that there are no oil spills and pollution from the movements of oil tankers, cargo boats and other sources within the forest.
- A forest crime control committee consisting of forest officials and members of the civil administration, police and judiciary shall be constituted in each district to periodically review the problems and progress of forest offence control and finalization of court cases and to take remedial measures as appropriate.

8.2.3 Reforestation/restoration of degraded state forests

The context and rationale

The objective of this programme is to reforest degraded forests, mostly in the hilly region. A total of about 322,716 ha, 40,000 ha in sal forests, 129,811 ha in hill forests outside the CHT and 152,905 ha in the CHT, has been identified for the purpose. These lands are shown as 'shrubs and grass' in the satellite-based maps (FD mapping 2013) of the hill/sal forests. These are areas where deep forests once existed and that have now become completely denuded because of large-scale extraction, both legal and illegal, and the failure, in many cases, to establish plantations successfully.

It is important from the environmental, social and economic points of views to bring these areas under tree cover. This activity will also create a larger carbon sink and a larger source of ecosystem goods and services.

The proposition and actions

Site- and situation-specific strategies shall be used for these plantations:

- A correct assessment of the actual status of natural forests and plantations, including areas needing rehabilitation, will be made using the information generated by the ongoing forest inventory. Additional surveys/assessments will be carried out where necessary.

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- A review of existing plantation practices and techniques in the context of the low survival of past plantations will be carried out, and steps necessary to improve survival through better planning, implementation, monitoring and protection, upgrading nursery and plantation techniques, improving accountability, training staff members and improved protection of plantation sites will be taken.
 - All areas currently under existing plantations will be mapped and their GPS co-ordinates recorded. The condition of each plantation at the time of mapping will be recorded, and all future monitoring will be done using the information so recorded as the benchmark. The information so gathered will be used while undertaking any restoration of the forest stand. The guidelines prepared by the IUCN under the Climate Resilient Participatory Afforestation and Reforestation Project (CRPARP) will be used, with any modifications needed, in undertaking the task.
 - Planting of sal seedlings in long-rotation sal forests and carrying out the necessary silvicultural operations will form the basis for restoration of the forests of this tract. Healthy seedlings of sal and other suitable indigenous species will be planted in the existing depleted forests. The forests will be protected against fire, often set off by the locals to increase grass production for their cattle.
 - Efforts will be made to consolidate *baid* land (high land) in sal forests, as far as possible, into small 'standalone' PAs for better protection.
 - Establishment of short-rotation plantations in the sal forests with community involvement under a participatory arrangement, avoiding establishment of plantations with single species, wherever possible, will be the main aim of the initiative.
 - Formulation and implementation of a strategy for rehabilitation and enrichment of all degraded forest ecosystems, catchments and other fragile and ecologically sensitive areas located within forests. Ecologically sensitive catchments and fragile areas will be declared PAs.
 - Making forest areas climate-resilient and creating larger carbon sinks in all natural forests through establishment of plantations and assisted regeneration programmes over large areas of barren or degraded forests, coastal accretions and other available land using appropriate site- and situation-specific models with community involvement wherever possible will be the main aim of the programme.
 - Silvicultural operations, including weeding, vacancy filling and thinning of all forest plantations, will be carried out strictly.
 - Phased out rehabilitation plan on the basis of a rapid survey of the candidate areas, based on updated and current maps, will be formulated and implemented. The survey will determine the extent of areas with existing coppice/root stock, regeneration or advance growth and those without any existing young stock. Investigations will be carried out into the feasibility of reduction of dependence on monocultures of *Acacia auriculiformis* (*akashmoni*) for buffer zones and participatory forest plantations by assessing the suitability of other fast-growing species for these plantations.
 - The current concept of buffer zones and the activities carried out in these areas will be reviewed and necessary recommendations formulated and implemented.

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- Based on the current impact of eucalyptus and akashmoni on the soil, a review will be undertaken and recommendations formulated. If the outcome of the study is favourable, plantations of the species will be established 'in purpose- and site-specific situations'.
 - In order to improve the quality of planting stock for both forest plantations and TOF, seed orchards that will ensure the supply of good-quality seeds will be established. Improvement and modernization of nursery management practices will be taken up to ensure the production of high-quality planting stocks.
 - Identification, demarcation and restoration of critical watershed areas and wildlife habitats will be carried out. In addition, where necessary, such areas will be declared PAs.
 - In view of the prevailing situation in the CHT, the establishment of plantations and their protection, involving local communities, the local administration, tribal chiefs, other leaders and credible non-governmental organizations (NGOs) will be promoted in areas where the BFD is currently facing difficulties in operating effectively. The models developed by Arannayk Foundation (AF) in the CHT, where payments are made to land holders/planters in instalments on the basis of the number of surviving saplings, and other integrated farming models will be adapted for restoration of state forests.
 - As the private sector is often seen as being better equipped to handle difficult situations, efforts will be made to engage the private sector and local entrepreneurs in establishing plantations in areas where the BFD has difficulty in operating. This outsourcing will include raising and maintenance of plantations till they are established. The parties involved will be responsible for planting, carrying out silvicultural operations and providing protection to the plantations under establishment.
 - PPPs with individuals or corporate groups will be promoted for establishment and management of plantations in areas where the BFD cannot undertake the task because of a shortage of funds.
 - An appropriate body in the public sector for spearheading and fast tracking the development of PPP projects and for channelizing institutional finance for reforestation of degraded state forests will be set up.
 - Initiatives will be taken to link the operations listed above with the Reducing Deforestation and Forest Degradation (REDD+), Clean Development Mechanism (CDM), Intended Nationally Determined Commitments (INDCs), Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Program of Action (NAPA) strategy of the country, as appropriate, at an early stage, in order to secure climate finance as well as to help fulfil the country's commitments under INDCs.

8.2.4 Afforestation/reforestation outside state forests including USF

The context and rationale

Bangladesh has abundant TOF. Nearly all the timber and fuelwood requirements of the country are now met from the TOF, mainly the homestead plantations. While the tree resources in the state forests have diminished over the years, the number of trees and the area under tree cover in areas outside state forests have very significantly increased. While the government has recognized the significance of TOF and made efforts to augment the area, its initiatives, which

were mostly financed through externally funded projects, were usually marred by discontinuity of project funding. NGOs have played a significant role in promoting TOF activities. The private sector has also been increasingly engaging in establishment of plantations.

For the purpose of the ecological security of the country, establishing a source of income for individuals, supply of wood and other related products to meet the growing needs of the country and mitigation of climate change, TOF shall be developed further.

The proposition and actions

- The structure of the Forest Extension Wing of the BFD will be upgraded. A set-up at each *upazila* level will be created with an Assistant Conservator of Forests (ACF) as the head of the office and other support staff for forest extension and nursery management-related activities. One forest nursery will be maintained in each *upazila* for production of high-quality seedlings and use as a field demonstration site for good nursery practices. As close to 500 ACFs will be needed for posting one in each *upazila*, the positions will be gradually filled over the next 10 years or so, starting with making one ACF responsible for four or five *upazilas*. The extension staff will undergo special training to prepare for the tasks there will be undertaking.
- The possibility of creating a group of extension foresters within the BFD will be considered. This will ensure retention of knowledge and developed skill within the extension wing of the BFD. Forest Extension personnel posted in *upazilas* will work in close collaboration with the *upazila*-level extension services of other government agencies and relevant NGOs.
- An assessment of the state of TOF will be carried out within 2 years to document the full dynamics of the issues faced by rural tree growers, which will include quantification of the forest produce that they produce and the kind of support that they will require to harvest the full potential of the sector. Similar assessments will be repeated every 5 years in order to determine the trends in species choice, demand and supply of wood products and any impediment to the growth of TOF.
- All fallow land in tea gardens, fruit orchards and government and private institutions, including military and railways and all other barren land suitable for tree plantation will be brought under tree cover.
- Promotion of cultivation of medicinal and aromatic plants along with other recurring income-generating plants will be carried out in government and private lands. Planting of aromatic plants such as agar and *chandani* (*Santalum album*), natural rubber and various medicinal plants will be included in social/participatory forestry programmes. Social forestry activities will be extended to small holdings with rubber and agar plantations.
- Reviewing and testing popular agro-forestry models developed by the Bangladesh Forest Research Institute (BFRI) in collaboration with other relevant institutions and universities for promoting agro-forestry practices outside encroached forest land will be carried out to select the best models for the field. Development of integrated models involving forestry, horticulture and animal husbandry will be promoted.
- A strong research programme on TOF, particularly species suitable for different plantation programmes, including situation-specific climate-resilient species, seed sources, growth rates of various species in different combinations, economic and

silvicultural rotation periods and timber quality, will be formulated and implemented through the BFRI, and a strong forestry extension programme will be developed to disseminate the findings in partnership with the BFD, NGOs, Department of Agriculture Extension, etc.

- Quality seed production and supply will be undertaken by the BFRI, in partnership with the BFD and other relevant agencies and the private sector, to ensure easy availability to nursery owners. The BFRI will develop and test in the field different varieties of clonal rubber plants for use in the country. A forest nursery and seed certification programme will be initiated to encourage best practices in nursery management.
- In order to ensure that the participating communities and individuals get a fair price for their products, a proper marketing mechanism, including a network of markets, will be established, and efforts will be made to eliminate middlemen so that most of the benefits are reaped.
- The forestry-related laws and regulations, particularly the Forest Transit Rules, will be reviewed and updated to liberalize the regulations and remove hindrances to developing TOF as a mainstream economic activity. The Social Forestry Rules will also be made more grower-friendly, if necessary.
- The proportion of the Tree Farming Fund (TFF) in social forestry plantations shall be enhanced by incorporating a government share in order to increase the momentum of the plantation programmes. A provision needs to be made to use the TFF to plant additional areas other than forest land (encroached or otherwise).
- The involvement of NGOs, such as BRAC, Proshika, RDRS, Caritas and AF, Grameen Bank etc in promoting and facilitating further development of the TOF programmes will be encouraged. Externally aided projects for planting TOF spearheaded by NGOs shall be designed and pursued with development partners. NGO-supported afforestation projects should also qualify for corporate social responsibility (CSR) funding as and when such a law is passed, possibly in the near future.
- In view of the role of the CHT as a major watershed in the country, soil and water conservation measures shall be taken up in the unclassed state forests (USF) as a part of the watershed management initiatives. Watershed management projects in the CHT shall have afforestation, reforestation and forest restoration (within reserve forests (RFs) as well as USF) as significant components.
- In order to reforest the degraded USF areas, *khas* land in USF shall be assigned to private, corporate or co-operative entities, including NGOs, for commercial plantations, including teak, *gamar*, rubber and agar. The assignment shall be under the PPP framework as suggested elsewhere in this chapter. The size of the assigned lot should be commercially viable; otherwise, there will be the danger of such lands being diverted for other purposes. A strong regulatory mechanism shall be developed before such a policy is implemented so that infringements of the policy can be checked. Local communities shall be given large stakes in such projects by making them shareholders as well as by creating job opportunities for them.

8.2.5 Coastal afforestation, including the creation of a green belt (shelter belt)

The context and rationale

The coast is the most vulnerable area of the country in the context of the impacts of climate change, and a belt of mangrove and non-mangrove tree species can be extremely helpful in protecting against damage to life and property during cyclones and storms. The main purpose of the coastal plantations on newly accreted land has been to establish a barrier against the onslaught of frequent storms from the sea and to help stabilize the land. Bangladesh has pioneered the establishment of plantations as a barrier against storms, and from the 1960s, plantations were established on the new coastal accretions as well as on the dykes built along the coast to keep sea water out. So far more than 200,000 ha of plantations has been established in the coastal areas, although a significant portion of these plantations have either been eroded by the sea, returned to the Revenue Department, as agreed, or destroyed under biotic pressure. As mentioned earlier, a detailed study on the establishment of a 'green belt' was carried out by the Centre for Environmental and Geographic Information Services (CEGIS) with funds from the CRPARP. Depending on the suitability of the available land, the green belt will comprise plantations of both mangrove and non-mangrove species. The CEGIS has proposed the creation of a coastal green belt over an area of 126,553 ha of land in 37 *upazilas*. Out of this land, 66,752 ha is reported to be government-owned *khas* land, and another 60,101 ha of land will have to be acquired from private owners to complete the green belt. The study has estimated the cost of the green belt plantation, including the acquisition of land and rehabilitation of displaced families, to be Tk.260,407 million.²² This report needs to be reviewed in details and adopted. However, from now on it is advisable to establish coastal plantations in such a manner that where feasible, the new plantations be established within the area earmarked for the green belt plantation by the CEGIS.

The proposition and actions

The main features of the coastal afforestation and green belt initiative shall be as follows:

- Continue to establish coastal plantations with climate-resilient mangrove and non-mangrove species with good carbon-sequestering abilities and create a multilayered multispecies tree formation that also allows accrual of some benefits to the neighbouring communities while continuing to perform its protective role.
- Plan to create a permanent green belt with mangrove and non-mangrove species on newly accreted land, as well as acquired land where accreted land is not available.
- From now on, all new plantations in the coastal area will be established within the area earmarked by the green belt study for creating a green belt.
- Ensure the protection of these plantations with support and co-operation from the local communities and through the creation of Plantation Protection Units, whose sole function will be to ensure protection of the coastal plantations, including green belts.
- Review the current rules governing the coastal plantations and make appropriate changes to make them more effective. In addition, as the shelter belt is a permanent

²² CEGIS 2016: Technical study for the mapping of potential greenbelt zone in the coastal areas of Bangladesh.

protective feature, the current policy of 20-year vesting of forests with the BFD will have to be revised to ensure that there is a provision in the policy for permanent retention of land under the green belt by the BFD.

- All *khas* lands, *char* lands, institutional areas, roadsides, embankments, dykes and all available land shall be planted to complete the green belt.
- Where *khas* land is not available for plantation according to the plan prepared by the CEGIS and land acquisition is difficult in view of the cost or other considerations, a policy of 'coastal protection easements' may be considered under which the state can make it obligatory for land owners to keep a minimum prescribed number of trees on their land. Bangladesh already has a law called the Easements Act, 1882 (Act No. V Of 1882), which may be suitably amended, if necessary, to impose such an easement on land owners.
- As an alternative, an incentive system for retaining trees on lands designated for the coastal green belt may also be considered, under which land owners get paid an annuity for keeping their land parcels appropriately wooded. Other incentive systems can also be examined and explored.
- The layout and the species to be planted shall be in accordance with the mapping results of the CEGIS study (2016)²³ conducted for the coastal green belt.

8.2.6 Management of PAs and protection of wildlife

The context and rationale

Once the wildlife of Bangladesh was very rich. The wildlife populations have declined over the years mainly due to the loss of habitats as a result of large-scale destruction of forests and physical alteration of other wildlife habitats in the country. As stated previously, the recently conducted Red Listing of the fauna of the country reflects this situation. The forests have become very fragmented in all areas except the Sundarbans, where human disturbance has also become a major issue. As it stands now, except in the Sundarbans, some PAs are the only places where wildlife can be found. The Sundarbans, however, still remains rich in both terrestrial and marine biodiversity.

Bangladesh has prepared a Wildlife Master Plan, which details the strategies and interventions needed to improve the situation for wildlife in the country. The overall goal of this plan is to ensure sustainable conservation of wildlife for the benefit of the current and future generations of the country. The specific objective is to create the conditions essential for sustainable management of wildlife in Bangladesh. Twelve strategies have been developed for facilitating the implementation of the objective of the plan:

Species Programme. Control of external factors such as poaching, encroachment and environmental issues backed by implementation of necessary interventions, where necessary, particularly in the case of threatened species and species that come into conflict with human

Habitat Management. Management of habitats in core zones to ensure that the natural conditions of the bio-ecological zones and local physical characteristics are maintained through

²³ Ibid.

reduction of the impact of human activities through implementation of interventions where necessary to restore habitats

Ecological Networks and PA Management. To ensure protection of all species, PAs will be created in all bio-ecological zones. To resolve the increasing connectivity issues in Chittagong hills and Chittagong Hill Districts, resulting elephant-human conflict, forest corridors shall be strengthened.

PA Management. Following a model developed by the World Commission on Protected Areas, a standard format has been prepared for preparing management plans for all the PAs in the country. Such plans will include management regimes and restrictions on different activities that may not be carried out.

Institutional Development and Capacity Building. The plan proposes reforms including the formation of a separate wing within the BFD under a DCCF, Wildlife with wildlife and territorial DFOs being responsible for wildlife management and crime control within their respective assigned jurisdictions. A comprehensive review of the administrative and operational procedures of the BFD will be conducted regarding recruitments, training, promotions and disciplinary systems. Active co-operation will be sought from other law-enforcing agencies.

Policy and Legal Framework Development. Measures will be taken to facilitate the adoption of the Biodiversity Policy, 2004 and Biodiversity act 2016 by the Government of Bangladesh (GoB), and the provisions of Land Use Policy will have to be implemented to arrest the conversion of forest land. To allow proper conservation of wildlife, operationalization of the Wildlife Act, 2012 is urgently needed. Rules and regulations prepared under the act will have to be adopted to make the act work. In addition, reviewing the act and formulation of necessary amendments, rules and regulations will be essential.

Wildlife Crime Control Strategy. Legal reforms, strengthening the criminal justice system, organizational reforms of the BFD, strengthening inter-agency co-operation, reducing the demand for wildlife products, strengthening border control and improving community stakes in combating wildlife crimes will be undertaken. Wildlife Crime Control Unit (WCCU) should be strengthened and operational in full swing.

Supporting Communities in Wildlife Zones. Stakes of communities in wildlife conservation and PA management will be strengthened through sharing of benefits, creation of employment opportunities and facilitating co-management wherever feasible.

International and Regional Co-operation. In order to effectively interact in international and regional collaborative fora and platforms, the national inter-agency collaboration will have to be strengthened and national partner agencies will have to be formed. Bangladesh's obligations under the treaties it ratified will have to be fulfilled.

Nature-Based Tourism Development. Nature-based tourism will be promoted. Tourism in PAs will be kept within sustainable limits, and livelihood opportunities will be created for communities.

Communication, Awareness and Education. A communication strategy targeting specific groups in relation to the roles they can play will be formulated. A common strategy aimed at reducing the demand for wildlife and habitat degradation will be formulated and implemented. Mass public awareness-raising will be undertaken.

Wildlife Research. Research in wildlife-related issues will be strengthened, and collaboration with other national and international research institutions will be sought to improve knowledge. Wildlife Center should be developed as a center of excellence in the field of wildlife research, monitoring and training in the country.

8.2.7 Maintenance and protection of existing plantations

The context and rationale

Establishing new plantations is an expensive forestry operation. But the budget for maintenance of plantations is normally provided only for the first 3 years. There is no provision for silvicultural operations after the third year, and tending operations like thinning at different ages of the plantation to enhance the size and quality of trees are no longer carried out. In the case of social forestry plantations, the beneficiaries continue to look after the plants, but in coastal and other long-rotation plantations, the plantations are virtually uncared for after the period of their initial establishment. Both large and small trees and even saplings are removed illicitly. More than 200,000 ha of coastal plantations, and an even larger area of plantations in the hilly region of the country, has been raised. In the absence of routine monitoring of the status of different plantations, no one seems to have a clear idea of what extent of these plantations is currently in existence.

The proposition and actions

The following measures shall be taken in order to ensure that all the plantations are looked after and protected in perpetuity:

- All required silvicultural operations will be carried out in all plantations. To ensure an enhanced quality of trees, necessary thinning operations, will be carried out as required, particularly in the long-rotation plantations. Intensive tending operations for all plantations will be carried out till the age of 5 years. The thinning operations will be carried out in older plantations on the basis of the management prescriptions formulated.
- Plantation protection measures for all types of forested areas will be strengthened by providing adequately trained manpower, the requisite tools and logistics along with support from other law enforcement agencies. This will include maintaining a watch over all plantations until they are felled.
- Innovative/participatory mechanisms for management and protection of existing plantations will be developed and implemented.
- The current practice of issuance of *jot* permits in the CHT will be reviewed and revised, and adequate measures will be incorporated in the process to ensure that this practice does not become a 'licence' for illegal transit of timber from the government forests of the area.
- Assistance shall be garnered from communities living near plantations by providing alternate income-generation activities.
- Engagement of local communities for protection of long-rotation plantations of teak and other species in the hill forests will be explored and facilitated on the basis of benefit-sharing arrangements made for social forestry.

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- Plantations of historic and heritage value shall not be harvested and shall be preserved as national monuments.
 - The state of all old plantations in the CHT and other hill areas shall be reviewed and a suitable programme to regenerate all destroyed/degraded plantations shall be developed in partnership with local people on the basis of social forestry provisions.

