

**People's Republic of Bangladesh**

**Data Collection Survey on  
Forest and Natural Resources Sectors for Climate  
Change Action in Bangladesh**

**Final Report**

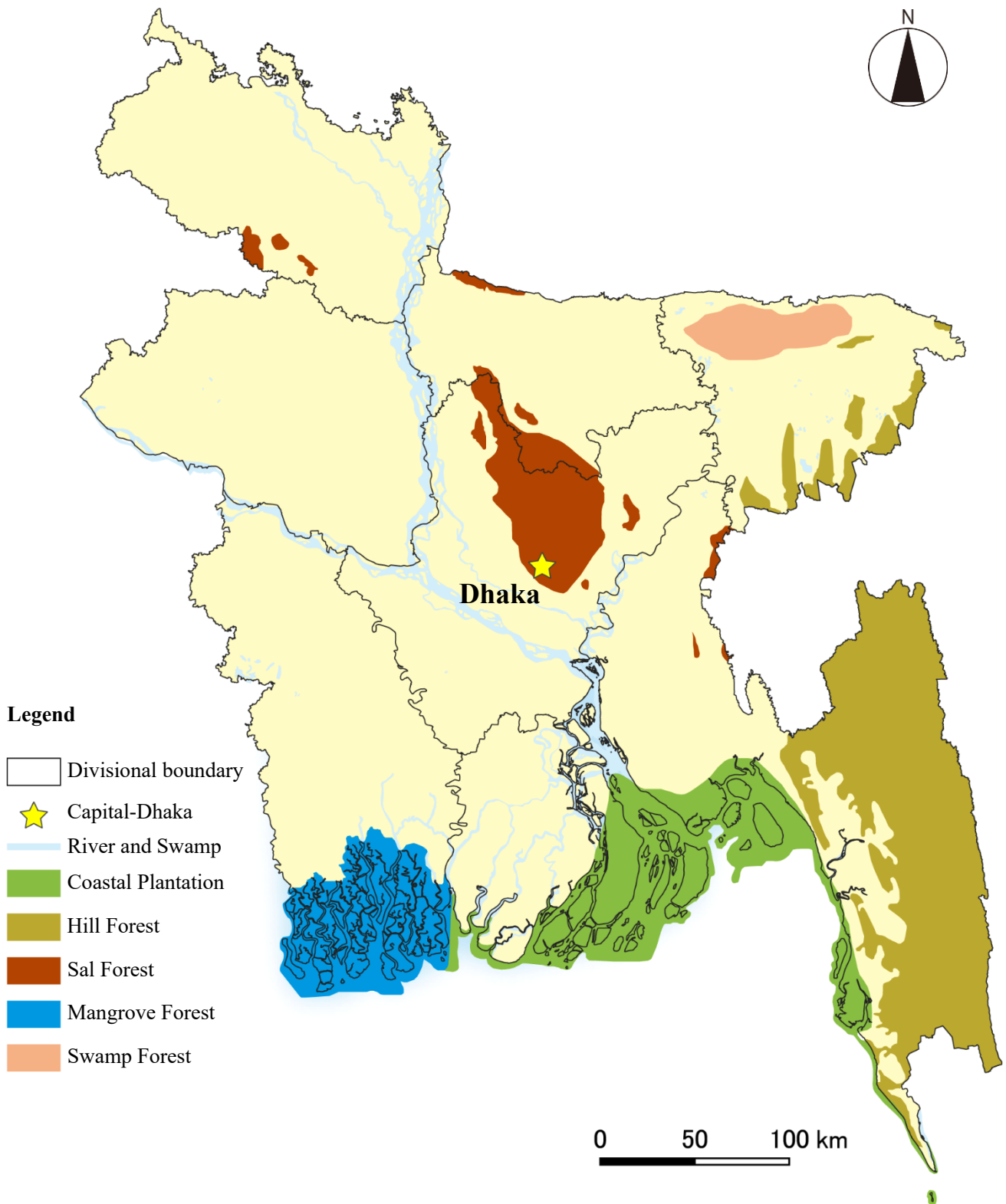
**January 2024**

**Japan International Cooperation Agency (JICA)**

**Nippon Koei Co., Ltd.**

<b>GE</b>
<b>JR</b>
<b>24-002</b>





Source: JICA Survey Team based on Bangladesh National REDD+ Strategy 2016-2030

**Location Map of the Survey Sites**



# Data Collection Survey on Forest and Natural Resources Sectors for Climate Change Action in Bangladesh

## Final Report

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Location Map of the Survey Sites

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### Abbreviation

Abbreviations	Official English name
ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
AI	Artificial intelligence
BAU	Business as Usual
BCC	Bangladesh Computer Council
BFI	Bangladesh Forest Inventory
BFIS	Bangladesh Forest Information System
BWDB	Bangladesh Water Development Board
CCF	Chief Conservator of Forests
CF	Conservator of Forests
CFM	Collaborative Forest Management
CHT	Chattogram Hill Tracts
DCCF	Deputy Chief Conservator of Forests
DFO	Divisional Forest Officer
DOE	Department of Environment
ECA	Ecologically Critical Area
EM	Ecological Monitoring
FAO	Food and Agriculture Organization
FD	Forest Department
FDC	Forest Dependent Community
FDTC	Forest Development and Training Centre
FLR	Forest Landscape Restoration
FRA	Forest Resource Assessment
FSTI	Forest Scientific Research Institutes
GEE	Google earth engine
GEF	Global Environment Facility
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (in German)
IAS	Invasive Alien Species
iCFM	Improved Collaborative Foerst Management
ICIMOD	International Centre for Integrated Mountain Development
ICT	Information and Communications Technology
IRMP	Integrated Resource Management Plan



<b>Abbreviations</b>	<b>Official English name</b>
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau (in German)
MoCHTA	Ministry of Chattogram Hill Tracts Affairs
MoEFCC	Ministry of Environment, Forest, and Climate Change
MoWR	Ministry of Water Resources
MPD	Management Planning Division
NAP	National Adaptation Plan
NASA	National Aeronautics and Space Administration
NbS	Nature-based Solution
NDC	Nationally Determined Contribution
NDRR	Nature-based Disaster Risk Reduction
NWI	Normalized Difference Water Index
NEC	National Economic Council
NGO	Non-Governmental Organization
ODA	Official development assistance
OECS	Other Effective Area-based Conservation Measures
PMU	Project Management Unit
REDD	Reducing Emissions from Deforestation and Forest Degradation
RF	Reserved Forest
RFM	Real Time Forest Monitoring
RIMS	Resources Information Management System
RUG	Resource Utilization Group
SAR	Synthetic Aperture Radar
SDGs	Sustainable Development Goals
SMART	Spatial Monitoring and Recording Tool
SOP	Standard Operation Procedure
SRF	Sundarbans Reserved Forest
SSP	Site Specific Planning
SUFAL	Sustainable Forest and Livelihood
TOF	Trees outside Forest
UAV	Unmanned Ariel Vehicle
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USF	Unclassified State Forest
USFS	United States Forest Service
VCF	Village Common Forest
WB	World Bank
WCS	Wildlife Conservation Society



## Chapter 1 Background, Purpose, and Method of the Survey

### 1.1 Background of the Survey

Bangladesh is one of the most vulnerable countries to climate change and natural disasters. The Eighth Five-Year Plan of Bangladesh (2020-2025) prioritizes climate change adaptation for sustainable development. To address it, the Ministry of Environment, Forest and Climate Change (MoEFCC) developed “The National Adaptation Plan (NAP) Bangladesh 2023~2050” in 2022.

Forests in Bangladesh serve as sinks for greenhouse gases (CO<sub>2</sub>) and contribute to strengthening social resilience against various natural hazards caused by climate change through the functions of ecosystem services. On the other hand, due to the population growth and economic development in recent years, the quality and area of forests distributed in several divisions in the country are steadily declining. According to the data published by MoEFCC in 2018, forests that were 2,624,487ha in 2000 declined to 2,298,904ha in 2015. In 15 years, 325,583 ha of forests have been degraded or converted to other land-use (12.4 percent in total, annual mean 0.8 percent reduction). For this reason, NAP has emphasized to strengthen the maintenance and management of forests and natural resources as one of its main challenges.<sup>1</sup>

In this situation, the Japan International Cooperation Agency (JICA) sent a survey team to Bangladesh to examine the possibility of supporting Bangladesh forestry sector in terms of climate-change. This survey is based on JICA Global Agenda (thematic strategies) 17 Natural Environment Conservation. Along with the conservation of the natural environment, forests have the function of providing multifaceted services in socioeconomic development contributing to both climate change mitigation and adaptation measures. In the survey, the policies of the forestry sector, achievements of programs and projects, and issues and challenges in Bangladesh were analyzed focusing the six main forest landscapes in the country which have different characteristics of forest vegetation, such as mangrove forests along the coast, forests in hilly areas, and wetland forests.

### 1.2 Purpose of the Survey

The purpose of this survey is to grasp and organize the present state of the forest and natural resources field and the issues for sustainable management in Bangladesh, and to collect and organize information for examining the possibility of future cooperation in the forest and natural resources sector contributing to climate change countermeasures.

### 1.3 Policy for Conducting the Survey

To achieve the above objectives, the team conducted the survey based on the following implementation policies.

#### (1) Strategic information gathering and proposals to formulate proposals for future cooperation

The first field survey focused on collecting and analyzing data on key project formulation and issues from multilateral and donor/governmental organizations engaged in activities related to potential future JICA co-operation. In terms of history of cooperation to the forestry sector of Bangladesh, there has not been any project or program by the Japanese government. Meanwhile, major international organizations and donor agencies such as the World Bank, UNDP, FAO, GIZ, and USAID have continued to contribute the forestry sector more than the decades. Under such circumstances, the survey team did interviews to the key personnel and site visits in the forest landscapes to understand the achievements and issues of past projects and programs by the Forest Department of government supported by the cooperation agencies. The team also grasped the needs for future international cooperation.

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<sup>1</sup> MoEFCC 2018. The submission of Bangladesh's Forest Reference Level for REDD+ under the UNFCCC. Ministry of Environment, Forest and Climate Change (MoEFCC), Government of the People's Republic of Bangladesh. Available at: [https://unfccc.int/files/adaptation/groups.../loss\\_and.../ds\\_bangladesh\\_report.pdf](https://unfccc.int/files/adaptation/groups.../loss_and.../ds_bangladesh_report.pdf)

## (2) Identification of Challenges in Major Forest Ecosystems

The forest area in Bangladesh is 2,298,904 ha, which is equivalent to 15.5% of the land area. Of these, 1,603,678ha (about 70% of all forests) is managed by the Forest Department and the remaining 695,221ha belong to the Ministry of Land. As shown in the introduction, forest ecosystems in Bangladesh are broadly divided into five types i.e., (i) Hill Forests, (ii) Sal Forests, (iii) Mangrove Forests, (iv) Coastal Plantations, and (v) Freshwater Wetlands Forests. In addition, the "Social Forestry Program" has been conducted to continuously plant trees in private lands (Table 1-1).<sup>2 3 4</sup>

**Table 1-1 Major Forest Ecosystems and Characteristics in Bangladesh**

Forest ecosystems	Features and Overview
01 Hill Forest	It consists of tropical evergreen/semi-evergreen forests and is distributed in the eastern part of the Sylhet district and in the hills of the Chattogram district. There are also a large number of <i>Dipterocarpaceae</i> , which are valuable not only from the viewpoint of economic value but also from the viewpoint of biodiversity and watershed conservation. Approx. 660,000 ha.
02 Sal Forest	This is a tropical deciduous forest distributed in the central area such as Dhaka district and is mainly forested by <i>Shorea robusta</i> . Community residents have been collecting firewood and charcoal for a long time. Approx. 120,000 ha.
03 Natural Mangrove Forest	The world's largest natural mangrove forest in southern Khulna district (Sundarbans). Many endangered species are recognized as World Heritage sites, and the ecosystem value is extremely high. Approx. 600,000 ha.
04 Coastal Afforestation	Artificial mangrove forests and coastal forests distributed in the southern coastal region. Regions that have been planted since the 1960s to stabilize new sedimentary areas and prevent erosion. Approx. 200,000 ha.
05 Freshwater Swamp Forest	Freshwater swamp forest mainly distributed in the northeastern Sylhet district. Biodiversity is also high and endangered species have been identified. Local inhabitants are utilized as fishery areas and have high economic value. Approx. 20,000 ha.

Source: Prepared by JICA Survey Team based on Bangladesh National REDD+ Strategy

In these forest ecosystems, about 152,000 ha of forests have declined between 2000 and 2015, and degradation has been reported in about 174,000 ha. Particularly, deforestation and forest degradation in Hill Forest are significant, followed by deforestation in Sal Forest. There are various backgrounds for deforestation and forest degradation in ecosystems around the country as shown in the introduction of this report.

Bangladesh is also extremely vulnerable to climate change due to its topographical conditions, high population density, and vulnerable social infrastructures.

These natural disasters are exacerbated by the degradation of forests in various regions, and at the same time pose the risk of further deforestation and degradation of forest ecosystems.

<sup>2</sup> MoEFCC 2018. The submission of Bangladesh's Forest Reference Level for REDD+ under the UNFCCC. Ministry of Environment, Forest and Climate Change (MoEFCC), Government of the People's Republic of Bangladesh. Available at: [https://unfccc.int/files/adaptation/groups.../loss\\_and.../ds\\_bangladesh\\_report.pdf](https://unfccc.int/files/adaptation/groups.../loss_and.../ds_bangladesh_report.pdf)

<sup>3</sup> Bangladesh Forest Department 2022. Bangladesh National REDD+ Strategy 2016-2030, MOEFCC.

<sup>4</sup> According to Bangladesh Forestry Master Plan 2017-2030, UNDP used "Climate and Disaster Vulnerability Index (CDVI)" to evaluate community vulnerabilities in six Landscape (hot spot). In considering climate change measures in the forest sector, the regional overlap between the six regions shown in Figure 1-1 and the five forest ecosystems can be identified to identify issues and proposals for measures in forests and surrounding villages.

Nowadays, the community's response to climate-intensified natural disasters is recognized as an issue of "Adaptation." Forests that have the function of reducing the adverse effects of natural disasters, such as recharge of water sources and prevention of sediment spills, are defined as "Nature-based Solution for Disaster Risk Reduction (NbS-DRR)" as a means of responding to adaptation issues.

In the survey, information was collected and summarized on disaster risks from climate change which forest ecosystems in each division of the country are facing in the field of adaptation. The issues identified are regarded as the foundation for the potential cooperation in the forestry sector that contributes to climate change.

### (3) Clarification of NbS-DRR functions in the forest landscape of Bangladesh

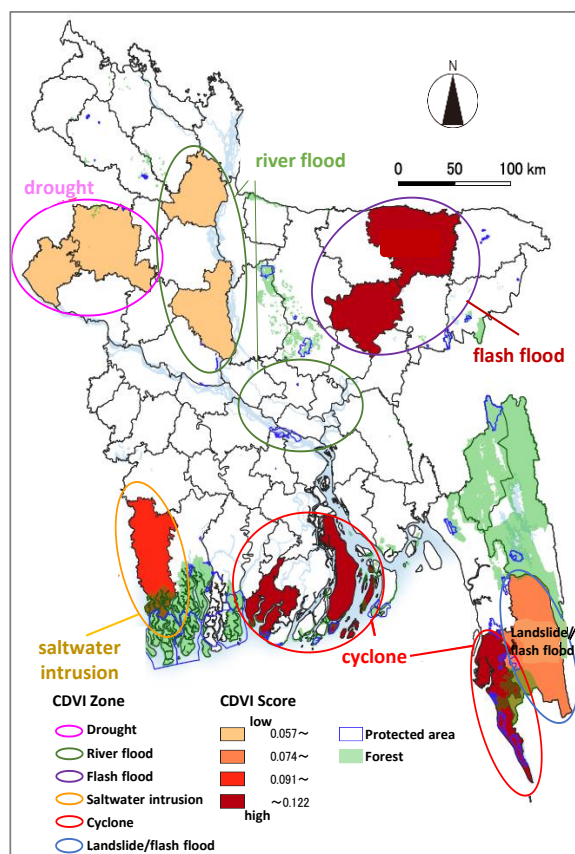
In proposing climate risk reduction through NbS-DRR, it is essential that the basic ideas on NbS-DRR should be reviewed in terms of the specific functions and effectiveness of conserving and developing natural and socioeconomic environments in each region.

According to Renaud et al.(2013), ecosystems have three functions in terms of reducing climatic risks. They are (i) To prevent or mitigate disasters as "natural infrastructures" e.g., to prevent surface erosion in forest land for mountain conservation, (ii) to mitigate disasters by creating spatial gaps e.g., to mitigate flood damage by floodplains, (iii) to sustain or support the people's livelihoods before and after the disaster by responding to basic human needs and supplying food.<sup>5</sup>

The functions of these NbS-DRR vary depending on the topography, location (e.g., mountainous areas and coastal areas), and type of ground vegetation and land cover. The concrete examples of NbS-DRR have some degree of commonality and universality in technical aspects, but at the same time, they have aspects defined by the natural conditions of the region, the socio-cultural conditions related to the livelihood of the inhabitants, and the characteristics of economic activities.

Therefore, when proposing a cooperative proposal using NbS-DRR for a particular region in this case, it is necessary to clarify the functions and practicable methods required for NbS-DRR based on the actual conditions and needs of the site. Furthermore, NbS-DRR defined by the characteristics of the region is an element constituting the landscape.

In a preliminary survey conducted by JICA in February 2023, the characteristics of six major domestic landscapes were considered. NbS-DRR that will be introduced in various regions through future cooperation must be designed and arranged in a balanced manner, in relation to various factors such as natural conditions and land-use, regional cultural and historical conditions, and socioeconomic conditions, as well as in the overall landscape that they comprise. The survey examined the introduction and utilization of NbS-DRR survey on this point.



Source: Prepared by JICA Survey Team based on Bangladesh Forestry Master Plan 201-2030

**Figure 1-1 Climate Change Risks Assessed by CDVI**

<sup>5</sup> Renald, F., Sudmeier-Rieux, K. & Estrella, M., 2013. The role of vegetation cover change in landslide hazard and risk. United Kingdom: United Nations University Press.

**(4) Consideration of potential cooperation with the Forest Department as a counterpart and implementing agency**

Climate change countermeasures require knowledge and insight into multifaceted environmental factors, such as the natural environment, social and economic activities, and local culture, as well as a variety of initiatives based on this knowledge and insight. This is essentially different from the activities of existing sectors alone. Therefore, it is necessary to take these characteristics of climate change measures into account when considering cooperation proposals that will contribute to climate change measures in the forest sector. For example, it is effective to take measures to enhance the functions of forests (e.g., afforestation and forest conservation) to mitigate meteorological disasters, and at the same time to consider integration with activities to reduce direct and indirect human and material damage caused by disasters, and to enhance the responsiveness and resilience of local communities.

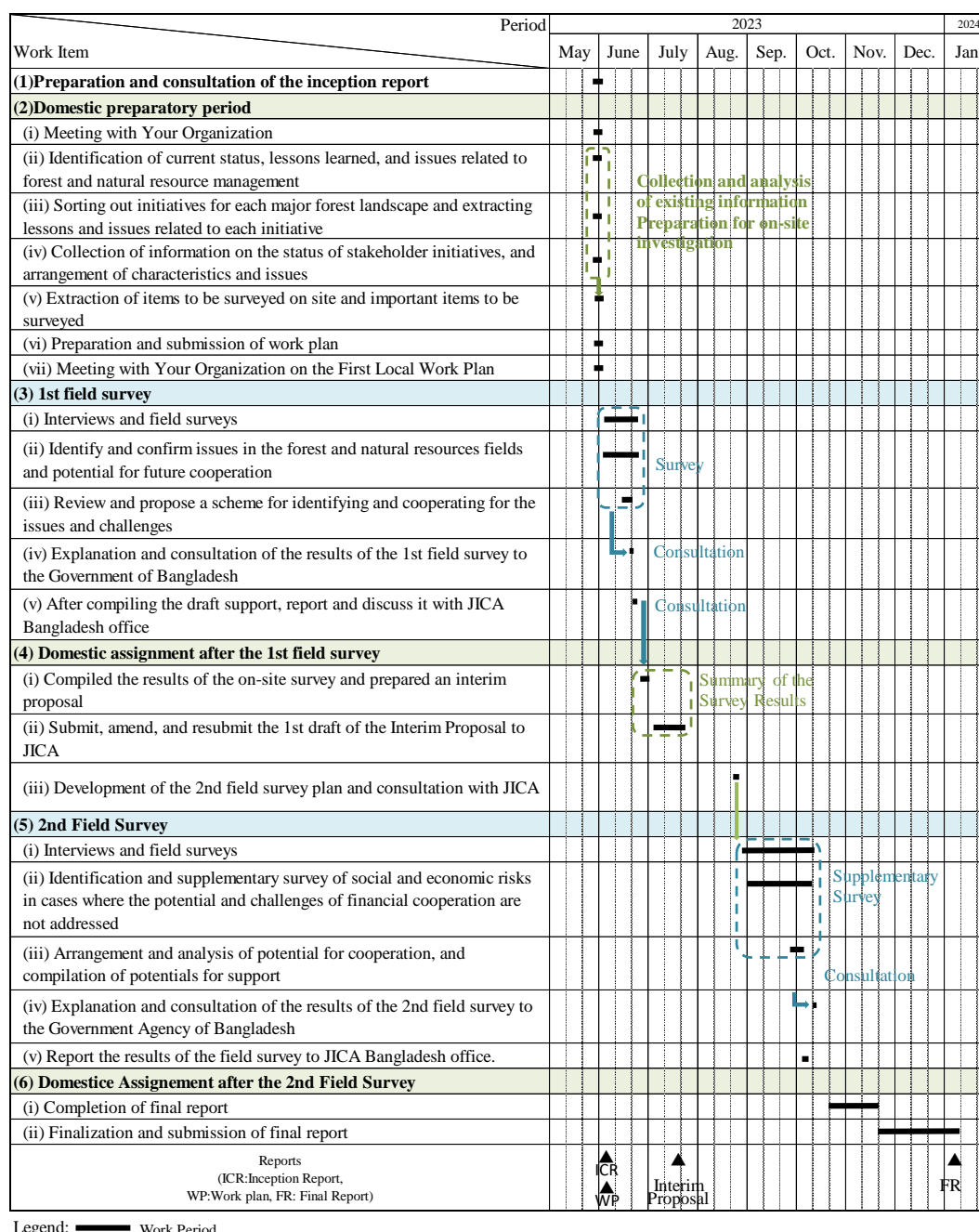
In detailed examination of the cooperation proposal in this survey, activities that can be addressed to the maximum extent within the responsibility of the Forest Department, and activities that require cooperation and collaboration of other related sectors (e.g., water resource management and disaster prevention management) were arranged on the assumption that the problems to be addressed simultaneously are diverse. And a proposal for cooperation that enables contribution to climate change countermeasures led by the forest sector was considered.

## Chapter 2 Survey Outline

### 2.1 Survey Flow and Input

#### 2.1.1 Survey Schedule

The overall flow of the survey consists of two field assignments and three home assignments in accordance with the instructions in the specifications of the consultant’s service contract. Figure 2-1 shows the entire process of the survey.



Source: JICA Survey Team

Figure 2-1 Schedule of the Survey 1

Table 2-1 shows the work items, the survey site, the period, and the corresponding products. Six forest landscapes in Bangladesh were visited during the two times of field assignment of the survey.

**Table 2-1 Work Items, Survey Sites, Period, and Deliverables 1**

Work items and survey sites	Period	Deliverable
Consultation of the Inception Report and domestic preparatory period	May to June 2023	Inception Report in Japanese and English, Work Plan in English
1 <sup>st</sup> field survey (Sundarbans, Southern Coast)	Jun 2023	Interim Report in Japanese
Domestic assignment	Jul 2023	
2 <sup>nd</sup> field survey (Chattogram Hill Forest, Sylhet Swamp Forest, Sal Forest)	Aug-Oct 2023.	Final Report in Japanese and English
Domestic assignment	November 2023- January 2024	

Source: JICA Survey Team

### 2.1.2 Dispatch of Survey Team and Recruitment of National Staff

Table 2-2 shows the results of the dispatch of the survey team and the input of person-month. In addition to Japanese experts, national staff were hired to conduct field visits to the six forest landscapes.

**Table 2-2 Person-Month/Day of Japanese Experts and National Staff<sup>2</sup>**

In charge	Person-month		Number of visits to Bangladesh
	Japan	Bangladesh	
<b>Expert</b>			
Chief Advisor/Climate Change Measures in the Forest Sector/Sustainable Forest Management	0.7	1.2	2
Eco-DRR/ Sustainable Land Use	0.3	1.1	2
Mangrove/Wetland Conservation/Biodiversity	0.3	1.1	2
Forest Resource Information	0.3	0.6	2
<b>National Staff</b>	<b>Person-day</b>		
Mangrove	-	5	-
Sustainable Forest Management		27	
Forest Information/Sustainable Land Use		45	
Biodiversity/Wetland Conservation		30	

Source: JICA Survey Team

## 2.2 Survey Objectives and Survey Items

### 2.2.1 Survey Area and Survey Objectives

#### (1) Survey area

In addition to information gathering by the central government, this survey inspected forest areas that could be covered by cooperative projects. The list is shown in Table 2-3. In this report, these sites are called "key forest landscapes". The five types of forest ecosystems shown in Table 1-1 are classified into two categories, the "Chattogram Hill Zone" and the "Chattogram West Forest Zone" on the east side of the five districts belonging to the Chattogram division, and the information was arranged and described in the Second Local Operations. Therefore, six types of forest landscape are surveyed, as shown in Table 2-3.<sup>6</sup>

Sundarbans and southern coast were visited at the 1<sup>st</sup> field survey in June, and the other three sites were visited at the 2<sup>nd</sup> field survey in August-October. Figure 2-2 shows the location of the site visited during the inspection.

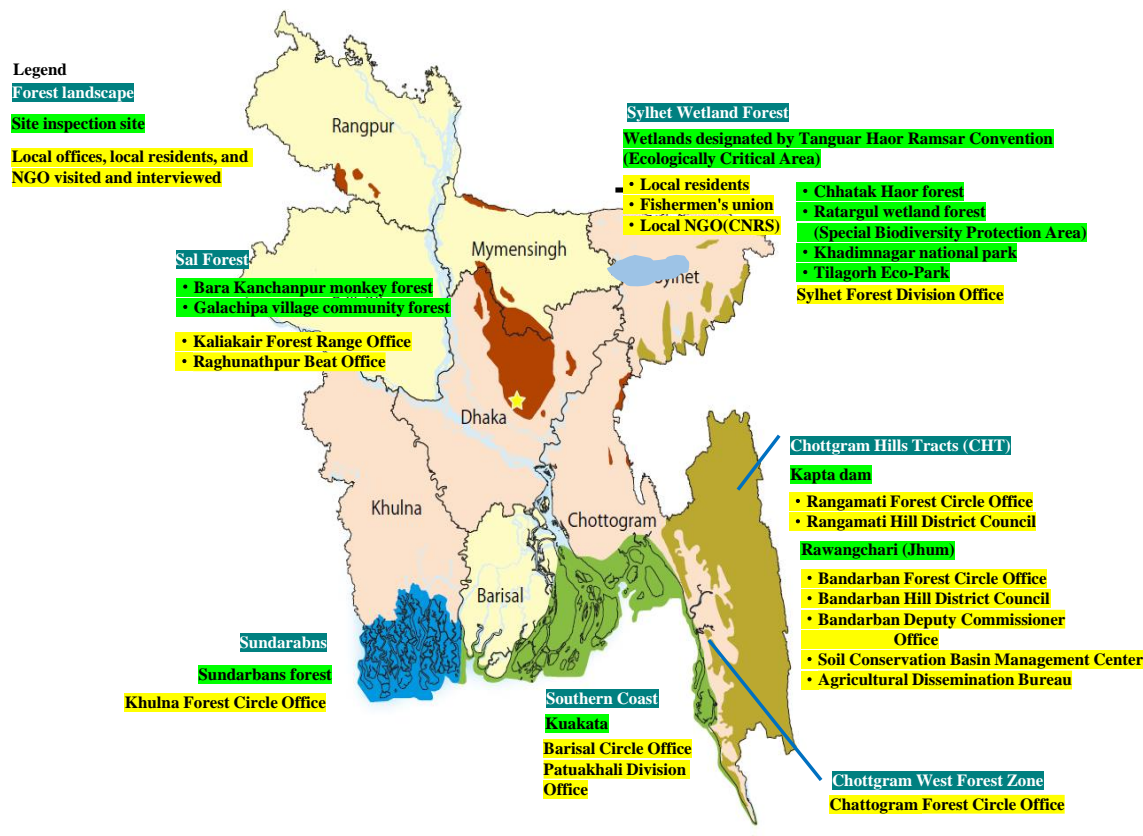
<sup>6</sup> Regarding the "forest area on the west side of the Chattogram", an Interview was conducted by the survey team to the Circle office of Chattogram District to collect the data. No on-site inspections were conducted.



**Table 2-3 Forest Landscapes Targeted in the Survey**

Forest Landscape <sup>7</sup>	Forest area (ha)	Target Division	Target District	Experts in charge
Chattogram Hill Tracts (CHT)	366,007	Chattogram	Bandarbands, Khagrachari, Rangamati	Imai
Chattogram West Forest Zone	147,149	Chattogram	Chattogram, Cox's Bazar	Imai
Sal Forest	64,299	Dhaka	Gazipur, Mymensing, Shepur, Tangail	Mizuno
Sundarbans	600,128	Khulna	Bagerhat, Khulna, Satkhira	Watanabe, Yasu
Southern Coast	103,452	Barishal	Barguna, Bhola, Lakshmipur, Noakhali, Patuakhali, Piropur,	Imai
Sylhet	50,000	Sylhet	Habiganj, Moulvibazar, Sunamganj, Sylhet,	Watanabe

Source: Prepared by JICA Survey Team based on forest area information (2019-2020) posted on the Forest Department website. The forest area shown in the tables is the area of Reserved Forest managed by the Forest Department under "Forest Act 1927, Clause 20" and does not include forests outside the state-owned forest.



Source: Prepared by JICA Survey Team based on the figures published in Bangladesh National REDD+ Strategy 2016-2030

**Figure 2-2 Location Map of the Survey Sites**

## (2) Government organizations

In this survey, questionnaires were prepared in advance for the government's forest sector and climate change countermeasures sector, as well as departments and agencies related to these sectors. In addition, interviews were held with the director-general and units presented on the websites of each department. In addition, for international organizations and donors currently providing support in the fields of forest

<sup>7</sup> The names of the forest ecosystems shown in Table 1-1 shall be referred to as forest landscapes hereinafter, reflecting the policy on landscapes described in Chapter 1.3 (4). The correspondence between the two is as follows. Hills → Chattogram, Natural mangrove forests → Sundarbans, Coastal plantations → Southern Coasts, Freshwater Wetlands → Sylhet.

and natural resource management and biodiversity, information gathering items were organized and interviewed based on the purpose of the survey. Table 2-4 lists the organizations and departments interviewed in the first and second field assignment.

**Table 2-4 Targets of the Interview**

<b>Government Offices</b>	
<b>Forest Department (FD) under the Ministry of Environment, Forest and Climate Change (MoEFCC)</b>	
Organization manager: Chief Conservator of Forests (CCF) Director-General of the Forest department	
Operation: Oversight of forest administration	
Contact information for key stakeholders: Mr. Md. Amir Hosain Chowdhury	
<b>Wing in the Forest Department</b>	
Forest Management Wing	Person in charge: Deputy Chief Conservator of Forests (DCCF) in Dhaka Person responsible for Circle interviewed during the site inspection: Conservator of Forests (CF) in Khulna Circle: Sundarbans East Forest Division Conservator of Forests (CF) in Coastal Circle: Patuakhali Coastal Forest Division Conservator of Forests (CF) in Central Circle: Sylhet Forest Division, Range and Beat office of Dhaka Forest Division Conservator of Forests (CF) in Chattogram Circle Conservator of Forests (CF) in Rangamati Circle
Planning Wing	Person in charge: Deputy Chief Conservator of Forests (DCCF) Person responsible for the following Unit: Deputy Conservator of Forests (DCF), Deputy Chief Conservator of Forests (DCCF) Divisional Forest Officer (DFO) of Management Plan Division, Khulna Department in charge of Resource Information Management Unit: Forest Information System (FIS) Monitoring & Evaluation Unit Development Planning Unit Management Planning Unit
Education & Training Wing	Person in charge: Deputy Chief Conservator of Forests (DCCF) There are two different parts, but the person responsible is the same person.
Social Forestry Wing	Responsible for issues (capacity building, social forestry) common to each site of the forest landscape.
<b>Other relevant organizations: Central level</b>	
Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources (MWR)	
<b>Other relevant agencies: local level (Chattogram region)</b>	
Rangamati Hill District Council	
Bandarban Hill District Council	
Bandarban Deputy Commissioner Office	
Soil Conservation and Watershed Management Centre in Bandarban District	
Bandarban Agricultural Extension Department	
<b>International organizations</b>	
<b>UNDP</b>	
Assistance to the government focusing on the formulation of National Adaptation Plan (NAP). In cooperation with USAID, the project has been promoting support activities in the Chattogram Hills, as well as cooperation between the natural mangrove forests in the Sundarbans region and the local government-related organizations.	
<b>World Bank</b>	
Currently expanding cooperation in Bangladesh, centered on climate change measures and the biodiversity conservation field (Sundarbans)	
<b>FAO</b>	
Support for the construction of forest information systems which was completed in 2018. Recently,	

Forest Landscape Restoration (FRL) has started supporting the forest sector.
<b>IUCN and WCS</b>
Support activities for the biodiversity conservation in Bangladesh
<b>Bilateral donor organizations</b>
<b>GIZ</b>
Supporting the conservation of natural mangrove forests in Sundarbans
<b>USAID</b>
Support activities for water and soil conservation and livelihoods improvement in Chattogram Hill Tracts (CHT) are ongoing.

Source: JICA Survey Team

## 2.2.2 Survey Items

Table 2-5 shows the survey items such as points of interviews and discussions with the survey targets listed in Table 2-4.

**Table 2-5 Survey Items (1): Collection of Information at the Central Level**

Organization	Survey items
<b>Government offices</b>	
Forest Department	Forest landscapes and forest planning in Bangladesh: Bangladesh has a unique distribution of forest landscapes. The sustainable conservation of these landscapes is an important issue. It is related not only to the conservation of forest resources but also to climate change measures (mitigation and adaptation). General question: (1) How do forest plans for forest landscapes across the country reflect the impacts of climate change? (2) What do you think about the needs for international cooperation in the forest sector?
Planning Wing	(1) The Bangladesh Forest Information System (Bangladesh Forest Information System: BFIS) was updated in 2018. (2) Updating of national forest cover using remote sensing technology (3) Progress and achievements in the introduction and operation of the Integrated National Forest Monitoring System (INFM) implemented with technical assistance from FAO and funding from USAID and UN-REDD+ (4) Challenges for technological advancement of BFIS in response to future climatic-risk mitigation (REDD+) and adaptation (Nature-based Solution: NbS)
Forest Management Wing	(1) Establishment of rights to land in the afforestation of the Department of Forestry in the sedimentary land (Char) in the southern coastal region. Related provisions of the Forest Law (1927) and the actual procedures. (2) Legal basis for ensuring the ownership of the land during the period in which the Department of Forestry establishes and maintains plantations in the southern coastal area, in particular, prior to the completion of its registration as a Reserved Forest under the provisions of the Forestry Act. (3) Issues in the long-term maintenance and management of plantations in the southern coastal areas established by the Forest Department. Especially regarding the measures against the increasing needs of land among the local communities for living and agricultural production.
Social Forestry Wing	(1) In Bangladesh, there is an overall shortage of land, but is there a region where the social forestry for public land and private land can expand in the future? (2) In social forestry, trees and forests that are planted on public or private land with seedlings provided by the Forest Department are regarded as "Trees Outside Forest" (TOF). Social forestry results are expressed in the number of seedlings (or area equivalent) provided by the Forest department. However, are the results and achievements of TOF monitored or recorded on the GIS databases including their location and size? (3) What are the challenges currently faced in expanding Bangladesh social forestry? (4) Is there a need for international cooperation to expand the social forestry in the country?

<b>Organization</b>	<b>Survey items</b>
Education and Training Wing	<p>(1) Policies and programs to develop the capacity of forestry personnel to address current and future global and national challenges, such as climate change and biodiversity conservation.</p> <p>(2) Capacity building of staff to implement joint forest management by the forest department and rural people.</p> <p>(3) Efforts to address gender issues in forest administration and related capacity building.</p> <p>(4) Capacity building, including the introduction of ICT, AI, DX and other advanced technologies for the administrations of the Forest Department.</p> <p>(5) Needs for international cooperation on capacity building in general by forest administration officials.</p>
Bangladesh Water Development Board (BWDB)	<p>(1) Issues which are described as the tasks of BWDB in the National Adaptation Program Bangladesh (NAP) 2023-2050 and their plan of implementation.</p> <p>(2) Coordination and cooperation with the Forest Department in addressing coastal area and disaster-related issues: The possibility of integrating civil engineering approaches by BWDB and NbS-DRR by the Forest Department, particularly in the planning and implementation of investment projects in the Sundarbans region and elsewhere in critical areas of climate change adaptation.</p>
<b>International organizations and donor agencies</b>	
UNDP	<p>As a central part of international cooperation in Khulna region,</p> <p>(1) Updates on the discussions at the donor meeting on conservation and management of natural mangrove forests, disaster management, and village development in the Sundarbans</p> <p>(2) Technical information and data on coastal resilience and disaster risk reduction by NbS-DRR</p> <p>(3) Challenges in developing NbS-DRR related techniques and approaches in the Sundarbans region.</p>
World Bank	<p>As a key organization in international cooperation in the Sundarbans region,</p> <p>(1) Potential for coordinating and collaboration between the World Bank and JICA in the provision of JICA assistance to the Forest Department for the conservation and management of mangroves in the Sundarbans Reserved Forest and livelihood support for the surrounding communities.</p> <p>(2) World Bank experiences in strengthening collaboration between the Water Resources Development Agency and the Forest Department in planning coastal protection and disaster risk reduction in the Sundarbans region through an integrated approach using civil engineering and NbS-DRR.</p> <p>(3) Issues in implementing international financing projects in the Sundarbans region, in particular capacity building of the forestry and rural communities through technical assistance.</p> <p>(4) Progress and results of Sustainable Forest and Livelihood (SUFAL) Project to support the Forest Department as part of BFIS in developing the Site-Specific Plan (SSP)</p>
FAO	<p>(1) Results and challenges of updating the Bangladesh Forest Information System (BFIS)</p>
ADB	<p>(1) Availability of the data used in "Bangladesh Climatic and Disaster Risk Atlas: Exposure, Vulnerability, Risk-II-December 2021", particularly division and district level data.</p>
GIZ	<p>(1) Progress, results, and issues of GIZ financed projects in the Sundarbans region.</p>
USAID	<p>(1) Progress and challenges in supporting the ecotourism sector in the Sundarbans region</p> <p>(2) Progress, results, and issues in maintaining and improving BFIS through financial support</p>

Source: JICA Survey Team

As an example, the questionnaire for the regional forest office during the field visit is shown in Table 2-6.

**Table 2-6 Survey Items (2): Information to be Collected at Regional Forest Office (example)**

Organization	Survey items
Regional Forest Office Khulna Circle Office In charge of natural mangrove forest management in the Sundarbans region	As the center of forest management in the Khulna division Within the reserved forest: (1) Structure, main operations, and issues for the management of the Sundarbans forests (600 thousand hectares of natural mangrove forest). Particularly, illegal acts in reserved forests and their countermeasures. (2) Duties of Circle office and subordinate divisional offices, Beat offices, and duties and roles in forest management. (3) International cooperation for natural mangrove forests and their ecosystems and biodiversity from research to practical activities. Results and future issues. Outside the reserved area: (1) Data maintenance of mangrove management in Circle office. (2) Effects of storm surges and saltwater intrusion in forests, trees outside the forest (TOF) and the livelihoods of local communities. (3) Circle office's missions and authorities to respond to climate change impacts (4) Structural and unstructured measures to mitigate climate change impacts to be implemented by Circle office (5) Mechanisms for coordinating and cooperating with relevant departmental offices in the Khulna division, such as water resources and disaster management sector, to implement local measures to address climate change.

Source: JICA Survey Team

## Chapter 3 Current Situation and Challenges in the Forest and Natural Resources Sector

### 3.1 Major Policies in the Forest and Natural Resources Sector

#### 3.1.1 Targets of the Forest Sector in the Government Key Policies

Table 3-1 lists the issues and objectives of the forest sector in the policy documents published by the Government of Bangladesh.

**Table 3-1 Issues and Targets of the Forest Sector Mentioned in the Major Policies**

No.	Policy	Content
1	Nationally Determined Contributions (NDCs) 2021 Bangladesh (updated)	<p>In August 2021, the Ministry of Environmental, Forest and Climate Change (MoEFCC) of Bangladesh issued an updated version of the old NDCs that was prepared in 2015 in accordance with IPCC's guidance.</p> <p>Based on the assessment of 2012 as the base year, greenhouse gas emissions from "Business-As-Usual" (BAU) scenarios in the target sectors through 2023, emissions reductions by implementing "unconditional" and "conditional" measures were estimated.</p> <p>Emissions and emissions reductions estimated over the period 2012-2030 are as follows:</p> <p>(1) Emissions from BAU scenarios. Emissions in all sectors increased from 169 million ton CO<sub>2</sub>eq to 409.4 million ton CO<sub>2</sub>eq, which is 2.42 times increase. In contrast,</p> <p>(2) Implementation of "unconditional" measures (utilizing existing domestic resources): 27.6 million ton of CO<sub>2</sub>eq in all sectors can be reduced (6.73% of BAU) compared to 2030.</p> <p>(3) "Conditional" measures (using international financial and technical assistance): Reduce emissions by 61.9 million ton of BAU (15.12% of CO<sub>2</sub>eq) compared to BAU by 2030.</p> <p>Breakdown of sector emissions (unit: millions ton of CO<sub>2</sub>eq per year): Energy sector is the largest. For the following BAU: BAU: Year of 2012 (i) Energy 93.09 (55.07%), (ii) Agriculture and Forestry and Other Land Use 46,24 (27.35%), (iii) Waste 24.11 (14.26%), (iv) Manufacturing 5.61 (3.32%) BAU: Year of 2030 (i) Energy 312.54 (76.34%), (ii) Agriculture and Forestry and Other Land Use 55.01 (13.44%), (iii) Waste 30.89 (7.55%), (iv) Manufacturing 10.97 (2.68%)</p> <p>Note: "Agriculture and forestry and other land use" is the second largest in emissions after the energy sector. Bulk of the emissions are from agriculture and livestock. Meanwhile, the emissions from the forest sector are 370,000 ton of CO<sub>2</sub>eq per year. (as described in Section 3.2.5 of this report)</p> <p>In addition to reducing emissions from conservation, forests are also absorption source of greenhouse gases (CO<sub>2</sub>) by growing trees. To reduce total emissions by increasing the area of carbon sinks, the Forest Department has planted 10 million seedlings so far. The Ministry of Disaster Management and Relief also planted 5.4 million palms. NDCs also set out the following measures to reduce emissions (strengthen carbon sinks) by 2030.</p> <p>&lt;Unconditional measures&gt; Efforts using existing domestic resources: (1) Increased forest cover, (2) tree cover increased from 22.37% (2014) to 24% (2030) of national land, (3) afforestation and reforestation of 150,000 ha in coastal and islands and degraded areas, (4) restoration of vegetation in the hilly and Sal forest: 137,800ha, (5) restoration of vegetation in the hilly</p>

No.	Policy	Content
		<p>and Sal forest: 200,000ha, and (6) promotion of afforestation along roads and levees and in private lands.</p> <p>&lt;Conditional measures&gt; Utilization of international financial and technical cooperation:</p> <p>(1) Collaborative Forest Management and Social Forestry, maintenance of forest and tree coverage, (2) Forest conservation activities for wide area and expansion of alternative income generating activities for forest-dependent residents (55,000 households), (3) Introduction of joint management for 72,000ha reserves, (4) Implementation of additional forest plantations in coastal areas, (5) Continuation of vegetation restoration activities for degraded forest and deforested area, and (6) Promotion of plantations along roads, levees and private lands</p>
2	Bangladesh Delta Plan 2100	<p>The National Economic Commission (NEC) approved in September 2018.</p> <p>Vision: A safe and environmental-resilient, prosperous delta environment</p> <p>Mission: Reduce vulnerability to natural disasters and build resilience to climate change</p> <p>Forest Sector-Related Goal 4: Protecting Wetlands and Ecosystems and Promoting their “Smart Use”.</p> <p>Note: As Delta Plan generally focuses on water management, it refers to wetlands in the forest sector agenda.</p>
3	National Adaptation Plan of Bangladesh 2023-2050 (NAP)	<p>Based on IPCC 6<sup>th</sup> Assessment Report published in 2022, the State of Bangladesh Adaptation Program 2030-2050 (NAP) was announced by the Ministry of Environment, Forest and Climate Change (MoEFCC) in October 2022. NAP consists of the following eight sectors as the key areas. (1) water resources, (2) disaster prevention and social safety and security, (3) agriculture, (4) fisheries and livestock industries, (5) urban areas, (6) ecosystems and wetlands and biodiversity, (7) policies and institutions, (8) capacity development and research and innovation. In addition, infrastructure, water and sanitation, health, gender, young generation, elderly, as well as various social and private sectors constitute NAP as cross-cutting issues.</p> <p>In the ecosystem and wetlands and biodiversity sector, the goals, and strategies relevant to this survey are as follows.</p> <p>Sector Goal 4: Promote Nature-based Solution to conserve forests and biodiversity and improve the welfare of the community.</p> <p>Strategy 4.1: Develop ecosystem-based adaptations for wetland conservation.</p> <p>Strategy 4.2: Restore and conserve animal and plant habitats, ecosystems, and biodiversity.</p> <p>Strategy 4.3: Expand community-based afforestation, reforestation, and tree planting.</p> <p>Note: 21 activities are shown in the ecosystem and wetland, biodiversity sector. Breakdown: Seven (7) country-wide activities and 14 activities for specific ecosystems.</p>
4	Making Vision 2041 a reality: Perspective Plan of Bangladesh 2021-2041 (PP 2041)	<p>Ministry of Planning formulated “Perspective Plan of Bangladesh 2021-2041(PP 2041) 2020 to implement a "Vision 2041" which aims at overcoming poverty and achieve the goals. As measures to secure a sustainable environment, to build a resilient society against climate change, and to open a way to a blue economy, the following numerical targets for forest and biodiversity conservation are set out in the "Central Objectives and Targets for Environmental Management."</p> <p>(1) Ratio of degraded land: 18% (base year 2018) ⇒ 5% (target year 2041)</p> <p>(2) Forest coverage: 15% (base year 2018) ⇒ 20% (target year 2041)</p>

No.	Policy	Content
		<p>(3) International ranking for the protection of habitats and biodiversity of animals and plants: Lower 5% (base year 2018) ⇒ Top 30% (target year 2041)</p> <p>(4) Environmental Performance Index International Ranking: Lower 5% (base year 2018) ⇒ Top 30% (target year 2041)</p> <p>The basic policy of the Strategy for environmental management and climate change strengthening in PP 2041 is to integrate environmental and climate change issues into national growth strategies. Specifically, the following measures will be taken.</p> <p>(1) Integrate environmental costs into the macroeconomic framework.</p> <p>(2) Implement the Delta-Plan (Delta Plan 2100) to reduce and strengthen vulnerability to climate change.</p> <p>(3) Reduce air and water pollution.</p> <p>(4) Ensure sustainable management of forest resources. Specifically, implement the Delta Plan and the National REDD + Strategy.</p> <p>(5) Strengthen the coordination functions and institutions of environmental administration.</p> <p>(6) Strengthen the functions of the Climate Change Trust Fund (CCTF).</p> <p>(7) Develop sound financing strategies for the environment and climate change.</p>
5	8 <sup>th</sup> Five Year Plan, July 2020-June 2025	<p>The eighth five-year plan was prepared by the Bangladesh Planning Committee in December 2020.</p> <p>Strategic objectives set for the forest sector are:</p> <p>(1) By 2025, 24% of national land will be covered with trees. (Note: Including trees in private land which is out of the management by the Forest Department),</p> <p>(2) Conserve ecosystems to improve biodiversity,</p> <p>(3) Mitigate the impacts of climate change and strengthen adaptability,</p> <p>(4) To improve the socioeconomic conditions of the poor and forest dependent communities.</p> <p>Specific strategies to address climate change are:</p> <p>(1) Coastal afforestation and greenbelt establishment<sup>8</sup></p> <p>(2) Conservation of natural mangrove forests in Sundarbans</p> <p>(3) Conservation of forests in hilly areas (CHT)</p> <p>Other programs from (4) to (10):</p> <p>(4) Conservation of natural forests; (5) regeneration of degraded forests; (6) control of protected areas and protection of wildlife; (7) dissemination and deployment of technologies and equipment to reduce fuel consumption; (8) strengthening forest and tree monitoring and information; (9) expanding social forestry and urban biodiversity; and (10) trees outside forests (TOF).</p>

Source: JICA Survey Team

### 3.1.2 Targets of Major Forest Sector Policies

Table 3-2 lists challenges and targets set forth in the policy document for the forest sector.

**Table 3-2 Challenges and Targets of the Forest Sector Policies**

No.	Policy	Content
1	Bangladesh Forestry Master Plan 2017 -2036	Based on the analysis of the present state of the forest in Bangladesh and the analysis of the problems, the policy of securing the financial resources necessary for the implementation and the measures to be tackled by the forest administration is indicated.

<sup>8</sup> According to the Forest Department, the target area is 50,000 ha.



No.	Policy	Content
		<p>Items of analysis: forest ecosystems, policies and laws and related regulations, forest administration organizations and forest information management, impacts of climate change.</p> <p><u>13 challenges:</u> (1) conservation of existing natural forests; (2) conservation of wildlife and biodiversity; (3) development and maintenance of artificial forests; (4) strengthening and expanding participatory forestry for TOF; (5) addressing increased demand for forest products and specialty forest products; (6) preventing deforestation; (7) combating climate-change impacts on forests; (8) revitalizing forestry-related organizations; (9) enhancing capacity for information management and monitoring; and (11) industrial development using forest resources; and (12) on-site operations: response to serious shortages of funds and capabilities required; and (13) compliance with international conventions.</p> <p><u>14 planning and strategies:</u> (1) development of management plans for national forests and TOF for climate change resilience; (2) conservation of existing natural forests; (3) reforestation and vegetation restoration of devastated forests; (4) afforestation and reforestation outside national forests, including unclassified forests; (5) afforestation of coastal areas, including green zones; (6) management of protected areas and protection of wildlife; (7) management and protection of existing plantation; (8) equipment and techniques for fuel conservation; and (9) plantations and related companies for non-timber forest products, (10) forest-related industries, (11) livelihoods support for forest-dependent communities, (12) control of forest encroachment, (13) climate change-related programs, and (14) forest and forestry research.</p>
2	Bangladesh National REDD+ Strategy 2016-2030	<p>(1) Conservation of existing forest of 1,269,070 ha. Afforest 637,259 ha bare land (Note: land inside and outside the forest). Promote restoration of vegetation in degraded forest of 173,498 ha. This will raise the nationwide forest ratio from 15.5% to 16.0%.</p> <p>(2) Strengthening forest management, improving the livelihoods of inhabitants, and reducing pressure on illegal reclamation and collection of firewood and charcoal.</p> <p>(3) The following six issues were set, and 17 measures were proposed. The issues and measures of item 6) below are related to climate change adaptation measures (reduction and absorption of greenhouse gas emissions).</p> <ol style="list-style-type: none"> <li>1) Promote the supply of alternative energy and efficiency technologies and alternative resources for wood</li> <li>2) Improve fuel supply in regions where forests are distributed</li> <li>3) Improving the livelihoods of people dependent on forests</li> <li>4) Solving problems related to the ownership of land with distributed forests</li> <li>5) Improve the practical capacities of forest administration officials</li> <li>6) Restore and conserve forests and forest vegetation</li> </ol>
3	National Forest Policy 2016 (Final Draft)	<p>Annex 4 (Strategies and concepts for implementing) of National Forest Policies defines keywords for forest policies and administration.</p> <p>4.4 Climate Resilient Forestry:</p> <ul style="list-style-type: none"> <li>- Impacts of climate change on forest ecosystems</li> <li>- Importance of Nature-based Solution and Disaster Risk Reduction (NbS-DRR): Coastal afforestation and mangrove regeneration to strengthen resilience,</li> <li>- Increased carbon stocks in forests,</li> <li>- Importance of Collaborative Management with forest dependent community.</li> </ul>

Source: JICA Survey Team

## 3.2 Current Situation and Challenges of Forest Management

### 3.2.1 Forest Distribution and Area

#### (1) Forest distribution

Forest resource information managed by the Forest Department is published in the Bangladesh Forest Information System (BFIS), which was established in 2018 with the assistance of World Bank and FAO. In addition to information on the location and area of forest conservation, tree species, and timber volume, BFIS also posts information on the forest sector on the website, including information on the forest-related projects and their progress, the affiliations and contacts of relevant local governments, local communities, and forest administrative officials, as well as international cooperation.<sup>9</sup>

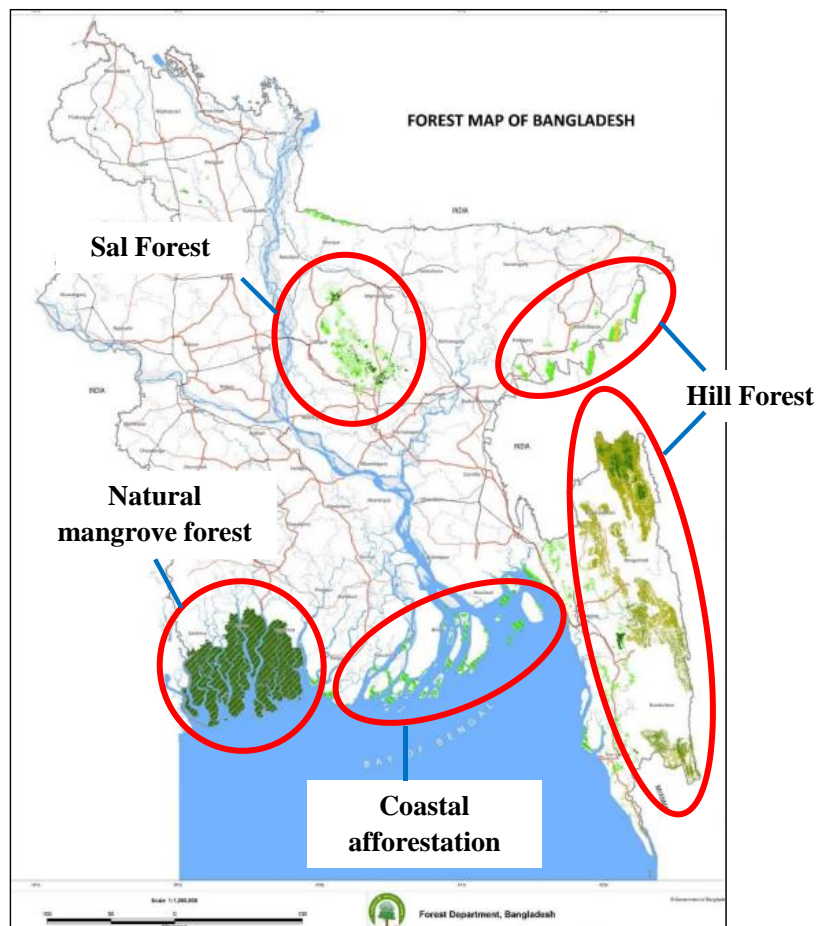
These pieces of information are arranged and uploaded for each item. Those information have been accumulated since the Forest Department started the services. Except for grasping the forest area by analyzing satellite-based images, there are few newly created and organized information for constructing BFIS, and basic information on forests and plantations on the site described in accordance with the format used in each period is uploaded as it is.