8.2.8 Firewood-saving devices and technologies

The context and rationale

It has been established that more than 80% of the wood used is consumed as cooking fuel and that a shortage of fuelwood in rural areas is the principal hindrance to increasing the tree cover both in forests and outside forests. However, the use of improved cook stoves can reduce the consumption of fuelwood by up to 50%. Apart from cook stoves, biogas, bottled gas and solar cookers can also reduce the consumption of fuelwood significantly. Preferential supply of cooking gas to forest-side communities can go a long way in protecting forests. Many NGOs are already working in this field, and considerable progress has been made in this regard. But there is plenty of scope to improve these technologies in aid of conservation of forests. Because of the important stakes of the forestry sector in this activity, the BFD should join hands with existing players to spread fuelwood-saving technologies, particularly in the impact zones of state forests.

Apart from cooking, illegal brick kilns are a major consumer of firewood and are considered an important degrading force of the forests nearby. The pollution caused by the fixed chimney kiln (FCK) industry is estimated to cause nearly 20% of the premature deaths in Dhaka city (World Bank 2011). The Brick Manufacturing and Brick Kilns Establishment (Control) Act, 2013 not only prohibits the use of firewood in brick burning but also prohibits old technology and the establishment of kilns within 2 km from the boundary of a public forest. However, due to several reasons, including a lack of enforcement, the expected transformation has not taken place although the United Nations Development Programme (UNDP) has installed a limited number of energy-efficient brick kilns to demonstrate energy-efficient brick making, under its Green Brick Project, since 2012.²⁴

The proposition and actions

The following steps shall be taken to promote fuel-saving devices and technologies in the country:

- Reviews will be conducted of the ongoing programmes of various agencies to promote various fuelwood-saving devices and technologies and to identify the interventions necessary to improve their effectiveness. The BFD will work with existing players active in promoting fuelwood-saving cooking devices to encourage their use in the impact zones.
- There will be collaboration with the Sustainable and Renewable Energy Development Authority (SREDA) and other agencies (e.g., Global Alliance for Clean Cook Stoves,

²⁴http://www.bd.undp.org/content/bangladesh/en/home/operations/projects/environment_and_energy/improving-kiln-efficiency-in-brick-making-industry-.html

National Cook Stove Testing and Knowledge Centre) to develop suitable subsidy programmes in order to increase the popularity of fuel-saving devices in the impact zone.

- The Social Forestry Wing of the BFD shall launch programmes related to fuelwood-saving activities and register these programmes as CDM, INDC or NAMA activities to generate more resources for conservation.
- The BFRI must take up research to develop innovative and cost-efficient energy-saving processes and devices in partnership with the NGOs and government agencies involved in conducting research and development on improved cook stoves, biogas and other relevant technologies.
- In view of the huge illegal consumption of fuelwood by the brick industry, the BFD shall collaborate with the Department of Environment (DoE) and Deputy Commissioners (DCs) in enforcing the Brick Manufacturing and Brick Kilns Establishment (Control) Act, 2013 effectively.
- All the brick kilns operating within the restricted zone around public forests shall be identified and a mission will be developed to have them shifted away from forests, in collaboration with the district administration.
- The BFD shall collaborate with relevant government departments in promoting new energy-efficient brick-manufacturing technologies through the following steps recommended by the World Bank (2011).
 - Recognize brick kilns as a formal industry. This would enable easier access to financial resources (which in turn would enable investment in cleaner technologies and access to flood-free land) and improved working conditions.
 - Create a brick technology centre to raise awareness about the benefits of cleaner technologies. The centre should (1) disseminate information on the social benefits provided by cleaner technologies, new wall materials (e.g., perforated and hollow bricks) and alternative raw materials; (2) promote pilot projects related to new technologies with improved provisions (e.g., mechanized, higher labour productivity and larger product lines); and (3) improve the use of existing dissemination channels (e.g., field visits to pilot plants, video demonstrations of the technologies, use of the Bangla language) and introduce new channels (e.g., newsletters, industry journals, conferences and Internet blogs).
 - Support research and development aiming at (1) exploring alternative raw materials that are locally available, brick diversification and the use of higher levels of mechanization and (2) conducting new studies such as energy consumption studies, land surveys and brick technology surveys.
 - Facilitate subsidized credit lines to account for reduced health impacts from pollution and other economic incentives supporting the production of new wall materials and use of alternative raw materials (e.g., via specific funds and preferential tax policies, as in China).
 - Provide access to carbon markets, on account of the carbon emission reductions provided by cleaner technologies.

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- Train several stakeholders with regard to the benefits of adopting cleaner technologies (e.g., brick owners, workers and the financial sector).

8.2.9 NTFP plantations and related enterprises

The context and rationale

Although reliable information on the subject is not available, the production of non-timber forest products (NTFPs) is believed to have gone down considerably with the degradation of forests in general. NTFPs such as bamboo, agar, cane, *murta* and honey, in addition to being the most significant components of forest biodiversity, have always been a significant part of the rural economy. Agar, which produces a high-value oil used as a perfume, particularly in the Arab countries, used to occur in the Sylhet, Chittagong and Chittagong Hiltrac forests in the past but now only occurs in plantations established in Sylhet and Chittagong. Likewise, rubber, which was originally a forest tree from Brazil, only grows in plantations in Bangladesh. Both agar and rubber have very high possibilities as income-generating tree products. For the purpose of this study, these will be considered as NTFPs. It needs to be mentioned here that the interest in medicinal herbs is growing globally and that Bangladesh imports a large quantity of medicinal plants from abroad.

The proposition and actions

The following actions are proposed to promote conservation and sustainable use of NTFPs:

- A comprehensive assessment of the status of various NTFPs in the wild as well as outside forests, the processing industry, employment, consumption and demand, etc. shall be carried out.
- On the basis of the assessment, a detailed plan for the conservation, cultivation, processing, marketing, etc. of NTFPs shall be prepared and implemented in consultation and partnership with various stakeholders. The main objective of this plan shall be to conserve wild genetic resources as well as generate the maximum employment through various NTFP items.
- NTFP species shall be introduced wherever possible in the plantations and natural forests. NTFPs will be used extensively in social forestry initiatives.
- Plantations of bamboo, cane, *murta*, *golpata*, etc., which are items of common use, shall be undertaken in their native forests.
- NTFP-producing forest trees such as arjun (*Terminalia arjuna*), bohera (*Terminalia bellirica*), chalmugra (*Hydnocarpus wightianus*), amloki (*Phyllanthus emblica*) and haritoki (*Terminalia chebula*) shall be included in the species mix of plantation establishment programmes.
- Cultivation of NTFPs outside forests and development of NTFP-based businesses shall be encouraged through suitable subsidies and incentives.
- Incentives and know-how will be extended to entrepreneurs interested in establishing small-scale NTFP-processing facilities.
- Agar is a high-value commodity in the international market. The cultivation of agar in TOF areas shall be encouraged. The long procedures involved in obtaining transit

passes for the movement of trees to processing plants and CITES certification for export of agar oil and tree chips shall be simplified.

- As rubber has a big demand in the country, most of which is met through imports, and it has high potential in Bangladesh, support and incentives shall be provided in the form of land for plantations, low-interest financing, tax concessions, management know-how and, most importantly, high-yielding planting materials. In order to promote the cultivation of rubber and agar trees, tree farmers will be provided incentives similar to those provided for agricultural crops.
- As Bangladesh still uses rubber planting material from very old stock that gives low yields, it is very important that efforts be made to increase the per-hectare yields by introducing recently developed clones and varieties that have much higher yields. The Association of Natural Rubber Producing Countries (ANRPC), an association of major natural rubber-producing countries, provides access to high-yielding varieties of rubber planting stock and other know-how. Bangladesh is joining this body and will benefit from gaining access to these resources. Bangladesh will also benefit by seeking help from Malaysia and India with its effort to create a productive rubber sector. India originally brought in high-yielding planting stock from Malaysia. However, it has developed its own clones since, and the production in Tripura, where rubber has become an important part of the state's economy, has reached 3-4 times the production in Bangladesh using, among others, the variety RRIM 600 from Malaysia and the locally developed varieties RRI105, 118 and 300 and the recent 400 series clones. The Bangladesh Rubber Board, which was established in 2013, will have to be made fully functional to take these tasks forward. Processing wild fruits from trees such as the *keora* (*Sonneratia apetala*), *golpata* (*Nypa fruticans*) and *amlaki* (*Phyllanthus emblica*) may be encouraged, especially through small-scale cottage industries.
- With the biodiversity of the Sundarbans being of special significance to the country, sustainable levels and methods of extraction of various NTFP items shall be studied and recommendations considered for implementation.
- As fishing in the Sundarbans is carried out mostly by poor fishermen, the current fee for fishing inside the forest shall be reduced substantially after a proper review, and a mechanism for extending loans to small fishermen will be established.

8.2.10 Forest-based industries

The context and rationale

As reported by the Bangladesh Bureau of Statistics (BBS), there are 33 kinds of industries and occupations based on wood and other forest products. Of these, the furniture manufacturing, construction and herbal medicines industries are perhaps the most significant ones. The furniture industry, for example, is valued at Tk.67 billion per annum and employs nearly 2 million people. Exports of wooden furniture are growing at a rate of nearly 104% per annum, and the government has declared the furniture industry as a thrust area of the economy. However, the use of local timber in furniture making is reported to be only 20%, while the rest of the timber used is either imported timber or imported processed wood products such as composite boards and veneers. The FMP shall aim to increase the share of local timber in furniture making as a means of import substitution as well as toning up the local timber production and markets. At

present the industry is suffering from a shortage of quality timber, a lack of access to modern technology and a shortage of skilled workers.

Likewise, the pulp and paper industry is suffering from an acute shortage of raw materials, and the entire requirement of raw materials of the private sector paper industry, which meets most of the paper and paper-product requirements of the country, is imported. The public sector-owned Karnafully Paper Mill, by far the largest paper mill in the country, is currently running at 50% capacity, mainly because of the shortage of raw materials—pulpwood and bamboo.

The proposition and actions

In view of the critical role that the forest product-based industry plays in the economy of the country, the following actions shall be taken:

- A comprehensive assessment of the forest product-based industry shall be launched to plan and encourage wood-based industries.
- Steps shall be taken to resolve the issues faced by forest product-based industries, such as supplying quality raw materials, facilitation of imports and exports, developing skilled manpower and rationalization of regulations.
- The Bangladesh Forest Industries Development Corporation (BFIDC) shall be entrusted with the responsibility of spearheading the growth and development of forest product-based industries and helping the overall development of the sector, including capacity building and taking the lead in implementing timber industry-related policies.
- The use of modern and efficient wood-processing technologies will be promoted and encouraged to ensure better-quality products and reduction of wastage during processing.
- As using substitutes will reduce the consumption of timber, establishment of industries engaged in producing wood substitute products will be encouraged by providing incentives, including tax breaks, for modern plants and equipment imports.
- Wood and other forest product-based industries will be encouraged to set up their own plantations.
- Establishment of pulpwood and bamboo plantations in the hill forests of the country will be promoted. The private sector will be encouraged to set up plantations in their own lands.
- Karnafully Paper Mill will be encouraged to develop pulpwood and bamboo plantations in the hill districts to meet its requirements of raw materials.
- Establishment of pulp mills to meet local requirements will be encouraged. The mills will be given support, in the form of land on lease, by the government for setting up pulpwood plantations.
- Establishment of commercial wood seasoning and treatment plants shall be encouraged, especially in the private sector. A massive drive to sensitize the industry and artisans about the importance of using seasoned and treated wood shall be launched.
- A value chain study will be undertaken to benefit both the growers of wood in the TOF and the wood-based industries.

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- The import duties on round-wood, processed raw materials and accessories of the furniture industry shall be reviewed in order to make the furniture industry more competitive in the export market.
 - The BFRI will undertake research on wood processing and will also provide training related to field application of their research findings.
 - Given the low level of production of rubber, compared with other major rubber-producing countries in the region, and the fact that the BFIDC's rubber estates are incurring huge losses every year, a detailed review of the viability of the BFIDC's continued management of these estates should be undertaken and the recommendations of the review implemented. Meanwhile, the establishment of rubber plantations, small and large, will be promoted with necessary support in the more efficient private sector.

8.2.11 Livelihood support to forest-dependent communities

The context and rationale

The well-being of the rural communities, especially those living near forests, and the forests are closely interlinked. Since the poor communities tend to overexploit their natural resources, the degradation of forests triggers further poverty among the communities concerned. Therefore, to help these poor rural communities towards sustainable livelihoods, it is important to facilitate and promote the development of alternative incomes through activities outside the forest and at the same time use these communities in forestry-related work as paid workers. The following actions are being proposed to strengthen and enhance the livelihoods of communities, especially those that are dependent on forests.

- A study will be undertaken to identify sustainable environment-friendly income-generating activities for the rural people that are practically feasible. This study will generate sets of recommendations region-wise, which will form the basis for livelihood support activities in the country. In addition, the study will also identify the mechanism, resources and technical know-how required, region-wise, for promoting alternate income-generating activities.
- The BFD, in association with interested NGOs and various rural development agencies, shall identify forest-dependent communities and/or families and shall assist them to secure viable alternative incomes outside forests to enhance their incomes and living standards.
- Where feasible, the BFD will allow intercropping of cash crops by participating communities in newly established plantations as long as such practices are not detrimental to the plantations where this activity is undertaken. Some such models have already been developed and successfully tested. These, in addition to developing other new and innovative models, will be further developed, fine-tuned and implemented.
- Financial and other incentives will be made available to marginalized forest-dependent communities and know-how provided for the development of small-scale enterprises.
- The BFD, in conjunction with the leaders of the forest-dependent communities and local elite, shall generate livelihood enhancement plans for each of the localities and identify the needs and availability of potential sources and implement the plan towards enhanced incomes and standards of living of the forest-dependent communities

concerned. They will also identify the local drivers of forest degradation and incorporate sustainable forest management approaches as required.

- Co-Management Committee (CMC) has been in practice since 2004. Now almost 28 CMC are established in about 22 protected areas.
- Communities will be involved in caring for and protecting forest plantations till such time when these are considered established. Provisions will be made in the budgets for plantation establishment for covering the costs of such assignments.
- The BFD, GoB, in concurrence with the Ministry of Finance, shall promulgate regulations to set aside 15-20% of all 'Forest Development Project Funds' towards a Community Development Fund to be used for the livelihood support of the forest-dependent communities for enhancing their incomes and standards of living. Detailed rules and regulations in this regard shall have to be promulgated in the next 2-5 years (from year 2016).
- Co-management system through CMCs should be strengthened and streamlined as strong element of the eco-development approach.

8.2.12 Control on forest encroachments

The context and rationale

Though the extent of the encroached forest lands in the country is reported to be about 104,000 ha, actually it is likely to be much larger. The dynamics of encroachment is complex, and both poor and well-to-do people are involved in the process. Many forest lands are claimed and occupied on the basis of dubious documents. Although forest encroachments are a complex socio-economic issue, forest lands have to be secured against unauthorized occupation in the interest of the environment and ecosystem services.

The proposition and actions

In order to ensure that no further encroachments on state forests take place, following steps are proposed:

- All state forest lands that are under the undisputed possession of the BFD will be immediately surveyed, demarcated and mapped, using the *mauza* maps, in conjunction with the LA&LR. The demarcation will be done with the help of permanent, conspicuous concrete pillars of uniform design that are visible from the pillars on either side. Every pillar shall be numbered and accurately recorded on the map along with its GPS readings.
- Cases of fresh encroachments will be quickly disposed of through quick eviction. Necessary revisions of the current rules and regulations regarding this will be undertaken to make sure that such evictions have legal coverage.
- The possibility of taking a decision by the highest authority of the government, if any category of poor and old encroacher (occupation prior to a specified date) is to be allowed to continue, will be considered and recommendations implemented. A suitable legal provision must be promulgated in this regard and the RORs are to be corrected accordingly.

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- All honeycombing encroachers whose claims are admitted shall be rehabilitated on the periphery of the forest block or nearby khash land. If no such lands can be made available, they shall be paid attractive cash compensations for vacating the forest land.
 - The government must allocate adequate funds to accomplish these activities as soon as possible.

8.2.13 Climate change-related programmes

The context and rationale

Bangladesh has been adjudged to be one of the most vulnerable countries in the world to the impacts of climate change. The magnitude of these impacts varies across the country. The coastal areas of the country are prone to impacts of sea level rise (SLR), salinity intrusion, tropical cyclones, tidal surges, etc. The floodplains in the central parts of the country are prone to erratic floods, recurrent droughts that may be very prolonged, etc. The north-eastern part of the country is vulnerable to flash floods. The hilly regions of the country are likely to be seriously affected by erosion and landslides. Recent studies have revealed changes in the rainfall pattern including intensive large-volume rainfall over short periods of time, causing greater surface runoff, soil erosion and flash floods. Such events will affect the country as a whole. Prolonged floods would severely affect many of the important crop and tree species of economic importance. The enhanced evapo-transpiration in winter will increase the moisture stress, especially in the plains sal forests.

Higher evapo-transpiration coupled with reduced flows in the rivers in winter are expected to enhance the soil salinity, which in turn would adversely affect the freshwater-loving species of the Sundarbans, especially the *sundari*. Such impacts generated by climate change will eventually lead to a change in species composition. Such forest degradation will also cause a gradual depletion of the rich floral biodiversity of the Sundarbans, which in turn will have serious adverse impacts on the fauna of the Sundarbans. The combined impact of reduced freshwater flow due to the loss of the connection with the Ganges, withdrawal and diversion of freshwater upstream and projected rise in sea level will alter the salinity regime. Such a situation will eventually alter the edaphic conditions, which in turn is likely to make the forests unsuitable for economic species such as the *sundari*.

Erratic rainfall patterns coupled with changes in the temperature may adversely affect the phenology. The flowering and fruiting timings may shift, resulting in reduced natural regeneration and establishment of tree cover. In addition, such changes will drastically reduce the ecosystem services, which will adversely affect the human well-being.

The proposition and actions

On the basis of the framework of the Inter-governmental Panel on Climate Change and key principles for integrating climate change in forestry, Bangladesh can effectively participate in REDD+ programmes and reduce its emissions by focusing on the following key approaches:

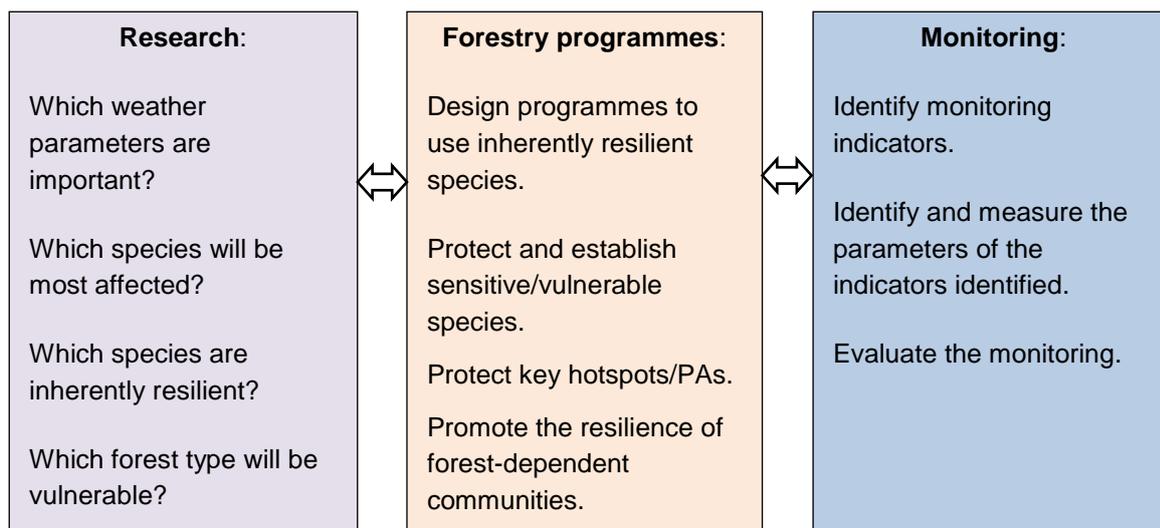
- Land use change from forestry to non-forestry uses will be minimized. Any release of land for non-forestry purpose will take place only in the case of utmost national-level necessity and such transfer will be compensated through the allocation of same sized area of suitable land elsewhere together with funding for the establishment of forest tress cover.

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- All degraded forest will be restored and managed under principles of “sustainable forest management”.
 - The drivers of the degradation of forests will identified and mechanism for dealing with these will be implemented ensuring that such interventions are environmentally appropriate, socially beneficial and economically valuable.