Given this circumstance, it is unclear whether BFIS information are subsequently regularly updated or not, and whether they are utilized in a useful way for planning forest administration every year or not.

On the other hand, at the time of BFIS construction (2018), satellite-based images such as SPOT were analyzed to identify "forests managed by the Forest Department" based on Forest Act 1927, Clause 20. Distribution of the forest as the results of analysis is indicated in Figure 3-1.

As shown in Figure 3-1, natural mangrove forests (about 0.6 million ha) are distributed along the southwestern coast in the Sundarbans area. In the eastern hilly area bordering the country, there is about 550,000 ha of natural hill forest. The coastal plantations in the southern part of the country are mainly planted by the Forest Department. Sal forest is spreading in the central part, but the conversion to other land use such as residential area and agricultural farms is going on. As a result, deforestation is expanding in the Sal Forest area. This is the same in the eastern Hill Forest.

Most of these forests are managed by the Forest Department designated in accordance with the procedures described in Article 4, Article 6 and Article 20 of the Forest Act 1927.



Source: Bangladesh Forestry Master Plan 2017-2030

**Figure 3-1 Distribution of Forests Managed by the Forest Department, 2018: Results of Spot Image Analysis**

<sup>9</sup> <http://www.bfisoest.gov.bd/bfis>

## (2) Forest management category and area

Forests in Bangladesh are categorized according to their management purposes and classification. The latest information on the Forest Department's website (2019-2020) is shown in Table 3-3. The above-mentioned reserved forest managed by the Forest Department belongs to the category "1" in Tables 3-3.

The governmental procedures for designating national land as a reserved forest are provided for in Articles 4, 6 and 20 of the Forest Act 1927, depending on the stages for designation. According to the Forest Department's explanation, the forests in category "2" are waiting for procedures in accordance with Article 20, which means the final stage for full scale designation as reserved forest. Forests in the category of "3" and "4" are managed by the Ministry of Land, but they are waiting for the designation process as reserved forests. Forests of category "5" and "6" are those managed by local governments and are often converted to residential land or agricultural land.

**Table 3-3 Forest Types and Their Total Areas**

No.	Forest type	Area (ha)	Remarks
1	Reserved Forest (Article 20 of the Forestry Law)	1,331,034	Land and forest management: belonging to the Forest Department
2	Reserved Forest (Article 4 and Article 6 of the Forestry Law)	457,827	Land and forest management: belonging to the Forest Department
3	Protected Forest <sup>10</sup>	34,294	Land Management: Ministry of Land Forest Management: Forest Department
4	Acquired Forest (forests previously expropriated from large-scale landowners)	11,063	Land Management: Ministry of Land Forest Management: Forest Department
5	Unclassified State Forest under the Management of the Forest Department	17,340	Land Management: Local Governments Forest Management: Forest Department
6	Unclassified State Forest under Management of Revenue Department	694,687	Land management: Revenue Department and Local Governments Forest Management: Forest Department

Source: Prepared by JICA Survey Team based on the website of the Forest Department

The regional distribution of forest types shown in Table 3-3 shows the characteristics. The forest-type numbers shown in Table 3-4 correspond to the numbers shown in No. in Table 3-3. "1" is the forest managed by the Forest Department, and "2" to "6" are forests under various management conditions.

As shown in Table 3-4, Chattogram contains forests under various conditions of management. In particular, "6: Revenue Department and Local Governments-Managed Forest Area" (692,960ha) is larger than "1: Forest Department Managed Area" (366,007ha). This region is said to be a region with remarkable deforestation, and it is thought that such a multi-layered management system affects the background of the issues in forest management in this region.

In addition, forests on the southern coast are distributed at approximately three times the size of "2: Forests awaiting designation as Reserved Forest under Article 20 of the Forest Act (307,524ha)" compared to "1: Forests managed by the Forest Department." This is considered afforestation site or potential afforestation site in the southern coastal region where the Forest Department has been planting in sedimentary lands since the 1960s, awaiting the procedures of the final stage to be designated as a Reserved Forest (Article 20 of the Forest Law). In addition, forests of type "2" are distributed in all forest landscapes except Sundarbans, although they vary in scale.

Forests in which the Forest Department manages its forest land and trees based on forest law are Reserved Forest. Reserved Forest was originally a forest aimed at logging commercially useful tree

<sup>10</sup> This type is different from the "Protected Area" (4.7 million ha) designated by the Forest Department at 51 locations in the country for biodiversity and ecosystem conservation.

species in natural forests. Since the purpose is to cut those types of trees in natural forests and the intention to manage the entire forest is originally weak, there is no land zoning on the ground, or there are no landmarks indicating boundaries at the site. Since 1989, when logging in natural forests was totally banned, logging-related operations by the Forest Department in Reserved Forest were suspended. In Bangladesh, where the population growth and land-use pressures for daily productive activities are extremely high, Reserved Forest where no cutting of commercial trees are conducted is recognized as an "unused land" for the neighboring communities. Therefore, it is thought that reclamation and settlement in Reserved Forest have been advancing since then. Under these circumstances, natural forests in Reserved Forest will be further reduced unless they are thoroughly managed based on clear zoning and maintenance operation.<sup>11</sup>

**Table 3-4 Distribution of Forest Type in the Forest Landscapes**

Forest landscape		Forest types shown in Tables 3-3 (corresponding numbers, ha)					
		1	2	3	4	5	6
I	Chattogram Hill Tracts	366,007	28,561	-	1	17,340	692,960
II	Chattogram West Forest Zone	147,149	70,938	32,357	6,638	-	-
III	Sal Forest	64,299	35,656	-	-	-	-
IV	Sundarbans	600,128	-	-	-	-	-
V	Southern coast	103,452	307,524	1,936	-	-	-
VI	Sylhet	50,000	15,148	-	4,424	-	1,727

Source: Prepared by JICA survey team based on the website information of the Forest Department

**Table 3-5 Forest Types and Their Areas in the Target Districts**

Forest Landscape		Forest types shown in Tables 3-3 (corresponding numbers, Unit: ha)					
		1	2	3	4	5	6
<b>1</b>	<b>Chattogram Hill Tracts</b>	<b>366,007</b>	<b>28,561</b>	<b>-</b>	<b>1</b>	<b>17,340</b>	<b>692,960</b>
1-1	Bandarbans	98,204	8,835	-	-	15,639	200,065
1-2	Khagrachari	35,812	2,971	-	-	1,701	183,759
1-3	Rangamati	231,991	16,755	-	1	-	309,136
<b>2</b>	<b>Chattogram West Forest Zone</b>	<b>147,149</b>	<b>70,938</b>	<b>32,357</b>	<b>6,638</b>	<b>-</b>	<b>-</b>
2-1	Chattogram	85,237	61,765	18,792	6,638	-	-
2-2	Cox's Bazar	61,911	9,173	13,566	-	-	-
<b>3</b>	<b>Sal Forest</b>	<b>64,299</b>	<b>35,656</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
3-1	Gazipur	17,883	8,492	-	-	-	-
3-2	Mymensing	13,984	1,742	-	-	-	-
3-3	Shepur	2,560	5,568	-	-	-	-
3-4	Tangail	29,872	19,854	-	-	-	-
<b>4</b>	<b>Sundarbans</b>	<b>600,128</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
4-1	Bagerhat	229,260	-	-	-	-	-
4-2	Khulna	220,991	-	-	-	-	-
4-3	Satkhira	149,877	-	-	-	-	-
<b>5</b>	<b>Southern coast</b>	<b>103,452</b>	<b>307,524</b>	<b>1,936</b>	<b>-</b>	<b>-</b>	<b>-</b>
5-1	Barguna	12,357	17,995	-	-	-	-
5-2	Bhola,	38,140	107,547	-	-	-	-
5-3	Lakshmipur	-	20,234	-	-	-	-
5-4	Noakhali	29,191	124,590	1,936	-	-	-

<sup>11</sup> According to information from the Planning Wing of the Forest Department, the boundaries of Reserved Forest on the ground are limited. Since the Ministry of Land has the power to define its boundaries, the Forest Department cannot define its boundaries on its own. This may contribute to the difficulty of the Forest Department in properly managing Reserved Forest.

Forest Landscape		Forest types shown in Tables 3-3 (corresponding numbers, Unit: ha)					
		1	2	3	4	5	6
5-5	Patuakhali	23,765	36,938	-	-	-	-
5-6	Piropur	-	220	-	-	-	-
<b>6</b>	<b>Sylhet</b>	<b>50,000</b>	<b>15,148</b>	-	<b>4,424</b>	-	<b>1,727</b>
6-1	Habiganj	13,713	111	-	-	-	890
6-2	Moulvibazar	24,011	16	-	4,424	-	437
6-3	Sunamganj	2,604	4,686	-	-	-	-
6-4	Sylhet	9,672	10,335	-	-	-	400

Source: Prepared by JICA Survey Team based on the website of the Forest department

### 3.2.2 Composition of the Forest Department

#### (1) Basic configuration

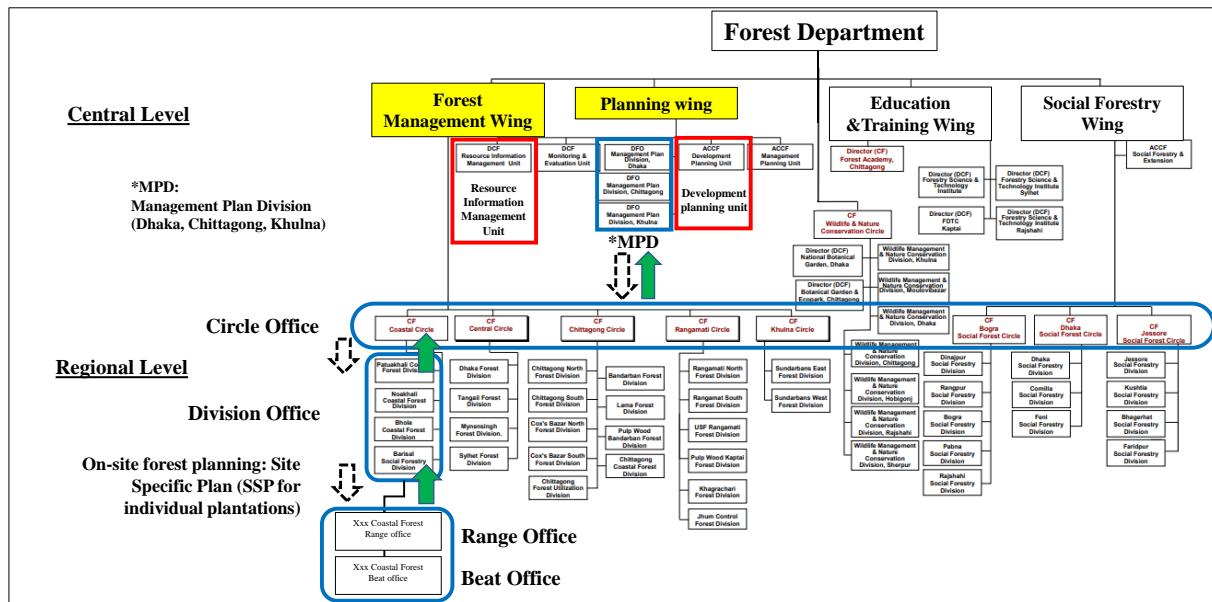
Figure 3-2 shows the structure of the Forest Department. However, this figure shows only technical departments, and omits legal, financial, and human resources departments. At the central level, there are four wings underneath the Director General of the Forest Department, each with a distinctive Unit, Division, Circle. In addition to the Director General of the Forest Department, the Planning Wing and the Forest Management Wing are deeply related to project formulation. The Planning Wing has a resource information management unit located immediately below it. When considering cooperation on forest information for the national forest landscapes, this unit will be covered. The Development Planning Unit is a window for new projects, and this unit is responsible for general consultation with the development partners.

Local Circle, Division, Range, and Beat offices are located below the Forest Management Wing. The offices in this line carry out forest administration such as management of reserved forests, protected areas, national parks, wildlife protected areas, afforestation, etc. in various places.

In this survey, information collection and their cross checking were carried out at both the central and local levels, mainly by interviews to the planning offices and the related units of the central level, and at the local level with the stakeholders of Circle and Division offices which are responsible to manage the site for field visit by the survey team.

Further looking at the middle level of the Department's structure in Figure 3-2, Management Planning Division marked "MPD" is located directly below the Planning Wing. The department has three offices in Dhaka, Chattogram, and Khulna. The task of this section is to collect, inspect, and submit the plan of planting and forest management and the monitoring reports prepared by the region Circle, Division, Range, Beat offices of the Forest Management Department.

In addition, although not shown in Figure 3-2, to operate the projects using external funds, a Project Management Unit (PMU) is established. Although PMU is a project-time-limited organization, its staffs are dedicated and are divided into technical, planning, and finance sections. They are responsible for project operations. While contract-based employment is common for PMU staff, PMU managers are often senior officials of the Forest Department.



Source: Prepared by JICA Survey Team based on the Forest Department website (only relevant departments are indicated)

**Figure 3-2 Organizational Structure of the Forest Department**

## (2) Central and Local Relationships in the Formulation, Implementation and Monitoring of Forest Management Plans

Based on BFIS established in 2018, a Site-Specific Plan (SSP) describing regional forest-management and forestation-site operation planning was introduced. This is the "operation planning" for each plantation/forestry operation site of afforestation and forest management as assessed by Range and Beat office as shown in Figure 3-2. SSP is created at Beat/Range office at site level and submitted to the central level via Division/Circle office aggregation (green arrows).

The survey team interviewed the forestry officers in the southern coastal region about the preparation of SSP. It revealed that the "bottom-up" process, in which the SSP is submitted to the central government, is functioning firmly. However, it could not confirm the data and information which show the extent of plantations or target area in the respective Circle, Division, Range, and Beat level. Also, it could not confirm how annual activities of plantation and its maintenance are taking place to achieve the overall targets during several years or, it was not clear the technical approaches and methodologies to grasp and evaluate annually the progress and achievement of the forestry operations conducted every year.

This mechanism is usually carried out by higher-level offices and departments within the organization, but it was not possible to confirm such mechanism of monitoring and evaluation as indicated by the dotted arrows in Figure 3-2, and the notification of the annual target area for tree planting from the upper level to the lower level, which is "top-down" information sharing.

To be able to directly monitor and evaluate planned values by top organizations, it is necessary to identify and evaluate plantations not in the range of tens of hectares covered by a single SSP but in the range covered by a single Circle office containing several Division, or larger forest landscape.

In this survey, focusing on sediment deposits on the southern coast, the flow of planning, implementation, monitoring, and evaluation confirmed "bottom-up, one-way communication" between the central and local governments. In areas where the shape of the land is changing due to typhoons and floods every year, such as sedimentary lands, it is necessary to grasp the afforestation target land from the macro level and to reflect it in the planning as "top-down approaches and communication".

### 3.2.3 Preparation, Updating and Management of Forest Information

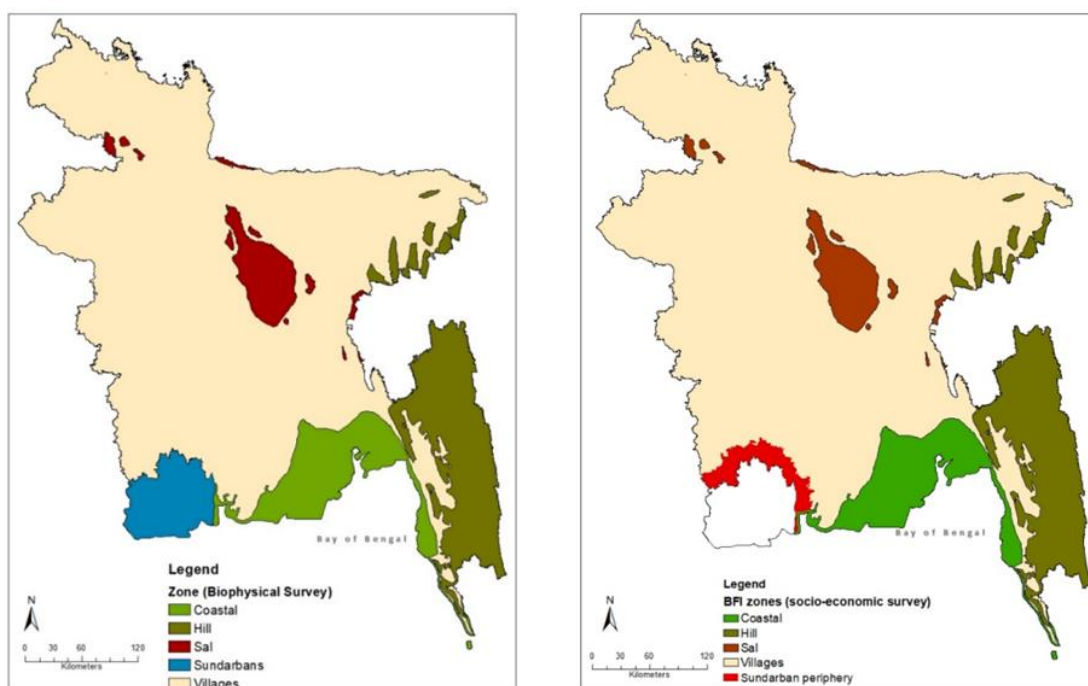
Regarding the state of improvement of forest information and issues that the resource information management unit of the Forest Department has been promoting, the following is a focus on the inventory of forest resources, mapping, monitoring, and management of the information.

## (1) Forest inventory

Bangladesh Forest Inventory (BFI) is used to analyze the drivers' dependence on forests, vegetation, natural resources, degradation, etc., not only on the biological aspects but also on the socioeconomic side. The first BFI in Bangladesh, supported by FAO and USAID, began its operation in 2015 and was completed in 2019. BFI unit of the Forest Department is responsible for preparing, analyzing, and coordinating between related organizations inside and outside of the Forest Department, and is to implement BFI every five years. Indicators of BFI are established based on the objectives described below.

1. Provision of basic information on national forest monitoring
2. Association between the Utilization of Forest and Natural Resources and the Value of Ecosystem Services
3. National Forest Management and Planning and Policy Development in the Forest Sector
4. Assistance at the level of sub-country management
5. Support for international reports on forest resources

The findings of BFI are used to assess the progress of the national five-year plan and the National Environmental Forest Climate Change Investment Plan, as well as to report to the International Convention on Climate Change, etc. BFI covers all forest areas, including TOF, and is divided into four categories (Coastal areas, Hills, Sal Forests, Sundarbans, and non-forest (villages)) shown in Figure 3-3. The left figure shows the inventory categories in terms of biological aspect and the right figure shows the inventory categories in terms of socioeconomic aspects. A different number of sampling plots and sampling densities were set for each segment, and over 1,500 field surveys were conducted in 2015-2019.



Source: BFI (2019)

**Figure 3-3 Result Map of the Bangladesh National Forest Inventory (BFI)**

(Left: Biological aspect, Right: Socioeconomic aspect)

All BFI reports and survey data are disclosed in the Bangladesh Forest Information System (BFIS).

## (2) Mapping

### i. Land cover map

The Forest Department's Resource Info-Management (RIM) Unit shall renew the land cover map every five years. The land-cover maps for 2000, 2005, and 2010 use Landsat images and



Spot images for 2015. A 2020 map has not yet been prepared but will be funded by SUFAL project. Land cover maps will be prepared for 2022 or 2023. With the assistance of the U.S. Forest Service (USFS), RIM Unit has received technical training in land-covering mapping using Google Earth Engine (GEE).

ii. Canopy covering map

The first canopy covering map in Bangladesh was developed from 2000 to 2014. RIM Unit is currently receiving funding from USAID and technical assistance from the University of Maryland (USA) and is preparing the figure for 2015-2022.

iii. Forest Management/Protected Area Management Boundaries

RIMS Unit of the Forest Department has created basic GIS on the forest management/reserve management diagram, including planning. The boundaries, including on-site checks, are determined by the Land Records Survey Department of the Ministry of Land.

iv. Other

USFS is strengthening RIM unit's capacity to utilize the software-called "I-tree" developed by USFS. The software aims to evaluate the carbon fixation and environmental pollution mitigation functions of urban green spaces. The software is evaluated for urban green spaces in Dhaka. RIMS Unit also creates additional maps based on requests from other parts of the Forest Department.

**(3) Monitoring**

i. Forest monitoring

In Bangladesh, no forest monitoring system has been developed, and land cover maps are being updated for monitoring purposes. RIM unit is interested in the construction of a more frequent forest-monitoring system using Google Earth Engine (GEE) and Sentinel satellites images, since the clearance interval of land-cover maps is as long as 5 years. With the support of USFS, RIM unit has acquired the basic skills of GEE, but it requires capacity building and financial support.

ii. Protected Area Monitoring

In Bangladesh, the "SMART"(Spatial Monitoring and Reporting Tool) and space monitoring reporting tool" developed by NGO, Wildlife Conservation Society (WCS) has been introduced in the patrol of reserves, and the patrol and monitoring of reserves using smart phones have been started. With the support of USAID, RIM unit is planning to develop a mechanism to utilize the monitoring data by SMART for BFIS.

The Forest Department owns a total of 13 drones (DJI Matrice 200 series) and is used to monitor protected areas but is not used to monitor after planting. RIM Unit is coordinating additional procurement and training of drones with South Korean support.

iii. Post-planting monitoring of coastal areas

The World Bank's SUFAL Project provides subsidies for technological development and R&D called "innovation grant fund" and attempts to develop methods to evaluate the growth status of mangrove forests after planting in coastal areas using AI and drones. However, due to the sea level rise, the development of a method for constantly grasping the growth state has not been completed.

**(4) Carbon stock estimation**

RIM Unit utilizes such data as BFI, land-cover maps, and canopy-cover maps to assess changes in forest carbon stocks based on IPCC software-methodology and to support the preparation of UNFCCC reports.

**(5) Information management**

iv. Bangladesh Forest Information System (BFIS)

BFIS was developed with FAO, USAID, UN-REDD programs and World Bank support for SUFAL projects. The operation responsible organization is RIM unit of the Forest Department, and the operation preparations and improvements are continuing, such as inputting data. To



operate all modules, it is necessary to expand human resources such as programmers and data input operators who maintain and manage BFIS. Currently, IT consultants are hired on a provisional basis in SUFAL projects-support maintenance. The Forest Department allocates the seats for one programmer and three assistants in the Department, but they are not hired at this time.

BFIS data are available for research and decision-making by staff of the Forest Department, other governmental agencies, research institutes, etc., and the access rights of registered users are granted and managed by the Forest Department. BFIS are shown in Tables 3-6.

**Table 3-6 Structure and Contents of BFIS as of September 2023**

Module name	Content
<b>Development and activities</b>	
Personnel Affairs	Staff information
Business	List of ongoing projects
Plan	Five-Year Forest Subsector Plan
SDG	SDGs indicators responsible for the Forest Department
<b>Management and maintenance</b>	
Social forestry	Implementation of the Social Forestry Regulations (2004) (Presentation of PDF Filing Materials)
Legal Affairs	Legal systems related to the Forest Department
Wildlife crime surveillance	A module developed by the International NGO WCS for reporting illegal activities involving wildlife by field employees of the Forest Department. Improvement work is continuing after implementation of training for on-site staff.
Afforestation	Forest Planting Results Database by the Forest Department since 2001
Nursery field	Number of seedlings, tree species, and sales results. It is a module developed recently, and the trial of the data input was started in the Dhaka district in July 2023. A Sub-district staff member is responsible for accessing Division within the target Division. Though the progress of the data input work is not good due to the shortage of staff, in the future, the operation of this module will be developed nationwide, and it will be used for the efficient distribution of seedlings.
Protected area	List of protected areas and the map database
REDD+	Outline of UN-REDD program and outcome documents
Forest record	Government Gazette on Land and Database on Maps
e-Government procurement	Link to the Bangladesh government's electronic procurement system
Integrated Budget Accounting System	National Budgeting Reporting System: "iBAS" ++ Integrated budget and accounting system on financial allocation and management"
Site Specific Planning	SSP is a small-scale forest-management plan and tree-planting records for plantations in reserved forest developed by SUFAL Project. SSP covered the official "plantation journal" used by the Forest Department and began using it at SUFAL site. In the future, it will be continuously used and developed as an official tool of the Forest Department. <u>Main contents of SSP:</u> Object site overview (GIS location map), forestation activity information (year, area, tree species, plot number, planting density, etc.), target site information (flood duration, geology, soil, etc.) such as afforestation/reforestation/replanting, etc. <u>SSP Creation Flow:</u> 1) In SUFAL project, an assessment survey was carried out on the afforestation potential area in the coastal area. Based on the results, the Forest Department selected candidates for afforestation. 2) The staff of Beat office, the site office of the Forest Department, surveys the candidates and proposes appropriate activities. In addition, the suggestions are recorded in SSP module of BFIS. Tree species selection is proposed based on the results of consultations with the

Module name	Content
	communities. 3) SSP is also assessed and approved by division and circle office officials of the Forest Department. The status of the approval process is also displayed on BFIS.
<b>Forest evaluation</b>	
Forest emission factor database	Information aggregation such as emission factor, wood volume density, allometric equation, etc.
BIFS geoportal	Forest-related geographic information platform.
Bangladesh Forest Inventory (BFI)	A data base that summarizes BFI reports, key outcomes, BFI implementations, land-cover maps, and other data on BFI.
Species identification module	Online database for identifying plant species from keywords, characteristics, etc.
Bangladesh Forest Ecosystem Services Valuation (ESV) Database	A database of papers, government documents, and other related business reports on the economic value assessment of forest ecosystem services.
<b>Knowledge management</b>	
BFIS e-Library	An electronic library that summarizes papers, reports, and many other documents held by the Forest Department using electronic information. Staff are freely accessible.
BFIS e-Multimedia	Photograph and video databases of forest administration activities in Bangladesh
Capacity building	Information database pertaining to training organizations, etc.

Source: Prepared by JICA Survey Team based on BFIS

v. BFIS Geo Portal (bforest.gov.bd):

BFIS Geospatial Portal is a platform for integrating geospatial data on forests in Bangladesh. Registered users, such as members of the Forest Department, can upload their own data to the platform, create maps on the platform, and share with other users.

vi. Data sharing with both inside and outside the Forest Department organization:

Data sharing within the current Forest Department organization (e.g., central government and local staff) is implemented by e-mail.

Data sharing with other government agencies and other organizations is limited due to the lack of measures to promote information sharing. However, regulations and sharing platforms for information sharing between ministries and agencies are scheduled to be developed.

RIM Unit utilizes such data as BFI, land-cover maps, and canopy-cover maps to assess changes in forest carbon stocks based on IPCC software-methodology and to support the preparation of UNFCCC reports.

As one of the "development and activities" modules shown in Table 3-6, the projects currently being implemented by the Forest Department are shown in Table 3-7.

**Table 3-7 Project Under Implementation by the Forest Department in 2023**

No.	Business Name	Subject land	Overview
1	Widening of Approach Road and Development of Other Essential Infrastructure of Bangabandhu Sheikh Mujib Safari Park, Gazipur	Dhaka	Eco-Park and Safari Park Infrastructure Development, Eco-Tourism Promotion, and Joint Management with Residents
2	Modernization of Existing Char Muguria Eco-Park under Madaripur District Project	Chattogram	
3	Sheikh Rasel Aviary and Eco- Park, Rangunia, Chattogram		
4	Development and Expansion of the Bangabandhu Sheikh Mujib Safari Park, Cox's Bazar		
5	Establishment of Greenbelt, Eco-restoration and Eco-		

No.	Business Name	Subject land	Overview
	tourism Development in Cox's Bazar District.		
6	Biodiversity Conservation and Eco-system Development of Mahamaya Eco-park Project		
7	Extension and Development of Ecotourism Facilities in Sundarbans Project	Khulna	Conservation of wildlife, development of ecotourism infrastructure and procurement of vehicles and equipment
8	Protection of the Sundarbans Reserved Forests		
9	Sundarbans Tiger Conservation Project		
10	Support to the Management of the Sundarbans Reserved Forest		
11	Reforestation and Infrastructure Development in Sylhet Forest Division to Mitigate Adverse Effect of Climate Change	Sylhet	Participatory afforestation and forest infrastructure development
12	Environment Protection through Social Forestry in the Rajshahi Barind Tract Region	Rajshahi	
13	Sustainable Forest and Livelihoods (SUFAL) Project	Multiple	Development of national information systems, development of ecosystem management systems, and promotion of social forestry

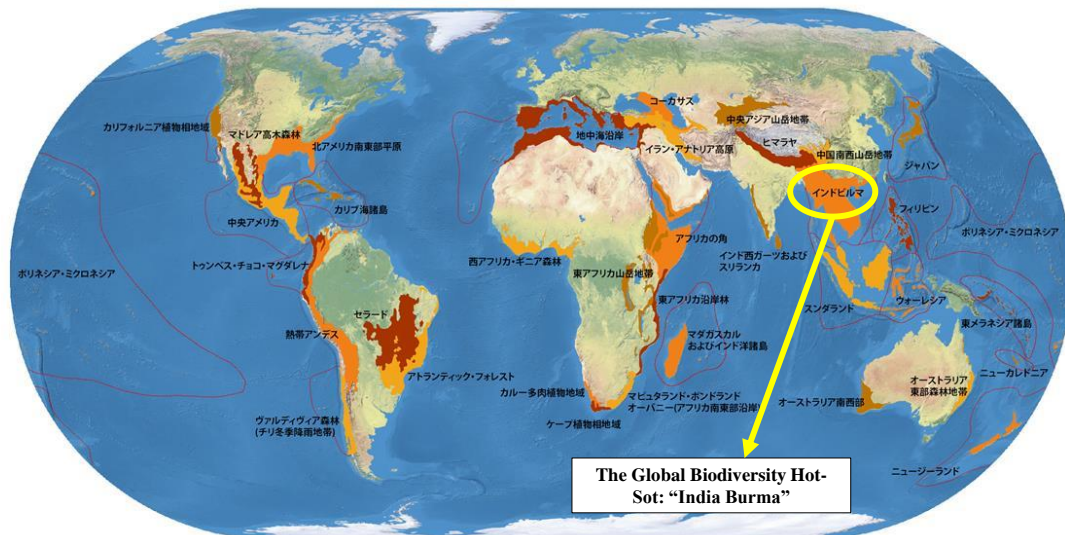
Source: Prepared by JICA Survey Team based on the Annual Report of the Bangladesh Forest Department

### 3.2.4 Conservation of Wildlife and Biodiversity

#### (1) Overview of wildlife and biodiversity in Bangladesh

Bangladesh is a subtropical country geographically located between the foothills of the Himalayas to the north and the Bay of Bengal to the south. Bangladesh belongs to the monsoon climate, and most of the year is a warm and humid climate. It is nurtured by the vast amount of surface water flowing from two major rivers, the Jamuna and Padma, and several hilly rivers originating in eastern India and Myanmar flow through the northeastern and eastern regions of Bangladesh. The country is so humid that the entire country can be called a wetland, especially during the rainy monsoon season.

Based on their topographic and climatic characteristics, diverse ecosystems are distributed, and biodiversity is also abundant. In particular, the eastern region of Bangladesh is included in the global biodiversity hotspot "India Burma" ("Indo-Burma", Figure 3-4). In other regions, there is the largest mangrove forest Sundarbans in the southwestern coastal region. It is a country with extremely rich biodiversity despite its small land area.



Source: Web Site of Conservation International<sup>12</sup>

**Figure 3-4 Global Biodiversity Hotspot (India Burma)**

## (2) Legal reserve

### (a) Current Status

The Government of Bangladesh revised the Wildlife Law enacted in 1974 and re-enacted it as "Wildlife (Conservation and Security) Act 2012" in 2012. This created more areas under the reserve system managed by the Forest Department.

According to the Forest Department, based on Wildlife (Conservation and Security) Act 2012, there are 56 reserves under the control of the Forest Department, including international reserves. It includes 20 national parks, 25 wildlife reserves (Wildlife Sanctuary), two Special Biodiversity Conservation Areas, and four Eco-Parks. Many other eco-parks are designated in the country, but only four are treated as protected areas under the Convention on Biological Diversity. Two Marine Protected Areas are designated in the Bay of Bengal under the control of the Forest Department.

Due to overlapping protected areas, the area cannot be simply totaled, but according to the "Protected Planet with UNEP and IUCN assistance", the land area is designated as 6,456km<sup>2</sup> (4.61%) and the area is designated as 4530 km<sup>2</sup> (5.36%), but since only 51 protected areas are counted, the actual value is estimated to be slightly larger than this.

<sup>12</sup> <https://jpn01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.conservation.org%2Fjapan%2Fbiodiversity-hotspots&data=05%7C01%7C%7C6749f987fb954e42d6ee08dbda0ea615%7Cec3aa4063a754d779a5f3a7467f1cd1b%7C0%7C0%7C638343528677140577%7CUnknown%7CTWFpbGZsb3d8eyJWIjojMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6IkhWwiLCJXVCi6Mn0%3D%7C3000%7C%7C%7C&sdata=pYDESRv%2BqHi7u3SNDgYtvIIxIVGIV%2BvDuYL4jU6QM8%3D&reserved=0>

**Table 3-8 Protected Areas Managed by the Forest Department**

No	Name	Type	DESIG_TYPE	Area (ha)	IUCN_CAT	Establishment
1	The Sundarbans	World Heritage Site (natural or mixed)	International	139,500	Not Applicable	1997
2	Sundarbans Reserved Forest	Ramsar Site	International	601,700	Not Reported	1992
3	Mirpur Botanic Garden NP	National Park	National	87	Not Reported	2018
4	Himchari NP	National Park	National	1,729	IV	1980
5	Bhawal NP	National Park	National	5,022	IV	1982
6	Madhupur NP	National Park	National	8,436	IV	1982
7	Lawachara NP	National Park	National	1,250	II	1996
8	Kaptai NP	National Park	National	5,465	II	1999
9	Ramsagar NP	National Park	National	28	IV	2001
10	Nijhum Dweep NP	National Park	National	16,352	IV	2001
11	Medhakachhapia NP	National Park	National	396	IV	2004
12	Satchari NP	National Park	National	243	II	2005
13	Khadimnagar NP	National Park	National	679	IV	2006
14	Baroiyadhala NP	National Park	National	2,934	II	2010
15	Kadigarh NP	National Park	National	344	IV	2010
16	Kuakata NP	National Park	National	1,613	II	2010
17	Nababganj NP	National Park	National	518	IV	2010
18	Singra NP	National Park	National	306	IV	2010
19	Altadighi NP	National Park	National	264	IV	2011
20	Birganj NP	National Park	National	169	IV	2011
21	Sheikh Jamal Inani NP	National Park	National	7,085	Not Reported	2019
22	Dharmapur NP	National Park	National	704	Not Reported	2021
23	Ratargul Special Biodiversity Conservation Area	Special Biodiversity Conservation Area	National	204	Not Reported	2015
24	Altadighi water based Special Biodiversity Conservation Area	Special Biodiversity Conservation Area	National	17	Not Reported	2016
25	Nagarbari-Mohonganj WS (Dolphin)	Wildlife (Dolphin) Sanctuary	National	408	VI	2013
26	Silanda-Nagdemra WS (Dolphin)	Wildlife (Dolphin) Sanctuary	National	24	VI	2013
27	Pankhali WS (Dolphin)	Wildlife (Dolphin) Sanctuary	National	404	Not Reported	2020
28	Vadra WS (Dolphin)	Wildlife (Dolphin) Sanctuary	National	868	Not Reported	2020
29	Nazirganj WS (Dolphin)	Wildlife (Dolphin) Sanctuary	National	146	VI	2013
30	Shibsha WS (Dolphin)	Wildlife (Dolphin) Sanctuary	National	2,155	Not Reported	2020
31	Char Kukri-Mukri WS	Wildlife Sanctuary	National	40	IV	1981
32	Rema Kalenga WS	Wildlife Sanctuary	National	1,796	II	1981
33	Pablakhali WS	Wildlife Sanctuary	National	42,069	II	1983
34	Chunati WS	Wildlife Sanctuary	National	7,764	IV	1986
35	Sundarban (East) WS	Wildlife Sanctuary	National	122,921	Ib	1996
36	Sundarban (South) WS	Wildlife Sanctuary	National	75,310	Ib	1996
37	Sundarban (West) WS	Wildlife Sanctuary	National	119,719	Ib	1996
38	Fasiakhali WS	Wildlife Sanctuary	National	1,302	IV	2007
39	Teknaf WS	Wildlife Sanctuary	National	11,615	IV	2009
40	Hajarikhil WS	Wildlife Sanctuary	National	1,178	II	2010
41	Dudpukuria-Dhopachari WS	Wildlife Sanctuary	National	4,717	IV	2010
42	Tengragiri WS	Wildlife Sanctuary	National	4,049	II	2010
43	Sangu WS	Wildlife Sanctuary	National	2,332	II	2010
44	Sonarchar WS	Wildlife Sanctuary	National	2,026	II	2011
45	Dudhmukhi WS	Wildlife Sanctuary	National	170	II	2012
46	Chandpai WS	Wildlife Sanctuary	National	560	II	2012
47	Dhangmari WS	Wildlife Sanctuary	National	340	II	2012
48	Padma Setu WS	Wildlife Sanctuary	National	1,773	Not Reported	2020
49	Baishari Bangdhepa WS	Wildlife Sanctuary	National	2,233	Not Reported	2023
50	Swatch of no ground Marine Protected Area	Marine Protected Area	National	173,800	Not Reported	2014
51	Saint Martin Marine Protected Areas	Marine Protected Area	National	174,300	Not Reported	2022
52	Madhabkundu Eco Park	Eco Park	National	266	Not Reported	2001
53	Tilagorh Eco Park	Eco Park	National	45	Not Reported	2006
54	Char-muguria Eco park	Eco Park	National	4	Not Reported	2015
55	Modhutila Eco Park	Eco Park	National	131	Not Reported	2023

\*Listed Eco Parks are designated as protected area by Bangladesh government

Source: Prepared by JICA Survey Team based on Protected Planet website <https://www.protectedplanet.net/country/BGD> and interviews with the Forest Department.





## (b) Issues

Population pressures on forest areas and other habitats have led to the loss of forests, the conversion of natural forests to planted forests, and the segregation of habitats, threatening the extinction of various wildlife. Therefore, to provide evacuation sites and increase the likelihood of survival, it is effective to establish protected areas with the purpose of protecting diverse habitats and different ecosystems.

Kunming Montreux Global Biodiversity Framework, adopted by the Convention on Biological Diversity COP15 in December 2022, sets a target (30by30) of making 30% of land and sea areas protected by 2030. On the other hand, according to Protected Planet's data, at present, the protected areas managed by the Forest Department are only 6,468km<sup>2</sup> (4.61%) of land area, and 6,726 km<sup>2</sup> (7.95%) of sea area.<sup>13</sup>

Therefore, it is necessary to significantly increase the number of protected areas to achieve the target. The Forest Department continues to newly designate various reserves, such as marine reserves, wildlife reserves, special reserves for biodiversity, and eco-parks. However, since Bangladesh is very densely populated and most of its land is developed as a residential area or agricultural land, it is difficult to drastically expand the reserves based on Wildlife (Conservation and Security) Act 2012 to achieve 30%. In addition, some of the measures taken to manage protected areas have been advanced, such as collection of admission fees to protected areas and joint management with local communities, due to Protected Area Rules 2017 of local forest pipes. However, the promotion of ecotourism, which is the core of sustainable use, cannot be confirmed except in the internationally famous Sundarbans, and the over-tourism by the usual commercial tourism is becoming an issue in Tanguar Haor.<sup>14</sup>

## (3) Wetland

### (a) Current Status

Most of the land area in Bangladesh is in the Bengal Basin, the world's largest delta formed by the Ganges, Bramapota, and Meguna rivers. The Bengal Basin is a vast lowland. This lowland basin is thought to have once been one of the largest wetlands in the world, but over the past few thousand years, the wetlands have been converted almost entirely to rice cultivation areas. The total area of the domestic wetland during the monsoon is estimated to be 7 million-8 million hectares, equivalent to about 50% of the total area. This includes 5.4 million hectares of floodplain wetlands and permanent wetlands that flood each year.

Two of them are designated as Wetlands under the Ramsar Convention, which are valuable from the viewpoint of biodiversity: Sundarbans Reserved Forest (SRF) and Tanguar Haor.

### 1) Sundarbans Reserved Forest (SRF)

SRF is in a large wetland formed at the confluence of the Ganges, Brahmaputra, and Meghna rivers, and 601,700ha is registered as the Ramsar Wetland. It is known as the world's largest mangrove forest and has long-term scientific management. Sundarbans is very rich in flora and fauna, many of which are also economically important. Beginning with Sundri (*Heritiera fomes*) that characterizes Sundarbans, Gewa (*Excoecaria agallocha*), Passur (*Xylocarpus mekongensis*) and other mangrove plants such as Dhundul (*Xylocarpus granatum*) are growing, while a large number of animals are inhabited, including endangered species such as Bengal tigers (*Panthera tigris*), Asian fin seals (*Heliopais personata*, Note: a type of waterfowl), Bengal vultures (*Gyps bengalensis*), Irie crocodiles (*Crocodylus porosus*), and Ganges' dismedillo sharks (*Glephys gangeticus*). The entire Sundarbans Reserved Forest under the Regional Forest Department is designated as a Ramsar wetland, and includes the World Natural Heritage Site, Sundarbans East Wildlife Sanctuary (WS) and three WS, five WS

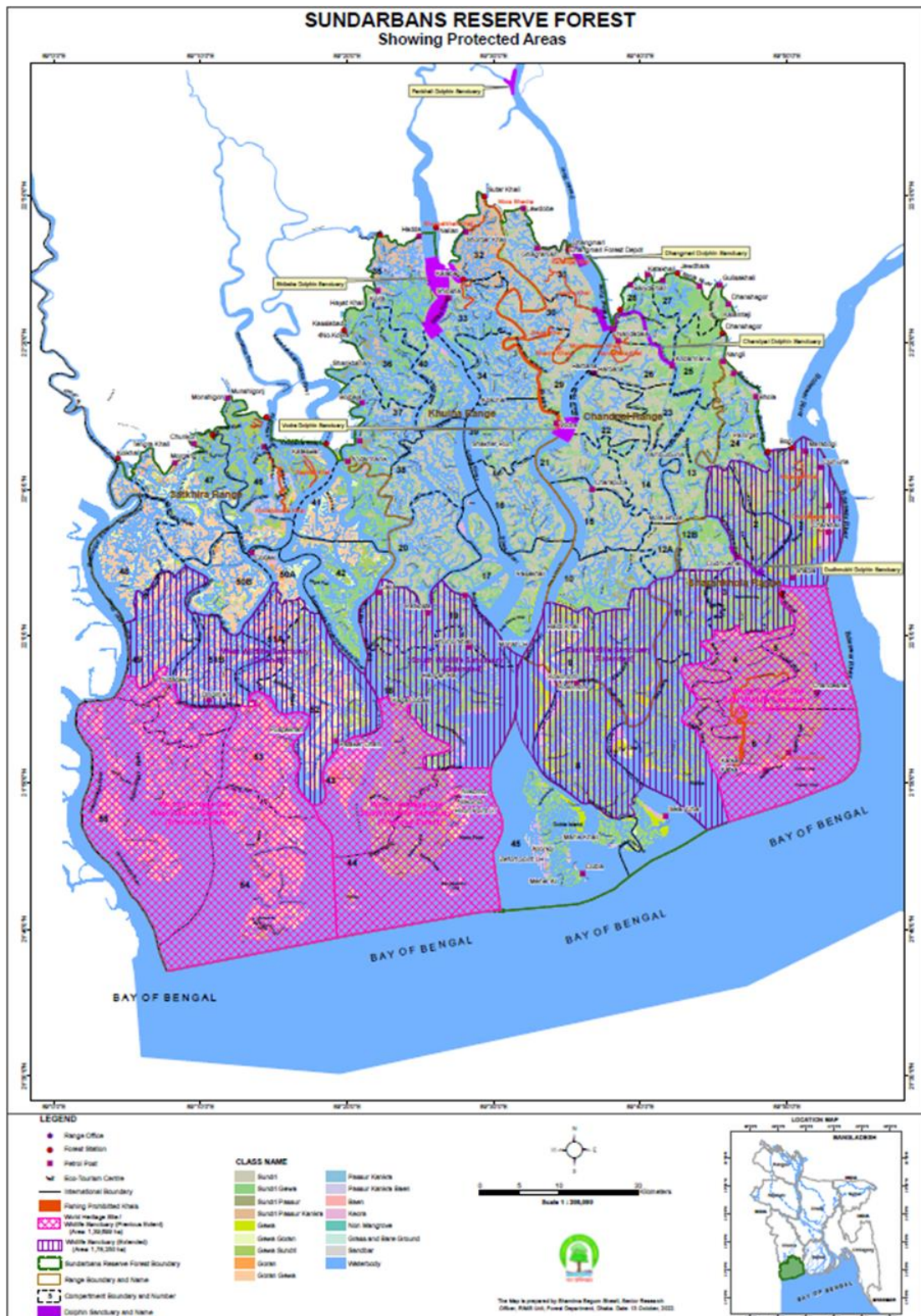
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<sup>13</sup> Protected Planet Website <https://www.protectedplanet.net/country/BGD>

<sup>14</sup> Accumulation of knowledge on eco-tourism at the regional level: The Ministry of Environment, Forest and Climate Change (MoEFCC) conducted training on eco-tourism for the fishermen of Tanguar Haor region in the "Community-based Sustainable Tanguar Haor Project-Phase III" funded by the Swiss Development Co-operation Agency (SDC) from 2013 to 2015.



(Dolphin Sanctuary in Sundarbans South WS), and Sundarbans West WS (Figure 3-6). A total of 800 Department officials are engaged in managing the Sundarbans Reserved Forest.



Source: Forest Department, Government of Bangladesh

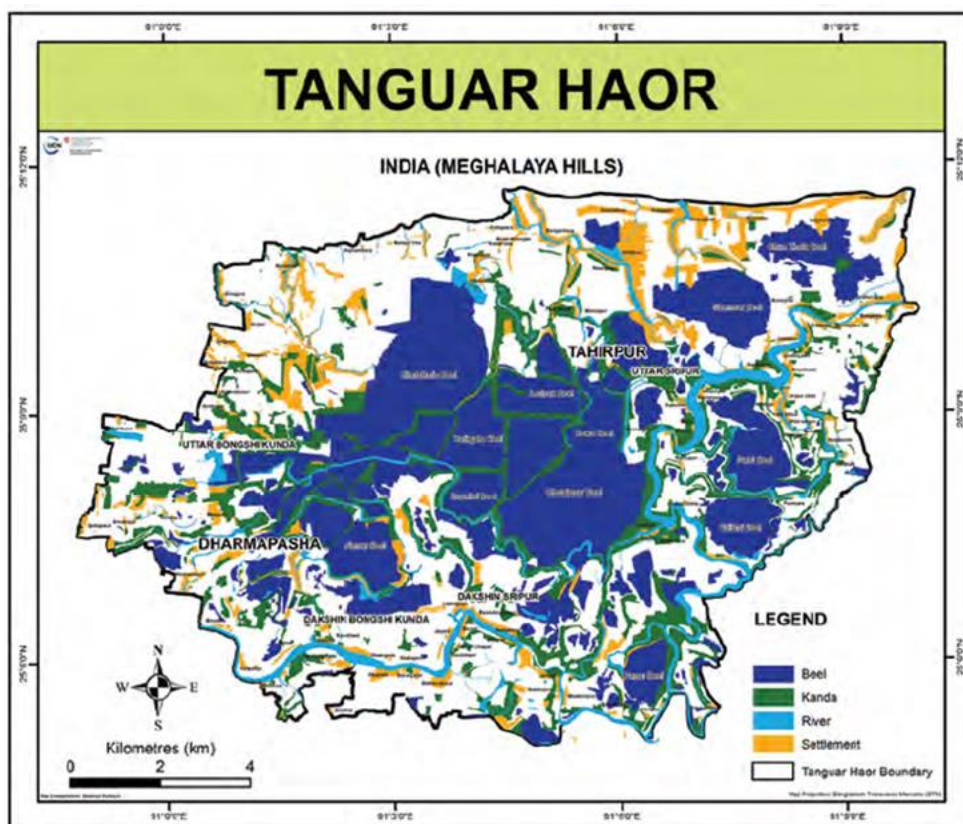
**Figure 3-6 Sundarbans Reserved Forest (SRF)**



## 2) Tanguar Haor <sup>15</sup>

Tanguar Haor spreads out in the floodplain of the Surma River, one of the tributaries of the Brahmaputra River, which flows at the foot of the Meghalaya Hills (India) (Figure 3-7). Tanguar Haor is in two sub-districts, Tahirupool and Darmapacia in Sunamganji district of Sylhet division. The area of Tanguar Haor is approximately 10,000 ha, supporting the population of about 60,000. In Tanguar Haor, as many as 60,000 migratory water birds and many resident birds, more than 140 species of fish live seasonally, and marsh forests remain. According to these facts, Tanguar Haor was registered as the second Ramsar wetland after the Sundarbans region in Bangladesh.

However, Tanguar Haor is not designated as a reserve for national law by the Forest Department, and except for small-scale afforestation projects, the Forest Department is not involved in the management of this area. On the other hand, it is designated as ECA (Ecologically Critical Area), and is managed by the Department of Environment (DOE) and the administrative organizations of the Sunamganj district. However, ECA designation by DOE is also covered by factors such as air, water, soil, and waste, and is not necessarily managed with a focus on biodiversity conservation. As a result, the biodiversity of Tanguar Haor is currently at greater threat to the unsustainable use of resources.



Note: Tanguar Haor of IUCN project-targeted area that is surrounded by the outermost black line. The entire area becomes wetland during the rainy season.

Source: IUCN Bangladesh

**Figure 3-7 Location of Tanguar Haor**

### (b) Issues

#### 1) Sundarbans Reserved Forest (SRF)

According to IUCN(2014), (i) resource overuse, (ii) resource overexploitation, (iii) changes in habitats due to natural phenomena, (iv) changes in hydrological regimes such as saltwater overflow due to

<sup>15</sup> This section and next Tanguar Haor information were collected through field visits as well as interview to IUCN Bangladesh Country Office's Program Officer.

reduced river flow, (v) sedimentation of sand in waterways, (vi) climatic and sea level rise, (vii) water pollution, and (viii) over-tourism are identified as the administrative issues of SRF.

Natural conditions that prevent human intrusion: According to interviews with the Forest Department, there are not enough manpower and staff capacities and materials, but illegal land-use within SRF has not been revealed. The background to this is that SRF and surrounding areas are separated by rivers, and that the presence of Bengal tiger hampers illegal intrusion and land/resource use.

Management by the Forest Department: (i) resource surveys in the northern region of SRF (e.g. Nippa palm) and issuance of permission to collect them based on their findings; (ii) fisheries and forest product collection by neighboring inhabitants during the breeding season of SRF for three months from June to August each year; and immigration ban measures. Payment of compensation to the inhabitants for prohibition, implementation of Ecological Monitoring Project with (iii) IUCN support, and promotion of ecotourism (installation of trails, observation towers, piers, etc.).

Monitoring of Rare Animals: SRF is a globally significant ecosystem, and projects aimed at protecting certain animals and plants, such as Tiger Conservation Project, are underway. In SRF, the population of Bengal tiger is recorded by individual identification by camera traps, and the number is slightly increasing from 106 in 2015 to 114 today.

Changes in vegetation due to increased salinity: The distribution tendency of mangrove vegetation in SRF is affected by salinity, etc. SRF characterization Sundri (*Heritiera fomes*) shows a tendency for long-term transitions to the more salinity-tolerant tree species Gewa (*Excoecaria agallocha*) and Goran (*Ceriops tagal*) due to increased salinity in SRF due to climate-change and decreased freshwater supplies, although dominated by intermediate salinity levels. In addition, Sundri of the native main tree species is also affected by the death of the canopy due to Top dying disease. Though the cause is not clear, it is considered that the oil content discharged from the ship inhibits respiration of the air root.

## 2) Tanguar Haor

The diversity of fauna and plants in Tanguar Hall is exposed to major threats due to the unsustainable use of resources.

Absence of management by the Forest Department: Tanguar Haor is registered as a Ramsar wetland and is designated as Ecologically Critical Area under the jurisdiction of the Department of Environment but is not designated as a reserve under the national law of the Forest Department and is not properly managed.

Absence of management as a Ramsar wetland: Ramsar Information Sheet(RIS) is obligated to be renewed every six years on a monitoring basis but has not been renewed since enrolment. Therefore, proper management as a Ramsar wetland is not carried out.

Government and International Organizational Initiatives for Administration: The Government of Bangladesh has formulated the Tanguar Haor Management Program (THMP), a comprehensive management program, to conserve ecosystems and animal and plant diversity, including migratory birds, and has attempted to improve the economic status of the communities as "smart use" of natural resources. IUCN Bangladesh implemented the Joint Management Initiative in 2006-2016 through a sustainable management project titled "Community Based Sustainable Management of Tanguar Haor Project: CBSMTHP" of Tanguar Haor by communities to promote the sustainable use of natural resources. Although this initiative introduced a joint wetland management system and established a permission fishery scheme, the project has not been continued since then.

## 3) Other issues

Conservation and management of wetlands under the International Convention: In the monsoon season, the country mostly turns to wetlands. These wetlands not only serve as a site for conservation of diverse biodiversity, including waterfowl and fish, but also serve as a site for rice cultivation, fishing grounds, grazing, tree planting, and tourism throughout the dry season and monsoon season. Thus, it is no exaggeration to say that Bangladesh is a country of wetlands, and that people live with wetlands. However, only the two Ramsar wetlands status above are designated for the purpose of conservation and sustainable use of wetlands, and there are problems in conservation and management of the two Ramsar wetlands.

While Sundarbans Reserved Forest is under the control of the Forest Department, Tangura Haor is under the control of the Department of Environment rather than under the control of the Forest Department. Protected area management should be done by the Forest Department, and Ramsar Treaty response was handled by the Forest Department, and the Forest Department was assigned to the focal organization.

However, since Tangur Haor is managed by the Environmental Department, the response to the Ramsar Convention was inadequate. In recent years, therefore, the focal organization of the Ramsar Convention have been changed to the Ministry of Environmental, Forest and Climate Change (MOEFCC).

In 2016, the Ministry of Water and Resources conducted a survey of all Haors, Beels in Bangladesh and listed candidates for Ramsar wetlands. However, no new Ramsar wetlands were designated at all after then.

The potential of Bangladesh is large, and the need for conservation of wetlands based on the Ramsar Convention is large in cooperation with not only protected areas with legal regulations but also OECM to be described later, and it is thought that there is much room for cooperation.

#### **(4) Additional reserves (OECM)**

##### **(a) Current Status**

Together with legal reserves and OECMs (Other Effective Area-based Conservation Measures), to achieve “30by30” of raising 30% of land and sea areas to equivalent reserves by 2030, the reserves and OECM need to be greatly expanded. However, considering the population density and land use conditions in Bangladesh, it is difficult to drastically expand the legal reserves. In this regard, it is necessary to greatly expand OECM that contributes to the conservation of biodiversity by effectively utilizing private land other than reserves.