All forest lands, which are devoid of any tree cover, will be brought under tree cover through afforestation and reforestation programmes. Afforestation programmes will be taken up for the newly accreted mudflats in the coastal areas and comprehensive reforestation programmes will be undertaken in the degraded forest land of both hill and sal forests. A detailed proposal for creating a ‘green belt’ of trees have been prepared under the CRPARP. Recommendation of this study will form the basis for all future coastal plantation programme. These key approaches need to be integrated into overall climate change mitigation measures. With climate change becoming a major element in forestry, the management of forests needs to be research and knowledge-based. This is particularly important in the context of Bangladesh where very little pertinent information is available. These practices need to be adaptive in nature, in order to maintain key processes and ensure healthy biodiversity, steady stream of ecosystem services and resilient livelihoods to local communities. Adaptation, in case of forestry may be practiced through the use of species manipulation that will be suitable under the changing climatic impacts.

In this context, till the required information in this regard are available, the broad areas of climate-resilient forest management framework will comprise the following:

- Identification of key climatic parameters, species-wise, that will have the most pronounced impacts. In addition, vulnerability within the life cycle of a species shall have to be identified. Till refined information in this regard is available, observations and experiences will be used.
- Climate-resilient species will be promoted and special programmes on species requiring recruitment will be designed, and support will be provided for any reforestation, afforestation and restoration programmes;
- Landscapes and community livelihoods shall be secured and improved so that they have better endurance against the impact of climate change; and
- Landscapes will be designed in such a way that the trees/forests continue to provide the required ecosystem services.
- The main aim will be to bring as much area as possible under tree cover, irrespective of what species are planted.



Within this framework, the programmes can be divided into two categories, namely adaptation and mitigation. Many of the recommendations corroborate the recommendations of the Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2009) and NAPA, 2005.

Research and monitoring programmes. The research activities necessary for adaptation and mitigation are listed here.

(A) Adaptation

- Forest, fruit and other trees/plant species that are climate inherently climate-resilient in general or at site-specific situations and those that are vulnerable will be identified. In addition to field trials and research, local knowledge about the suitability of species will be taken into account in selecting species. Weather parameters such as dry spells, prolonged droughts and erratic rainfall that cause physiological stress will be reviewed and assessed. This experience and field knowledge will be put to use till firm research findings are available.
- A forestry-related climate change early-warning system will be developed, and a system for assessing the possible impact of climate change will be put in place. A well-designed monitoring system for region-wise evaluation of the changes in ecosystems will be set up. Mass participation in the monitoring process will be encouraged and institutionalized.
- Forest areas vulnerable to pests, diseases and other exogenous causes will be identified, together with any changes in the phenology.
- Modelling of inundation, salinity, SLR, etc., region-wise, with specific time lines, will be carried out and the results utilized.

(B) Mitigation

- A prioritized list of species and forest types, with respect to their carbon sequestration capabilities, will be developed to facilitate species choice in forestry programmes.
- The scope of carbon credit under REDD+ and investments thereto will be determined, and actions will be taken to access such funding.
- Research will be conducted to assess the changes in silvicultural treatments, such as thinning, pruning and climber cutting, in the context of climate change, and possible interventions for redressing the situation will be formulated and recommended for use in

the field. In addition, research will be carried out on the impact of climate change on the environmental and socio-economic functions of ecosystems.

Afforestation, reforestation and restoration programmes. The approaches to afforestation, reforestation and restoration programmes in the adaptation and mitigation context in connection with climate change are listed here.

(A) Adaptation

- Support will be provided to existing and new coastal afforestation programmes, along with the creation of a coastal green belt, taking into account the probable impacts of climate change.
- Henceforth, all coastal plantation establishment programmes will be confined, as far as feasible, to the area earmarked under the study on the creation of a coastal green belt, with the aim of creating a continuous green belt.
- The area under tree cover will be increased all over the country, including forests, using inherently climate-resilient species. The main objective of this initiative will be to increase the tree cover in the country through the establishment of plantations, irrespective of whether the trees are forest or non-forest species.
- The area under PAs will be extended and managed properly to ensure that the tree cover in these areas is maintained. Special interventions will be initiated to conserve biodiversity, especially vulnerable species, and significant ecosystems.
- Adaptation plans for important but vulnerable tree species will be formulated and implemented on the basis of research findings and a vulnerability analysis.
- Awareness-raising programmes aimed at the public will be undertaken so that they can adapt better to climate change.
- Capacity for handling climate change-related issues will be developed within the BFD. This will include basic exposure to and training in climate change-related issues. In addition, specialized training on different aspects of climate change and how to address these will be given to some officials so that the BFD has in-house capacity for handling climate change-related issues.
- Re-introduction of recently extirpated species, natural regeneration, assisted regeneration and maintenance of mixed-species forests to enhance resilience to pests and diseases will be promoted.
- As forest fires bring about changes in edaphic condition and lead to the elimination of many useful soil organisms, burning of debris during preparation for establishment of plantations slash-and-burn farming will be discouraged.
- Local people, NGOs, the private sector, etc. will be involved, where appropriate, in afforestation, reforestation and restoration programmes to inculcate some sort of ownership of public forests. Only climate-adapted species that are salinity resistant, water-efficient, drought-resistant, wind-resistant, etc. will be selected for future planting programmes. Ecologically harmful species, including invasive ones, will be avoided.
- Silvicultural operations will be carried out strictly to facilitated healthy growth of desired species and control of undergrowth and undesirable species. The planting designs in all

forest types will provide the maximum protection against erosion, landslides, etc. and in the case of coastal plantations will trap silt more efficiently.

Mitigation

- High-quality planting materials, inherently climate-resilient species, modern planting techniques, proper silvicultural practices, scientific forest management, etc. will be employed. There will be strict protection, community involvement, people's participation, etc. to ensure high levels of success in the establishment of plantations.
- The forest cover will be increased through approaches appropriate for a given locations and suitable and beneficial to local communities. Efforts will be made to reduce evapotranspiration and competition for water through vegetation management techniques such as thinning, pruning and planting deciduous and narrow-leaf species.
- Provisional plus trees or mother trees will be developed as sources of good-quality seeds for establishing climate-resilient and high-carbon-sequestering forests. Seed orchards of desired species will be developed as long-term sources of good-quality planting materials.
- The carbon sequestration capacity of forest stands will be maintained or increased by avoiding forest degradation and by manipulating the management regime in a manner that favours species with better carbon sequestration capacity so that the carbon stocks remain constant or are enhanced over time.

Landscape and livelihood programmes. The adaptation and mitigation approaches in the context of climate change that will be used for landscape and livelihood programmes are described here.

(A) Adaptation

- Comprehensive and participatory planning and investment for climate resilience are to be planned in such a manner that the incomes, job opportunities, health, etc. of the communities living in and around the forests are not adversely affected.
- An extensive programme will be implemented to enhance the endurance of settlements in coastal and other vulnerable areas against the onslaughts of cyclones, tidal bores, other natural hazards, etc.
- Roads, embankments, coastal plantations and social forestry programmes at a landscape level are to be designed in such a manner as to minimize wind thrust, wave action, tidal surge thrust, etc. Multi-storied forests, forests with high floral diversity, deep-rooted trees and tree species that can withstand salinity, high rainfall, droughts, etc. that are likely to benefit the local communities need to be used while designing such programmes. Such programmes will enhance the carbon sequestration as well.
- Landscape connectivity will be maintained and corridors established through restoration and reforestation, through people's participation if required.
- Alternative livelihood support will be provided to the poor, especially women and children engaged in fuelwood collection for their livelihoods.
- Off-forest income-generating activities will be promoted and facilitated for forest-dependent communities, especially women and children engaged in fuelwood collection.

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- Steep and unstable slopes (with or without settlements) will be identified and best practices and guidelines developed. These guidelines will be implemented with the involvement of the local communities to check soil erosion, landslides and other related natural hazards.

(B) Mitigation

- The use of different site- and regionspecific species suitable for homesteads and social forestry in climate change mitigation approaches at the landscape level will be promoted and the necessary support provided.
- Knowledge about climate change mitigation issues among vulnerable communities will be improved through awareness-building programmes so that they can assist the climate change mitigation approach at the landscape level.
- Programmes to raise awareness about forest laws, rules, etc. will be implemented to ease the prevailing perceptions among the people in general. These legal tools will also be reviewed and made more people-friendly. This will bring local communities and the BFD closer and help tree planting in the TOF areas, which in turn will increase the carbon sequestration capacity of TOF in different areas.
- Support will be provided to existing and new homesteads through social forestry programmes, which will help the climate change mitigation approach at the landscape level.
- The development and implementation of field projects having a tree-planting component will be supported for enhancing the carbon stock in the area (TOF), and this will assist the climate change mitigation approach at the landscape level.
- Climate-resilient agro-forestry techniques and models will be developed for the hills and the coastal and central zones. Implementation of such agro-forestry programmes, especially on private lands, will enhance the carbon stock to assist climate change mitigation at the landscape level.
- Capacity building of all forest extension officers about the implications of forestry and tree planting on climate change mitigation approach will be undertaken.
- Programmes will be undertaken to increase the supply of fuelwood and timber supply from TOF areas through extension forestry. This will reduce the demand for these forest products and shall thereby reduce degradation of the forests, which will assist the climate change mitigation approach at the landscape level.
- The use of improved cook stoves, biogas plants, solar cookers, etc. will be promoted in rural areas (TOF). This will reduce the forest degradation and assist the climate change mitigation approach at the landscape level.
- Financing climate change-related programmes
- Addressing climate change issues is a major technology-, know-how- and resource-intensive exercise that countries like Bangladesh are unable to fund. However, funds have been made available under different bilateral and multilateral arrangements.
- Under the aegis of the United Nations Framework Convention on Climate Change (UNFCCC), there are several mechanisms such as CDM, REDD+, INDCs, NAPAs and

NAMAs that entitle developing countries to sell carbon credits earned by sequestering carbon or by preventing emissions of greenhouse gases to developing country entities to help them offset their carbon emissions. Although carbon prices have sharply declined over the last many years and currently hover around \$5 per CER, taking action to sequester carbon or prevent emission is still high on the agendas of governments because these actions bring in huge co-benefits. For example, preventing deforestation or degradation of forests in pursuit of carbon credits under the REDD+ framework benefits a country through enhanced production of wood, generation of employment, conservation of soil and water, mitigating floods and other climate induced hazards and so on. Countries can also get international assistance for setting up the institutions and processes that can enable them to launch programmes to produce carbon credits for sale. REDD+ is the most significant programme due to the huge co-benefits that a national REDD+ programme can generate for the country while setting the stage for earning significant revenues from the sale of carbon credits as the forests mature. As most of Bangladesh's natural forests have already been degraded and destroyed, the potential for earning credits under a REDD+ programme is quite good as there is not much more to destroy and the only way the country can go is upwards.

- Bangladesh is preparing to set up its National REDD+ Programme, under the UN REDD+ programme, which will encompass all the forests of Bangladesh, as has already been suggested in the BCCSAP. Afforestation/reforestation under the CDM is not considered a feasible option due to heavy administrative overheads, the absence of Annex I partners to finance the activities and the uncertainty over the continuation of the mechanism under the new climate agreement that will come into effect in 2020.

Note: For additional information on steps taken to strengthen community resilience and adaptation to climate change, please see 'Adaptation policies and practices for communities' (Chapter 5 Climate Change Impacts, Section 5.4.2).

8.2.14 Forestry research

The context and rationale

Modern forestry is highly dependent on scientific research and analysis. Forestry is facing many new challenges that can be addressed only on the basis of solid information collected through scientific programmes. In order to enable science- and knowledge-based decision making in forestry, research in forestry and allied disciplines shall be provided adequate support. Forestry research in Bangladesh suffers from various issues and problems associated with a lack of direction, inadequate resources, facilities and capacity and administrative red tape. No research is being carried out currently on the important challenges and emerging issues.

The proposition and actions

The following actions shall be taken in this regard:

- As a part of a review of the sector, the current issues and problems will be reviewed and recommendations formulated and implemented. On the basis of the outcome of this review, the BFRI shall be modernized and strengthened with resources and staff members to enable it to take the lead in forestry research in the country.
- Given the lengthy bureaucratic process associated with recruitment, procurement and other routine activities of the BFRI, a comprehensive assessment of the need to make

the BFRI a partially or fully autonomous organization shall be reviewed and the recommendations implemented.

- A forestry research plan will be prepared in consultation with the BFD, the BFIDC, forest resource-based industries and relevant private sector organizations and implemented.
- Facilities for research on climate change issues, NTFPs, genetics and plant breeding and silvicultural issues will be established on a priority basis. This research will include identification of tree species not vulnerable to climate change and efficient in carbon sequestration for plantation programmes in different types of forests of the country; studies and field trials related to the suitability of different species for the different sites and forest types of the country; economic feasibility; development of improved varieties of planting material; regulation of the yield of oil from agarwood; and more efficient use of wood and wood products.
- Improvement of planting materials, particularly rubber, will be undertaken under the genetics and plant breeding programme. Collaborations will be established with rubber research facilities in Malaysia and India. As rubber cultivation has been a major success in the Indian state of Tripura, where high-yielding clones are reported to be yielding up to four times the average production in Bangladesh, Tripura has very similar climatic and edaphic conditions and part of Tripura is an extension of the hills of the Chittagong hill districts and Sylhet, the possibility of recommending clones from Tripura for Bangladesh plantations will be assessed. Research on the suitability of other clones from different sources will be tested, and new clones will be developed.
- The capacity for research on the social and economic aspects of forestry will be strengthened.
- The forestry and wildlife programmes at different universities will be encouraged to undertake applied research in these disciplines. Some applied research, which the universities are better qualified to undertake, will be outsourced to them.
- A definite allocation will be made available to the BFRI and other research institutions to cover the costs of research undertaken on their behalf. These institutions will include the BFD, the BFIDC and other clients from the sector and outside.
- The BFRI shall organize forestry research seminars in which forest scientists will present their work and the user agencies, such as the BFD, private planters, forest-based industries and NGOs will evaluate their work and will communicate their research needs to researchers.

8.3 Supportive strategies

The success and effectiveness of the implementation of the above programmes shall depend on the progress made in respect of certain systemic changes and developments required in the forestry sector institutions, approaches and working environment. Actually, these are basic prerequisites for a successful implementation of actions and interventions listed in this plan. The strategies to improve the effectiveness of the programmes shall be as follows:

8.3.1 Reforming institutions and enhancing the capacity

The context and rationale

The current administrative structure of the BFD is the result of several 'add-ons' added over several decades. These endeavours were ad hoc at best and not based on a comprehensive administrative review and its recommendations. This has resulted in a structure that is not always cohesive and effective.

In addition to the set of urgent issues that have already been discussed, the situation relating to the manpower and in-house capacity of the BFD has become alarming. In addition to half the posts currently lying vacant in the top two tiers of positions, cadre positions and Forest Rangers, the institutional capacity, administrative problems, litigations and unwise reorganization-related decisions have made the situation almost untenable. This has created a situation where there is insufficient manpower and capacity to handle the current load of activities properly, let alone undertake new tasks. As discussed previously, the BFD recruited a large number of ACFs starting in the early 1990s against projects who were, though retained on completion of these projects, not absorbed in the BCS (Forest) cadre. While a number of attempts were made to have them encadred, the issue has not been resolved yet, and around 80 highly experienced and mostly foreign-trained officers are still working as ACFs even though some have put in around 25 years of service in the BFD. If this set of officers had been inducted into the cadre, there would have been a much stronger professional forestry cadre. In addition, with most of the senior officers retiring in less than 2 years, there is virtually nobody to replace them as the next lot of officers have not put in the prescribed length of service yet to qualify for some of the seniormost positions in the department. Although expedited recruitment of cadre officers is reported to be in the offing, the planned recruitment is not even adequate to meet the vacancies at the junior level. The situation in the technical/sub-ordinate service is no better. Direct recruitment at the level of Forest Ranger, which is a vital position in the forest administration, has been discontinued since 1995, and about 90% of the currently serving Forest Rangers will retire by 2020! Almost all positions of Deputy Rangers are presently vacant. A problem similar to that involving non-cadre ACFs also exists in the case of lower-level officials. While recruitments at the Forester and Forest Guards levels are being undertaken in large numbers to fill vacant positions, such quick fixes are not possible in the case of ACFs and Forest Rangers. In addition, in order to implement the activities proposed under this plan, a large number of additional cadre officers, over the current sanctioned number, will be needed. The BFD proposes to raise its staff strength from the current number of around 10,000 to 14,000 by 2020. While recruitment of large batches is not a desirable option, this is the only recourse available to the BFD. The conflict of seniority and the resulting litigations and other complexities involving cadre and non-cadre officers, absence of capacity-building programmes, low capacity, shortage of staff members at the professional, sub-professional and technical levels, absence of clearly planned regular annual inductions into the service, lack of organizational emphasis on

supporting TOF, poor information management, poor logistics, inadequate laws/rules, etc. are the other problems plaguing the BFD. The situations at the the BFRI, Bangladesh National Herbarium (BNH) and BFIDC are even worse. In the case of the BFRI, a shortage of staff members, particularly scientists, outdated recruitment rules, a lengthy recruitment process, a lack of opportunities for career progression, an overall lack of facilities and a lack of capacity for meeting new and emerging issues and problems are the main hindrance to the smooth functioning of the organization. The BNH also has problems similar to those of the BFRI. In spite of its name, the BFIDC does not undertake any development activity in the forest industries sector and is only involved in managing some furniture plants and rubber gardens. It has not made any profit in recent years and suffers from shortages of both staff members and skills. The rubber plantations are low-yielding, and a significant area is under old rubber trees. The yield in this area is either low or non-existent.

The proposition and actions

In view of the above, it is recommended that the following major institutional reforms be undertaken to ensure effective functioning of the forestry sector institutions. It is proposed that a sectoral review be undertaken first to identify the issues, constraints, possibilities and prospects so that these can be addressed through the formulation of an agency-level review and interventions.

Reorganization and strengthening of BFD

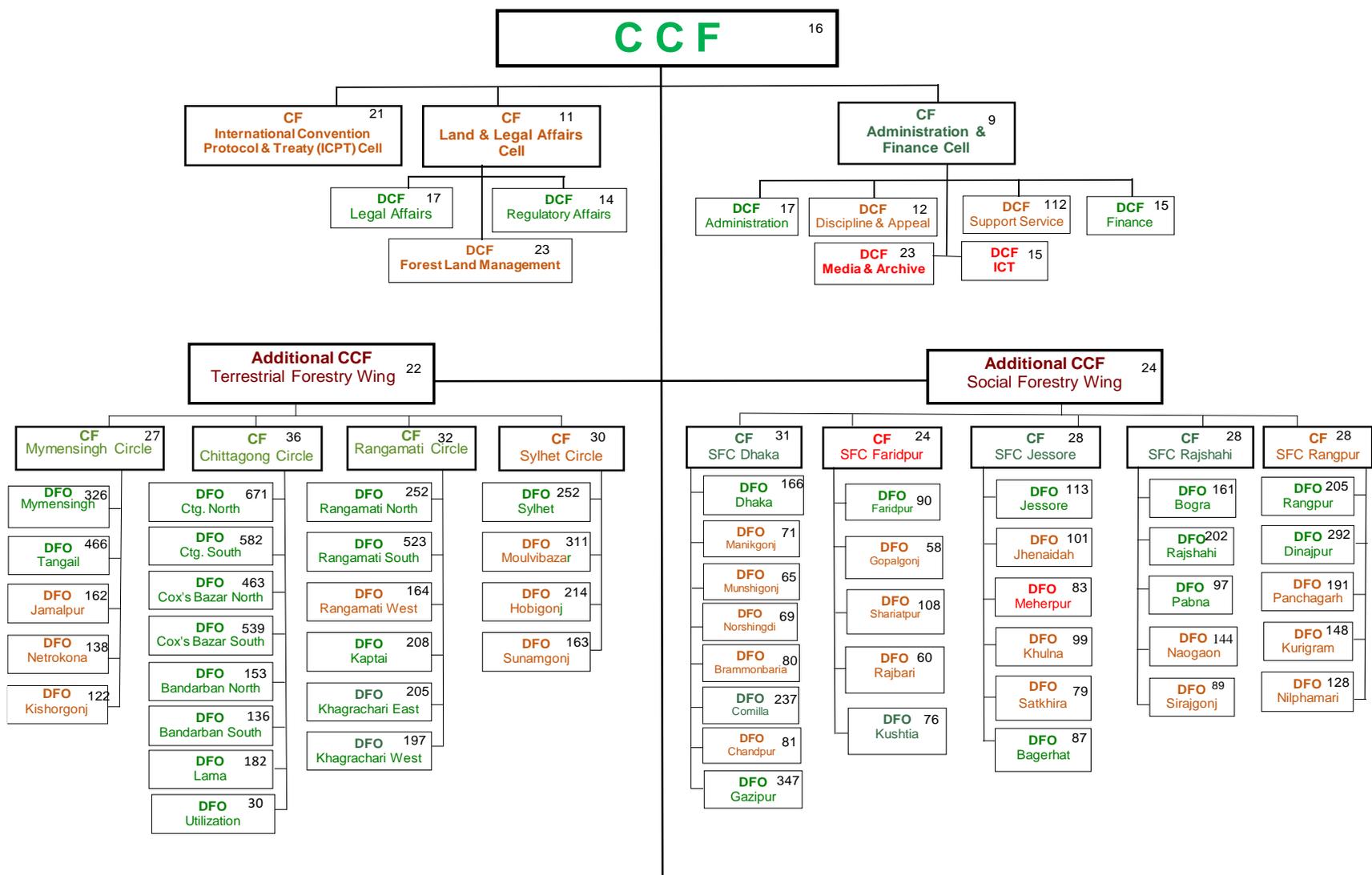
The organizational structure of the BFD has not undergone any fundamental change in decades. To meet the challenges of the present, the BFD is currently revising its organizational structure to streamline its operations and strengthen its effectiveness in shouldering its responsibilities and responding to emerging challenges. It has proposed a major restructuring, addition of new units to handle emerging and important issues and strengthening of the manpower at the field level. The master plan exercise has reviewed the proposal and finds it rational and endorses it. The main features of the proposal are the following:

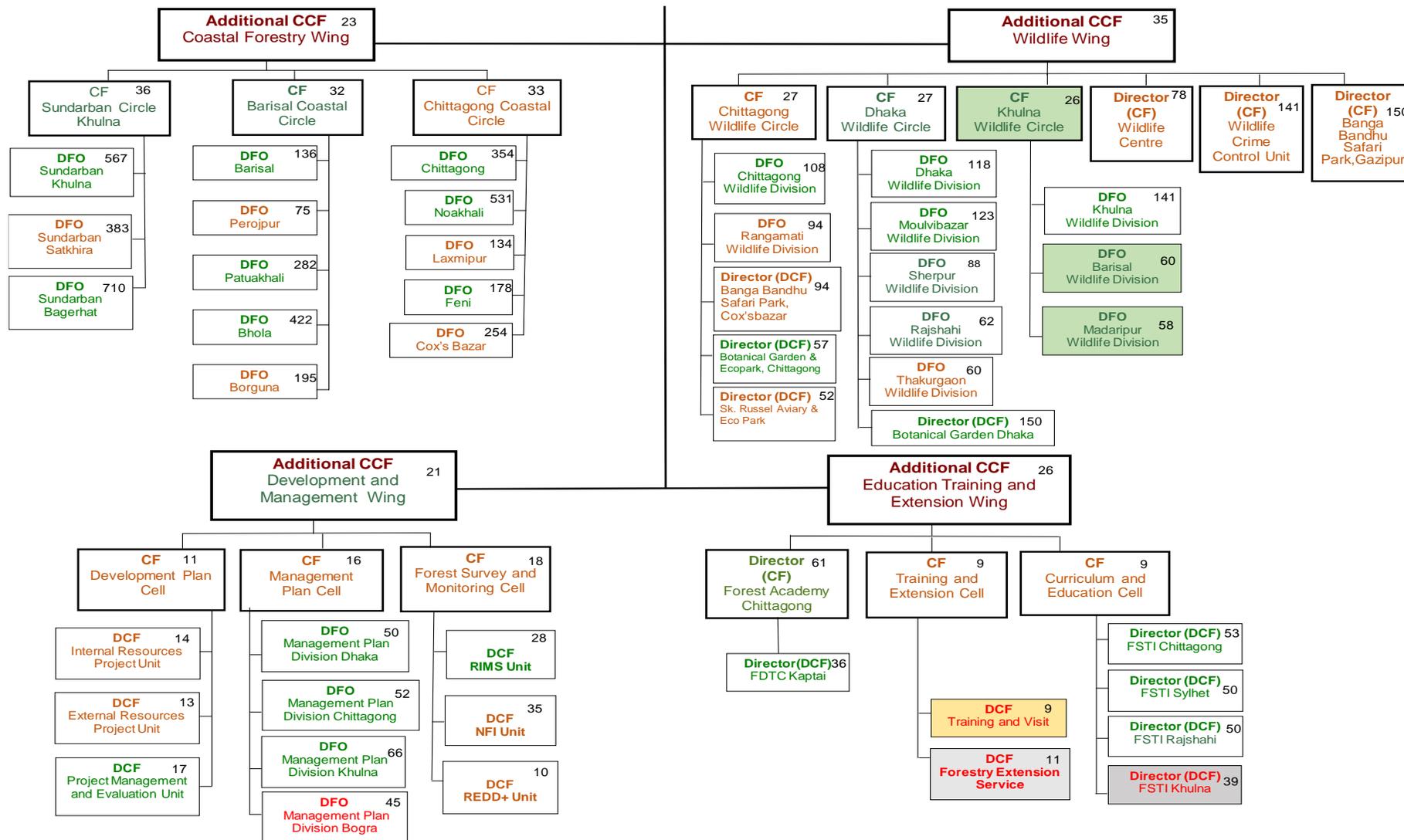
- To minimize the load on the CCF, the number of wings have been raised to six from four. The two new wings are the Coastal Afforestation and Wildlife wings. These wings will be headed by newly proposed Additional Chief Conservators of Forests (CCFs), who are Grade 2 officials.
- The field-level presence in the Territorial, Social Forestry and Wildlife wings has been extended by creating new forest circles and divisions. Both the Social Forestry and Wildlife wings have been greatly strengthened. The new proposal proposes the creation of 6 new positions of Additional CCF, abolition of 4 positions of Deputy Chief Conservator and 42 new posts of Deputy Conservators, 120 Senior Assistant Conservators, 274 Forest Rangers, 146 Deputy Rangers, 218 Foresters, 1856 Assistant Foresters and 1638 Forest Guards, as well as staff members in other positions. Like the position of Additional Chief Conservator, the position of Senior Assistant Conservator is a new addition to the BFD's hierarchy. This revision of the staffing will greatly enhance the capacity of the BFD in discharging its mandate.
- Because of the importance and emphasis on the growth of TOF, to strengthen the BFD's outreach, two new Social Forestry circles and 16 new forest divisions have been proposed. This will greatly increase the capacity for reaching out to parties interested in tree farming outside the government forest areas. One new circle, the Coastal

Afforestation Circle, and six new forest divisions have been proposed. Likewise, in the case of the Wildlife Wing, one new circle two new units, to handle wildlife crimes and to handle research and capacity building with regard to wildlife, respectively, with ranks of Conservators of Forest, and the new Wildlife Division have been proposed. A number of cells have been proposed to handle specialized tasks. These are the International Conventions, Protocols and Treaties Cell, the Forest Land and Legal Affairs Cell, the Forest Management Cell, the Development Plan Cell and Forest Survey and Monitoring Cell.

- The proposal for a position of Senior ACF between the ranks of ACF and DCF is in line with the hierarchy in other civil service cadres. The new position will shorten the period an officer needs to spend as ACF and will remove some of the obstacles to recruitment at the ACF level.
- Strengthening the field-level presence in ranges, beat offices, patrol and toll stations and Social Forestry units has been proposed. The forest beats have been categorized into 'A' and 'B' on the basis of their sizes, and the staffing has been proposed taking this into consideration. The number of forest divisions is proposed to be raised to 74. The presence of the Social Forestry Unit will be established in all 492 *upazilas*. It is proposed that these offices will be headed by Forest Rangers. However, the Master Plan exercise proposed the creation of a cadre position in each *upazila*. This proposal is in line with the staffing of other civil service officials posted to *upazilas*.
- This proposed reorganization is in line with the recommendations of the Master Plan. However, a comprehensive review of the organization, as proposed, will give an opportunity to fine-tune the structure.
- A self-explanatory organogram (Table 8-3) providing the necessary details is furnished here. The numbers to the right of each position denote the number of staff members in each office.

Figure 8-1: Proposed organogram of the BFD





Manpower	
Grade 1-9	- 601
Grade 10	- 759
Grade 11-17	-10450
Grade 18-20	- 5834

ABBREVIATIONS	
CCF	Chief Conservator of Forests
CF	Conservator of Forests
DCF	Deputy Conservator of Forests
DFO	Divisional Forest Officer
SACF	Senior Assistant Conservator of Forests
ICPT	International Convention Protocol and Treaty
SFC	Social Forestry Circle
FSTI	Forestry Science & Technology Institute
CFD	Coastal Forest Division
SF Div	Social Forestry Division
FDTC	Forestry Development & Training Centre
NFI	National Forest Inventory
SFNTC	Social Forestry Nursery & Training Centre

Proposed Office/ Units		
Sl no.	Name of Office /Unit	No.
1	Wing	6
2	Circle	15
3	Academy	1
4	Wildlife Centre	1
5	Wildlife Crime Control Unit	1
6	Botanical Garden	2
7	Safari Park	2
8	Aviary Park	1
9	Institute	4
10	FDTC	1
11	Forest Division	65
12	Wildlife Division	10
13	Management Plan Division	4
14	Metro- Plantation Unit	2
15	Upazilla Forest Office	497
16	SFNTC	105
17	Range	216
18	Timber Depot	7
19	Forest Check Station	58
20	Beat "A" Type	207
21	Beat "B" Type	271
22	Petrol Post	73
23	Tourist Support Unit	3
24	Dock Yard	1

The proposed structural revisions would increase the sanctioned manpower from 10,240 to 17,644 (Table 8-4).

Table 8-4: Comparison of number of BFD posts under the current and proposed organizational structures*

Grade	Current Organizational Structure	Proposed Organizational Structure
1-9	297	601
10	424	759
11-17	5349	10,450
18-20 (+ outsourcing)	4170	5834
Total	10,240	17,644

*The number of staff members in each class of post varies slightly from report to report.

A summary of the revised number of units in the BFD is given in Table 8-5.

Table 8-5: Proposed office/units

Sl. No.	Name of Office/Unit	No.
1	Wing	6
2	Circle	15
3	Academy	1
4	Wildlife Centre	1
5	Wildlife Crime Control Unit	1
6	Botanical Garden	2
7	Safari Park	2
8	Aviary Park	1
9	Institute	4
10	FDTC	1
11	Forest Division	65
12	Wildlife Division	10
13	Management Plan Division	4
14	Metro Plantation Unit	2
15	Upazila Forest Office	497
16	SFNTC	105
17	Range	216
18	Timber Depot	7
19	Forest Check Station	58
20	Beat 'A' Type	207
21	Beat 'B' Type	271
22	Petrol Post	73
23	Tourist Support Unit	3
24	Dock Yard	1

There are several inherent advantages associated with the adoption of the proposed revisions in the organizational structure that (1) address the principal institutional constraints that were discussed in Sub-report 7 of Task-1 and (2) provide an appropriate institutional structure, as well as arrangements for planning, implementing, and monitoring the Forest Management Plans. These are represented by the following proposed structural revisions and reforms:

- The integration of the planning and management functions under one wing, rather than under two detached wings, with increased manpower would not only increase the synergy between these interrelated functions, which would be strengthened with the presence of eight research planning officers, but would also increase the effectiveness of the management applications of the sustainable resource management plans developed as part of collaborative undertakings. It would also promote the establishment of more effective communication channels through multiple feedback paths, which would improve the operations of both the planning and management functions.
- The incorporation of a Geographic Information System (GIS) and Remote Sensing Unit into the Development and Management Wing under the proposed restructuring would expand the prospects for integrating spatial as well as other forms of data into the planning and management functions of the organization. It would also facilitate the planning and conducting of critical resource surveys and inventories supported through the presence of both a National Forest Inventory (NFI) Unit and a REDD+ Unit with sufficient resources, including remote sensing analysts and computer operators, as well as adequate financing, to preclude continued dependence on external project support. The placement of the RIMS in that unit, moreover, would provide an efficient mechanism for establishing centralized networking operations to strengthen the generation, management and dissemination of resource-related information through every level of the organization as well as establish a central point for consolidating information required to monitor the implementation of plans established in the Management and Development Wing.
- The establishment of a monitoring cell in the Development and Management Wing would complement these, as well as other related, developments by providing the structure required for improving the organization's monitoring and evaluation systems and ensuring efficient collection, collation and assessment of, even the most routine management-related information. The process of collecting those data would be supported by procedures that would enable the digitization of range and divisional forest cash books, which are the field repositories of forest resource management information, and introduce an efficient system of annual reporting that would enhance a reliable flow of information from the lowest to the highest levels of the organization.
- The upgrading of the Land and Legal Affairs Unit into a cross-cutting office under the administration of the CCF would expedite efforts to (1) amend notifications that would empower non-gazetted field staff members to exercise those powers that have heretofore been invested in gazetted forest officers to ensure that they have the power to enforce the Forest Act; (2) operationalize the Wildlife (Conservation and Security) Act, 2012 by promulgating the required rules and issuing appropriate empowering notifications; (3) unify the existing transit rules; and (4) review notifications of the Forest Act, 1927 that may have become obsolete or un-implementable over time as the result of changes in the organizational structure of the BFD.

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- Raising the level of the Wildlife and Nature Conservation Circle and CF Coastal Forestry Circle to the level of a wing (headed by an Additional CCF) is significant and points to the growing importance of their activities. Seamless planning of recruitment, HRD and HRM affairs is critical to the efficient operation of the organization.
 - Increasing the numbers of forest divisions of all kinds will fit well with the increase in work pressure expected with the implementation of the FMP. The increase in the number of training institutions will help meet the enhanced need for training with the increase in the strength of the staff and diversification of responsibilities.
 - The creation of 490 Upazila Forest Extension Offices will meet the long-felt need of the BFD to intensify its presence at the grassroots level, in the context of the need to promote homestead forestry and agro-forestry. This will also make for better co-ordination with other rural development departments as nearly all of them have *upazila* offices as their basic units.
 - Raising the profile of the two safari parks is important in view of the huge number of visitors and VIPs visiting these places on a regular basis. To manage a large influx of visitors and decision makers, the management staff need to be sufficiently senior and adequately empowered.
 - The creation of the new GIS, remote sensing, ICT, NFI and REDD+ offices indicates the growing importance of modern management tools and emerging areas of specialization. However, it would have been better to integrate all these units into the existing RIMS unit by raising its status to the level of a wing under an Additional CCF.

Irrespective of the configuration of the organizational structure of the BFD, however, there are several systemic constraints that were described in Sub-report 7 of Task-1 that would have to be resolved at the same time as the revision in its organizational structure if the performance of the organization were to be strengthened and the FMP were to be effectively implemented. The resolution of those restrictions would have to recognize (1) the irregular patterns of recruitment that have characterized the BFD's actions over the years, which have intensified cadre management problems, in which bulk recruitments to fill vacant positions, after years of no recruitment, have led to dissatisfied cadres due to the government's inability to ensure equal promotional opportunities to all members of bulk batches; and (2) the ad hoc recruitment practices of the BFD, which are perhaps best exemplified by the previous recruitment of a large number of ACFs on various projects who were transferred from the development budget to the revenue budget, their services regularized after the reorganization of the BFD in 2001 but not encadred yet.

The iterative, stepwise, systemized approach to remove the current distortions in the age structure and recruitment practices within the BFD would encompass the following sequence of actions:

1. A comprehensive plan for staff development and recruitment taking into account phased retirements, promotions and fresh recruitments will be developed. It is proposed that all newly recruited ACFs, Forest Rangers, Foresters, Forest Guards and Plantation Malis go through a training course after their recruitment in one of the BFD's training facilities. Within this training programme they will be taught about official antiquates, norms and disciplines and other topics that are not taught in an

academic programme. All recruits will have to spend a period, as appropriate, of on-the-job training before they take up positions of substantive responsibility.

2. A review of the facilities available for training new recruits will be undertaken, and these facilities will be strengthened and restored/reconstructed to facilitate the training of the larger-than-ever number of trainees.
3. As the Forestry Science and Technology Institute (FSTI), Chittagong has limited capacity and a shortage of qualified training staff members and other resources, necessary actions will be taken to address these issues so that the quality of training improves. In addition, in order to fill the vacancies available annually at the BFD and other agencies that have a requirement of forestry diploma holders, either the capacity of the institute will have to be increased or a similar programme will have to be started at another FSTI. The curriculum of the diploma programme will be reviewed to make it more in tune with the requirements of a field position in the BFD.
4. As a large number of new Foresters will be required to fill in the vacant and newly created posts over the next 3 years, a special programme for recruitment of additional Foresters shall be launched.
5. Because of the rigorous nature of the jobs they discharge, it is proposed that the maximum age limit for recruitment as Foresters be set at 25 years and that for Forest Guards at 20 years.
6. The BFD currently operates six training facilities. These are the Forest Academy, three FSTIs, the FTDC and the newly established Wildlife Centre. In this institute, updated and appropriate training programs need to be introduced to increase the knowledge capacity and skills of BDF officer and staff.
7. To attract qualified instructors at different forestry training institutions, it is proposed that a separate system be put in place where all the instructors serving in different training facilities will be enrolled as members and their promotions will be decided on the basis of seniority and other factors. In addition, time scale increments will be introduced in cases where an instructor has served the required number of years for promotion and cannot be promoted because of non-availability of vacant positions.
8. In this age of technology, which requires personnel with higher education, with computer literacy and exposure to data management and GIS systems, it is proposed that recruitments of Forest Rangers be resumed immediately, with graduation with a forestry degree from universities as the minimum required qualification. Seventy-five percent of the positions of Forest Rangers will be filled through direct recruitment and the rest through promotion. To attract more qualified candidates, efforts will be made to elevate the position of Forest Ranger to Non-cadre Class I from Class II.
9. In the interest of the BFD and to meet its organizational needs, the issue of the non-cadre ACFs needs to be resolved following existing rules and regulations without any further delay.
10. In future any recruitment against development projects will be avoided. Where unavoidable, the services of the recruits involved will be terminated from the dates of completion of the projects for which such recruitments have been made.

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11. Specialized training for forestry officials will be emphasized so that they can handle specialized jobs such as information and knowledge management, climate change issues, wildlife management, forest economics-related topics including valuation of ecosystem services and payment for ecosystem services, forest statistics, growth and yield forecasts and remote sensing and geographical information systems to ensure that the BFD has the required in-house capacity and is not dependent on external experts.
 12. Similar problems have been recently created by recruiting a large number of persons under designations which were not traditionally found in the BFD, but they are performing the functions of established ranks/designations (e.g., Wildlife Rangers, Biodiversity Conservation Officers, Wildlife Scouts). It is proposed that these designations be merged, as appropriate, with the mainstream designations (Forest Rangers, Forest Guards etc.) of equivalent ranks.
 13. As reflected in the BFD's proposal, it is proposed that a position of Senior ACF or Additional DCF be created between the ranks of ACF and DCF. This arrangement, which is in line with the hierarchy in other branches of the Bangladesh Civil Service, will shorten the time needed by an ACF to qualify for a promotion and take the officer up the ladder after 4 years to a higher position with increased salary, which will be an incentive. Likewise, in line with the positions in other similar government agencies, it is proposed that the post of Additional CCF be created in National Pay Scale Grade 2 and that the post of Conservators be in Grade 3. As the qualification for entry at the Forester's level is a diploma from the Technical Education Board, it is proposed that foresters be placed in the same level in the government service as that of other technical diploma holders. To attract more qualified candidates, efforts will be made to elevate the positions of Forest Rangers to Non-cadre Class I.
 14. It is important that the manpower needs of the department be assessed and appraised by a team of experts in view of the emerging administrative, managerial and technical needs of the sector. While the proposed new structure needs to be put in place immediately, a detailed organizational study should be commissioned to identify the needs and redundancies of the new structure, and the most efficient use and deployment of the available resources must be planned. The BFD has already prepared a proposal to increase the staff strength to nearly 19,635 by 2025, in view of the ever-enlarging mandate of the department. This proposal should be examined by some external experts and approved with necessary modifications if these are found appropriate.
 15. Specialized staff members with skills in modern technologies such as GIS, remote sensing, database administration and computer operation will be appointed on contract basis till such time when the BFD has gained the skills to handle such assignments. Adequate numbers of IT support staff members will be placed in the field offices to facilitate the transition to a modern management.
 16. Time scale-based incentives will be given as assured career progression to the incumbents in any posts where a regular cadre structure for promotions is not available or the career advancement opportunities are too narrow due to the small number of cadres.

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17. The three universities involved in forestry education are producing nearly 150 bachelor's and master's degrees in forestry each year. These institutions have qualified professors and required facilities and produce graduates of good quality. They can continue to be the source of ACFs and Forest Rangers. However, it is proposed that the curricula of the forestry programmes of the universities be reviewed and fine-tuned, where necessary, to make a perfect match with the BFD's needs.
 18. The practice of not promoting officials when both vacant positions and qualified officials are available should henceforth be avoided to avoid the problems created. The MoEF will set a time limit by which the BFD will submit a proposal for filling a vacant post. The CCF will ensure that a similar practice is pursued in the case of staff members whose promotion is his responsibility
 19. Provisions for special allowances will be made for officials serving in non-family remote offices.
 20. The human resource management processes will be upgraded and modernized, and the skills necessary to handle such systems will be acquired.