The Forest Department is currently undertaking projects to identify potential areas of OECMs nationwide. Land OECM is being identified by Arannayk Foundation while wetlands OECM is explored by IUCN Bangladesh. Sea area OECM is surveyed by WCS Bangladesh and reported to the Forest Department, which is supported by the Forest Department. The Fishery Department join the task as a stakeholder to identify OECM in sea area.

##### **(b) Issues**

OECM program is ongoing, and with land, wetland, and marine partners-guidelines are being developed to identify, designate, and manage potential OECM sites. Meanwhile, the schedule for registering OECM in the global data base has not been materialized yet.

OECM is an effort to designate areas corresponding to protected areas, including private land other than public land, and to register and manage them in the global data base. Recently, the ministries and agencies and the offices of special economic zones have become more supportive and cooperative in designating OECM.

AS for OECM in land area, the tea fields owned by Tea Company are promising candidates for OECM because they play key roles in the conservation of biodiversity in terrestrial areas both functionally and in terms of area. However, Tea Company was not cooperative at this stage. As shown in the photo below, unlike tea plantations in Japan, tea plantations in Bangladesh have multi-storied forests where tea is planted on the forest floor, and rice paddies are sometimes mixed with these tea plantations forming a mosaic like land cover.



Note: A mosaic environment in which tea is planted on the forest floor of shade trees with mosaic like paddy rice on the ground.

Source: JICA Survey Team

**Figure 3-8 A View of Tea Field: a Candidate for OECM**

## **(5) Endangered species**

### **(a) Current status**

In 2000, the first Red List was developed for endangered species in Bangladesh, and in 2015 the Forest Department and IUCN Bangladesh developed seven taxa (mammals, birds, reptiles, amphibians, fish, crustaceans, and butterflies) of fauna in the country as shown in Tables 3-9. A total of 1,619 of these seven taxa were evaluated, and 511 were ranked and described as some endangered species. For endangered species, various distributions are indicated and serve as effective basic data for biodiversity conservation. According to the interview with IUCN Bangladesh, the process of creating a red list of plants is currently in progress and will be published soon.

The Red List describes the distribution of endangered species at the national level and serves as an important basic data for not only grasping the distribution of endangered species in Bangladesh but also taking environmental considerations in development projects. Figure 3-9 shows the locations where endangered species are concentrated by overlaying the distribution of all listed species in the Red List published to date.

However, it shows that the Red List species are concentrated in the hills of the Chattogram and Sylhet division, indicating that these regions are important for biodiversity and that consideration for biodiversity is important in various development projects. On the other hand, it is the Sundarbans area in Khulna district which is noticed internationally and has many conservation projects. In this diagram, it is shown as a region with relatively few endangered species. This is because Sundarbans is the largest mangrove forest in the world. Although it is a habitat for endangered species such as Bengal tiger and saltwater crocodile, it is relatively uniform and monotonous in the environment. Therefore, the number of endangered species appears to be small, but it should be noted that conservation is of high importance.

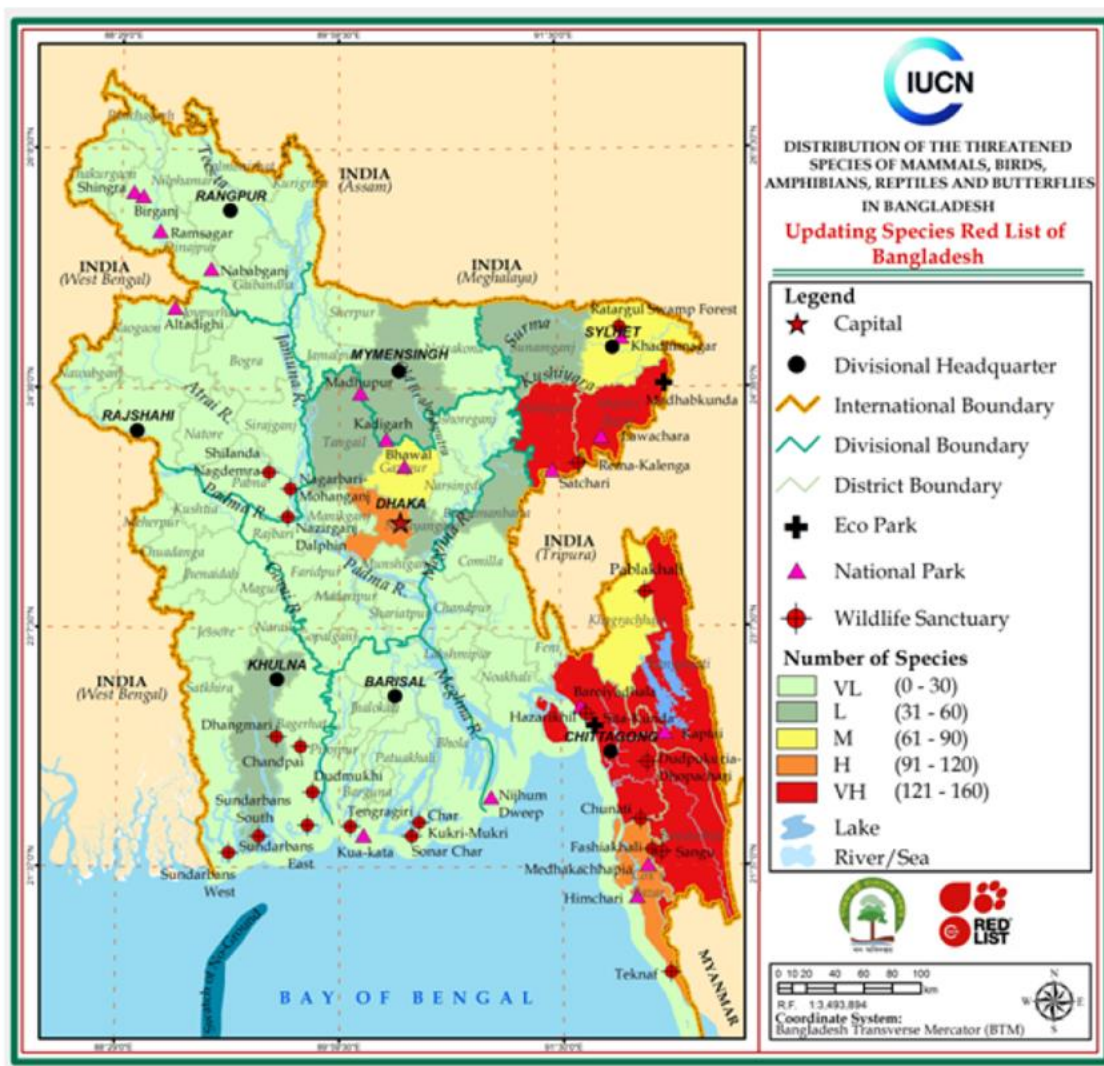


**Table 3-9 Situation of Endangered Species in Seven Animal Classes in Bangladesh**

Categories	MA		BI		CR		RE		AM		FI		BU		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Extinct (EX)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extinct in the Wild (EW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regionally Extinct (RE)	11	0.70	19	1.2	0	0	1	0.06	0	0	0	0	0	0	31	2
Critically Endangered (CR)	17	1	10	0.6	0	0	17	1	2	0.02	9	0.56	1	0.06	56	3.46
Endangered (EN)	12	0.75	12	0.75	2	0.02	10	0.6	3	0.03	30	1.85	112	6.91	181	11.18
Vulnerable (VU)	9	0.56	17	1	11	0.7	11	0.7	5	0.3	25	1.5	75	4.63	153	9.46
Near Threatened (NT)	9	0.56	29	1.8	1	0.06	18	1.17	6	0.37	27	1.67	0	0	90	5.56
Least Concern (LC)	34	2.1	424	26.8	47	2.9	63	3.89	27	1.67	122	7.54	85	5.25	802	49.53
Data Deficient (DD)	39	2.40	55	3.4	79	4.88	27	1.4	6	0.37	40	2.47	32	1.97	278	17.17
Not Evaluated (NE)	7	0.43	0	0	1	0.06	20	1.23	0	0	0	0	0	0	28	1.72
<b>Total</b>	<b>138</b>	<b>8.52</b>	<b>566</b>	<b>34.94</b>	<b>141</b>	<b>8.7</b>	<b>167</b>	<b>10.31</b>	<b>49</b>	<b>3.02</b>	<b>253</b>	<b>15.62</b>	<b>305</b>	<b>18.83</b>	<b>1619</b>	<b>100</b>

MA: mammalian BI: bird CR: crustacean RE: amphibian AM: amphibian FI: fish BU: butterflies

Source: IUCN Bangladesh



Source: IUCN Bangladesh

**Figure 3-9 Distribution of Endangered Species in Bangladesh (mammals, birds, reptiles, amphibians, and butterflies)**

**(b) Issues**

For the seven taxa, a detailed Red List has been developed by IUCN Bangladesh and is considered a valuable basis. Plants are currently under development and are scheduled to be announced in near future. On the other hand, red lists have not been formulated for insects other than butterflies, spiders, and terrestrial shellfish, and some taxa are not covered.

In addition, major endangered species such as Bengal tiger, Asian elephants, seaweeds, and dolphins among the species listed in the Red List of Animals have been protected by a protection project. However, the number of other endangered species is large, and monitoring and protection measures for each species have not been successfully implemented.

Looking at the areas where the Red List species are found, Sundarbans which is currently attracting worldwide attention and has been designated as a reserve in a large, unitary area, may be a habitat for symbolic species such as Bengal tiger, and it is relatively subject to projects/resources related to control planning and conservation. On the other hand, the eastern region including Chattogram Hills Tracts has more threatened species which are concentrated and distributed among the Red List species. Thus, it is an issue to formulate and implement the projects to protect those species, including designation of protected areas.

**(6) Invasive alien species**

**(a) Current Status**

As a threat to ecosystems distributed in specific regions, the impacts of foreign species brought from other regions are enormous. Particularly it is necessary to grasp and control the present state of invasive alien species (IAS: Invasive Alien Species) that cause harm to ecosystems, agriculture, forestry and fisheries, and humans, among alien species.

According to Sharif A. Mukul (2021), 63 kinds of IAS are recorded in Bangladesh. For example, the indigenous fish of Chinese genus was introduced for food became established as a IAS and pressed the indigenous species, and African Sharp Teeth Catfish (*Clarias gariepinus*, native to Africa) caused the decline of the indigenous fish which is the fishing target species of the local inhabitants by the direct predation. In Bangladesh, Haor is the habitat of a very diverse freshwater fish fauna, and IAS invasion is a threat to the native freshwater fish fauna.<sup>16</sup>

In forest ecosystems, fast-growing exotic species such as Acacia, Eucalyptus, and *Leucaena leucocephala* introduced for wood production compete with indigenous tree species for soil nutrients and water availability.

During the 2<sup>nd</sup> field survey, it was observed that Water Hyacinth (*Eichhornia crassipes*, native to South America), grows in water bodies, and this was confirmed to be an obstacle to shore transport and paddy cultivation as shown in Figure 3-10. The example of Water Hyacinth suggests that various invasive alien species cause this kind of problem in the country.

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<sup>16</sup> Sharif A. Mukul and others (2021) Invasive Alien Species of Bangladesh,  
<https://www.researchgate.net/publication/348002595>



Source: JICA Survey Team

**Figure 3-10 Water Hyacinth Rapidly Breeding near Paddy Field in Haor**

### (b) Issues

In Bangladesh, no law has been enacted to control invasive alien species that fall under, for example the Japanese Legislation on the “Prevention of Damage to Ecosystems caused by Specified Foreign Species (Foreign Organism Act)”. The monitoring and surveillance system against alien species have not been developed.

The situation of invasive alien organism was arranged referring to the existing academic paper. The Forest Department has jurisdiction over the control of alien species. However, the survey of the invasion status of IAS is insufficient, and there are many related issues and challenges to be addressed such as legal development, appropriate quarantine measures when importing alien species into the country, and the development of monitoring systems.

### 3.2.5 Impacts of Climate Change and Related Policies and Measures

#### (1) Mitigation

i) Nationally determined contributions (Nationally Determined Contributions (NDCs) 2021 Bangladesh)

In 2021, the Ministry of Environment, Forest, and Climate Change (MoEFCC) issued Nationally Determined Contributions (NDCs) 2021 Bangladesh. The forest sector is defined as a part of AFOLU (Agriculture, Forestry and Other Land Use) Sector.

**Table 3-10 GHG Emission in the Base Year (2012) and BAU Scenarios (2030) in NDCs**

Sector	Base year 2012 (a)		BAU scenario 2030 (b)		Increase (c = b-a)	
	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%
Energy	93.09	55.07	312.54	76.34	219.45	91.30



Sector	Base year 2012 (a)		BAU scenario 2030 (b)		Increase (c = b-a)	
	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%
Cement and fertilizer	5.61	3.32	10.97	2.68	5.36	2.23
Agriculture and livestock	45.87	27.13	54.64	13.35	8.77	3.65
Forest	0.37	0.22	0.37	0.09	0.00	0.00
Waste and wastewater	24.11	14.26	30.89	7.55	6.78	2.82
<b>Total</b>	<b>169.05</b>	<b>100.00</b>	<b>409.41</b>	<b>100.00</b>	<b>240.36</b>	<b>100.00</b>

Source: Prepared by JICA Survey Team based on the tables in Nationally Determined Contributions (NDCs) 2021 Bangladesh.

"NDCs 2021" shows emissions from the forest sector are 370,000 ton CO<sub>2</sub>eq in the base year 2012 (Page 4 Table 1 in Table 3-10, "NDCs 2021"). This is IPCC methodology-based reference period (Historical Reference Period) set from 2000 to 2015 for average annual emissions of 1,190,000 ton CO<sub>2</sub>eq per year, while an estimated removal of 810,000 ton CO<sub>2</sub>eq per year. Net emissions become 370,000 ton CO<sub>2</sub>eq per year as the difference between the average annual emission and the estimated removal, which is forest reference level (FRL).

In NDCs for emissions from the forestry sector in BAU (Business as Usual), it is assumed to be constant and unchanged at forest-reference level of 370,000 ton CO<sub>2</sub>e per year. Therefore, BAU scenarios show 370,000 ton of CO<sub>2</sub>eq per year in the forest sector in 2030, the same as in 2012 (Page 6 Table 2 in Table 3-11, "NDCs 2021").

In BAU scenarios, other sectors, such as energy-based and agricultural and livestock-based industries, anticipate increased emissions of CO<sub>2</sub> in accordance with the industrial development policies planned in the master plan through 2030. On the other hand, only the forest sector did not show an increase in emissions between 2012 and 2030. Therefore, the ratio of emissions from the forest sector to the total sector declined from 0.22% to 0.09% between 2012 and 2030. For "other land use" in the forest sector, the effects to reduce emissions are not considered.<sup>17</sup>

CO<sub>2</sub> emissions from the forestry sector are low compared to other sectors, based on the above analysis and assessment of current conditions in 2012 and the setting of BAU scenarios for 2030.

The "NDCs 2021" also lists targets for reducing CO<sub>2</sub> emissions. The two categories of initiatives are "unconditional contribution" and "conditional contribution". The former is based on domestic capacity and national resources while the latter is based on international funding and technical cooperation. As shown in Table 3-11, for all sectors up to 2030, the "unconditional" effort sets emissions reduction target of 25.76 million ton CO<sub>2</sub>eq per year (6.73% of BAU2030 annual emissions reduction of 409.41 million ton CO<sub>2</sub>eq per year) and the "conditional" effort sets a emissions reduction target of 61.90 million ton CO<sub>2</sub>eq per year (15.12% of BAU2030 annual emissions reduction of 409.41 million ton per year).

**Table 3-11 Targets of GHG Emissions Reduction for the Respective Sectors in NDCs**

UNFCCC sector	Unconditional (a)		Conditional (b)		Total (c=a+b)	
	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%
Energy	26.31	95.46	59.71	96.46	85.98	96.10
Cement and fertilizer	-	-	-	-	-	-
Agriculture and livestock	0.64	2.32	0.40	0.65	1.04	1.16

<sup>17</sup> According to Bangladesh Forestry Master Plan 2017-2036, the area of "Other land with trees" has increased by 8.7 times between 1990 (270 ha) and 2015 (2,356ha). This is Trees Outside Forest (TOF) that is planted outside the forest. If the trees planted continue to grow, they will serve as a sink to absorb CO<sub>2</sub>, affecting to further reduce the net emissions in BAU scenarios.



UNFCCC sector	Unconditional (a)		Conditional (b)		Total (c=a+b)	
	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%
Forest	-	-	-	-	-	-
Waste and wastewater	0.61	2.21	1.84	2.97	2.45	2.74
<b>Total</b>	<b>27.56</b>	<b>100.00</b>	<b>61.95</b>	<b>100.00</b>	<b>89.47</b>	<b>100.00</b>

Source: Prepared by JICA Survey Team based on the tables in Nationally Determined Contributions (NDCs) 2021 Bangladesh.

However, in setting this target, the emission reduction target for the forest sector is "0" as shown in Table 3-12. This is due to the fact that emissions are very low, and therefore no reduction targets have been set as a sector.

On the other hand, although no numerical targets are given for emission reductions at the national level, activities aimed at emission reductions in the forest sector are indicated in NDCs 2021 as shown in Table 3-12. In unconditional initiatives led by the government, concrete numerical targets and details of activities are proposed. On the other hand, in the conditional approach, the content of taking over the unconditional approach or the approach concerning the introduction of the new method are the main contents.

**Table 3-12 "Unconditional" and "Conditional" Efforts to Reduce GHG Emission**

Item	Activities to be implemented by 2030
<b>Unconditional efforts</b>	<b>Unconditional efforts</b>
Reducing deforestation	➤ Expansion of forest cover
Afforestation and tree planting	➤ Expand forest cover from 22.37% (2014) to 24%
Recovery of forest vegetation	➤ Afforestation and reforestation 150,000 ha in coastal areas, islands, and degraded land
Expansion of tree cover	➤ Restoration of forestland vegetation in a hilly and flat Sal Forest area 137,800ha of non-wooded area
	➤ Restoration of vegetation in degraded forests in hilly and flat Sal Forest 200,000ha
	➤ Tree planting on roadside, levees, and private land
<b>Conditional Efforts</b>	<b>Conditional Efforts</b>
Reducing deforestation	➤ Maintenance of forests and tree cover through collaborative forest management, social forestry, and other programs
Afforestation and tree planting	➤ Implementation of forest conservation through wide-area implementation of alternative livelihoods for forest dependent communities (for 55,000 households)
Recovery of forest vegetation	➤ Introduction of joint management for protected areas (72,000 ha)
Maintenance of forests and tree cover	➤ Additional coastal afforestation activities
	➤ Maintenance of vegetation recovery in degraded forests and non-wooden areas
	➤ Tree planting on roadside and levees and private land

Source: Prepared by JICA Survey Team based on the tables in Nationally Determined Contributions (NDCs) 2021 Bangladesh.

#### ii) Bangladesh National REDD+ Strategy 2016-2030 (BNRS)

Since 2010, with the assistance of UN-REDD Program, the Government of Bangladesh has continued efforts to reduce greenhouse gas emissions from the forest sector and improve its function as a sink. To forecast future greenhouse gas (CO<sub>2</sub>) emissions and removals by forests, the Ministry of Environmental and Forestry and Climate Change and the Forest Department assessed trends over 2000 and 2015. Consequently, it was estimated that 1,188,971 ton CO<sub>2</sub>ep per year was discharged due to deforestation caused by land-use change, and 814,718 ton CO<sub>2</sub>eq per year was absorbed by plantations, forest vegetation restoration, and forest conservation. Accordingly, 374,253 ton CO<sub>2</sub>eq per year of net emissions, the difference between emissions and removals, was set as FRL for greenhouse gas emissions

from the forest sector.

The calculation of emissions and sinks in different forest landscapes is presented in the Bangladesh National REDD+ Strategy 2016-2030 (BNRS). "Emissions" in Table 3-13 shows the sum of emissions from deforestation and forest degradation (high and low levels), and "Absorption" shows the sum of emissions from afforestation, reforestation, and vegetation restoration (high and low levels). The net emissions are the largest in the Chattogram Hill Tracts, whereas the southern coast shows the largest removals.

**Table 3-13 Estimation of Emissions and Removals of CO<sub>2</sub> in the Forest Landscapes**

Forest landscape	Emission (a)		Absorption (b)		Emission-Absorption (c = a-b)
	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq	%	million ton CO <sub>2</sub> eq
Chattogram Hill Tracts	1,007,738	84.71	427,688	52.50	580,050
Sal Forest	112,710	9.49	45,783	5.62	66,927
Southern coast	44,547	3.76	286,590	35.18	-242,043
Sundarbans	12,066	1.02	23,499	2.88	-11,433
Village	11,957	1.02	31,153	3.82	-19,196
<b>Total</b>	<b>1,188,971</b>	<b>100.00</b>	<b>814,718</b>	<b>100.00</b>	<b>374,253</b>

Source: Prepared by JICA Survey Team based on tables published in Bangladesh National REDD+ Strategy 2016-2030

Based on these figures, efforts to reduce greenhouse gas (CO<sub>2</sub>) emissions and improve sinks between 2016 and 2030 are shown in BNRS. As shown in Table 3-2, BNRS has two strategies, six issues, and 17 measures. Among them, Table 3-14 shows the contents of "Strategy: Enhancement of Forest Carbon Storage" related to climate change mitigation measures.

**Table 3-14 Mitigation Measures Presented in BNRS**

Strategy	Issues and Measures
Enhancement of carbon storage in forests	<p><b>Challenges: Efforts to Increase Reforestation and Increase Forest Coverage to 16%</b></p> <p><u>Policy 15</u>: Reforestation of bare land and new forestation of coastal sediment Target area: 637,259 ha (hilly area: 522,158 ha, southern coastal area: 111,715 ha, Sal Forest: 2,080 ha, village area: 1,306 ha)</p> <p><u>Policy 16</u>: Restoring vegetation in degraded forests, target area: 173,671 ha</p> <p><u>Policy 17</u>: Conservation of forests, target area: 323,047 ha</p> <p>Emission reductions through the above measures: 135.79 million ton CO<sub>2</sub>eq (from 2015 to 2030)</p>

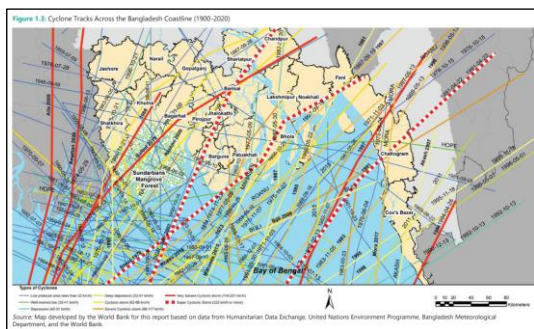
Source: Prepared by JICA Survey Team based on Table 9 of Bangladesh National REDD+ Strategy 2016 – 2030

## (2) Potential for investment in afforestation projects through carbon finance

In Table 3-13, the activities presented in "Conditional Efforts" include "additional coastal afforestation activities," "vegetation recovery in devastated and unstated areas," and "afforestation in roadside and levees and private lands."

In the context of climate change mitigation, it is possible to create and implement projects aiming at absorbing CO<sub>2</sub> through afforestation and generating carbon credits. Particularly by private investment which intends to sell credits in the voluntary market.

This point was explained to Forest Department, and the opinion was heard on the relevant and the potential and opportunities as a business. However, the information and comment which were the reference for the future cooperation proposal examination in this field were not particularly collected.



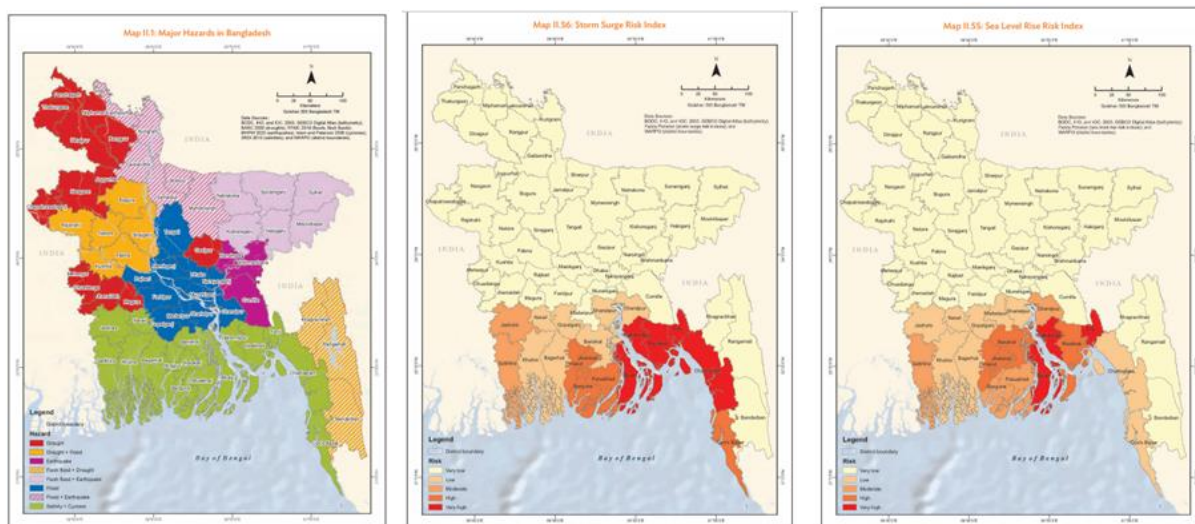
Source: Bangladesh Enhancing Coastal Resilience in a Changing Climate (World Bank, 2022)

**Figure 3-11 Cyclone Routes from 1946 to 2010**

### (3) Adaptation

The forest sector is very much involved in the field of climate change adaptation. Among natural disasters, storms caused by cyclones give damages almost every year by flooding and storm surges in houses, fields, flooding of various infrastructure facilities, and damage to buildings and houses caused by strong winds. According to World Bank documents, 90% of casualties and 40% of economic losses from natural disasters in Bangladesh are attributed to storms caused by cyclones over the 25-year period from 1990 to 2014. The damage over the past 65 years (1946-2010) in Figure 3-11, shows that cyclones that went north from the Indian Ocean almost every year land along the southern and eastern coastal areas, some of which reached inland. And this trend remains unchanged.

The types of damage caused by cyclones and other natural disasters (droughts, earthquakes) and affected areas are shown in Figure 3-12 based on ADB data. As the left figure shows, natural disasters affect the entire country, with conspicuous cyclones in coastal areas and local flash flood and extensive floods in inland areas. Southern coastal areas are at risk of storm surges and sea level rise.



Legend: Map in the left  
Red: Drought  
Orange: Drought + Flood  
Purple: gun or flood + earthquake  
Blue: Flood  
Green: Salinized + cyclone (strong wind + heavy rain + storm surge)

Source: Bangladesh Climate and Disaster Risk Atlas (ADB, 2021)

**Figure 3-12 Risk Assessment for Major Hazard Impacts(left), Storm Surge (middle), and Sea Level Rise (right)**

In response, Bangladesh has been engaged in afforestation in the southern coastal areas since the 1960s with the aim of creating greenbelt. It is effective in reducing strong winds and tidal current speeds caused by cyclones, in reducing storm surges and erosion, and in reducing tsunami damage caused by earthquakes. A study report shows that (i) if flooding due to storm surge is more than 6m, the width of the green zone should be 1,000m, (ii) if flooding is between 4 to 6m, the width should be 400~1,000m, and (iii) if flooding is 2 to 4m, the width should be 200~800m.<sup>18</sup> In major governmental policies such as NDCs and the Eighth Five-Year Plan, afforestation in the southern coastal region aimed at disaster prevention and mitigation is regarded as a key issue.

<sup>18</sup> Final Report of Technical Study for Mapping of Potential Greenbelt Zone in the Coastal Regions of Bangladesh under Climate Resilient Participatory Afforestation and Reforestation Project, BFD 2016.