➤ **Forestry research**

- The BFRI and the BNH, the two research institutions in the forestry sector, suffer from similar problems. These include a shortage of staff, particularly scientists, a cumbersome recruitment process, outdated recruitment rules, a lack of opportunities for career progression, a scarcity of funds for research, inadequate facilities for research, a lack of focus on emerging and current issues, outdated equipment, a lack of access to the Internet, an absence of planning for research and a lack of linkages with other sectoral agencies. The following actions are proposed to address the issues and problems. A review of the existing situations at the two research institutions will be undertaken and the recommended reforms implemented. However, it is proposed that the following tasks be undertaken.
 - The outdated recruitment rules will be revised and made up-to-date. This will involve, among other things, inclusion of candidates qualified in forestry, climate change and other required disciplines eligible for applying for jobs at the BFRI.
 - The current lengthy and bureaucratic recruitment process will be simplified and streamlined, with powers to recruit, in the case of approved positions, devolved to the Directors of the two institutions.
 - New research facilities for pursuing research on current and emerging issues such as climate change, TOF, NTFPs, site-specific species suitability, modelling of participatory integrated planting systems, genetics and plant breeding, etc. will be established.
 - Research facilities at the research institutions will be modernized, and IT, computer and Internet facilities will be improved. Modern analytical tools will be made available.

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- The current situation of career progression will be improved through promotions and introduction of time scales where a promotion is not available after serving the qualifying years and fulfilling other requirements. Additionally, provisions for incentives may be created if research grants can be arranged by scientists.
 - Provisions for scholarships and other facilities for research and education, both abroad and in the universities in the country, will be made. In addition, scientists will be allowed to go abroad to pursue higher education when they are able to make such arrangements privately.
 - Provisions for special allowances will be made for staff members serving in non-family/hardship field stations.
 - Human resource management processes will be upgraded and modernized, and the skills necessary to handle such systems will be acquired.

➤ **Forest-based industries**

- The BFIDC suffers from shortages of both skill and manpower. Its senior management is mostly made up of officials deputed for short tenures from the government. There is an acute shortage of skilled manpower, particularly in the rubber plantation sector, where in spite of the fact that the BFIDC manages the largest area under rubber plantations in the country, it does not have a single staff member who can be described as ‘an expert on rubber plantation management’! While many of the senior positions are vacant, the staff size in the lower ranks is large. The following recommendations are made for addressing the manpower issue at the BFIDC.
- A review will be undertaken to identify the issues and problems relating to the manpower situation faced by the organization. The review will discuss the situation and make recommendations for a lean and efficient outfit comprising skilled managers and other experts.
- A cadre of qualified and experienced officers will be created through recruitment, exposure and training of staff members. Over time, a situation will be created where most senior officials, if not all, have come up through the ranks and identify with the well-being of the institution.
- To make the rubber sector profitable, in addition to replacing the low-yielding variety of rubber, a unit with necessary expertise will be created that will be responsible for identification of varieties/clones of rubber, conducting field trials and formulating and implementing management regimes.
- Higher levels of training and education in rubber-related subjects will be made available to relevant staff members.
- The BFIDC will make institutional arrangements for promoting and supporting the development of forest-based industries and providing initial technical advice.
- Rubber estate managers will be given training in management of rubber plantations, and the topics in such training programmes will include measures and practices that will increase the yield.

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- In the industrial sector, skills will be developed and staffing rationalized so that BFIDC products can compete with similar private sector products.
 - Human resource management processes will be upgraded and modernized, and the skills necessary to handle such systems will be acquired.

8.3.2 Legal reforms

The weaknesses of the following forest laws, rules and other related legal instruments shall be addressed within 1 year to strengthen the enforcement of the Forest Act and the Wildlife Act:

- a. Revision of notification nos. 2404, 2405 and 2406 of 26 December 1956, which invest only gazetted forest officers with powers under Section 72 of the Forest Act, 1927 (related to dealing with forest offences) to confer these powers on Deputy Rangers, Foresters and Forest Guards also.
- b. Revision of notification no. 2396 dated 26 December 1956 regarding the appointment of Forest Officers under Section 2 of the Forest Act, 1927 to include all newly created designations such as Wildlife Guards, Wildlife Inspectors and Wildlife Rangers.
- c. Amendment of the Wildlife (Conservation and Security) Act, 2012 to confer powers of arrest on forest officers, among many other amendments that the act urgently needs.
- d. Promulgation of all the necessary rules and issuing all the notifications required under the Wildlife (Conservation and Security) Act, 2012 to make it operational.
- e. In addition to these, the Forest Transit Rules (three versions) need to be amended with the objective of minimizing the bureaucratic hurdles in boosting the tree planting activity outside the state forests.

8.3.3 Developing public private partnerships (PPP) for reforestation of hill forests

The context and rationale

Reforestation of the denuded and degraded hill forests (nearly 300,000 ha) is a huge task that needs to be accomplished quickly in view of the importance of the hill forests to the ecological and economic security of the people. In addition, large areas of land outside government forests in several districts in eastern Bangladesh are denuded and require reforestation. As the government is unlikely to be able to provide the required funds, even with donor support, it is necessary to explore the possibility of restoring these forests with the help of the private sector, by developing partnerships (PPP). Despite the reservation of many foresters and conservationists on the subject, there seems to be no other way of securing these lands for re-vegetation. While the denuded lands are fast degrading, they are extremely vulnerable to encroachment and other forms of alienation as well. If these lands are demanded by other agencies for developmental purposes, arguments against such proposals will be very weak if the land is bare and unproductive. Bangladesh has already passed the PPP Act, 2015 and has created the PPP Authority in the office of the Prime Minister to facilitate and fast track PPP projects in core sectors of the economy.

The proposition and actions

The following steps shall be taken, in consultation with the PPP Authority, to initialize and institutionalize PPP in Bangladesh forestry:

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- An appropriate body will be set up to oversee PPP initiatives. Proper ground rules will be formulated for management and supervision of PPP. This body will have a clear mandate and well-defined roles and responsibilities. The area to be brought under PPP will be identified and delineated. Partners for the initiatives will be selected after conducting a detailed due diligence exercise.
 - The treatment plan for the area shall be based on a vision document prepared for the region and vetted by an expert committee, in accordance with the need for developing climate resilience and other ecological and socio-economic imperatives.
 - Among other things, the regulatory framework and terms of the contract shall provide the lessee/contractor a reasonably long tenure over the forest, *khas* or USF land that the party will reforest using its own resources. The proceeds will be shared with the government and stakeholder communities, in accordance with an agreed formula. The lessee shall never be allowed to bring any part of the given land under any type of non-forestry activity.
 - Provisions will be made for appropriate incentives for the participating parties.
 - The project design shall be such that while it is profitable to the lessee, participating local communities start getting benefits as early as possible, through intercropping agricultural and medicinal crops, thinning or short-rotation trees.

8.3.4 Consolidating and expanding community participation

The context and rationale

As explained in the previous chapters, the well-being of communities and their neighbouring forests are interdependent. Strengthening community stakes in forests ensures long-term protection of the forests from wanton destruction. Communities have come forward to participate in social forestry in Bangladesh, and it is proposed that this participation be further expanded and consolidated under the new FMP.

The proposition and actions

In view of the critical role that community participation can play in the conservation of state forests and development of the TOF sector, the following steps shall be taken to strengthen community participation in forestry:

- Credible environmental/development NGOs shall be encouraged to undertake social forestry and agro-forestry programmes by mobilizing communities and creating a favourable environment for extending tree cover outside the forests.
- A mass awareness campaign shall be launched to apprise the people of the country about their natural resources and the role they can play in rectifying the situation. The campaign shall specially target women and children in the communities living in and around the forests.
- Selection of social forestry participants shall be made more transparent and in strict compliance with the rules. Participants will have a role in decision making and defined roles, responsibilities and benefits.

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- All new coastal plantation programmes shall have a provision for arranging alternative income-generation activities for the beneficiaries. This will include options that may or may not be related to tree farming.
 - The co-management approach that is currently being practised by the BFD with regard to PAs shall be reviewed to ensure and strengthen effective participation of the local communities in the protection of natural resources, particularly in the cases of those PAs that do not have any tourism income or externally funded projects to support community participation.
 - Small landholders shall be encouraged to participate in social forestry programmes and to seek help and know-how from extension foresters regarding the kind of tree farming that will give them the best returns. Non-forestry recurring income-generating activities in different combinations will be encouraged.
 - Disputes about community rights in forest lands in the CHT shall be resolved by recognizing traditional rights through an appropriate mechanism and by reviewing how such issues have been resolved in other countries. Community livelihoods shall be made a strong component of all forest rehabilitation programmes in the country in order to secure a buy-in from the local people.

8.3.5 Strengthening of monitoring, evaluation and database facilities

The context and rationale

It is well known that what cannot be measured and monitored cannot be managed. The forests of Bangladesh have virtually disappeared without the country taking serious notice, primarily because there is no regular assessment of the state of the forests. The BFD does not have the manpower, funds and technical strength needed to monitor the state of the forests regularly. Similarly, monitoring management inputs and outcomes is not carried out properly because of the lack of technology and resources. There is no system in place for creating any kind of database to enable decision making based on facts. It is, therefore, proposed that a strong emphasis be given to the development of this capability.

The proposition and actions

The following actions shall be taken to strengthen the database, monitoring and evaluation capabilities of the BFD:

- The RIMS Unit shall be suitably strengthened and upgraded to enable it to carry out this important task efficiently. The new unit shall be mandated to carry out all monitoring work on behalf of the BFD and maintain a fully functional database, Management Information System (MIS) and GIS, which can generate important reports on demand. The proposed new organogram of the BFD shall be suitably modified to accommodate this important requirement. The staff strength in this unit shall be as per the recommendations of the CRPARP package BFD/S-4²⁵ report.

²⁵ Technical Study to Strengthen Forest Resources Monitoring and Assessment and Forest Resources Management Information System in Bangladesh Forest Department

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- As all RIMS projects are outsourced to vendors, both public and private, the core capacity of RIMS to conceive, plan and outsource projects and meet the highest standards of quality assurance shall be strengthened. For this, highly qualified professional staff members and the required equipment and funds to meet operating expenses shall be provided. RIMS shall be authorized to hire technical staff members on contract for running the facilities created by various projects.
 - Action shall be taken immediately to set up a Forest Resources Monitoring and Assessment (FRMA) and Forest Resources Management Information System (FRMIS) programme as proposed under CRPARP package BFD/S-4, in accordance with the RIMS Business Plan. The expert report, organized into six task reports, deals with the following subjects:
 - Upgrading the MIS and GIS hardware, server, software and approaches used to strengthen the RIMS Unit
 - Forms for reporting on forests and trees resources at the project, Forest Division, national and international levels shall be designed keeping in mind the data needs at each level
 - Production of data sets and layers of maps to demonstrate the status and changes in forests and tree resources and their bio-physical and socio-economic characteristics.
 - Upgrading remote sensing capacities and capabilities
 - Upgrading the existing forest inventory capacities, approaches, technologies, methods and tools in the BFD, building upon what exists
 - Developing a new design for the inventory to meet the needs of multiple clients and multiple uses.
 - Developing an implementation plan for the forest inventory
 - Linking best practices adopted in other countries for socio-economic household surveys to the forest inventory
 - Linking a new design of conducting socio-economic surveys with remote sensing and the forest inventory
 - Developing an implementation plan for socio-economic household surveys
 - Developing a Forest Resources Monitoring and Assessment Protocol covering MIS, GIS, remote sensing, forest inventories and socio-economic surveys. is the protocol will be an important manual for the foresters in Bangladesh at the central and forest division levels in relation to national forest inventories and socio-economic surveys.
 - Developing alternative business models for a sustainable RIMS Unit to provide forest resource monitoring and assessment (remote sensing, forest inventory and socio-economic survey) data sets, reports and maps to clients on a 'user pays' basis.

The report provides that all data shall be captured with the help of a personal digital device (PDA) or a mobile phone so that they can be compiled and transmitted in real time or near-real time.

- Apart from the Forest Resources Monitoring and Assessment (FRMA) and Forest Resources Management Information System (FRMIS) set-ups, a wide area network

(WAN)-based MIS shall be established across all offices of the BFD so that all management input and output data flow into the MIS and are available to all authorized persons, in real time or near-real time. This system shall house information on all administrative and managerial aspects of the organization, such as personnel, budgets revenue and expenses, management plans, operations and projects, land records, forest offences and forest production. When fully functional, the MIS will eliminate the need for internal reporting as all offices will be able to generate their own reports according to their mandate and requirements.

- The computerization of the BFD shall be strengthened so that computers are available and the Internet accessible at each beat office. All business processes and data collection, storage and communication processes shall be digitized at the earliest. This is critical for running the FRMA, FRMIS and other systems properly.
- The status of the forest and tree resources of the country shall be assessed every 5 years uniformly by carrying out a national forest inventory (NFI) according to the procedures and protocol prescribed in the consultancy report BFD/S-4, as updated from time to time.
- The criteria for measuring and monitoring the success of plantations and restoration programmes on state land shall be reviewed in the light of international practices, and an appropriate monitoring protocol shall be implemented. Methodologies developed by the IUCN in the BFD/s-3 package for monitoring the carbon, biomass, growth and survival of plantations shall be internalized and implemented.²⁶
- Apart from other measures, smart patrolling approaches and tools shall be used for generating continuous field data on the condition of the forests and important field events such as encroachments, forest offences and fires. Smart patrolling data shall also be captured with the help of digital devices so that they can be transmitted effortlessly and merged with a Web-based MIS for analysis and evaluation.

8.3.6 Ensuring basic amenities and logistic support for FMP implementation

The context and rationale

Basic amenities such as proper housing, access to safe medical facilities or even drinking water are often not available to the frontline field staff. In addition, their mobility is often restricted by the lack of departmental transport, adequate funds for fuel or rented transport and travel allowances. This is a serious situation and needs to be addressed. The current need for amenities and logistic support will be assessed, and the following will be considered:

The proposition and actions

3. Provisions will be made for transport in the form of motor launches, speed boats, trawler boats, jeeps, pickups and motorcycles.
4. Budgetary provisions for operational costs on account of transport will be included in the annual revenue budgets.

²⁶ Technical Study for Land Use Mapping, Assessment and Monitoring of Proposed Afforestation and Reforestation Sites (Package No. BFD/S-3)

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5. Adequate housing, access to safe drinking water and other basic amenities will be provided for the field staff.
 6. Office equipment and expendables, including computers, printers, projectors, map printers, photocopiers, document storage facilities and stationery, will be made available to the field and other offices.
 7. Adequate allocations for travel and allowances, if any, will be made available to the field-level staff.

The task of providing the recommended amenities and logistics will be completed within 3 years.

8.3.7 Putting in place necessary institutional arrangements for implementation of FMP

Proposition and actions

A dedicated, fully-equipped office shall be created to direct and monitor the implementation of the FMP. This office shall be responsible, in collaboration with other wings, for proactively preparing projects to implement the recommendations of the FMP, monitor their progress and report to the government. This office will also explore possibilities of procuring funds from various sources within or outside the government to implement the projects. Five-year implementation plans in alignment with the 5-year plans of the government shall be prepared, and the respective wings shall report their progress to the FMP implementation office according to an agreed schedule.

8.4 Facilitating achievement of Sustainable Development Goals through FMP

- The Sustainable Development Goals (SDGs) were adopted in 2015 as part of the ‘2030 Agenda for Sustainable Development’. Seventeen SDGs have been defined, of which Goal 15 is of direct concern to the forestry sector: ‘Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss’. Under this goal, the following topics are most relevant:
- By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements. (15.1)
- By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally. (15.2)
- Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species. (15.5)
- Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products. (15.7)

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- By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts. (15.9)

FMP programmes and strategies have been designed to contribute to the achievement of the SDG objectives, individually as well as collectively. Although it is unlikely that full progress will be made by 2020 in this direction, in view of the enormity of the task and shortage of capacity and resources, the FMP shall be able to set the course by 2020 so that faster progress can be made if resources are available.

Apart from Goal 15, the FMP will also contribute towards the achievement of many other goals, such as Goal 1 (No Poverty), Goal 2 (Zero Hunger), Goal 3 (Good Health and Well-being), Goal 7 (Affordable and Clean Energy), Goal 8 (Decent Work and Economic Growth) and Goal 9 (Industry, Innovation and Infrastructure). Important guiding instruments of the forestry sector such as the Social Forestry Rules and the National Forestry Policy (draft) emphasize gender equality in forestry operations and benefit distribution and thus also contribute to the achievement of Goal 5 (Gender Equality). More specifically, the following FMP programmatic activities have a direct relevance for, and bearing on, the aforementioned SDGs and targets (Table 8-6):

Table 8-6: An Illustration of the functional links between relevant SDGs and FMP programmes

SDG Goals and Targets	FMP Programmes Addressing the SDG	Relevant FMP Strategies
<p>Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.</p>	<ul style="list-style-type: none"> • Formulation of forest management plans • Reforestation of degraded forests • Management of PAs and protection of wildlife • Promotion of firewood-saving devices and technologies • Afforestation outside forests, including USF • Livelihood support to communities • Control on forest encroachments • REDD+ and other climate change-related programmes 	<ul style="list-style-type: none"> • Institutional reforms and capacity building • Strengthening community participation • Strengthen legal tools • Strengthening monitoring, evaluation and database facilities
<p>By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. (15.1)</p>	<p>Do Full achievement by 2020 not possible</p>	<p>Do Full achievement by 2020 not possible</p>
<p>By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally. (15.2)</p>	<ul style="list-style-type: none"> • Formulation of forest management plans • Reforestation of degraded forests • Management of PAs • Promotion of firewood-saving devices and technologies • Afforestation outside forests, including USF • Livelihood support to communities • Control on forest encroachments • REDD+ and other climate change-related programmes 	<p>Do</p>

SDG Goals and Targets	FMP Programmes Addressing the SDG	Relevant FMP Strategies
Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species. (15.5)	Do	Do
Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products. (15.7)	Implementation of Wildlife Action Plan (2015), which includes the establishment of a Wildlife Crime Control Unit and a forensics laboratory, among many other things Promulgation of new CITES rules, implementation of the Wildlife (Conservation and Security) Act, 2012	Promulgation of new CITES rules, implementation of the Wildlife (Conservation and Security) Act, 2012
By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts. (15.9)	Strengthening forestry research	Strengthening monitoring evaluation and database facilities
Goal 1 (No Poverty)	Reforestation of degraded forests Afforestation outside state forests Livelihood support to forest-dependent communities Promotion of firewood-saving devices and technologies	PPP in forestry Strengthening community participation in forestry
Goal 2 (Zero Hunger)	Do	Do
Goal 3 (Good Health and Well-being)	Do	Do
Goal 7 (Affordable and Clean Energy)	Promotion of firewood-saving devices and technologies (renewable energy)	—
Goal 8 (Decent Work and Economic Growth)	Reforestation of degraded forests Afforestation outside state forests Livelihood support to forest-dependent communities Promotion of firewood-saving devices and technologies Promotion of forest-based industries	PPP in forestry Strengthening community participation in forestry
Goal 9 (Industry, Innovation and Infrastructure)	Promotion of forest-based industries	Strengthening of ICT infrastructure of BFD Strengthening database facilities of BFD PPP in forestry

8.5 Potential new project ideas for implementing FMP

New projects need to be developed with the following themes in order to make progress towards achieving the objectives of the FMP. The list is only indicative and should be further developed as new opportunities and challenges are identified.

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- Watershed management and reforestation of denuded hill forests
 - Community-based conservation of hill forests
 - Development of a PPP framework and a pilot project for reforestation of the denuded hill forests of Bangladesh
 - *Char* land afforestation and completion of coastal green belt in Bangladesh
 - Community-based conservation of sal forests of Bangladesh
 - Development of a network of timber markets for promoting homestead forests in Bangladesh
 - Assessment of the status and issues facing homestead forests and other private plantations in Bangladesh
 - Assessment of the status of forest product-based industries and occupations and issues faced by the industry in Bangladesh
 - Conservation of NTFPs and development of sustainable businesses based on NTFPs
 - Strengthening of forestry extension services aimed at development of homestead forests in Bangladesh
 - Internalizing climate change impacts, mitigation and adaptation in the BFD (climate change education for foresters)
 - Sustainable livelihoods for forest-dependent communities in Bangladesh
 - Renewable and alternative energy programme for conservation of forests in Bangladesh
 - Rejuvenation of lost plantations in the hill forests of Bangladesh through community participation
 - Development of infrastructure for conservation of forests in Bangladesh
 - Sustainable management and conservation of the remaining natural forests in the sal and hill regions of Bangladesh
 - Preparation of sustainable forest management plans (working plans) for Bangladesh
 - REDD+ through community-based conservation of forests in Bangladesh
 - Strengthening forest management monitoring and evaluation in Bangladesh through an online (Web-based) FRMA and Forest Resource Management Information System (FRMIS)
 - Development of a forest nursery certification system for improving the planting stock of homestead forests in Bangladesh
 - An assessment of the level of wildlife trade and consumption in Bangladesh and development of an integrated approach to conserve wildlife
 - Conservation and restoration of natural forests through community-based, professionally run, ecotourism
 - An assessment of the forest land tenure issues in the CHT and options to resolve the stalemate

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- Development of the infrastructure, organizational structure and professional capacity of BFRRI scientists with a view to combating climate change impacts
 - A critical assessment of the organizational structure, workflow and capacity of the BFD with a view to reorganizing it for meeting the emerging challenges and responsibilities
 - Development of an HRD plan for the BFD in view of the emerging challenges and opportunities

9 Financial Resources: Requirement and Mobilization

The master plan is a long-term planning framework and has to provide for the inevitable uncertainties and probabilities of capacities and resources that the sector shall encounter during the next 20 years. Given the cost escalations and other associated factors, making a correct estimation for a 20-year plan is tricky under the best of circumstances. Bangladesh has an annual inflation rate of around 5.5%, and in addition, other seen and yet unseen factors contribute to a steady price escalation, making a correct assessment of costs over a long period of time difficult. For the purpose of this exercise, the current rates of cost escalation were considered. The estimates will have to be reviewed whenever they are used.

Forestry programmes in Bangladesh are funded by various combinations of the government's own resources and external financing, in the form of both credit and development grants, from a variety of development partners. However, as the allocations from the government sources in the forestry sector have always been limited and have, in recent years, not even covered the basic costs of the Bangladesh Forest Department (BFD), let alone allowed much-needed development work, including plantation establishment and other necessary tasks, to be taken up, most of the developmental activities in the sector have only been possible because of external support. Traditionally, formal investments in the forestry sector have been seen as synonymous with the conservation and development of state forests and/or strengthening of the forestry sector government organizations and institutions. However, much more non-governmental investment now goes into the growing of trees outside forests (TOF) by rural communities and the corporate and private sectors. The investments of the private sector in developing and operating tree farms and forest product-based industries and occupations are also substantial. In the absence of any authentic information regarding such investments, it is difficult to keep track of them. Their volume is assumed to be much more than that of the formal investments made by the government in the forestry sector. In view of this difficulty, the following discussion does not include private investments. For the purpose of this exercise, the planning period is taken as 20 years, starting with the financial year 2017-2018 and ending with 2035-2036. This period partially or fully covers the 5-year planning cycles 7 to 11 (FYP 7 to FYP 11) of the Government of Bangladesh (GoB). Given the short time available for the formulation of the master plan, which is based on secondary information, because of a lack of the detailed information required for a detailed planning exercise for the other three sectoral organizations, elaborate itemized analysis of the financial requirements and scheduling of activities for the next 20 years have been performed for the Bangladesh Forest Department (BFD) only. For this reason, it is important that a detailed review of all the agencies in the forestry sector be undertaken at the earliest and issues and problems identified so that the tasks to be undertaken can be assessed and the requirement of funds estimated. Such an exercise will facilitate identification of the needs and implementation of all future activities pursued by the other sectoral organizations in a focused, planned and organized manner. Where detailing of activities in an itemized fashion was not possible, lump sum allocations were made so that tasks could be undertaken. These estimates will require to be scrutinized further after the sectoral review is completed.

9.1 Scenarios of financial requirements and availability

Although the forestry sector institutions include the BFD, Bangladesh Forest Research Institute (BFRI), Bangladesh National Herbarium (BNH) and Bangladesh Forest Industries Development

Corporation (BFIDC), only the BFD gets any development budget on a regular basis although the amount made available is not adequate. All the other institutions, except the BFIDC, generally receive grants only out of the revenue budget, which primarily caters to the basic maintenance of the institutions and has very limited amounts available for any new work or asset creation. Even the BFD's development budget, which is always inadequate for the routine and developmental costs of the department, has fluctuated wildly in the past, depending on the donor participation, from year to year. However, the allocations have steadied a little in the last 5 years (Table 9-1).

Table 9-1: Development finance available to BFD (amounts in crores* BDT)

Financial Year	Revised ADP**	Expenditure (Net Grant)	Project Aid
2011-2012	221.8	207.5	59.1
2013-2014	263.4	211.1	192
2014-2015	302.44	294.9	216.43
2015-2016	292.04	269.1	224.52
Average	246.75	220.5	153.63

*1 crore = 10 million

** ADP = Annual Development Programme

Thus, the development funds to the tune of approximately Tk.246.75 crore per annum have been available to the BFD in the last 5 years. Project aid received from various development partners represents nearly 62% of these funds. It has been seen that after some years in which there are good flows of resources, there are years when no or very little donor funding is available. For example, after 5 years of hyperactivity, there is no significant project to carry out afforestation/reforestation in the current year (2016-2017). Therefore, the financial scenarios will have to be created on the basis of this experience, adjusted for the expected inflation, in both allocations and expenditure. A rate of inflation of 6% is used to make projections. However, it is pertinent to mention here that given the current state of affairs in the sector, it is very important that the government significantly increase its allocations to the sector so that a sustained development process can be initiated and completed. In addition, given the budget cuts experienced in different donor countries, the amount of support available from external sources has started to diminish. Also, as seen for the experience in the past, a mostly donor-driven situation is not sustainable, and the gains made under such endeavours are often lost once the financing ceases.

As discussed previously, the BFD has been suffering from acute shortages of manpower, funds and in-house capacity and a number of other problems. The purpose of the present exercise is to create a financial scenario aimed at complete rehabilitation of the department and restoration of its assets. On the basis of the discussions held with the BFD on the rehabilitation of the

department, future investments in the forestry sector are envisioned in the following three scenarios.

Scenario 1: This scenario depicts a situation where, in the absence of any external support, the BFD will have to rely entirely on the resources allocated by the government. An annual average of funds made available to the Forest Department only from internal Bangladesh Government sources during the last few years have been used as the basis for formulating this scenario. In such a situation, unless the allocation from the government is substantially increased, the salaries of the staff will be covered and around Tk.100 crores per year will be available for meeting all other development, management and protection costs. While the total estimated cost is Tk.7673 crores (Table 9-2), about three-fourths of the amount consists of the salaries of the staff alone! This leaves a meagre amount for plantation establishment, rehabilitation, management and protection of natural forests and protected areas and maintenance of other assets owned by the BFD. This scenario is not a viable option because the identified needs of the department are not addressed and the current steady deterioration of the department will not be arrested.

Table 9-2: Programmes and indicative costs in Scenario 1 (amounts in crores BDT)

Sl. No.	Programme	Unit	Extent or Target in 20 Years	Rates	Financial Target for 20 Years
1	Staff salaries	Number	10224		5733
2	Preparation of forest management plans	Number	10	1.5	15
3	Conservation of natural forest—sal	Hectares	80	0.0035	28
4	Conservation of natural forest—hill	Hectares	100	0.0025	25
5	Conservation of natural forest—Sundarbans Reserve Forest (SRF)	Hectares	4000	0.002	800
6	New plantations—all types	Hectares per kilometre	400	0.015	600
7	Promotion of TOF sector (forestry extension)	Hectares	500	0.0005	25
8	Protected area and wildlife management	Hectares	1000	0.0025	250
9	Management and protection of existing plantations	Hectares	600	0.0005	30
10	Promotion of firewood-saving devices and technologies	Lump sum (LS)	Multiple activities (MA)		10
11	Non-timber forest product (NTFP) development	LS	MA		10
12	Development of forest industries	LS	MA		12
13	Strengthening forestry research	LS	MA		10
14	Strengthening community participation and rural livelihoods	LS	MA		20
15	Management of forest encroachments	LS	MA		25
16	Institutional reforms and capacity building	LS	MA		10
17	Promotion of PPP for reforestation		MA		10
18	Strengthening monitoring and evaluation (development of Forest Resources Monitoring and Assessment (FRMA) system/Forest Resources Management Information System (FRMIS))	LS	MA		20
19	Civil works, vehicles, boats, etc.	LS	MA		40
	Total				7673

Scenario 2: This scenario is based on an estimation of what it will take to implement essential tasks needed to rehabilitate the BFD through the implementation of the Forestry Master Plan

(FMP) and the mandates enshrined in the National Forestry Policy, 2016. The funds needed to implement the provisions laid out in the master plan, over 20 years, adjusted for potential inflation, have been estimated at Tk.53,871 crores. This amount includes the salaries and estimates of various allowances admissible for the currently proposed 13,996 staff members over the next 20 years. It does not provide for any increase in staff strength and/or higher scales of salary, which will come into effect in the future. There is a provision for detailed reviews of the sector, twice, 10 years apart, during the plan period. The first review will help formulate and implement necessary interventions aimed at the rehabilitation of the BFRI, BNH and BFIDC fine tune the recommendations made for the BFD under this plan. The second review will examine the status of the sectoral organizations 10 years after the implementation of the plan begins. In order to ensure that all forest areas are managed under the prescriptions formulated for each forest in 10-year management plans, financial provisions have been made for covering the cost of preparation of adequate numbers of such plans. Financial provisions are made in this scenario for the restoration and conservation of natural forest in the hill, sal and mangrove (the Sundarbans) forest areas. In addition, provisions are made for the establishment and maintenance, including silvicultural operations, of different types of plantations. In order to promote TOF further, significant allocations have been made. The related activities will include capacity development among tree growers, providing access to extension services and higher quality planting stock and promotion of entrepreneurship among tree growers. Financial provisions have been made for having all the forest land surveyed in collaboration with the Department of Land Records during the plan period, delineating forest boundaries, maintaining land records and gaining repossession of encroached forest land. Provisions have been made to strengthen community participation in forestry activities through incentives and lessening dependence on forests for livelihoods through the creation of alternative income-generating activities. The capacity of the BFD will be enhanced through staff capacity building, installation of a robust monitoring and evaluation system, establishment of self-contained IT infrastructure down to the field level, upgrading and reconstruction of BFD facilities and improvement of logistic support and basic amenities provided for the staff. Sufficient financial provisions have been made for rehabilitation of the research facilities and capacities at the BFRI and BNH, improvement of the training and capacity-building facilities within the BFD and strengthening academic research and studies at the forestry programmes at different universities. These provisions will facilitate upgrading of the existing research facilities, establishment of new research programmes related to current and emerging issues and enhancing the capacities of these institutions. Given the importance of NTFP, provisions have been made for promoting these products, through technical support, research and institution of incentives. As the promotion of forest industries needs support, provisions have been made to promote forest product-based industries in both the public and private sectors. Provisions are also made for continuous collection of data and information from the large number of sample plots that have been established under the ongoing forest resources inventory and for collation of this information every 5 year, with some additional data collection, where needed for revising and updating the forest inventory results. The estimated amount does not include the costs of implementing the Wildlife Master Plan. However, the costs of some activities that have been recommended under both plans have been included in this estimate. Likewise, while adequate funds have been provided for the creation of a green belt of trees along the coast, the entire cost of implementation of the activity has not been included in this estimate. It is proposed that this scenario be implemented and that, depending on the availability of resources, the activities be scaled up or down. A broad item-wise costing is furnished in Table 9-3.

Table 9-3: Programmes and indicative costs in Scenario 2 (amounts in crores BDT)

Sl. No.	Programmes	Unit	Target Set	Rate/Unit	Total Requirement for 20 years
1	Thorough review of Bangladesh forestry sector	Number	2	25	50
2	Staff salaries	Number	13,996	0.54094	7571
3	Preparation of forest management plans	Number	60	1.5	90
4	Conservation of natural forest—sal	Hectares	80,000	0.002	160
5	Conservation of natural forest—hill	Hectares	250,000	0.004	1000
6	Conservation of natural forest—SRF	Hectares	600,000	0.0025	1500
7	New plantations—all types	Hectares per kilometer	400,000	0.0225	9000
8	Promotion of TOF sector (forestry extension)	Hectares	2,000,000	0.005	10,000
9	Protected area and wildlife management	Hectares	60,000	0.15	9000
10	Management and protection of existing plantations	Hectares	250,000	0.012	3000
11	Promotion of firewood-saving devices and technologies	LS			50
12	NTFP development	LS			500
13	Development of forest industries	LS			500
14	Strengthening forestry research	LS			1000
15	Strengthening community participation and rural livelihoods	LS			3500
16	Management of forest encroachments	LS			1000
17	Institutional reforms and capacity building	LS			500
18	Promotion of public-private partnerships (PPP) for reforestation	LS			50
19	Strengthening of monitoring and evaluation (development of FRMA/FRMIS)	LS			300
20	Civil works, vehicles, boats, etc., including institutional buildings	LS			2700
21	Forest boundary demarcation	LS			2000
22	Forest resource inventory	LS			100
23	IT infrastructure development in BFD	LS			300
	Total				53,871

Scenario 3: This scenario depicts a situation in which there will be no resource or capacity constraints and the funds needed for the complete development of the sector, as envisaged today, will be readily available. The activities listed for this scenario are identical to those of Scenario 2. However, the quantum of activities to be undertaken in most of the components is greater so that complete rehabilitation of the sector is achieved. The additional staff needed for implementing the targeted activities has also been provided for. While there is no clear vision regarding where all the needed funds will come from, this scenario incorporates the possibility of tapping non-traditional and innovative approaches to financing and seeking a larger allocation from the government's exchequer, PPP, institutional financing and other possible sources. It is anticipated that under this scenario the total requirement for the 20-year FMP period will be about **Tk.75,419 crores** (Table 9-4).

Table 9-4: Programmes and indicative costs in Scenario 3 (amounts in crores BDT)

Sl. No.	Programme	Units	Target Set	Rate/Unit	Total Requirement for 20 years
1	Thorough review of Bangladesh forestry sector	Number	2	35	70
2	Staff salaries	Number	13,996	0.757316376	10,599
3	Preparation of forest management plans	Number	60	2.1	126
4	Conservation of natural forest—sal	Hectares	117,196	0.001911328	224
5	Conservation of natural forest—hill	Hectares	694,482	0.002015891	1400
6	Conservation of natural forest—SRF	Hectares	6,600,376	0.000318164	2100
7	New plantations—all types	Hectares per kilometre	400,000	0.0315	12,600
8	Promotion of TOF sector (forestry extension)	LS			14,000
9	Protected area and wildlife management as per Wildlife Master Plan	Hectares	300,000	0.042	12,600
10	Management and protection of existing plantations	Hectares	300,000	0.014	4200
11	Promotion of firewood-saving devices and technologies	LS			70
12	NTFP development	LS			700
13	Development of forest industries	LS			700
14	Strengthening forestry research and education	LS			1400
15	Strengthening community participation and rural livelihoods	LS			4900
16	Management of forest encroachments	LS			1400
17	Institutional reforms and capacity building	LS			700
18	Promotion of PPP for reforestation	LS			70
19	Strengthening of monitoring and evaluation (development of FRMA/FRMIS)	LS			420
20	Civil works, vehicles, boats, etc., including institutional buildings	LS			3780
21	Forest boundary demarcation	LS			2800
22	Forest resource inventory	LS			140
23	IT infrastructure development in BFD				420
	Total				75,419

Scenario 2, suggesting an availability of approximately Tk.2610 crores (inflation-adjusted) as the annual development budget, seems to be the most likely scenario for achieving the present-day real goals of the BFD. Proper implementation of this scenario will allow the sector to be rehabilitated and capacities installed for continued development of the sector in the right direction. While Scenario 3 envisages complete rehabilitation of the sector, at this point of time, the available facilities and capacities will make it impossible to implement such an ambitious plan even if the required funds are made available. While Scenario 2 also presents a hugely challenging task, proper leadership, availability of funds and other needed support from the government, will make it doable. In view of the recent recognition of forestry as an important mitigation and adaptation tool against the impacts of the looming climate change, the recognition of Bangladesh as one of the most vulnerable countries and the enhanced availability of international resources for dealing with climate change-related issues, there is the possibility of an improvement in the funding situation although it will need serious efforts from the BFD and the GoB to benefit from these opportunities.

For the three scenarios, the estimated costs of plantation and other activities have been worked out with a small annual escalation. The average cost of plantation depends on the type of the plantation, such as long-rotation plantation, short-rotation plantation, strip plantation and mangrove plantation. The cost may change if the relative proportions of the different types change. In the present mix, for the plan period, the average cost per hectare comes to Tk.225,000/ha/km, including the costs of maintenance (including conducting the necessary silvicultural operations within the first 5 years).

Given the importance of the forestry sector in the national economy, the role it can play in minimizing the impact of climate change on the country and the goods and services it can provide, the government needs to treat forestry as a priority sector and substantially increase the allocation to the sector from its own resources. The government also needs to increase its efforts to raise more funds for the sector from different sources both in the country and outside. If the available funds are less than what have been envisaged herein, the priorities among the various items will have to be decided on the basis of available resources from year to year and on the basis of the needs.

The details of the actual activities to be undertaken under each programme will be worked out after allocation of funds on the basis of the broad criteria as indicated in the foregoing. The activities proposed under each programme are listed in the respective chapters of the FMP.

In Scenario 2, the maximum expenditure is proposed for capacity building, afforestation, reforestation, conservation of natural forests, protection of wildlife and improvement of TOF areas. Afforestation and reforestation at this proposed scale will be possible only if some non-traditional sources of finances are tapped. A large part of the institutional expenses proposed will, in fact, have to be used for improving the forestry educational institutions. The amount of Tk.7571 crores shown against 'Staff salaries and allowances' has to come from the revenue or normal budget as these are obligatory expenditure. Although it seems to be a difficult goal at the moment, with concerted efforts on the part of the BFD and Ministry of Environment and Forests (MoEF), it can be achieved.

The scheduling of activities in the plan should be considered as provisional and is based on the incomplete information that was available. So, before any activities listed in the plan are implemented, a detailed plan of operation, based on the on-the-ground situation and any recommendation contained in the proposed sectoral review, will have to be formulated.

9.2 Phasing of the financial requirements, aligned with 5-year plans

As mentioned previously, Scenario 2 is the recommended scenario because it is based on a rational plan for restoration of the sector to good health through different 'must-undertake' initiatives and interventions, which is considered achievable. Phasing of the physical and financial targets, under Scenario 2, over the 20-year plan period, is proposed as described in the following.

9.2.1 Phasing of financial targets

The total allocations of Tk.53,871 crores proposed for the 20-year FMP period have been phased out as in Table 9-5 and Table 9-6. Table 9-5 lists the total allocations in 5-year slots. The table also shows the proportion of funds, as a percentage, allocated to each 5-year slot.

Table 9-5: Phasing of the 20-year allocations in 5-year slots (amounts in crores BDT)

Programme	Unit	Target Set	Rate/Unit	Amount Required for the Plan Period	Allocation for First 5 years (20%)	Allocation for Second 5 years (25%)	Allocation for Third 5 years (26%)	Allocation for Fourth 5 years (29%)
Thorough review of Bangladesh forestry sector	Number	2	25	50	30		20	
Staff salaries	Number	13,996	0.54094	7571	1892.75	1892.75	1892.75	1892.75
Preparation of forest management plans	Number	60	1.5	90	18	22.5	23.4	26.1
Conservation of natural forest—sal	Hectares	80,000	0.002	160	32	40	41.6	46.4
Conservation of natural forest—hill	Hectares	250,000	0.004	1000	200	250	260	290
Conservation of natural forest—SRF	Hectares	600,000	0.0025	1500	300	375	390	435
New plantations—all types	Hectares per kilometre	400,000	0.0225	9000	1800	2250	2340	2610
Promotion of TOF sector (forestry extension)	Hectares	2,000,000	0.005	10,000	2000	2500	2600	2900
Protected area and wildlife management	Hectares	60,000	0.15	9000	1800	2250	2340	2610
Management and protection of existing plantations	Hectares	250,000	0.012	3000	600	750	780	870
Promotion of firewood-saving devices and technologies	LS			50	10	12.5	13	14.5
NTFP development	LS			500	100	125	130	145
Development of forest industries	LS			500	100	125	130	145
Strengthening forestry research	LS			1000	200	250	260	290
Strengthening community participation and rural livelihoods	LS			3500	700	875	910	1015
Management of forest encroachments	LS			1000	200	250	260	290
Institutional reforms and capacity building	LS			500	100	125	130	145
Promotion of PPP for reforestation	LS			50	10	12.5	13	14.5
Strengthening of monitoring and evaluation (development of FRMA/FRMIS)	LS			300	60	75	78	87

Programme	Unit	Target Set	Rate/Unit	Amount Required for the Plan Period	Allocation for First 5 years (20%)	Allocation for Second 5 years (25%)	Allocation for Third 5 years (26%)	Allocation for Fourth 5 years (29%)
Civil works, vehicles, boats, etc., including institutional buildings	LS			2700	540	675	702	783
Forest boundary demarcation	LS			2000	400	500	520	580
Forest resource inventory	LS			100	20	25	26	29
IT infrastructure development in BFD	LS			300	60	75	78	87
Total				53,871	11,172.75	13,455.25	13,937.75	15,305.25

Table 9-6 provides a break-up of the annual allocations under Scenario 2 during the first 5 years of the project. Twenty percent of the total cost of implementation of the FMP has been allocated to the first 5-year period at an incremental annual rate.