### 3.2.6 Digital Transformation (DX) Related Measures and Planning

In Bangladesh, the Information and Communication Technology Division (ICTD) is in charge of DX, formulate related measures such as National ICT Policy (2018), and promote DX of other ministries and agencies. In ICTD, the Bangladesh Computer Council (BCC) was established to undertake policy-implementation tasks such as the formulation of specific plans, development of ICT infrastructures, and capacity building. The Forest Department has not yet developed its own DX related plans, and DX is conducted in accordance with the national policies and plans developed by ICTD as shown below.

#### (1) National ICT Policy (2018)

National ICT policy aims to make Bangladesh a digital nation by 2021, use information and communication technologies by 2041 to develop a transparent and responsible nation, and to disseminate administrative services through public-private partnerships. This policy presents eight goals, 55 strategic themes, and 343 actions. "Environmental, climate-change and disaster-management" in which the Forest Department is related to one of the goals is mentioned, and remote sensing and GIS technical utilization are mentioned.

#### (2) e-Government Master Plan for Digital Bangladesh (2019)

e-Government master plan was developed with the support of the Korean International Cooperation Organization, and a roadmap for digital Bangladesh has been proposed.

The roadmap consists of three phase approaches: 1) establishment of e-government, 2) integration of services, and 3) modernization. The following four points are presented as pillars to be strengthened. 1) Legislation, 2) Government Services (G to G), 3) e-service (G to G and G to B), and 4) Digital infrastructures.

### 3.3 Stakeholder Analysis

In the forest sector of Bangladesh, cooperation by international organizations and major Western donors began as early as the 1980s. Since then, large-scale disasters have already occurred due to floods caused by cyclone every year, and various issues have been recognized in the fields of natural environment and biodiversity conservation due to population growth and industrial expansion and structural changes.

#### 3.3.1 International Organizations and Donor Agencies

This chapter describes current status of international organizations and donor agencies cooperating with the Bangladesh forestry sector, as well as suggestions for future collaboration proposals. The current status information is extracted from interviews with stakeholders and from the organization's website.

#### (1) UNDP

<Overall>

(i) Implementation of Community Partnerships to Strengthen Sustainable Development Program (Compass for Chattogram Hills (CHT) (Note: See USAID section at the bottom for more information on the project) from 2019 to 2024.

The project-titled "Strengthening Inclusive Development in Chattogram Hill Tracts, UNDP-A Project of the Ministry of Chattogram Hill Tracts Affairs"-shows UNDP's efforts in CHT. It is implemented by the Chattogram Hill Country Department (the Ministry of Chattogram Hill Tracts Affairs, MCHTA).

(ii) Initiatives targeting mangrove forests in the Sundarbans region: To promote conservation of the largest mangrove forest in the world and its biodiversity, UNDP leads to strengthen collaboration with administrative organizations in Khulna division, with "Nature-Based Solutions (NbS)" and "Locally Led Adaptation (LLA)". To address conservation of mangrove forest and biodiversity, the policy is to focus the local administrative organizations at the center of the actors, and to develop cooperative projects. (Reference information in the lower part)

<Implications for Cooperation Proposals>

As an international organization, UNDP will take the initiative in addressing the most important issues in the forest and natural sectors of Bangladesh and will cooperate with donors to link these issues to projects. In CHT, USAID and in Sundarbans, GIZ have established cooperative relations as UNDP

partners. In considering future cooperation proposals, it is essential to continue exploring possibility of cooperation with UNDP.

<Reference information>

<https://www.undp.org/bangladesh/press-releases/nature-based-solutions-and-local-led-adaptation-are-essential-sustainable-development-sundarbans>

## (2) World Bank

<Overall>

The World Bank has been cooperating for the forest sector in Bangladesh since 1980. Currently, the Medium-Term Cooperation Policy "Country Partnership Framework (CPF) for FY 2023-2027" is linked to the policies set forth in the Eighth Five-Year Plan and Long-Term Plan (2021-2041) of the Government, and the basic policy is to assist Bangladesh to become a "top middle-income country" by 2031.

<Key projects in the past>

Projects aimed at combating illegal trafficking in Strengthening Regional Co-operation for the Wildlife Protection Project, 2011~2016. The main achievements are the establishment of a system for compliance with laws and regulations on wildlife protection at the national and local levels. In the Forest Department, a section in charge of control of wild animal related crimes was established to improve the capacities of the persons concerned. (Reference information at the bottom)

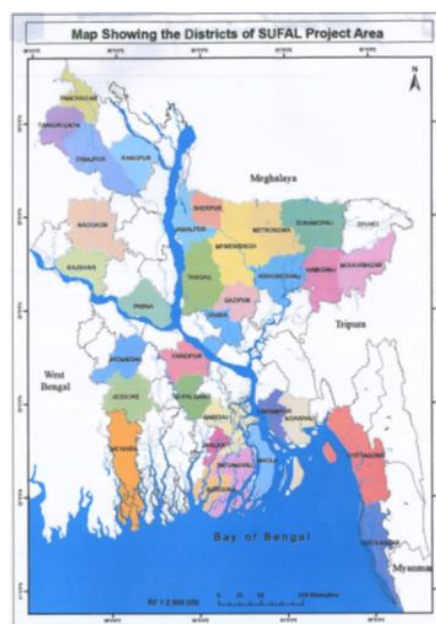
As part of efforts to strengthen the resilience of ecosystems and societies to the impacts of Climate Resilient Participatory Afforestation and Reforestation Project, 2013~2016 climate-change, community participatory methods were applied to forest plantations in southern coastal and hilly areas. (Reference information at the bottom)<sup>19</sup>

<Current Project>

A project aimed at improving the benefits of Forest Dependent Community (FDC) through afforestation and forest management activities by implementing a joint management method called Collaborative Forest Management (CFM), which was implemented in the above Climate Resilient Participatory Afforestation and Reforestation Project of Sustainable Forests and Livelihood Project (SUFAL) 2018~2024. It consists of components such as strengthening of systems and systems related to implementation, strengthening of information systems, improvement of organizational implementation capacities, improvement of implementation and management methods, and research activities. As shown in Figure 3-13, the target area covers almost all districts across the country. However, as of 2023, the forest landscape covered in this case overlaps with the southern coastal and the Sal Forest area in northern Dhaka.

Source: Forest Department

**Figure 3-13 Target Districts of SUFAL Project**



<Future Plan>

New Grant-based programs (partly loan) are being considered in the Sundarbans region. World Bank considers the use of the Climate Change Fund established in the Ministry of Environmental, Forest and Climate Change. A program aimed at improving infrastructure and livelihoods related to communications and transportation for residents living in the Sundarbans area (areas surrounding the reserved forest). It is assumed that it will start in 2024 or 2025.

<Implications for Cooperation Proposals>

<sup>19</sup> According to a Senior Environment Specialist at the World Bank's Bangladesh Office, all areas planted in coastal sedimentary lands as greenbelt were designated as the reserved forest without being converted to other land-use.



SUFAL project (described in detail in Section 4.9.2 (2)) is a loan project aimed at taking advantage of the achievements of FAO in building a forest-information system and using it in the field. Practice of Site Specific Plan (SSP) in planning and Collaborative Forest Management (CFM) in implementation, and development of the results in other regions are assumed. This concept is in line with the basic policy of formulating future cooperative plans of JICA which technological development, demonstration and social implementation, and widespread dissemination should be used as a reference when formulating future projects.

<Reference information>

[https://ieg.worldbankgroup.org/sites/default/files/Data/reports/ppar\\_bangladeshandnepalwildlife\\_0.pdf](https://ieg.worldbankgroup.org/sites/default/files/Data/reports/ppar_bangladeshandnepalwildlife_0.pdf)

<https://projects.worldbank.org/en/projects-operations/project-detail/P127015>

<https://projects.worldbank.org/en/projects-operations/project-detail/P16199>

### (3) FAO

<Overall>

FAO is committed to fostering human resources and organizations in the forest sector so that the Government of Bangladesh can take the initiative in implementing projects to achieve environmental conservation and sustainable forest administration.

<Past Projects>

Technical assistance related to the construction of Bangladesh Forest Information System (BFIS). The Bangladesh Forest Information System was completed in 2018, which was constructed so that all information on the forest sector could be collected and used. The key factors are Site Specific Planning (SSP) and Collaborative Forest Management (CFM). SSP consists of Beat forest operation charts and work plans for forest development and forest management. The information is updated as appropriate. CFM will implement joint controls, including the provision of alternative livelihoods and sustainable harvesting activities within forests, for citizens living in and around national forest areas under the jurisdiction of the Forest Department, including reserved forests. A local NGO is in charge of implementing CFM as a subcontractor. SSP and CFM are implemented SUFAL Project World Bank loans.

<Current Project>

Technical Assistance for Strengthening Collaborative Forest Management Plans Project (ongoing), 2023~2024: A technical assistance project aimed at improving "the method of managing forests" Collaborative Forest Management (CFM) jointly by residents and the Forest Department, which has been introduced SUFAL Project the World Bank loan. Based on the results of SUFAL Project mainly on the southern coast and Sal Forest, this paper improves the technique assuming the wide-area deployment.

Projects aimed at introducing Forest Landscape Restoration method that Forest Landscape Restoration Project: FAO is promoting it in the countries in South and Southeast Asia and the Pacific (reference sources below).

<Implications for Cooperation Proposals>

Cooperation with emphasis on the infrastructure development of the government including forest information system is being developed. FAO's policies and results should be used as a great reference in considering future Japanese cooperation, particularly cooperation proposals that will strengthen the infrastructures of the forest sector administration.

<Reference Sources>

<https://www.fao.org/bangladesh/news/detail-events/en/c/1650871/>

### (4) ADB

<Overall>

ADB focuses on cooperating with the forest sector to combat climate change. The Bangladesh-Delta Plan 2100 supported the Government in the development process. The basic concept of "Delta Plan

2100" is sustainable management of water resources and environmental, ecosystems, and natural resources, and ADB is cooperating in accordance with this policy.

<Current Project>

Construct small-scale infrastructures and conserve and manage small basins in villages in three districts in Climate-Resilient Livelihood Improvement and Watershed Management in Chattogram Hill Tracts Sector Project, approved in 2023: To target three districts in CHT i.e., Khagrachari, Rangamati, and Bandarban, process and sell agricultural products, train young people in the non-agricultural sector, improve the capacity of administrative organizations, and improve the rural road network.

<Implications for Cooperation Proposals>

ADB is planning to improve CHT infrastructures and livelihoods, empower local banks, and provide vocational training through loans. Approaches and methodologies for ADB projects will be useful for examining loan projects for a wide area in future cooperative proposals.

<Reference information>

<https://www.adb.org/documents/bangladesh-country-partnership-strategy-2021-2025>

<https://www.adb.org/projects/54047-001/main>

## **(5) GIZ**

<Overall>

In the field of natural environment, it has been tackled from the conservation of wetlands, and is currently targeted at the Sundarbans region. Key areas include climate change, urban development, and ecosystem conservation. Regarding the conservation of the Sundarbans region, cooperation between India and Bangladesh is being promoted, and activities are scheduled to begin soon.

As for other forest landscapes, GIZ is interested in land competition issues in Sal Forest areas, conservation of buffer zones in protected areas, and related gender issues.

<Last Project>

Support to the Management of the Sundarbans Mangrove Forests in Bangladesh (SMP-II), 2019~2022 Introduced "Spatial Monitoring and Recording Tool (SMART)" to monitor illegal activities in mangrove forests to conserve mangrove ecosystems in the Sundarbans region. 30 sets of related equipment and drones have been provided. In the future, "SMART" will be introduced for the conservation of marine ecosystems and ecosystems in the suburbs of cities. Employs NGO as a contractor and establishes a joint management structure involving neighboring residents to support activities.

<Future Plans>

While GIZ is centered on technical assistance, KfW is interested in the conservation of biodiversity in urban areas targeting Sal Forest in northern Dhaka. GIZ is planning a new project for this region and is scheduled to begin in 2025. In addition, an integrated project for the conservation of coastal areas and the conservation of afforestation and marine ecosystems will be launched in 2024.

<Implications for Cooperation Proposals>

Projects scheduled to be launched in 2024 may be considered for the possibility of collaboration, after confirming whether the project is a successor to SMP-II and the specific target site and size of the project.

<Reference Sources>

<https://www.giz.de/en/worldwide/351.html>

<https://www.giz.de/en/worldwide/37949.html>

## **(6) USAID**

<Overall>

In the field of natural resource control, USAID provides support to residents living inside and outside protected areas. In particular, it supports the Forest Department through the implementation and recording of Community-based Co-management, CBM).

<Current Project>

Community Partnerships to Strengthen Sustainable Development Program (Compass), 2019~2024. For "Forests Outside Forests (Unclassified State Forest, USF)" and inhabitants living in the Chattogram Hill Tracts (CHT), which are not under the jurisdiction of the Forest Department, distributed in Bandarban district, the conversion from slash-and-burn cultivation to agroforestry and the improvement of livelihoods, and measures to prevent erosion of mountainous slopes using check dams and herbs and trees for the conservation of water and soil were implemented. Projects are run by professionals and NGO in Bangladesh, and there is no local operation of foreign professionals. Conducted technical training and mutual visits and research cooperation with universities in the United States. The Forest Department is assisting with capacity building for forest surveys.

<Future Plans>

As a successor to the above-mentioned current project, "Enabling integrated ecosystem management of headwater Reserved Forests, Protected Areas and Village Common Forests in partnerships with community people and institutions" is being considered. A project aimed at establishing a sustainable management system for reserved forests and protected areas and village common forest with the aim of adopting a microscale watershed management approach.

<Implications for Cooperation Proposals>

Approaches and methodologies based on community participation will be helpful, but with regard to the target areas and scales, and the implementation system, it is necessary to carefully consider whether the area and scale of the activities are extremely limited and whether international experts can provide direct support for the operation by National Expert/Staff.

<Reference Sources>

[https://www.usaid.gov/sites/default/files/2023-06/Bangladesh-CDCS-2020-2027-FINAL\\_1.pdf](https://www.usaid.gov/sites/default/files/2023-06/Bangladesh-CDCS-2020-2027-FINAL_1.pdf)

### 3.3.2 NGO and Other Relevant Agencies

#### (1) International NGO

Both of IUCN (International Union for Conservation of Nature,) and WCS (Wildlife Conservation Society) have their offices in Dhaka and are active.

IUCN is working to coordinate the establishment of Other Effective Area Based Conservation Measures, OECM other than protected areas that contribute to the conservation of biodiversity and to develop domestically distributed avian censuses. WCS also focuses on marine ecosystems to collect information on the distribution of fish and mammalian species, disseminate information to related organizations, and promote awareness of the ecology of marine organisms in collaboration with governmental organizations in the fisheries and fisheries sectors.<sup>20</sup>

#### (2) National NGO

National NGOs operate as contractors of business by the Forest Department. An example is shown in Table 3-15. Other than Arannayk Foundation, NGO linked to the divisions in the table are those registered as a contractor for SUFAL project. They are mainly in charge of activities of implementing Collaborative Forest Management.

**Table3-15 National NGOs Working in the Forestry Sector**

Target area Project	NGO organizational name
NGO working on USAID/UNDP projects in CHT	Arannayk Foundation <a href="https://arannayk.org">https://arannayk.org</a> Activities in the areas of forest, biodiversity conservation, and natural resource management <u>Major projects (from the website)</u> 2023 Mitigation of Unfavorable Conflict between Humans and Elephants 2022 (1) Selection and assessment of areas other than protected areas that contribute to biodiversity conservation (Other Effective Area Based Conservation Measures, OECM) and areas where measures for biodiversity

<sup>20</sup> IUCN <https://www.iucn.org/our-work/region/asia/countries/bangladesh> WCS <https://bangladesh.wcs.org/About-Us>



Target area Project	NGO organizational name																														
	conservation may be applied; and (2) Market survey of other wood products, including woodchips, sawdust, and furniture (demand and supply). 2021 (1) CHT Rural Landscape Rehabilitation Project, (2) Modelling and planning in the Landscape selected by CHT (Note: These are the outsourcing of the project by USAID/UNDP)																														
Local NGO in the Forest Department's SUFAL Project	<table border="0"> <thead> <tr> <th data-bbox="475 456 895 517"><u>Regional Name: Administrative Unit of Forest Department</u></th> <th data-bbox="1007 488 1294 517"><u>NGO organizational name</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="475 521 895 551">Chattogram North Forest Division</td> <td data-bbox="927 521 1361 551">: Dhaka Ahsania Mission</td> </tr> <tr> <td data-bbox="475 555 895 584">Chattogram South Forest Division</td> <td data-bbox="927 555 1361 584">: Dhaka Ahsania Mission</td> </tr> <tr> <td data-bbox="475 589 895 618">Wildlife Management &amp; Nature Conservation Division, Ctg</td> <td data-bbox="927 611 1361 640">: Dhaka Ahsania Mission</td> </tr> <tr> <td data-bbox="475 645 895 674">Coastal Forest Division, Bhola</td> <td data-bbox="927 645 1361 674">: Proshika Manobik Unnayan kendra</td> </tr> <tr> <td data-bbox="475 678 895 707">Coastal Forest Division, Patuakhali</td> <td data-bbox="927 678 1361 707">: Proshika Manobik Unnayan kendra</td> </tr> <tr> <td data-bbox="475 712 895 741">Costal Forest Division Chattogram</td> <td data-bbox="927 712 1361 741">: Shabolombi Samaj Unnayan Sangstha</td> </tr> <tr> <td data-bbox="475 745 895 775">Costal Forest Division, Noakhali</td> <td data-bbox="927 745 1361 775">: Shabolombi Samaj Unnayan Sangstha</td> </tr> <tr> <td data-bbox="475 779 895 808">Cox's Bazar North Forest Division</td> <td data-bbox="927 779 1361 808">: Nature Conservation Management</td> </tr> <tr> <td data-bbox="475 813 895 842">Cox's Bazar South Forest Division</td> <td data-bbox="927 813 1361 842">: Nature Conservation Management</td> </tr> <tr> <td data-bbox="475 846 895 875">Dhaka Forest Division</td> <td data-bbox="927 846 1361 875">: Eco-Social Development Organization</td> </tr> <tr> <td data-bbox="475 880 895 909">Tangail Forest Division</td> <td data-bbox="927 880 1361 909">: Eco-Social Development Organization</td> </tr> <tr> <td data-bbox="475 913 895 943">Mymensingh Forest Division</td> <td data-bbox="927 913 1361 943">: Eco-Social Development Organization</td> </tr> <tr> <td data-bbox="475 947 895 976">Sylhet Forest Division</td> <td data-bbox="927 947 1361 976">: Centre for Natural Resource Studies</td> </tr> <tr> <td data-bbox="475 981 895 1010">Wildlife Management &amp; Nature Conservation Division, Moulabi Bazar</td> <td data-bbox="927 981 1361 1010">: Centre for Natural Resource Studies</td> </tr> </tbody> </table>	<u>Regional Name: Administrative Unit of Forest Department</u>	<u>NGO organizational name</u>	Chattogram North Forest Division	: Dhaka Ahsania Mission	Chattogram South Forest Division	: Dhaka Ahsania Mission	Wildlife Management & Nature Conservation Division, Ctg	: Dhaka Ahsania Mission	Coastal Forest Division, Bhola	: Proshika Manobik Unnayan kendra	Coastal Forest Division, Patuakhali	: Proshika Manobik Unnayan kendra	Costal Forest Division Chattogram	: Shabolombi Samaj Unnayan Sangstha	Costal Forest Division, Noakhali	: Shabolombi Samaj Unnayan Sangstha	Cox's Bazar North Forest Division	: Nature Conservation Management	Cox's Bazar South Forest Division	: Nature Conservation Management	Dhaka Forest Division	: Eco-Social Development Organization	Tangail Forest Division	: Eco-Social Development Organization	Mymensingh Forest Division	: Eco-Social Development Organization	Sylhet Forest Division	: Centre for Natural Resource Studies	Wildlife Management & Nature Conservation Division, Moulabi Bazar	: Centre for Natural Resource Studies
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Mymensingh Forest Division	: Eco-Social Development Organization																														
Sylhet Forest Division	: Centre for Natural Resource Studies																														
Wildlife Management & Nature Conservation Division, Moulabi Bazar	: Centre for Natural Resource Studies																														

Source: JICA Survey Team

## (7) Other related organizations

Educational research institutes include universities and research institutes under the umbrella of the Forest Department. Khulna University is in the center of the Khulna district where the mangrove forest in Sundarbans is distributed, and there is a laboratory of mangrove forest in the University of Forestry, and a professor who acquired a degree in Ryuky University is engaged in research and student education. The Department of Education, Training and Training of the Forest Department includes the Chattogram University of Forestry and the Laboratory of Forest Sciences (Daka, Sylhet, Rashani Rajshani). In addition, in Kaptai, Langamati district, CHT, there is a training institute "Forest Development and Training Centre (FDTC)" for Forest Department staff.

## 3.4 Other Government Agencies

### (1) Bangladesh Water Development Board (BWDB)

The Bangladesh Water Development Board (BWDB) is an organization under the Ministry of Water Resources (MoWR). Embankments are being constructed as part of water management and flood control measures in rural and urban areas outside forests. The ongoing "Coastal Embankment Improvement Project" (World Bank Financial Support) covers the southern coastal area, and the "Haor Flood Management and Livelihood Improvement Project" (Japanese ODA Yen Loan Project) covers the Haor (large wetlands in the northeastern region) in the Sylhet division.

When planting trees in the surrounding area, BWDB entrusts the afforestation activities to the Forest Department. Activities by the Forest Department for levee afforestation (NbS-DRR) under this system are included in the potential collaboration in two divisions, Sundarbans and Sylhet, proposed in Chapter 5 (see Tables 5-7 and 5-9).

## Chapter 4 Current Situation and Challenges of Major Forest Landscapes

For the major forest landscapes in Bangladesh shown in Figure 2-2, Chapter 4.1 through Chapter 4.6 describe forest types, their areas, status, and challenges in forest management. It is added with the key socioeconomic data of population and agricultural production.

Chapter 4.7 through Chapter 4.9 describes the key issues in the forestry sector associated to all forest landscapes such as utilization of the advanced technologies in forest monitoring and information system, mobilization of external fund, management of the reserved forests, collaborative forest management, capacity development of the offices and staff of the Forest Department, etc.

### 4.1 Chattogram Hill Tracts (CHT)

#### (1) Forest area on the land cover map

The Chattogram Hill Tracts are the forest landscape in Bangladesh where natural distributes in hilly and mountainous areas. There are very few planted forests compared to the scale of natural forests. In the land cover map, the area of "shrub with scattered trees" is equal to or larger than that of natural forests, and all districts are occupied by these two types of vegetation, particularly in Bandarban and Khagrachari districts. This indicates that shifting cultivation with short-term fallow has been traditionally practiced and is currently in the process of expanding in natural forest areas.

**Table 4-1 Forest Types and Areas in CHT (ha)**

Target district	Natural forest	Artificial forest	Mangrove natural forest	Mangrove plantation	Other
Bandarban	216,201	103	-	-	-
Khagrachari	103,121	3	-	-	-
Rangamati	308,554	-	-	-	-
<b>Total</b>	<b>627,876</b>	<b>106</b>	-	-	-

Source: "Land Cover Atlas of Bangladesh 2015 in Support of REDD+ ". The Forest Department, Government of Bangladesh, 2022.

#### (2) Natural area of districts, population, number of households and sub-districts

Total area of the three districts located in the Chattogram Hill Tracts is 13,344 km<sup>2</sup>, which accounts for 9.08% of the national land. The population is approximately 1,840,000 and represents approximately 1.12% of the total population of the country. The population density is 184 people per km<sup>2</sup>, which is about 10% of the national average. Compared to the paddy farming villages in the delta area which occupy most of the land area of the country, ethnic minorities who engage in traditional shifting cultivation form scattered settlements in hilly areas that are mainly sloped and have poor access to transportation and water resources.

**Table 4-2 Area, Population, Number of Households, and Sub-districts in CHT**

District	Area(km <sup>2</sup> )	Population	Number of households	Sub-district <sup>1)</sup>
Bandarbans	4,479.0	481,109	106,167	Six sub-districts: Alikadam, Bandarbans Sadar, Lama, Naikhyongchari, Ruma, Thanchi
Khagrachari	2,749.2	714,119	169,526	Nine sub-districts: Dighinal, Guimara, Khagrachari Sadar, Laxmichari, Mahalchari, Manikchari, Matiranga, Panchari, Ramgarh
Rangamati	6,116.1	647,587	153,484	10 sub-districts: Bagaichari, Barkal, Belaichari, Juraichari, Kaptai, Kaukhali, Langadu, Nanniarchar, Rajosthali, Rangamati Sadar

District	Area(km <sup>2</sup> )	Population	Number of households	Sub-district <sup>1)</sup>
<b>Total</b>	<b>13,344.3</b>	<b>1,842,815</b>	<b>429,177</b>	<b>25 sub-districts</b>

Note 1): Sub-district is called "Upazila" in Bengali. It is a key unit of local administration.

Source: Website of the Forest Department and the Population and Housing Census (2022), compiled by JICA Survey Team

### (3) Agricultural population and production

The percentage of agricultural population in the Chattogram Hill Tracts is 27.70%, which is more than twice the national average of 13.48%. However, due to the lack of flat land and the extending hilly terrain, hemp is not produced, and the production of paddy rice, potatoes, and bananas is lower than in other areas.

Not included in agricultural census, but because of the tradition of shifting cultivation on mountainous slopes, the production of upland rice, not paddy rice, should be well practiced. The two districts of Rangamati and Khagrachari produce 1,846 ton and 2,626 ton of corn, respectively, which are higher than the other district of Chattogram division. Agricultural production in this region is characterized by hilly areas, low population density, and traditional shifting cultivation.

**Table 4-3 Agricultural Population and Production of Major Crops in CHT**

Target district	Agricultural population	Agricultural population ratio (%)	Paddy rice	Hemp	Potato	Banana
Bandarbans	119,960	24.93	78,735	-	5,729	18,430
Khagrachari	173,488	24.29	139,838	-	7,000	26,938
Rangamati	217,019	33.51	66,031	-	3,433	42,734
<b>Total</b>	<b>510,467</b>	<b>27.70</b>	<b>284,604</b>	<b>-</b>	<b>16,162</b>	<b>88,102</b>

Note :All agricultural crops (paddy rice, hemp, potato, banana) are indicated in ton (1 ton=1,000 kg).

Source: Prepared by JICA Survey Team based on the data provided in Agriculture Census 2019, Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of Bangladesh.

### (4) Current situation and challenges of forest management

Table 4-4 shows the current situation and challenges of forest management in Chattogram Hill Tracts.