Table 9-6: Phasing of the 20-year FMP allocations for the first 5 years and in yearly slots (amounts in crores BDT)

Programme	Amount Required for the Plan Period	Allocation for First 5 years (20% of the total)	Allocation for First Year (2017) (15% of First 5 years)	Allocation for Second Year (2018) (17% of First 5 years)	Allocation for Third Year (2019) (18% of First 5 years)	Allocation for Fourth Year (2020) (23% of First 5 years)	Allocation for Fifth Year (2021) (27% of First 5 years)
Thorough review of Bangladesh forestry sector	50	30	10	20			
Staff salaries	7571	1892.75	378.55	378.55	378.55	378.55	378.55
Preparation of forest management plans	90	18	2.7	3.06	3.24	4.14	4.86
Conservation of natural forest—sal	160	32	4.8	5.44	5.76	7.36	8.64
Conservation of natural forest—hill	1000	200	30	34	36	46	54
Conservation of natural forest—SRF	1500	300	45	51	54	69	81
New plantations—all types	9000	1800	270	306	324	414	486
Promotion of TOF sector (forestry extension)	10,000	2000	300	340	360	460	540
Protected area and wildlife management	9000	1800	270	306	324	414	486
Management and protection of existing plantations	3000	600	90	102	108	138	162
Promotion of firewood-saving devices and technologies	50	10	1.5	1.7	1.8	2.3	2.7
NTFP development	500	100	15	17	18	23	27
Development of forest industries	500	100	15	17	18	23	27
Strengthening forestry research	1000	200	30	34	36	46	54
Strengthening community participation and rural livelihoods	3500	700	105	119	126	161	189
Management of forest encroachments	1000	200	30	34	36	46	54

Programme	Amount Required for the Plan Period	Allocation for First 5 years (20% of the total)	Allocation for First Year (2017) (15% of First 5 years)	Allocation for Second Year (2018) (17% of First 5 years)	Allocation for Third Year (2019) (18% of First 5 years)	Allocation for Fourth Year (2020) (23% of First 5 years)	Allocation for Fifth Year (2021) (27% of First 5 years)
Institutional reforms and capacity building	500	100	15	17	18	23	27
Promotion of PPP for reforestation	50	10	1.5	1.7	1.8	2.3	2.7
Strengthening of monitoring and evaluation (development of FRMA/FRMIS)	300	60	9	10.2	10.8	13.8	16.2
Civil works, vehicles, boats, etc., including institutional buildings	2700	540	81	91.8	97.2	124.2	145.8
Forest boundary demarcation	2000	400	60	68	72	92	108
Forest resources inventory	100	20	3	3.4	3.6	4.6	5.4
IT infrastructure development in FD	300	60	9	10.2	10.8	13.8	16.2
Total	53,871	11,172.75	1776.05	1971.05	2043.55	2506.05	2876.05

The planning process of the GoB encompasses 5 years, and national plans are prepared accordingly. The government's programmes and financial allocations are also made for the same 5-year period. The FMP period of 20 years will start with the second year of the ongoing FYP 7 and end in the first year of FYP 11. Thus FYP 7 and FYP 11 are going to be partly involved with the FMP. The FMP allocations are thus proposed as in the following against the expected FYP of the GoB. Table 9-7 provides the details.

Table 9-7: Phasing of 20-year FMP allocations matching the 5-year planning cycle of GoB (amounts in crores BDT)

Programme	FYP 7 (2017-2020)	FYP 8 (2021-2025)	FYP 9 (2026-2030)	FYP 10 (2031-2035)	FYP 11 (2036)	Total for FMP Period of 20 years
Thorough review of Bangladesh forestry sector	30	0	20	0	0	50
Staff salaries	1514.2	1892.75	1892.75	1892.75	378.55	7571
Preparation of forest management plans	13.14	22.86	23.22	25.56	5.22	90
Conservation of natural forest—sal	23.36	40.64	41.28	45.44	9.28	160
Conservation of natural forest—hill	146	254	258	284	58	1000
Conservation of natural forest—SRF	219	381	387	426	87	1500
New plantations—all types	1314	2286	2322	2556	522	9000
Promotion of TOF sector (forestry extension)	1460	2540	2580	2840	580	10,000
Protected area and wildlife management	1314	2286	2322	2556	522	9000
Management and protection of existing plantations	438	762	774	852	174	3000
Promotion of firewood-saving devices and technologies	7.3	12.7	12.9	14.2	2.9	50
NTFP development	73	127	129	142	29	500
Development of forest industries	73	127	129	142	29	500
Strengthening forestry research	146	254	258	284	58	1000
Strengthening community participation and rural livelihoods	511	889	903	994	203	3500
Management of forest encroachments	146	254	258	284	58	1000

Programme	FYP 7 (2017-2020)	FYP 8 (2021-2025)	FYP 9 (2026-2030)	FYP 10 (2031-2035)	FYP 11 (2036)	Total for FMP Period of 20 years
Institutional reforms and capacity building	73	127	129	142	29	500
Promotion of PPP for reforestation	7.3	12.7	12.9	14.2	2.9	50
Strengthening of monitoring and evaluation (development of FRMA/FRMIS)	43.8	76.2	77.4	85.2	17.4	300
Civil works, vehicles, boats, etc., including institutional buildings	394.2	685.8	696.6	766.8	156.6	2700
Forest boundary demarcation	292	508	516	568	116	2000
Forest resources inventory	14.6	25.4	25.8	28.4	5.8	100
IT infrastructure development in BFD	43.8	76.2	77.4	85.2	17.4	300
TOTAL	8296.7	13,640.25	13,845.25	15,027.75	3061.05	53,871

9.2.2 Phasing of physical targets

The physical targets under the various items are phased on the same principles as described in the foregoing. The physical targets are primarily of three types:

1. Repetitive tasks, which do not change from year to year, such as the protection of plantations, protected area management and conservation of natural forests, because the entire extent is covered each year
2. Additive tasks, which change from year to year on the basis of available funds, such as raising new plantations and distribution of seedlings
3. Lump sum targets consisting of multiple activities, such as improvement of monitoring and evaluation capacity, development of PPP policy and projects, promotion of forest industries and promotion of TOF. These programmes consist of several sub-components and activities that may have annual targets, but the entire programme cannot be described in terms of physical targets.

Accordingly, the various kinds of plantations that will be raised under Scenario 2 during the 20-year FMP period, along with their phasing, aligned with the 5-year plans, are given in Table 9-8.

Table 9-8: Phasing of plantation, type-wise during each of the 5-year plan periods of GoB under the 20-year FMP duration

Type of Plantation (Ha/km)	FYP 7 (2017-2020)	FYP 8 (2021-2025)	FYP 9 (2026-2030)	FYP 10 (2031-2035)	FYP 11 (2036)	Total
Hill forest	28,973	36,216	36,216	38,390	7243	147,039
Plain land sal forest	296	369	369	392	73	1500
Agroforestry and other reforestation programmes on encroached lands	2582	3226	3226	3420	645	13,098
Enrichment plantations with assisted natural regeneration (hills and sal)	12,084	15,105	15,105	16,012	3021	61,327
Agar/rubber plantation	2900	3625	3625	3843	725	14,718
Bamboo, cane and <i>murta</i> plantations (overlapping)	2461	3076	3076	3261	615	12,490
Strip plantations (seedling km)	2117	2644	2644	2803	530	10,738
Mangrove plantation (ha)	17,054	21,319	21,319	22,597	4264	86,553
Enrichment planting—coastal (ha)	230	287	287	305	57	1167
Non-mangrove coastal plantation	4646	5808	5808	6156	1162	23,580
Casuarina, palms along sandy beaches	1143	1430	1430	1516	286	5804
<i>Golpata</i> plantation (km)	974	1218	1218	1291	244	4944
Plantation along sides of road/embankment, homestead/institutional planting (seedling km/ha)	2117	2644	2644	2803	530	10,738
Inland <i>char</i> plantations	1232	1538	1538	1631	308	6247
Seedling sale/distribution	113,938,041	142,422,551	142,422,551	150,967,904	28,484,510	578,235,557
Total plantation area	78,808	98,507	98,507	104,419	19,702	399,942

The total plantation establishment during the 20-year FMP is 399,942, i.e., 400,000 ha/km, as envisaged in Table 9-5 (row 7). Although the cost of the plantations varies from type to type, the average cost per hectare per kilometre over the entire FMP period of 20 years has been estimated at Tk.225,000.

9.3 National and international sources of funds

9.3.1 National sources

The GoB provides regular budgetary grants to various forestry sector organizations for maintenance and for limited development work. Most of this money comes in the form of the 'revenue budget'. All the developmental work in the BFD is now done in the form of projects funded either by the state itself or by external donor/lender agencies. However, the collective overall allocation to the forestry sector is much lower than what is needed. Given that one of the main reasons for the current dismal state of affairs in the sector is the lack of availability of funds for carrying out routine and developmental work, the GoB, which is financially in a situation, where it is possible for it to commit more funds to the sector, it is urged that the decision makers involved attach higher priority to the rebuilding of the forestry sector and allocate substantially more funds to this sector. Additionally, resources will be sought from other sources, both local and international. However, looking at the growing needs of the sector, some traditional and non-traditional sources of funds can also be explored as indicated in the following sections. It may be mentioned here that a steady and cohesive rehabilitation of the forestry sector is only

possible with a regular infusion of funds by the government for carrying out the needed intervention. Time-bound donor support can only achieve limited results, which are often lost once such funding ends, because resources are not available to build on the gains made.

9.3.2 Traditional development partners

As stated previously, forestry in Bangladesh has traditionally been heavily dependent on external assistance. The GoB provides funds for the maintenance of the BFD in the form of salaries and other core liabilities, but very limited development work has been done on the strength of purely local resources. Institutions other than the BFD, in the forestry sector, get hardly any development budget from the government. The funds available from the government are not adequate for meeting the routine forest establishment-related expenses of the department. The situation is also similar in the case of the BFRI and BNH. Bangladesh has been receiving international assistance from a large number of development partners, such as the World Bank, Asian Development Bank (ADB), United Nations Development Programme (UNDP), UNESCO and Global Environment Facility (GEF) and bilateral donor agencies such as USAID, SIDA, DFID, GIZ and EU.

While Bangladesh has been receiving funds from a number of bilateral donors since its independence, it is the multi-lateral organizations like the UNDP, the World Bank and the ADB that have made major financial contributions to the forestry sector in recent years. While the ADB has currently disengaged itself from the forestry sector, both the World Bank and the UNDP are still providing substantial support for development, particularly that of the BFD. The master plan exercise has been funded through the World Bank, and it is expected that it will play a major role in its implementation. In order to qualify for funding from/through such agencies, the government should ensure that the necessary pre-requisites are met.

The influx of refugees into Europe in the last few years has led to the diversion of development funds to in-country refugee-related expenditure and has greatly reduced the funds available for supporting conservation-related activities. With the new government in place in the US, conservation- and climate change-related activities are no longer on the priority list of the country. As a result, the possibility of receiving any financial support for climate change- and associated forest rehabilitation-related work has greatly been diminished. Given this scenario, the GoB will have to allocate significantly larger sums of money to complement the support, which will be received from multilateral agencies.

However, many countries have recently established new funding programmes, mainly focused on climate change-related issues, to support developing countries to undertake mitigation or adaptation projects in the forestry sector. Some such programmes make provisions mostly for up-front financing of REDD+ readiness activities, prior to the availability of results-based finance only. Here are some examples of such bilateral opportunities:

- **Norway International Climate and Forest Initiative (NICFI).** NICFI has provided large amounts of money to several countries, including the highly publicized \$1 billion pledges to Brazil and Indonesia, with smaller but still substantial amounts going to Guyana and

Tanzania. NICFI is also a major donor to the UN-REDD Programme and international financial institution (IFI) programmes.²⁷

- **Germany REDD Early Movers Program (REM).** The REM supports REDD+ pioneer countries who are taking initiatives in forest conservation for climate change mitigation. The programme rewards the climate change mitigation performances of those countries by buying up verified emission reductions and promotes sustainable development for the benefit of small-scale farmers as well as forest-dependent and indigenous communities, through fair benefit sharing. Technical support is provided by GIZ, and the finance is managed by KfW.²⁸
- **USAID, United States Forest Service and Tropical Forest Alliance 2020 (TFA).** The US is providing substantial support to forestry operations through the Tropical Forest Alliance 2020. In addition, its regular forestry programmes conducted through USAID and the Forest Service are strongly focused on REDD+. However, with the change in the focus of the programme support, it is not clear how much fund will be available through this US window.
- **Global Climate Change Alliance (GCCA).** The GCCA was established by the European Union (EU) in 2007 to strengthen dialogue and co-operation with developing countries, in particular least developed countries (LDCs), and Small Island Developing States (SIDS). By fostering effective dialogue and co-operation on climate change, the alliance helps ensure that poor developing countries, which are most vulnerable to climate change, increase their capacities to adapt to the effects of climate change, in support of the achievement of the Millennium Development Goals (MDGs). Where this benefits their poverty reduction objectives, the alliance also helps such countries to participate in the global climate change mitigation effort.
- **Forest Carbon Partnership Facility (FCPF).** The (FCPF) is a global partnership of governments, businesses, civil society and indigenous peoples focused on reducing emissions from deforestation and forest degradation, forest carbon stock conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (activities commonly referred to as REDD+). The FCPF has two separate but complementary funding mechanisms—the Readiness Fund and the Carbon Fund—to achieve its strategic objectives. Both funds are underpinned by a multi-donor fund of governments and non-governmental entities, including private companies, which make a minimum financial contribution of \$5 million.

9.3.3 Climate finance options for forestry under the UNFCCC

The various options that are available through the UNFCCC process are presented in more detail in Table 9-9.

²⁷<https://www.regjeringen.no/en/topics/climate-and-environment/climate/climate-and-forest-rk>

²⁸<https://www.giz.de/en/worldwide/33356.html>

Table 9-9: Climate finance options for forestry in Bangladesh

Mechanism	Characteristics
Clean Development Mechanism (CDM)	
Overview	The CDM of the Kyoto Protocol has as the objective the reduction of GHG emissions through provision of financial and technical assistance from Annex I countries to non-Annex I countries in the establishment of projects. Under the CDM, Scope 14 is for afforestation and reforestation. CDM has fairly elaborated administrative, reporting and validation requirements, reasons why many afforestation and reforestation projects have not been successful in accessing CDM financing because the overhead costs erode the financial viability of the project. As a result, small-scale activities were allowed, with reduced administrative requirements and hence lower overhead costs. More interestingly, a Programme of Activities (PoA) can be defined that acts as an umbrella for multiple small projects in a country, with its concomitant benefits of scale. For instance, a PoA for social forestry could include all new plantations on degraded reserve forest (RF) land throughout the country and then be registered as a single CDM project.
Scope	For afforestation projects, only that land can be included that did not support actual forest in the past 50 years. For reforestation projects only that land can be included that did not support actual forest since 1 January 1990. The minimum area would be several tens of thousands of hectares ²⁹ for the project to be financially viable.
Requirements	Bangladesh needs to submit the CDM proposals formally to the UNFCCC. Local stakeholders need to be consulted and detailed assessments need to be made available.
Financing	CDM projects always need a donor country that provides technology and financing of the project. CER certificates is an important issue.
Feasibility	The Kyoto Protocol, of which the CDM is a part, is currently in its second commitment period, and it is doubtful if the Kyoto Protocol will be extended following the adoption of the new climate agreement at COP-21 in December 2015, which will become operational from 2020 onwards. Individual afforestation and reforestation projects are not likely to be financially viable, but bundling them into a PoA is a more tenable option.
Reducing Emissions from Deforestation and Forest Degradation (REDD+)	
Overview	The REDD+ mechanism was proposed in 2005 to enable the incorporation of reduction of GHG emissions from natural forests in non-Annex I countries into mitigation programmes. The REDD+ mechanism is still under negotiation as of June 2016 although most elements of the mechanism have been defined in a series of decisions from the Conference of the Parties to the UNFCCC. The REDD+ mechanism has five eligible activities: <ol style="list-style-type: none"> 1. Reducing emissions from deforestation 2. Reducing emissions from forest degradation 3. Conservation of forest carbon stocks 4. Sustainable management of forests 5. Enhancement of forest carbon stocks
Scope	If Bangladesh opts for the REDD+ mechanism, then all forest land ³⁰ in Bangladesh will have to be included in the National REDD+ Programme. The only exceptions will be the forests included in other climate finance agreements, such as the CDM, FCPF, Forest Investment Programme (FIP), etc.
Requirements	Decision 1/CP.16 defines the four required elements of a National REDD+ Programme: <ol style="list-style-type: none"> 1. A national strategy or action plan

²⁹A regular CDM project should have a minimum projected annual emission reduction of 16 ktCO₂e/yr (decision 9/CMP.3), and the amount is less for a small-scale CDM project. Given the administrative overhead and low price of Certified Emission Reduction (CER) certificates, projects tend not to be financially viable unless much higher annual emission reductions are achieved.

³⁰'Forest Land' is a land use category under the IPCC Guidelines. In principle it contains all land that is currently forested, but it should also include land that is designated as forest even though it is not currently forested, such as degraded RF land and land accretion in RF areas.

Mechanism	Characteristics
	<ol style="list-style-type: none"> 2. A national forest reference emission level and/or forest reference level, in accordance with the national circumstances 3. A robust and transparent national forest monitoring system for monitoring and reporting the eligible activities, in accordance with national circumstances 4. A system for providing information on how the safeguards are being addressed and respected throughout the implementation of the eligible activities 5. In effect, the safeguards require Bangladesh to have full and effective engagement of all local stakeholders, specifically indigenous peoples and local communities, in all relevant aspects of any activities implemented under the National REDD+ Programme.
Financing	<p>Bangladesh has to prepare a Technical Annex to the National Communication with full details of the REDD+ Programme and activities. This Technical Annex will be assessed through the International Consultation and Analysis process organized by the UNFCCC Secretariat. If the Technical Annex is found to be compliant with UNFCCC decisions, then Bangladesh can apply for 'results-based finance' at the Green Climate Fund.</p> <p>The current (June 2016) price for REDD+ GHG emission reductions is approximately \$5-5.5 per ton of CO₂ equivalent. Any amounts awarded would accrue directly to Bangladesh and are expected to be applied towards the operation of the National REDD+ Programme and otherwise be distributed to the stakeholders of the REDD+ activities in a form deemed appropriate by the government.</p>
Feasibility	<p>Once the system is properly set up, it is rather straightforward and many current programmes and activities could be brought under the National REDD+ Programme with limited additional work, such as the social forestry programme. However, establishing the reference (emission) levels and the national forest monitoring system are complex undertakings, and a continuous system for forest resource assessment has to be set up and maintained.</p> <p>Bangladesh is actively participating in various REDD+ initiatives, and a project is currently being implemented with support from the UN-REDD Programme.</p>
Nationally Appropriate Mitigation Actions (NAMA)	
Overview	Under the NAMA mechanism non-Annex I countries like Bangladesh can develop projects that reduce GHG emissions and enhance removal of GHGs from the atmosphere and register these with the UNFCCC Secretariat to solicit funding for further development and/or implementation.
Scope	There are limited guidelines regarding the scope of projects that can be proposed, implying that a wide range of projects and activities are eligible.
Requirements	There are no specific requirements for NAMA proposals or projects. Reporting on NAMAs is largely voluntary, but emission reductions or enhanced removals should be accounted for in national GHG accounts.
Financing	Donor countries or IFIs can browse the NAMA registry and decide to support a proposal for further development and/or implementation. Otherwise there are no standards, guidelines or requirements for financing.
Feasibility	Bangladesh has not developed any NAMA proposals in the forestry sector. While such proposals can be developed and submitted, there is no guarantee of financing.
Intended Nationally Determined Contributions (INDC)	
Overview	<p>In decisions 1/CP.19 and 1/CP.20, the UNFCCC invited all Parties to communicate to the Secretariat their INDCs well in advance of COP-21, where the new climate agreement, of which the INDCs are part, was to be adopted. The INDCs are an intention of the Parties to reduce GHG emissions and enhance GHG removals.</p> <p>Individual activities identified in the INDC of non-Annex I countries can attract funding from Annex I countries or IFIs.</p>
Scope	The INDCs are completely open-ended.
Requirements	There are no specific requirements for INDC activities.
Financing	Donor countries or IFIs can browse the INDC portal and decide to support a proposal for further development and/or implementation. Otherwise there are no standards, guidelines or requirements for financing.
Feasibility	<p>Bangladesh submitted its initial INDC in September 2015 with the following mitigation activities for the forestry sector:</p> <ol style="list-style-type: none"> 1. Coastal mangrove plantations 2. Reforestation and afforestation in the reserved forests 3. Plantation in the island areas of Bangladesh 4. Continuation of social and homestead forestry <p>In adaptation, the priority activity of 'biodiversity and ecosystem conservation' has been identified.</p>

There are several other funds operated by the UNFCCC to assist developing countries in the mitigation of, and adaptation to, climate change impacts. Forestry is one of the activities envisaged for funding under these programmes. A few examples of these funds are described in the following.