**Table 4-4 Current Situation and Challenges of Forest Management in CHT**

Item	Content
Target forest area (ha)	<ul style="list-style-type: none"> <li>➤ Approximately 64% of the forest area is Unclassified State Forest (USF), but most of it is managed by District Council's Revenue Department. Major part of this forest is sparse woodland and bare land.</li> <li>➤ The remaining 36% are Reserved Forest (RF) managed by the Forest Department. Many of Reserved Forests have closed canopy.</li> <li>➤ The Reserved Forest managed by the Forest Department is 394,567 ha, the forest of USF managed by the district council is 692,960 ha. USF is 1.76 times larger than RF.</li> </ul>
Vegetation	<ul style="list-style-type: none"> <li>➤ Forests in CHT are semi-evergreen forests (intermediate between deciduous and evergreen forests)</li> <li>➤ Representative tree species: <i>Anisoptera scapula</i>, <i>Artocarpus chama</i>, <i>Chukrasia velutina</i>, <i>Dipterocarpus spp.</i>, <i>Duabanga grandiflora</i>, <i>Hopea odorata</i>, <i>Michelia champaca</i>, <i>Swintonia floribunda</i>, <i>Syzygium firmum</i>, <i>Toona ciliata</i>, <i>Xylia xylocarp</i></li> </ul>
Issues and Responses	<p>1) General situation</p> <p>CHT remains the only mountain forest in Bangladesh, which is included in the Global Biodiversity Hotspot (Indo-Burma). Although endangered species are also concentrated in the country their habitats continue to deteriorate and shrink as economic development and population pressure expand. For example, peculiar animal and plant species including endangered species lose their habitats, such as disruption of the Asian elephants' migration pathways, and thus face a dangerous situation in biodiversity conservation.</p>

Item	Content
	<p>On the other hand, a project is underway to promote the introduction of agroforestry to reduce the dependency on natural forest resources for residents living in forest USF managed by District Council by USADI/UNDP and technology transfer to ordinary fields incorporating soil conservation technology in sloped land. It is hoped that the results of activities at the pilot level will be developed in a wide area in the future.</p> <p>2) Technical challenges</p> <ul style="list-style-type: none"> <li>➤ Traditional shifting cultivation called "Jhum" Cultivation has been carried out.</li> <li>➤ Previously, the fallow period was 10-20 years, but now it is shorter than 3-4 years, and as a result, the period of bare ground becomes relatively longer, and the degree of erosion becomes high.</li> <li>➤ This causes deforestation and forest degradation, and the recovery of land fertility cannot be achieved.</li> <li>➤ As a result, this phenomenon causes sheet erosion and flows into the river, and the rise of the riverbed expands the scale of the flood and increases the damage.</li> </ul> <p>3) Administrative organizational issues</p> <ul style="list-style-type: none"> <li>➤ The Forest Department mainly manages the Reserve Forests while the District Council manages Unclassified State Forest (USF).</li> <li>➤ The Forest Department is under the Ministry of Environmental, Forest and Climate Change (MoEFCC) of the central government. District council is under the Minister for the Ministry of Chattogram Hill Tracts Affair (MoCHTA).</li> <li>➤ There are six organizations under MoCHTA, and District council are in the center of the district.<sup>21</sup></li> <li>➤ There are many stakeholders involved in forest issues, which requires due attention in designing the mechanism of the project operation in this area.</li> </ul>

Source: JICA Survey Team

## 4.2 Chattogram West Forest Zone

### (1) Forest area on the land cover map

In the western forest area of the Chattogram, natural forests are distributed in areas near the Chattogram Hill Tracts, particularly on the east side, among the hilly areas extending from north to south. Plantations are distributed in the hilly areas on the west side near the sea in two districts, Chattogram and Cox's Bazar. Mangrove plantation in two districts is concentrated in coastal area in the northern region, which is the result of afforestation in the past.<sup>22</sup>

**Table 4-5 Forest Types and Areas in Chattogram West Forest Zone (ha)**

Target district	Natural forest	Artificial forest	Mangrove natural forest	Mangrove plantation	Other
Chattogram	41,324	13,756	-	5,094	-
Cox's Bazar	6,754	8,386	-	5,658	-
<b>Total</b>	<b>48,078</b>	<b>22,142</b>	-	<b>10,752</b>	-

Source: "Land Cover Atlas of Bangladesh 2015 in Support of REDD+ ". The Forest Department, Government of Bangladesh, 2022.

### (2) Natural Area of districts, population, number of households, and sub-districts

The total area of the two districts in Chattogram West Forest Zone is 7,775 km<sup>2</sup>, which accounts for 5.29% of the national land. The population is approximately 1.2 million and represents approximately 7.23% of the total population. Density is 1,542 people per km<sup>2</sup>, which is close to 1.4 times the national average.

One of the reasons for this high population density is the presence of Chattogram City (population: about 2.6 million), the second largest city in Bangladesh after Dhaka, and the fact that, unlike the three

<sup>21</sup> (1) Chattogram Hill Tracts Regional Council,(2) Chattogram Hill Tracts Development Board,(3) Task Force on Repatriation and Resettlement of Returned Tribal Refugees and Internal Refugee Designation and Resettlement (4) Rangamati Hill District Council,(5) Khagrachari Hill District Council,(6) Bandarban Hill District Council,

<sup>22</sup> As mentioned in the footnote in Section 2.2.1(1), field survey was not done in Chattogram West Forest Zone.

districts in the Chattogram Hill Tracts to the east, the Chattogram West Forest Zone has been cultivated from the delta area in the past, and rural settlements and arable land have spread to the hills. In recent years, there has been an influx of refugees from neighboring Myanmar into Cox's bazar district.

**Table 4-6 Area, Population, Number of Households, List of Sub-district in Chattogram West Forest Zone**

District	Area(km <sup>2</sup> )	Population	Number of households	Sub-district
Chattogram	5,282.9	9,169,464	2,143,958	15 sub-districts: Anwara, Anchali, Boalkhali, Chandanaish, Fatikchhari, Hathazari, Karnaphuli, Lohagara, Mirsharai, Patiya, Rangunia, Raojan, Satkania, Sitakunda, Sandwip
Cox's Bazar	2,491.9	2,823,265	587,127	Eight sub-districts: Chakoria, Cox's Bazar Sadar, Kutubdia, Moheshkhali, Pekua, Ramu, Tekanf, Ukhyia
<b>Total</b>	<b>7,774.8</b>	<b>11,992,729</b>	<b>2,731,085</b>	<b>23 sub-districts</b>

Source: Website of the Forest Department and the Population and Housing Census (2022), compiled by JICA Survey Team

### (3) Agricultural population and production

The agricultural population in Chattogram West Forest Zone is 5.25%, which is less than half of the national average of 13.48%. This lower value is thought to be influenced by the concentration of non-agricultural population in the Chattogram, the second city of Bangladesh. Paddy rice-based agriculture is practiced on the narrow plains.

**Table 4-7 Agricultural Population and Production of Major Crops in Chattogram West Forest Zone**

Target district	Agricultural population	Agricultural population ratio (%)	Paddy rice	Hemp	Potato	Banana
Chattogram	439,066	4.79	789,221	-	47,804	14,513
Cox's Bazar	190,144	6.73	415,327	-	16,085	2,316
<b>Total</b>	<b>629,210</b>	<b>5.25</b>	<b>1,204,548</b>	<b>-</b>	<b>63,889</b>	<b>16,829</b>

Note: All agricultural crops (paddy rice, hemp, potato, banana) are produced in ton (1 ton=1,000 kg).

Source: Prepared by JICA Survey Team based on the data provided in Agriculture Census 2019, Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of Bangladesh.

### (4) Current situation and challenges of forests management

Table 4-8 shows the present status and challenges of forest management in Chattogram West Forest Zone.

**Table 4-8 Current Situation and Challenges of Forest Management in Chattogram West Forest Zone**

Item	Content
Target forest area (ha)	<ul style="list-style-type: none"> <li>➤ Forests managed by the Forest Department: Reserved Forest: 218,087 ha, Protected Forest: 32,357 ha, Acquired Forest: 6,638 ha, Total: 257,083 ha,</li> <li>➤ About 85% of the forest area is Reserved Forests, 12.6% is protected forest.</li> </ul>
Vegetation	<p>Forest is a semi-evergreen forest (intermediate between deciduous and evergreen forests)</p> <p>Representative Trees: Same as Chattogram Hills Tracts</p> <p><i>Anisoptera scapula</i>, <i>Artocarpus chama</i>, <i>Chukrasia velutina</i>, <i>Dipterocarpus spp.</i>, <i>Duabanga grandiflora</i>, <i>Hopea odorata</i>, <i>Michelia champaca</i>, <i>Swintonia floribunda</i>, <i>Syzygium firmum</i>, <i>Toona ciliata</i>, <i>Xylia xylocarpa</i></p>

Item	Content
Issues and Responses	<ul style="list-style-type: none"> <li>➤ Encroachment and settlement are advancing in Reserve Forest distributed in mountainous areas of Chattogram and Cox's Bazar districts. Under these circumstances, Reserved Forest vegetation needs to be restored by planting.</li> <li>➤ The approach of Collaborative Forest Management (CFM) implemented by SUFAL Project in the southern coastal area can be applied, but its improvements is necessary based on experiences and lessons learned.</li> <li>➤ According to the Forest Department, most of the population settled in the Reserved Forest are Bengal people rather than the ethnic minorities. However, the relations between the Forest Department and the population in Reserved Forest are rather severe than those in the southern coastal areas.</li> <li>➤ It is not clear what kind of the forest management is necessary for Reserved Forest applying CFM which can coexist the forest management and the livelihood of local people. It is obvious that forest conservation in Reserved Forest and the securing of livelihoods for the inhabitants are the main issue to tackle the problem, and the Forest Department is the main actor in this trend.</li> <li>➤ To address these challenges, the Forest Department is continuing to manage forests for Reserved Forest. More involvement of the rural communities is the key issue in securing the forest conservation and improving the livelihood of the forest dependent community.</li> </ul>

Source: JICA Survey Team

### 4.3 Sal Foerst

#### (1) Forest area on the land cover map

Natural forests in the Sal Forest of northern Dhaka are mainly composed of Sal tree *Shorea robusta* and *Dipterocarpus spp.* are distributed in a few hilly areas (Gazipur district) and flat areas. Planted forests may include *Albizia spp.* forests planted in and around the Indian border hills (Sherpur district) and protected areas, as well as forests on public and private lands through social forestry programs. There is no mangrove forest in this area.

**Table 4-9 Forest Types and Areas in Sal Forest (ha)**

Target	Natural forest	Artificial forest	Mangrove natural forest	Mangrove plantation	Other
Gazipur	7,894	5,706	-	-	-
Mymensing	1,317	1,628	-	-	-
Sherpur	490	3,073	-	-	-
Tangail	6,674	9,654	-	-	-
<b>Total</b>	<b>16,375</b>	<b>20,061</b>	-	-	-

Source: "Land Cover Atlas of Bangladesh 2015 in support of REDD+ ". The Forest Department, Government of Bangladesh, 2022.

#### (2) Natural Area of district, population, number of households, and sub-districts

The total area of the four districts included in the Sal Forest area is 10,980 km<sup>2</sup>, 7.47% of total land area. The population is about 16.7 million and corresponds to about 10% of the total population. Density is 1,521 people per km<sup>2</sup>, which is higher than the national mean of 1,113 people per km<sup>2</sup>. Although it is a forest area, it is a flat land located near the metropolitan area of Dhaka, with a large population of major cities such as Gaziphur and Mymensing, which is likely to affect to deforestation and expanding cultivation.

**Table 4-10 Area, Population, Number of Households, and Sub-district in Sal Forest**

District	Area(km <sup>2</sup> )	Population	Number of households	Sub-district
Gazipur	1,806.4	5,263,474	1,579,844	Five sub-districts: Gazipur Sadar, Kaliganj, Kalikoir, Kapasia, Sreepur

District	Area(km <sup>2</sup> )	Population	Number of households	Sub-district
Mymensing	4,394.6	5,899,052	1,460,900	13 sub-districts: Bhaluka, Dhobaura, Fulbari, Gaffargaon, Gouripur, Haluaghat, Ishwarganj, Muktaganj, Mymensing Sadar, Nandail, Phulpur, Tarakhandi, Trishal
Sherpur	1,364.7	1,501,853	396,151	Five sub-districts: Nalitabari, Jhenaigati, Nakla, Sherpur Sadar, Sreebordi
Tangali	3,414.3	4,037,608	1,061,749	11 sub-districts: Basail, Bhuanpur, Delduar, Dhanbari, Ghatail, Gopalpur, Kalihati, Madhupur, Mirzpur, Nagarpur, Shakhipur,
<b>Total</b>	<b>10,980.00</b>	<b>16,701,987</b>	<b>4,498,644</b>	<b>34 sub-districts</b>

Source: Website of the Forest Department and Population and Housing Census (2022), compiled by JICA Survey Team

### (3) Agricultural population and production

The agricultural population of Sal Forest area is 15.90%, which is slightly higher than the national average of 13.48%. It has major cities such as Gazipur and Mymensing, but its surroundings are rural areas of delta. It produces paddy rice (three seasonal crops throughout the year), hemp, and potatoes and bananas.<sup>23</sup>

**Table 4-11 Agricultural Population and Production of Major Crops in Sal Forest**

Target district	Agricultural population	Agricultural population ratio (%)	Paddy rice	Hemp	Potato	Banana
Gazipur	223,292	4.24	396,413	12,918	3,825	9,163
Mymensin	815,759	13.83	1,776,406	52,209	41,217	36,200
Sherpur	569,918	37.95	582,160	17,666	83,350	3,481
Tangali	1,046,419	25.92	945,777	151,530	53,054	88,315
<b>Total</b>	<b>2,655,388</b>	<b>15.90</b>	<b>3,700,486</b>	<b>234,323</b>	<b>181,446</b>	<b>137,159</b>

Note: All agricultural crops (paddy rice, hemp, potato, banana) are produced in ton (1 ton=1,000 kg).

Source: Prepared by JICA Survey Team based on the data provided in Agriculture Census 2019, Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of Bangladesh.

### (4) Current situation and challenges of forest management

Table 4-12 shows the present status and challenges of forest management in Sal Forest.

**Table 4-12 Current Situation and Challenges of Forest Management in Sal Forest**

Item	Content
Target forest area (ha)	<ul style="list-style-type: none"> <li>➤ Reserved Forest (RF): 99,955ha managed by the Forest Department</li> <li>➤ Trees Outside Forest (TOF): 488,092 ha</li> <li>➤ Area of deforestation (2000-2015) negative 18%. The rate of deforestation is the highest among six forest landscapes. Most are TOF.</li> </ul>
Vegetation	Priority <i>Shorea robusta</i> , and other <i>Albizia spp.</i> , <i>Artocarpus heterophyllus</i> ,
Issues and Responses	<ul style="list-style-type: none"> <li>➤ Forests in this area are mainly distributed in TOF and are highly vulnerable to land use conversion. In TOF, planting agreement with inhabitants to prioritize use of agricultural land and securing planting area are problems. Even if planting is agreed, in reality, the planting tree species are biased to the exotic</li> </ul>

<sup>23</sup> The yield of paddy rice is the sum of the three periods. The cultivars differ in each season. (One example of cultivation period) "Aman" Rice: July to November, "Boro" Rice: 12 months to March, "Aus" Rice: April to June. In addition, the cultivation area and the cropping season of hemp are almost the same as those of "Aus" Rice cultivated in high rice fields. (Source: Haruo Tanaka, "Stabilization of Flood Damage and Rain Rice Culture in Haor, Bangladesh," Journal of the Agricultural and Civil Engineering Society, Vol. 60, No. 6, 1990)

Item	Content
	<p>fast-growing trees by the intention of the inhabitants. Approximately 50% of the species are exotic species. Repeated short-term harvest rotation of premature trees has reduced soil fertility and impacted negatively to harvest volume and earnings. There is concern about the progress of agricultural land conversion.</p> <ul style="list-style-type: none"> <li>➤ In Reserved Forest, people participate in tree-planting activities based on Social Forestry Rule. As a consequence, the number of exotic tree species is increasing in Reserved Forests.</li> <li>➤ The introduction of Collaboration management (incentive-giving to the inhabitants) is assisting in natural renewal and promoting the creation of mixed forests by the mixed planting of native trees in degraded areas.</li> <li>➤ This aims to change the forest species from the economic forest to the environmental forest. Density control and thinning plans after planting have not been prepared. In the future, management planning will be prepared with the support of FAO.</li> <li>➤ In order to reduce the reliance on forest resources such as wood and fuel, SUFAL Project began a project to create alternative livelihoods as an incentive for cooperative management. Consideration of transfer to cooperative management is under way.</li> <li>➤ Field workers survey and identify the areas to be replanted, but this method requires a lot of time and cost.</li> </ul>

Source: JICA Survey Team

#### 4.4 Sundarbans

##### (1) Forest area on the land cover map

Forests distributed in Sundarbans are natural mangrove forests, almost entirely designated as Reserved Forest. The artificial forest is a slightly planted in the riverbank outside the Reserved Forest. The area has no natural forests in the inland area except for the natural mangrove forest of the Sundarbans reserved forest, and the artificial forest by the afforestation is very small.<sup>24</sup>

**Table 4-13 Forest Types and Areas in Sundarbans (ha)**

Target district	Natural forest	Artificial forest	Mangrove natural forest	Mangrove plantation	Other
Bagerhat	-	-	149,714	69	-
Khulna	-	-	146,849	112	-
Satkhira	-	-	103,331	230	-
<b>Total</b>	-	-	<b>399,894</b>	<b>411</b>	-

Source: "Land Cover Atlas of Bangladesh 2015 in support of REDD+ ". The Forest Department, Government of Bangladesh, 2022.

##### (2) Natural Area of the districts, population, number of households and sub-districts

The total area of the three districts in Sundarbans is 12,171 km<sup>2</sup>, which occupies 8.28% of the country land. The population is approximately 6,420,000 and represents approximately 3.89% of the total population. Density is 528 people per km<sup>2</sup>, which is about a half of the national average. This is because about a half of the area (6,000 km<sup>2</sup> = 0.6 million hectares) is designated as the Sundarbans Reserved Forest in the natural mangrove forest, and there are densely populated rural and urban areas outside the forest.

<sup>24</sup> According to "Land Use Atlas 2015", the area of mangrove natural forests is about 0.4 million hectares. This should be the same as the area of Sundarbans Reserved Forest, which is reported in other government documents as 0.6 million hectares. This discrepancy is probably because the registered reserved forest area includes water surface as shown in Figure 3-7.



**Table 4-14 Area, Population, Number of Households, and Sub-district in Sundarbans**

District	Area(km <sup>2</sup> )	Population	Number of households	Sub-district
Bagerhat	3,959.1	1,613,079	408,862	Nine sub-districts: Begarhat Sadar, Chitalmari, Fakirhat, Kachua, Mollahat, Mongla, Morelganj, Rampal, Sarankhola
Khulna	4,394.4	2,613,385	670,923	Nine sub-districts: Batiaghata, Dacope, Dighalia, Dumuria, Koira, Pikagacha, Phultala, Terokhada, Rupsha
Satkhira	3,817.3	2,196,581	566,752	4 sub-districts: Kaliganj, Satkhira Sadar, Shyamnagar, Tala
<b>Total</b>	<b>12,170.8</b>	<b>6,423,045</b>	<b>1,646,537</b>	<b>22 sub-districts</b>

Source: Website of the Forest Department and Population and Housing Census (2022), compiled by JICA Survey Team

### (3) Agricultural population and production

Ratio of agricultural population in the Sundarbans area is 15.06%, which is slightly higher than the national average of 13.48%. The outside of the Sundarbans Reserved Forest is rural area of delta similar the Sal Forest where paddy rice, hemp, and bananas are produced. However, because of the widespread environment of natural mangroves, the production of potatoes and bananas is lower than that of inland areas.

**Table 4-15 Agricultural Population and Production of Major Crops in Sundarbans**

Target district	Agricultural population	Agricultural population ratio (%)	Paddy rice	Hemp	Potato	Banana
Bagerhat	208,590	12.93	435,720	18,269	5,733	8,637
Khulna	443,230	16.96	514,397	16,383	10,616	5,124
Satkhira	315,750	14.37	548,397	126,129	40,498	6,241
<b>Total</b>	<b>967,570</b>	<b>15.06</b>	<b>1,498,514</b>	<b>160,781</b>	<b>56,847</b>	<b>20,002</b>

Note: All agricultural crops (paddy rice, hemp, potato, banana) are produced in ton (1 ton=1,000 kg).

Source: Prepared by JICA Survey Team based on the data provided in Agriculture Census 2019, Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of Bangladesh.

### (4) Current situation and challenges of forest management

Table 4-16 shows the status and challenges of forests management in the Sundarbans area.

**Table 4-16 Current Situation and Challenges of Forest Management in Sundarbans**

Item	Content
Target forest area (ha)	The forest area 600,129ha is all reserved forests (Sundarbans Reserved Forest: SRF) managed by the Forest Department. Most of them are natural mangrove forests, some of which are designated as World Natural Heritage Sites and all of which are designated as Ramsar Wetlands.
Vegetation	Major mangrove species: Sundri ( <i>Heritiera fomes</i> ): A native tree from which the name of "Sundarbans" was derived. (See photo in right) Gewa ( <i>Excoecaria agallocha</i> ) Goran( <i>Ceriops tagal</i> ) Passur ( <i>Xylocarpus mekongensis</i> ) Dhundul ( <i>Xylocarpus granatum</i> )
Issues and Responses	1) Technical challenges ➤ According to IUCN(2014), (i) resource overuse, (ii) resource overexploitation, (iii) changes in habitats due to natural phenomena, (iv) changes in hydrological regimes such as saltwater overflow due to reduced



Item	Content
	<p>river flow, (v) sedimentation of sand in waterways, (vi) climate change and sea level rise, (vii) water pollution, and (viii) over-tourism are issues.</p> <p>2) Social and political issues</p> <ul style="list-style-type: none"> <li>➤ Mangrove forests extend beyond national borders to the Indian side, and endangered species such as Bengal tiger need to be managed in cooperation with India.</li> <li>➤ Within SRF, it was designated as a strict reserve (such as World Heritage Sites: WHS, Wildlife Sanctuary: WS) mainly in the south. In other northern regions, administrative activities such as the promulgation of permission for collection to residents based on the Forest Department's Resource Survey (Nippa palm, etc.), prohibition of fishing and harvesting of forest products during the breeding season of animals living in SRF, and prohibition of residents from entering the border are required for three months from June to August of each year.</li> </ul> <p>3) Administrative organizational issues</p> <ul style="list-style-type: none"> <li>➤ According to interviews with the Forest Department, manpower, staff capacities, and materials and equipment are assigned to manage SRF. In addition, GIZ has been cooperating in monitoring and reporting illegal activities using IT. However, this situation is insufficient in comparison with the size of the target area.</li> </ul> <p>4) Biodiversity Conservation Issues</p> <ul style="list-style-type: none"> <li>➤ Sundri (<i>Heritiera fomes</i>) characterizes SRF predominate in intermediate salinity but tends to transition over time to more salinity tolerant tree species such as Gewa (<i>Excoecaria agallocha</i>) and Goran (<i>Ceriops tagal</i>) due to climatic changes and increased salinity caused by decreased freshwater supplies from rivers. In addition, Sundri of the main native tree species is problematic that the canopy is dead due to top dying disease. Though the cause is not clear, there is a possibility that the air root is hindered by the diffusion of the oil component by the passage of the ship, and the respiration necessary for the growth is inhibited.</li> <li>➤ SRF is a globally significant ecosystem, and projects aimed at protecting specified animals and plants, such as Tiger Conservation Project, are being carried out. The population of Bengal tiger is monitored by means of identification using camera traps. It has increased slightly from 106 in 2015 to 114 at present.</li> <li>➤ SRF is a Ramsar Treaty wetland as an internationally protected area but has not been managed as a Ramsar wetland, which requires monitoring by Ramsar Information Sheet, RIS, reporting, etc.</li> </ul> <p>5) Issues related to climate change</p> <ul style="list-style-type: none"> <li>➤ Saltwater ascending with decreasing river flow. Increase in salinity due to shortage of fresh water supply caused by decrease in flow rate (change in hydrological regime). As a countermeasure, BWBD (Bangladesh Water Development Board) and the Forest Department are working together to construct levees to prevent the entry of salt water and to plant trees to reinforce them.</li> </ul>

Source: JICA Survey Team

## 4.5 Southern Coast

### (1) Forest area on the land cover map

In the southern coast, three districts of Bhola and Patuakhali, Noakhali have planted trees in sedimentary lands. These plantations are the result of the government afforestation project since the 1960s. On the

other hand, there are no mangrove natural forests in these districts. In Barguna district, mangrove natural forests and plantation are distributed in the southern areas facing the Bay of Bengal. In the other two divisions (Pirojpur, Lakhapur), both the natural forest and the plantation of mangroves are not equal. Since the coastal area is easily accessed from the inland area, reclamation and settlement proceed from an early stage, and the cultivated land and settlement extends in the coast area.

**Table 4-17 Forest Types and Areas in Southern Coast (ha)**

Target district	Natural forest	Artificial forest	Mangrove natural forest	Mangrove plantation	Other
Barguna	-	-	2,292	2,778	-
Bhola	-	-	-	13,429	-
Lakhapur	-	-	-	-	-
Noakhali	-	-	-	13,833	-
Patuakhali	-	-	-	13,215	-
Pirojpur	-	-	-	159	-
<b>Total</b>	-	-	<b>2,292</b>	<b>43,414</b>	-

Source: "Land Cover Atlas of Bangladesh 2015 in support of REDD+ ". The Forest Department, Government of Bangladesh, 2022.

## (2) Natural area of districts, population, number of households, and sub-district

The total area of six district in the southern coast is 14,241 km<sup>2</sup>, which accounts for 9.69% of the national land area. The population is approximately 11,430,000 and represents approximately 6.93% of the total population. Population density is 803 people per km<sup>2</sup>, which is about 70% of the national average. Paddy rice cultivation and rural settlements account for major part of the land use. Six districts in the southern coast are located at the southernmost end of the delta, remote from the densely populated inland, and the lack of populated major cities is the background of relatively low population density as a whole.<sup>25</sup>

**Table 4-18 Area, Population, Number of Households, and Sub-districts in Southern Coast**

District	Area (km <sup>2</sup> )	Population	Number of households	Sub-district
Barguna	1,831.3	1,010,530	255,390	Six sub-districts: Amtali, Bamna, Barguna Sadar, Betagi, Pathargat, Taltali
Bhola	2,784.5	1,932,514	448,933	Seven sub-districts: Bhola Sadar, Borhanuddin, Charfassion, Daulatkhan, Lalmohan, Monpura, Tazumuddin
Lakshampur	1,440.4	1,938,111	459,381	Five sub-districts: Komol Nagar, Lakshampur Sadar, Raipur, Ramganj, Ramgati
Noakhali	3,685.9	3,625,252	776,034	Nine sub-districts: Begumganj, Chatkhil, Companiganj, Hatiya, Kabir Hat, Noakhali Sadar, Senbag, Sonaimuri, Subarnachar
Patuakhali	3,221.3	1,727,254	424,745	Eight sub-districts: Bauphal, Dashmina, Dumki, Galachipa, Kalapara, Mirjaganj, Patuakhali Sadar, Rangabali
Pirojpur	1,277.8	1,198,193	298,488	Seven sub-districts: Kawkhali, Mothbaria, Nazirpur, Nesarabad, Pirojpur Sadar, Zianagar, Bhandaria
<b>Total</b>	<b>14,241.2</b>	<b>11,431,854</b>	<b>2,662,971</b>	<b>42 Sub-districts</b>

<sup>25</sup> There are 11 major cities in Bangladesh where the government is governed by the "City Corporation." Of these, the five cities covered in this report are Gazipur and Mymensingh (Sal Forest), Sylhet, Khulna (Sundarbans), and Chattogram (west side of Chattogram forest).

Source: Website of the Forest Department and Population and Housing Census (2022), compiled by JICA Survey Team

### (3) Agricultural population and production

The agricultural population ratio in the southern coastal region is 11.49%, which is slightly lower than the national average of 13.48%. However, only Bhola district is 26.50%, more than twice the average. The paddy rice cultivation in low-lying land including sedimentary land is mainly carried out, and in Bhola district, the cultivation of potatoes seems to be also popular. Unlike inland areas, hemp is not cultivated except in Lakshmipur district.

**Table 4-19 Agricultural Population and Production of Major Crops in Southern Coast**

Target district	Agricultural population	Agricultural population ratio (%)	Paddy rice	Hemp	Potato	Banana
Barguna	122,560	12.13	341,054	-	11,866	1,397
Bhola	512,063	26.50	749,434	-	119,387	2,039
Lakshmipur	142,237	7.34	386,418	1,859	3,763	12,432
Noakhali	218,110	6.02	794,239	-	4,203	3,493
Patuakhali	178,816	10.35	411,820	-	9,335	1,886
Pirojpur	139,251	11.62	228,513	-	15,280	13,454
<b>Total</b>	<b>1,313,037</b>	<b>11.49</b>	<b>2,911,478</b>	<b>1,859</b>	<b>163,834</b>	<b>34,701</b>

Note: All agricultural crops (paddy rice, hemp, potato, banana) are produced in ton (1 ton=1,000 kg).

Source: Prepared by JICA Survey Team based on the data provided in Agriculture Census 2019, Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of Bangladesh.