Box 9-1: UN-REDD Bangladesh Programme overview

Bangladesh is a Partner Country of the UN-REDD Programme. A collaboration between the FAO, UNDP and UNEP¹, over the period from June 2015 to March 2018, the national programme will be implemented with a \$2.3 million grant. Till February 2016 the program had not been started, due to delays of approvals.

The outcomes of the programme are:

- Improved stakeholder awareness and effective stakeholder engagement
- National REDD+ strategy preparation supported
- Capacities to develop and test National Forest Reference Emission Level (REL) and/or Forest Reference Level (RL) are in place

The National Forest Information System can be used to develop a National Greenhouse Gas Inventory for the Forest Sector when the above outcomes have been achieved. Bangladesh should have all the skills and capacities in place to produce the materials necessary to comply with the requirements of the UNFCCC for participation in the REDD+ mechanism.

Special Climate Change Fund

The Special Climate Change Fund (SCCF) was established under the convention (UNFCCC) in 2001 to finance projects relating to adaptation; technology transfer and capacity building; energy, transport, industry, agriculture, forestry and waste management; and economic diversification. This fund should complement other funding mechanisms for the implementation of the convention.

Adaptation Fund

The Adaptation Fund was established in 2001 to finance concrete adaptation projects and programmes in developing-country Parties to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change. The Adaptation Fund is financed with a share of proceeds from the CDM project activities and other sources of funding. The share of the proceeds amounts to 2% of the CERs issued for a CDM project activity. As the CDM is currently not doing well, this fund is being supplemented by other sources as well.

Least Developed Countries Fund

The Least Developed Countries Fund (LDCF) was established to support a work programme to assist Least Developed Country Parties (LDCs) carry out, inter alia, the preparation and implementation of national adaptation programmes of action (NAPAs). The LDCF provides support to eligible countries for implementation of NAPAs, guidance regarding priority areas, and full-cost funding and a co-financing scale.

Climate finance options for forestry through IFIs

IFIs are also providing climate-related financial instruments for forestry projects, in particular in support of the REDD+ mechanism. Bangladesh is not currently participating in any of these programmes, although the Forest Investment Program (FIP), administered by the World Bank, awarded a grant of \$250,000 to Bangladesh in July 2015 to develop a Forest Investment Plan, which may lead to further financing. The World Bank is likely to finance a project worth \$50-80 million under the FIP and Green Climate Fund (GCF).

The GCF acts as the finance institution of the UNFCCC and has been allocated funds to provide assistance to developing country Parties to undertake mitigation and adaptation projects. For REDD+ programmes, this is the main conduit of results-based finance, but other forestry activities might also be eligible for funding, especially in the area of adaptation to climate change. By June 2016, the GCF had not yet published its modalities for financing mitigation and adaptation projects. The fund has a target of collecting \$100 billion by 2021.

Pilot Programme for Climate Resilience

The \$1.2 billion Pilot Programme for Climate Resilience (PPCR) is a funding window of the Climate Investment Funds (CIF). Using a two-phase, programmatic approach, the PPCR assists national governments in integrating climate resilience into development planning across sectors and stakeholder groups. It then provides additional funding to put the plan into action and pilot innovative public and private sector solutions to pressing climate-related risks.

The PPCR empowers countries to approach climate resilience in a programmatic manner. Moving beyond project-by-project activities that have limited potential to effect national or sector-wide transformations, the programmatic approach of the PPCR entails a long-term strategic arrangement of linked investment projects and activities to achieve large-scale, systematic impacts and take advantage of synergies and co-financing opportunities.

Giving priority to highly vulnerable least developed countries, including SIDS, the PPCR provides grants and highly concessional financing (near-zero interest credits with a grant element of 75%) for investments supporting a wide range of activities, such as water resource management, urban development, infrastructure, enabling environment, coastal zone management, climate information systems and disaster risk management, and agriculture and landscape management.

Voluntary carbon market

In anticipation of the conclusion of the negotiations related to REDD+ at the UNFCCC, the voluntary carbon market has developed methodologies for REDD+ projects in any country in the world.³¹ Project proposals can apply these methodologies and apply for registration with certification bodies such as Voluntary Carbon Standards (VCS).³² Projects have to be verified by independent auditors and, if the proposals are successful, carbon credits can then be registered in an international market for purchase by others, usually companies or public entities in

³¹Technically speaking, projects in the voluntary carbon market cannot be REDD+ because the decisions taken by the UNFCCC define REDD+ as a national programme with requirements that cannot be met by project-based activities.

³²<http://www.v-c-s.org>

industrialized countries who want to reduce their own net carbon emissions as part of their corporate social responsibility (CSR).

The supply of carbon credits in the voluntary carbon market has been growing rapidly in recent years, but there is a mismatch with demand, leading to uncertainties for project developers and a reduced market price for carbon credits, which in 2014 reached a historical low of \$3.8 per tCO₂e.³³

Private foundations and other sources

A number of private foundations support developmental work and in the past have made substantial contributions to conservation. While the focus of most of these organizations has since changed, many of them still commit significant funds to climate change and other activities including reforestation/afforestation as long as it is seen as a climate change mitigative measure. Most these bodies are based in the US, and the more prominent ones include the Ford Foundation, MacArthur Foundation and Rockefeller Foundation.

A number of zoos are active in providing technical and material support to zoos and botanical gardens in developing countries. These outfits can be approached for help with capacity building, support for development of PAs and parks, etc. The Bronx Zoo, Munich Zoo, Kew Garden and Chicago Zoo are some of the well-known ones.

9.3.4 Local sources

Bangladesh Climate Change Trust Fund

- In 2010, the GoB created the Bangladesh Climate Change Trust Fund (BCCTF) under the Climate Change Act to finance climate change mitigation and adaptation activities. The BCCTF is resourced entirely from the government's own budget. The GoB has allocated Tk.3100 crores (\$400 million approximately) to the BCCTF so far. As of June 2016, 440 projects were undertaken. A total of 377 projects are being implemented by government, semi-government and autonomous agencies, while 63 projects are being implemented by non-governmental organizations (NGOs) under the supervision of the Palli Karma-Sahayak Foundation (PKSF). Although forestry is a key sector that is impacted by climate change, it is a high-potential mitigation tool. No significant forestry projects have been supported by the BCCTF so far although the fund has been supporting tree planting, establishment of biogas plants and distribution of cook stoves. This fund holds potential for financing core forestry activities as well, and possibilities of access should be seriously explored.

Bangladesh Climate Change Resilience Fund

- The GoB has created the Bangladesh Climate Change Resilience Fund (BCCRF) with funds pledged and provided by developed countries or groups. The BCCRF is a co-ordinated financing mechanism of the GoB, development partners and the World Bank to address the impacts of climate change. The fund was established in May 2010 with financial support from Denmark, the European Union, Sweden and the UK. Switzerland, Australia and the US subsequently joined the fund. This mechanism has enabled the

³³State of the Voluntary Carbon Markets 2015, Forest Trends.http://foresttrends.org/releases/uploads/SOVCM2015_FullReport.pdf

government to channel grant funds amounting to more than \$188 million to building the people's resilience to the effects of climate change. This fund also supports forestry activities in the form of projects such as CRPARP. However, this fund is scheduled to close in June 2017 and may not be relevant in the future unless an alternative system is put in place.

Public-private partnerships

As indicated previously, the GoB, in partnership with development partners and IFIs, invests funds in taking care of the state forest lands, promoting the TOF sector, research and other programmes of common public interest, while people invest in planting and maintaining trees on their personal lands. However, in view of the persistent shortfall in the funds required to meet the sectoral requirements, despite continued donor/lender support, particularly for reforestation of degraded forest lands, it is important to look beyond the traditional sources of forestry financing. Governments across the globe, including the GoB, are resorting to PPP modes of financing public programmes in a way that the programme becomes profitable as a business to a private investor while serving public purposes. In August 2010, the GoB issued the 'Policy and Strategy for Public Private Partnership (PPP)' to facilitate the development of core sector public infrastructure and services vital for the people of Bangladesh. The PPP programme is part of the Government's Vision 2021, among the goals of which are ensuring a more rapid, inclusive growth trajectory and better meeting the need for enhanced, high-quality, public services in a fiscally sustainable manner.

Under this new national policy, the PPP Authority was established as a separate, autonomous office in the Prime Minister's Office to support line ministries to facilitate identification, development and tendering of PPP projects to international standards. A PPP Unit under the Ministry of Finance was established to foster an environment of fiscal responsibility and sustainability in PPP projects.³⁴ The Bangladesh Public Private Partnership (PPP) Act, 2015 is in place to regulate the PPP projects. A provision for providing viability gap funding (VGF) to social sector projects that do not have inherent potential for profit is already there. So far the forestry sector has not explored the PPP option to finance projects. The BFD should start discussions with the PPP Authority to bring the forestry sector into the ambit of PPP. While all reforestation projects have a high element of social benefit and may or not be highly profitable, they will often need support. Properly crafted initiatives implemented using innovative models can be financially rewarding. If a proper policy for facilitating PPP in forestry, particularly in reforestation of degraded hill forests, both BFD-owned or *khas* and USF, is created, achieving the tree-cover targets (20% of geographical area), along with all the concomitant benefits, will become much easier for the country. This is an avenue that must be explored in view of the dire needs of the country.

Institutional financing

Developing degraded forests using money borrowed commercially from banks and non-banking financial institutions is another option available to the forestry sector. India set up a series of state-level Forest Development Corporations (FDCs) to channelize institutional financing into forestry in the 1960s and 1970s. These corporations undertook large-scale commercial

³⁴<http://www.pppo.gov.bd/>

plantation of teak and other species in forest lands allotted to them. The plantations are now maturing and giving the FDCs substantial returns. The possibility of a similar approach can be evaluated for Bangladesh. A commercial body like an FDC can use both PPP and commercial borrowings to reforest hill forests. The use of short-rotation and other economically important species such as rubber and agar, with intercropping in early years with suitable species for generation of recurring income, should be attractive for such investments. To promote such financing, it is proposed that the rate of interest of loans for such activities be brought down to the level of agricultural loans.

Corporate social responsibility

Industries and businesses spending funds on social and environmental causes is a global practice, and this practice is growing. Most companies tend to invest in social and environmental programmes, in the name of CSR, either as a sense of responsibility towards common causes or as a result of political or business compulsions (their customers desiring it). The scale of CSR in Bangladesh is not big at present, but it is likely to grow with industrial development and improvements in the economy. Therefore, the BFD should interact with major industrial houses to help them plan their CSR inputs in the forestry sector. At present, most companies focus their CSR work on sectors such as community livelihoods, health, sanitation and education. Tree planting is generally done at a limited level. However, as forestry has a strong stake in community livelihoods, attracting these inputs towards forest-dependent communities can be a direct contribution to forestry.

At present, Bangladesh does not have any law related to CSR, but sooner or later such a law will be passed, as in most other countries. These laws oblige all big corporates to spend a part of their earnings (2-3%) on social causes. It is important that whenever such a law is passed, forestry be one of the eligible sectors to benefit from CSR. CSR support to forestry may never be big at the national level, but, whatever inputs are provided can often make a difference at the local level. CSR inputs, even at low levels, can easily assist running environmental awareness campaigns or forestry extension programmes.

Available financial resources

It is obvious from this account that several diverse sources of funds are available for the forestry sector. Apart from the normal budget of the government, projects worth nearly Tk.1500 crores, have either been approved or are under discussion with various donors, for the next 5 years. In addition, the World Bank is looking for an opportunity to invest approximately \$50-80 million (at least Tk.400 crores over 5 years) under FIP. This indicates an average Annual Development Programme (ADP) size of approximately Tk.300-400 crores, which is significantly below the projected requirement in Scenario 2 of the FMP but indicates some increase from the previous trend. If this trend persists, it should be possible to achieve Scenario 2 targets with some effort. But the implementation of Scenario 3, with a target of Tk.73,029.6 crores for the 20-year FMP period, will not be possible unless the BFD is thoroughly overhauled with respect to manpower, capacity building, logistics, finance and legal empowerment. The Ministry of Environment and Forests (MOEF) shall have to be dynamic and active, and must take leading initiatives, if the government is at all interested in the natural resources of the country.

It is also obvious that a large number of hitherto unexplored international avenues for concessional funding for forestry are available for Bangladesh, both as a least developed country (LDC) and as the most climate-vulnerable country in the world. The country has to

develop its institutional capacity to access these resources. Therefore, the BFD should create a dedicated unit to develop expertise in developing suitable proposals/projects.

Other resources required

Apart from funds, manpower, technical capacity and equipment, a forestry enterprise requires many other kinds of resources from time to time, such as land, water, nutrients and labour.

The national target of bringing 20% of the country's area under tree cover envisages the use of nearly 2.95 million ha of land, with 2.49 million ha already under tree cover (10% or more canopy density). Thus, the country needs to bring another 0.5 million ha (460,000 ha to be precise) of land under tree cover to meet the national target. Out of this, nearly 300,000 ha of degraded land is available for reforestation in the hill forests, while another 100,000 ha is available for coastal plantations according to the FIGNSP 2013 report. Thus, the country shall have to increase the tree cover on private lands, homesteads, unused wasteland and cultivated lands, to the extent of 40,000-50,000 ha, to make up for the shortage of land in government custody. Going by the perceived trends in the growth of TOF, an increase in TOF seems to be quite likely as it is driven by private capital and economic interest. The real question is whether the GoB will be able to garner the resources to reforest its own state forests.

In forestry, irrigation is required primarily for raising nurseries. Although irrigated plantations do show higher growth rates, the economics of irrigation in forestry is often unattractive. With a pronounced dry season, irrigation is necessary to ensure the production of high-quality planting materials. In Bangladesh, most of the plantations are going to be raised in the hill areas, which receive the highest rainfall in the country, and in the *chars*, which are inundated, often daily. Thus, they are not going to need any irrigation support. There are plenty of opportunities to set up site-level nurseries near perennial rivers. Although the water table is receding even in Bangladesh, due to decreasing recharge rates and high extraction rates, finding enough ground water for nurseries, if necessary, is not going to be difficult.

Again, the economics of fertilization of forestry plantations is debatable, although nutrient supplementation is a standard practice in nurseries. All the commonly used fertilizers, particularly NPK-based preparations, are easily available in the markets, and their availability is not likely to be an issue.

Although Bangladesh is a labour-surplus country, timely availability of labour can be affected by festival seasons and alternative employment opportunities available locally. With the rate at which Bangladesh is urbanizing, labour shortages may be experienced in the rural areas in the future. Moreover, as plantation work is going to be concentrated in a few tracts, i.e., hill areas and coastal areas, local shortages of labour may affect operations here and there. Quite often, forestry operations are afflicted with labour shortages as the working season coincides with some festival or the other. In general, however, availability of labour may not be a serious issue in forestry operations in Bangladesh.

10 Conclusions

This master plan clearly indicates that all the institutions in the forestry sector are suffering from serious shortcomings and deficiencies, which include shortages of resources and manpower, shortage of IT professionals, inadequate legal cover and poor enforcement and many other anomalies. These need immediate and elaborate reviews to identify the causes and possible remedies. While these issues have been building up over the years, any worthwhile efforts to address these do not seem to have been initiated. While some of the issues and problems were possibly beyond the means of these sectoral organisations to resolve, those that could have been addressed if proper actions had been taken have also been left to simmer and become larger problems and issues.

A revision of the National Forestry Policy has been completed that addresses all the aforementioned issues and other important matters and submitted to the Ministry of Environment and Forests for approval and follow-up actions. The master plan details actions needed to both address the issues and problems identified through this exercise and operationalize the statements formulated in the National Forestry Policy.

The sector does not have the required financial resources and necessary tools to implement the plan and, given the annual budgetary allocations, will require massive infusions of funds from external sources to implement the recommended programmatic interventions. However, the whole sector is currently in a catch-22 situation, where donors will only extend support when they feel that their resources will be efficiently utilized in a timely manner. So a comprehensive programme for institutional development that covers manpower recruitment and development will have to be initiated immediately. In addition, an effective mechanism for the sustainable management and adequate protection of the resources and production of all desired deliverables will have to be ensured. Administrative, legal and regulatory instruments, including laws, rules and empowering notifications, will have to be revised and updated.

The Bangladesh Forest Department is suffering from a large number of serious problems that require urgent resolution. The department now has on its staff a small fraction of the sanctioned cadre strength, which is far short of the needed number of officials for managing the department's current activities. The situation is even worse in the cases of Forest Rangers and Deputy Rangers. The implementation of the Forestry Master Plan and the Wildlife Master Plan and other associated activities will require a much larger, well-trained staff in place, and it takes time to induct forest officers of different levels. The recruitment process at different levels need to be streamlined and induction training programmes carried out properly. The field offices of the department suffer from an acute shortage of basic amenities. The training institutions are in dilapidated conditions, have an acute shortage of qualified instructors and lack required facilities. Anomalies in the recruitment of Assistant Conservators of Forest and other staff members without following a proper procedure has created a major problem, which has not been resolved over almost 2 decades. Both natural forests and plantations are reported to be not up to the mark, and the actual area under tree cover in the government forests has declined to some extent. A large area of forest under the management of the Bangladesh Forest Department has become denuded or near-denuded and requires urgent restoration. This and the protection of the forests and their resources have become very daunting tasks. Many regulatory tolls are either out of date or inadequate for handling the current situation. The shortage of staff & lack of resources have created a situation to which the department needs to

pay attention immediately. Trees outside forests have become a major source of tree-based products in the country and need to be promoted further. The proposed expansion of the extension network of the Bangladesh Forest Department is a step in the right direction. However, this needs to be converted into a national movement, with all stakeholders participating. In addition, this programme needs the government's wholehearted blessings and adequate financial support. Urgent targeted intervention is needed to salvage the department from its current situation, and this will require both the support of the government and allocation of resources backed by a comprehensive plan of action. With donor support diminishing steadily, the Government of Bangladesh will have to review the matter seriously, assign high priority, allocate needed funds to match whatever external financing is available and facilitate the rehabilitation of the department. The Bangladesh Forest research Institute and the Bangladesh National Herbarium are suffering from an acute shortage of manpower, equipment and resources that are necessary to undertake regular and needed research programmes. The recruitment rules are outdated and the processes highly bureaucratic. Promotions are slow, and there are very few other incentives to work at these institutions. The forestry programmes in the universities at Chittagong, Khulna and Sylhet have a large number of highly qualified faculty members and have been undertaking impressive forestry research with assistance from their students and have come up with several publications in international journals. These institutions need to be promoted.

The Bangladesh Forest Industries Development Corporation (BFIDC) is suffering from an array of serious problems. The performances of the different enterprises run by the BFIDC need to be reviewed immediately. The rubber plantations under the management of the BFIDC have very low yields. This is primarily because of the use of low-yielding planting material. Replacement of existing plantations with high-yielding clones of rubber is not a difficult task as long as the management practices are upgraded and financial resources and know-how are made available. The organization needs to reorient its mandate and include promotion of forest industries in the private sector as a major focus of its programmes. Private sector industries need attention and incentives, and these need to be looked into.

The forestry sector institutions need immediate attention from the Government of Bangladesh. The right level of priority needs to be assigned to the sector by the government. In an atmosphere where donor support has diminished, the government needs to step in and provide the necessary financial and other inputs to ensure that the sector is completely rehabilitated. In addition, it needs to create an enabling environment for the growth of the involvement of the private sector in forestry.

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List of Annexes (Separately available)

1. Task report 1: 9 sectoral reports on the state of forests and forestry.
 2. Task report 2: Strategies, programmes and resources.
 3. Task report 4: Climate change projections, impacts and vulnerability analysis.
 4. Task report 5: Sustainable forest management practices.
 5. Task report 6: Forestry policies, institutions and resources for the FMP implementation.
 6. Task report 7: Monitoring of socioeconomic and ecosystem services impact indicators.
16. Note: Task 3 was deleted.