### (4) Current situation and challenges of forests management

Table 4-20 shows the current situation and challenges of forests in the southern coast.

**Table 4-20 Current Situation and Challenges of Forest Management in Southern Coast**

Item	Content
Target forest area (ha)	<ul style="list-style-type: none"> <li>➤ Six districts of Noakhali, Lakhimpur, Patuakhali, Barguna, Pirojpur, Bhola</li> <li>➤ Reserved forests managed by the Forest Department (the sum of types 1 and 2 shown in Reserved Forest, Tables 3-5) 410,976 ha and other forest reserves (Protected Forest) 1,936 ha, total 412,913 ha, and 99.5% of the forest area is protected forests).</li> </ul>
Vegetation	<ul style="list-style-type: none"> <li>➤ Most of the forests in this area are plantation of mangrove species.</li> <li>➤ Representative species of afforestation: <i>Sonneratia apetala</i> and <i>Avicennia officinalis</i>, which account for 85% and 15% of plantations, respectively. In addition, native tree species such as <i>Heritiera fomes</i>, <i>Excoecaria agallocha</i>, <i>Xylocarpus mekongensis</i>, <i>Bruguiera sexangula</i>, <i>Ceriops dacandra</i>, <i>Sonneratia caseolaris</i> are also planted, but the survival rate is considerably lower.</li> <li>➤ Foreign fast-growing trees such as <i>Samanea saman</i>, <i>Casuarina equisetifolia</i>, <i>Pithecolobium dulce</i>, <i>Acacia nilotica</i>, <i>Albizia procera</i> other than mangrove tree species have also been planted and found to be suitable for coastal sedimentary areas.</li> </ul>
Issues and Responses	<ul style="list-style-type: none"> <li>➤ Coastal erosion and sedimentation due to cyclones, rising water levels, and flooding have reduced forests and threatened the living spheres of coastal inhabitants.</li> <li>➤ Tree planting is carried out in sediment (called "Char"), which is said to have 2,000 ha been newly formed every year. However, the concept of disaster prevention has not been introduced, and the target sites causing erosion and sedimentation have not been identified/predicted.</li> <li>➤ Forestry officials and local residents visually confirm the appearance of Char from the coast and plant trees there. The identification of the afforestation target site depends on the perceptual grasp of the site level, and there is no planning as a project.</li> </ul>

Item	Content
	➤ In Char, forestation has been carried out and a joint management approach between the Forest Department and the local community has been introduced. However, the sustainable management system has not been established, and the monitoring is also insufficient. Especially, the personnel and technical capability of the Forest Department are insufficient, and the management after the afforestation is not based on the objective data, and the actual condition is unknown.

Source: JICA Survey Team

## 4.6 Sylhet

### (1) Forest area on the land cover map

Forests distributed in the Sylhet area are broadly divided into two areas from their location. Since Sylhet and Sumanganj districts are mostly occupied by year-round and seasonal wetlands, marsh forests and marsh plantation are distributed. Natural forests and plantation in Sylhet are small-scale forests scattered in the surrounding hilly areas. The wet reeds are distributed in 11,109 ha. As shown in Tables 3-3, the Reserved Forest managed by the Forest Department in Sylhet division is approximately 65,000 ha, so it is probable that part of the wetland, which is the reed plain, is also included in the reserved forest. On the other hand, natural forests and plantation distributed in Habiganj and Moulvobazar districts are forests in mountainous areas that continue from Chattogram Hill Tract.

**Table 4-21 Forest Types and Areas in Sylhet (ha)**

Target district	Swamp forest	Marsh plantation	Natural forest	Artificial forest	Reed plain
Habiganj	-	-	5,077	3,916	-
Moulvobazar	-	-	2,605	22,571	-
Sunamganj	-	83	-	-	1,821
Sylhet	140	541	387	2,991	9,288
<b>Total</b>	<b>140</b>	<b>624</b>	<b>8,069</b>	<b>29,523</b>	<b>11,109</b>

Source: "Land Cover Atlas of Bangladesh 2015 in support of REDD+ ". The Forest Department, Government of Bangladesh, 2022.

### (2) Natural area of districts, population, number of households, and sub-district

The total area of the four districts included in Sylhet division is 12,635 km<sup>2</sup>, which occupies 8.59% of the national land. The population is approximately 11 million and represents approximately 6.67% of the total population. The population density is 873 people per km<sup>2</sup>, which is about 20% lower than the national mean. Seasonally extensive wetlands in addition to permanent wetlands may contribute to the lower rural population than the national average.

**Table 4-22 Area, Population, Number of Households, and Sub-districts in Sylhet**

District	Area (km <sup>2</sup> )	Population	Number of households	Sub-district
Habiganji	2,636.6	2,358,886	491,886	Nine sub-districts: Azmiriganj, Bahubal, Baniachong, Chunarugaht, Habiganj Sadar, Lakhai, Madhbpur, Nabiganj, Sayestagani
Moulvobazar	2,799.4	2,123,445	446,354	Seven sub-districts: Barlekha, Juri, Kamalganj, Kuluara, Moulvibazar Sadar, Rajnagar, Sreemangal
Sunamganji	3,747.1	2,695,495	528,550	12 sub-districts: Bishwamvarpur, Chhatak, Shantiganj, Derai, Dharamapasha, Dowarabazar, Jagannathpur, Jamalganj, Sullah, Sunamganj Sadar, Tahirpur, Madhyanagar

District	Area (km <sup>2</sup> )	Population	Number of households	Sub-district
Sylhet	3,452.1	3,857,037	746,867	13 sub-districts: Balaganj, Beanibazar, Biswanath, Companiganj, Dakhin Surma, Fenchuganj, Golapganj, Gowainghat, Jointiapur, Kanaighat, Osmaninagar, Sylhet Sadar, Zakiganj
<b>Total</b>	<b>12,635.2</b>	<b>11,034,863</b>	<b>2,207,489</b>	<b>41 sub-districts</b>

Source: Website of the Forest Department and Population and Housing Census (2022), compiled by JICA Survey Team

### (3) Agricultural population and production

The percentage of agricultural population in the Sylhet area is 10.32%, which is slightly lower than the national average of 13.48%. Paddy rice is produced actively because of the prevailing annual and seasonal wetlands, but the production of other crops is not as high as in other regions.

**Table 4-23 Agricultural Population and Production of Major Crops in Sylhet**

Target district	Agricultural population	Agricultural population ratio (%)	Paddy rice	Hemp	Potato	Banana
Habiganji	353,037	14.97	907,017	4,038	22,044	36,093
Moulvobazar	173,773	8.18	634,995	-	24,020	5,938
Sunamganji	370,200	13.73	617,496	2,698	3,818	N.A.
Sylhet	241,529	6.26	803,424	3,933	10,922	4,978
<b>Total</b>	<b>1,138,539</b>	<b>10.32</b>	<b>2,962,932</b>	<b>10,669</b>	<b>60,804</b>	<b>47,009</b>

Note: All agricultural crops (paddy rice, hemp, potato, banana) are produced in ton (1 ton=1,000 kg).

Source: Prepared by JICA Survey Team based on the data provided in Agriculture Census 2019, Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of Bangladesh.

### (4) Current situation and challenges of forests management

Table 4-24 shows the status and challenges of forests distributed in Sylhet.

**Table 4-24 Current Situation and Challenges of Forest Management in Sylhet**

Item	Content
Target forest area (ha)	Approximately 97% of 71,300 ha forest area in Sylhet division is managed by the Forest Department. In addition, 94% of them are managed as Reserved Forest, which is about 65,000 ha. As a characteristic of Sylhet district, there are cases where the wetland is designated as reserved forest and is managed by the Forest Department. The reserved forest area of Sunamuganji district where Tanguar Haor is distributed is 7,289 ha. On the other hand, in Sunamganj district, the area covered by the reserved forest 7,289ha should be a swamp forest (throughout the year and season) where the forest is scattered. Forests other than wetlands are mixed evergreen forest extending in the hilly area which continues from Chattogram Hill Tracts and extends north.
Vegetation	<b>Wetlands: Marsh and Swamp Forest</b> Koroch ( <i>Pongamia pinnata</i> ) Hijol ( <i>Barringtonia acutangular</i> ) Kadam ( <i>Anthocephala chinensis</i> ) Murta ( <i>Clinogyne dichotoma</i> ) <b>Hilly area: Mixed Evergreen Forests</b> <i>Shorea robusta</i> <i>Dipterocarpus turbinatus</i> <i>Michelia champaca</i> <i>Artocarpus chama</i>

Item	Content
Issues	<p><i>Lagerstroemia speciosa</i></p> <p>Sylhet division is divided into a seasonal wetland represented by Haor and hilly area. Therefore, the issues differ between wetland where swamp forests distribute and hilly evergreen forests.</p> <p><b>Wetland (Swamp Forest)</b></p> <p>1) Technical challenges</p> <ul style="list-style-type: none"> <li>➤ Tanguar Haor is a Ramsar Treaty wetland which is an internationally protected area. In the context of other reserves, they should be managed mainly by the Forest Department which has jurisdiction over reserve management and technical expertise such as monitoring, conservation of endangered species, control of alien species, management of over-use, and joint management with the community. However, there is no management by the Forest Department as a protected area at present.</li> <li>➤ In low-lying areas in Sunamganj district, the Forest Department manages the seasonal wetlands in Haor through social forestry scheme, but it is not the management based on the flood-disaster control and biodiversity conservation.</li> <li>➤ Seasonal wetland Haor is managed by the Forest Department as a reserved forest. Encroachment by the local communities for cultivation is a problem, but the effective and efficient patrol has not been carried out.</li> <li>➤ For reserved forests managed as protection objectives, there are some problems of over-tourism. The impact of noise on ecosystems due to lack of understanding by tour visitors and the dumping of waste including plastic waste give negative impacts to the surrounding environment.</li> </ul> <p>2) Social and political issues</p> <ul style="list-style-type: none"> <li>➤ As for Tanguar Haor, the owner of commercial tourism and the district authority who operate sightseeing boats in wetlands do not seem to wish to manage them as natural reserves because it restricts their business activities. Management by the Department of Environment (DOE) does not control commercial tourism thus, it is not sufficient to realize “wise use” of wetland as it is required by the Ramsar Treaty.</li> <li>➤ For the above reasons, many international projects have been implemented and are under planning, but they have not been sufficiently effective from the perspective of realizing biodiversity conservation and improving the livelihoods of the local communities at the same time.</li> </ul> <p>3) Administrative organizational issues</p> <ul style="list-style-type: none"> <li>➤ Tanguar Haor is designated as a Ramsar Treaty Wetland as an internationally protected area but not as a protected area under national law governed by the Forest Department. Instead, as Ecologically Critical Area (ECA) governed by the Tourism Department. However, its management is inadequate as mentioned above.</li> <li>➤ The resources of the Forest Department for the management of reserved forests including protected areas are not sufficient.</li> </ul> <p>4) Biodiversity conservation</p> <ul style="list-style-type: none"> <li>➤ Tanguar Haor is distributed not only in Haor, which is a seasonal wetland, but also in dry season, in which small wetlands called Beel are concentrated. Therefore, it is an extremely important for the conservation of biodiversity where many aquatic birds and fish are concentrated. However, management from the viewpoint of biodiversity is inadequate due to the lack of management by the Forest Department.</li> <li>➤ In addition to Tanguar Haor, there are wetlands that are treated as reserved forests managed by the Forest Department, and they are valuable as protected areas from the viewpoint of conservation of biodiversity.</li> </ul> <p>5) Issues related to climate change</p>



Item	Content
	<p>➤ Haor is a region where flooding damage frequently occurs, and tree planting in river embankments as a Nature-based DRR seems to be useful as an overwater countermeasure..</p> <p><b>Mixed Evergreen Forests (Hills)</b></p> <p>1) Technical challenges</p> <p>➤ The Forest Department manages seasonal wetland Haor as a reserved forest. However, illegal collection of firewood by the community people has become an issue while patrols to control it effectively have not been carried out.</p> <p>➤ For reserved forests managed as protected areas in national parks, etc., there are some problems with over-tourism. The impact of noise on ecosystems due to lack of understanding by tour visitors and the dumping of waste including plastic waste gives negative impacts to the surrounding environment.</p> <p>2) Social and political issues</p> <p>➤ As protected areas of national parks, etc., joint control with local communities based on Protected Rule 2017 is being carried out, but the capacity of both the Forest Department and the local communities to conduct their responsibilities is insufficient.</p> <p>3) Administrative organizational issues</p> <p>➤ The resources of the Forest Department for the management of reserved forests including protected areas are insufficient.</p> <p>4) Biodiversity Conservation Issues</p> <p>➤ Tours with noise and garbage problems caused by visitors in protected areas have adverse impacts on biodiversity.</p>

Source: 1) BFI (2015-2019), and JICA Survey Team

#### 4.7 Utilization of Advanced Technologies

In the Bangladeshi forest sector, introduction of the advanced technologies is being implemented in research programs, training and demonstration projects, based on the governmental DX promotion policies. This section outlines the main technologies which are being tested and practiced in the forest sector.

##### 4.7.1 Utilization of Advanced Technologies in Forest Management

- Utilization of UAV-Research stage  
UAV (Unmanned Ariel Vehicle) Identification and Survival Rate Survey of Tree Individuals Using Ultra High-Resolution Images (Case Study Stage at SUFAL Project Site)
- Applications of UAV x AI-Research stage  
Health monitoring of mangrove forests by remote sensing using Mangrove Health Index (MHI (case study stage at SUFAL project site)
- Lidar Biomass Estimation-Training stage  
With the support of USAID and others, several RIMS staff members participated in Lidar technical training in the Philippines. In Bangladesh, there are still no practical or demonstrative applications.
- Forest Mapping and Monitoring by Remote Sensing Using Synthetic Aperture Radar (Synthetic aperture radar : SAR)-Training stage.  
11 FD staff members participated in the forestry training held in 2022 by USAID, NASA and International Centre for Integrated Mountain Development (ICIMOD) using SAR imaging. The Forest Department staff are interested in the use of SAR images for forest-mapping and monitoring but have not yet been practiced enough.
- Smart Field Survey-Practical stage

- In SUFAL Project, i) smart field activity and status record (SSP) which records the planting place information using smart phones and tablets was introduced, and ii) monitoring application after planting is being developed.

#### 4.7.2 Utilization of Advanced Technologies in Biodiversity Conservation and Wildlife Management

- SMART-Practical stage  
An application SMART (Spatial Monitoring and Reporting Tool developed by the Global NGO WCS for Forest Department site workers has been introduced. With the assistance of USAID, a system is being developed to integrate the reported findings into BFIS.
- UAV-Practical stage  
The Forest Department has about 13 drones (DJI Matrice 200 series), which are used for surveillance of protected areas. However, they have not yet been used by forest administration, such as monitoring plantations after planting. According to RIMS Unit, there is a plan to further increase the number by the support of South Korean company.

### 4.8 Mobilization of External Funds

#### 4.8.1 Support by International Organizations and Major Donors

Projects supported by major donors and international organizations are shown in Table 4-25. Except for the World Bank-funded SUFAL Project shown in No.8, all supports are technical assistances. In the operation of SUFAL Project, a Project Management Unit has been set up in the Forest Department, and a dedicated staff member is engaged in assigned duties.

**Table 4-25 Projects Listed in the Annual Report of the Forest Department in 2022**

No	Organization	Completion year	Project Title
1	IDA of WB	2016	Strengthening Regional Cooperation for Wildlife Protection Project
2	BCCRF of WB	2016	Bangladesh Climate Resilience Participatory Afforestation and Reforestation Project
3	USAID	2017	Bengal Tiger Conservation Activity in Sundarbans
4	USAID	2018	Strengthening National Forest Inventory and Satellite Land Monitoring System in Support of REDD+ Bangladesh
5	UNDP, FAO	2018	UN REDD+ Bangladesh National Program
6	GEF	2020	Integrating Community-based Adaptation into Afforestation and Reforestation Program
7	GIZ	2022	Support to the Management of the Sundarbans Mangrove Forests (SMP-II)
8	WB	Implemented (2024)	Sustainable Forest and Livelihood Project (SUFAL, Loan)
9	GIZ	In progress	Integrated Management of the Coastal and Marine Areas of the Sundarbans and Swatch to No Ground

Source: JICA Survey Team

Although the content of Table 4-25 alone is not sufficient, the followings can be pointed out based on the information collected through the interviews to the stakeholders.

#### (1) Role of international organizations and cooperation with donor agencies

International organizations such as UNDP and FAO play a key role in networking donors and international NGOs in supporting the forestry sector of Bangladesh. For example, FAO took the lead in developing the Bangladesh Forest Information System (BFIS), which is the most important infrastructure in the forest sector, in connection with Forest Resource Assessment (FRA) which is implemented every five years. Currently, FAO is playing a leading role in introducing the concept and

approach of Forest Landscape Restoration (FLR), which is being promoted in the countries of Asian and Oceanian regions. In response to FAO's leadership, donors are developing concrete projects.

UNDP, on the other hand, has taken the lead in developing support and co-operation arrangements for the traditional areas in the forestry and natural resource sector, such as the Sundarbans and Chattogram Hill Tracts. Based on this, major donors such as USAID and GIZ have been developing technical assistance projects.

## (2) Terms of introducing financial assistance and background of SUFAL Project funded by the World Bank

On the other hand, the World Bank and ADB provide funding for issues that are conditioned to a certain extent. The three prerequisites for enabling financial cooperation in the forest sector are: (i) the existence of a certain number of lands for afforestation and afforestation that have not yet been a target of other financial assistance, and (ii) the existence of technical, methodological, and standardized designs that can be used for afforestation as government regulations, and (iii) the establishment of a project management unit (PMU) under the government budget by the Forest Department and the employment of dedicated staff and the establishment and management of a project implementation structure.

After the feasibility study was conducted in 2016, the conditions above were in place to start the SUFAL project financed by the World bank. In the context of technical cooperation, it is particularly important that "available technologies, methodologies, and standard designs and standards exist as government regulations" as mentioned in (ii). The government of Bangladesh has been planting trees for disaster prevention in the southern coastal region since the 1960s. Therefore, a technical system and standard designs for afforestation have been developed since then.<sup>26</sup>

Assuming that there is a need for financial cooperation in the government, if there is a certain scale of land subject to afforestation and reforestation, and if there is a government-defined technology and standard that can be utilized like the southern coastal region, the funding side will be able to consider implementing cooperation. This in turn motivates government agencies to launch their own government-funded setups of the project operation.

### 4.8.2 Projects Supported by the External Financial Sources

The following is an overview of typical external financing projects.

#### (1) Sustainable Forest and Livelihoods (SUFAL) Project

Sources of funds	World Bank: Financial Cooperation
Term	October 2018-December 2024
Subject land	64 sub-districts in 32 districts including four major forest ecosystems
Purpose	Improve forest collaboration management and increase the benefits of local residents relying on forest resources in target areas
Outline of Activities	<ul style="list-style-type: none"> <li>➤ Component 1: Organization Strengthening, Information Systems and Training                             <ul style="list-style-type: none"> <li>1.1 To strengthen institutional capacities</li> <li>1.2 Applied research</li> <li>1.3 Training</li> <li>1.4 Strengthening monitoring, information management system and forest inventory</li> <li>1.5 Public relations</li> </ul> </li> <li>➤ Component 2: Enhance collaborative forest management and protected area management                             <ul style="list-style-type: none"> <li>2.1 Institutionalization of collaborative management</li> <li>2.2 Rehabilitation of degraded forests and coastal areas, and renovation of site infrastructure</li> <li>2.3 Improvement of reserves and wildlife management</li> </ul> </li> </ul>

<sup>26</sup> It is necessary to confirm the existence of the technical system and standard design and standard in future.

	<ul style="list-style-type: none"> <li>➤ Component 3: Enhance access to alternative livelihoods creation and forest technology extension services and trees outside forests               <ul style="list-style-type: none"> <li>3.1 Promotion and organization of regional communities</li> <li>3.2 Activities to create alternative livelihoods</li> <li>3.3 Technology dissemination service for forests outside forests</li> </ul> </li> <li>➤ Component 4: Business management, monitoring and reporting               <ul style="list-style-type: none"> <li>4.1 Business management</li> <li>4.2 Monitoring, reporting and evaluation</li> </ul> </li> </ul>
Main results (As of August 2023)	<ul style="list-style-type: none"> <li>- A national integrated forest information system called BFIS was developed and started operation.</li> <li>- Site Specific Plan (SSP) were created in forested areas above 60,000ha, and collaborative management was introduced. Tree planting consists mainly of mixed planting of fast-growing trees and indigenous species in hilly areas (about 18,000ha) and planting of mangroves in coastal areas (about 25,000ha).</li> <li>- Institutionalization of forest management systems in cooperation with the communities who rely on forest resources living in and near forest areas (preparation of manuals, community organizing and implementation, etc.)</li> </ul>

Source: JICA Survey Team

## (2) Community Partnerships to Strengthen Sustainable Development Program (Compass)

Sources of funds	USAID: Technical assistance
Implementation period	From July 2019 to July 2024 (five years)
Target area	Bandarbans district in Chattogram division
Project Overview	<ul style="list-style-type: none"> <li>➤ Five components: (1) to establish the Bangladesh Youth Conservation Corps (YCC), (2) to strengthen the capacity of local communities and promote people's participation, (3) to strengthen technical cooperation on forest and ecosystem management, (4) to strengthen the capacity of academic and research institutions in natural resource management and ecosystem management, and (5) to promote international exchanges of knowledge and skills on natural resources.</li> <li>➤ Priority activities: 1) Introduction of agriculture improvement technique for reducing adverse effects by short fallow of the shifting cultivation "Jhum", 2) Support for improvement of livelihood: branding of NTFP and on-line market support, 3) Research by cooperation with U.S. universities, 4) Measures against erosion using local materials: Combination of bamboo check dam and conventional vegetation</li> </ul>
Implementation system and other features	<ul style="list-style-type: none"> <li>➤ USAID contributes funds, and United States Forest Service (USFS) is responsible for the implementation of the project.</li> <li>➤ USFS employs 25 Bangladesh national experts such as general managers, experts, administrations, coordinators, etc. to form a project-team. The project office is in Dhaka.</li> <li>➤ Field activities are carried out by national and local NGO. To carry out the activities, a contract is exchanged between USFS and those NGOs. National NGO has several field officers and staff who work with local NGO in the project target sites.</li> <li>➤ To improve expertise and skills, universities in the USA and Bangladesh connect each other to conduct together field surveys and present research results.</li> <li>➤ Capacity development for the staff of the Forest Department especially in forest inventory are also ongoing. This is based on the basic agreement between USAID and the government of Bangladesh.</li> </ul>

Source: USFS IP | Bangladesh (usfsbd.org), JICA Survey Team

### (3) Support to the Management of the Sundarbans Reserved Forest Project (SMP II)

Sources of funds	Technical assistance provided by GIZ
Implementation period	May 2019-July 2022
Target area	Sundarbans mangrove forests and neighboring communities
Project Overview	<ul style="list-style-type: none"> <li>➤ Sundarbans is the largest mangrove forest in the world. It is registered as a World Heritage Site in UNESCO as an important site for biodiversity conservation. In addition, the forests support more than 3.5 million livelihoods in 10km areas around Sundarbans. The Forest Department is working to protect mangrove forests, but the livelihoods of the neighboring people continue to affect Sundarbans.</li> <li>➤ To protect and manage 0.6 million hectares of mangrove forests, it is necessary for the Forest Department to acquire modern skills. On the other hand, local people who depend on forest resources, especially women, need to be involved in the management of natural resources.</li> <li>➤ Therefore, SMP II supported the joint management of forests and their resources. Based on the best practices and lessons learned in SMP I (2015~2019), the project enabled stakeholders to understand the benefits of conservation as well as asserting their rights. The Forest Department also introduced evidence-based monitoring and reporting tools (SMART).</li> </ul>
Implementation system and other features	<ul style="list-style-type: none"> <li>➤ SMP II cooperated with various groups such as the Village Conservation Forum (VCF), the Resource Utilization Group (RUG), and the Women Group (WG) to implement joint management.</li> <li>➤ The Forest Department introduced SMART to support the activities of the ranges of the Forest Department. This tool collects, stores, and analyses data on illegal behavior, wildlife witness information, patrol routes, etc., and provides effective insights to forest managers.</li> <li>➤ The introduction of systematic long-term ecological monitoring (EM) in Sundarbans has enabled us to grasp the present state of ecosystems and predict their effects. These measures were reflected in an updated version of the Integrated Resource Management Plan (IRMP 2030) for more effective conservation of Sundarbans.</li> </ul>

Sources: giz2022-en-support-to-the-management-of-the-sundarbans-reserved-forest-project.pdf (sharepoint.com) and JICA Survey Team

#### 4.8.3 Lessons Learned from Externally Funded Projects

##### (1) Improve efficiency and sustainability of support through collaboration with related ministries and agencies

In SUFAL Project, the Forest Department is working to maintain sustainability by carrying out activities in coordination with other related ministries and agencies. For example, the Ministry of Cooperative has concluded a memorandum on the sustainable management of alternative livelihoods generation projects and community-based organizations and has begun coordinating concrete collaborations. In addition, technical training on livestock and fisheries to communities in the alternative livelihood creation project involves technical extension workers in livestock and fisheries. Support is being provided to build relationships between the extension workers and the communities so that they can consult with the extension workers themselves even after the project is completed.

##### (2) Scaling up the project's outputs by mainstreaming them to maintain sustainability

SUFAL Project has developed a variety of tooling systems, including BFIS, SSP and collaborative management systems. These outcomes are urged to be integrated into part of the normal operations of the Forest Department. For example, BFIS is positioned as a national forest information-management

system. SSP is recognized as a formal tool for registering forest activities at the site. If the capacity of users is strengthened, the nationwide deployment of tool utilization will be realized. In addition, the Forest Department is urging the Ministry of Environmental, Forestry and Climate Change to continue the collaborative management system and develop it in other regions.

### **(3) Efficient support by multilateral institutions through collaboration with experienced NGO and private companies, and sustainability of support results**

In SUFAL Project, the creation of alternative livelihoods took the approach of the World Bank's Poverty-Reducing and Livelihood Improvement Program and entrusted the project to select NGO experienced in implementing the program. As a result, the Forest Department was able to streamline the training for NGO by focusing on the World Bank's safeguards and collaborative management manuals.

In the second field survey, JICA survey team conducted a workshop which was attended by NGO and forestry officials, both of whom are entrusted with livelihood-related projects. It was confirmed through comments and discussions by participants to continue and develop the community funds that have been created after the completion of the project. It is necessary to establish partnerships with banks that support fund management. Furthermore, to develop activities related to alternative livelihoods, it is necessary to strengthen cooperation with private companies. SUFAL Project is working to strengthen partnerships with related organizations to ensure the continuity of activities after the completion of the project in 2024.

### **(4) Ensuring a sufficient period for securing sustainability of project achievements and outputs**

As mentioned above, to strengthen the sustainability of activities related to alternative livelihoods, it is necessary to strengthen the relationship between the communities and the staff of the Forest Department, formulate exit strategies, and collaborate with other departments and the private sector to sustain the results of the project supports. However, in SUFAL project, related activities were suspended due to the impacts of COVID-19. Therefore, the implementation period of the activity became shorter than the initial plan, and the period for the sustainability enhancement was not sufficiently secured.

This was a case of an unexpected force majeure by COVID-19. At the same time, it was confirmed as a lesson to propose a process of securing a sufficient period of preparation for promoting the sustainability enhancement of activities related to livelihoods within the project period.

### **(5) Activities led by national expert and NGO who has contacts in the Forest Department**

UNDP and USAID employ local experts and contracts with national NGOs who further contracts with local NGO to carry out field activities. In this system of the project implementation, there is no international experts to be assigned in the target area. Instead, the project adopts advanced technology through collaboration between universities in the United States and Bangladesh.

In addition, in National NGO at Dhaka, which is responsible for on-site activities, senior officials who temporarily retire from the Forest Department and are scheduled to return to work in the future are assigned with the titles of director and specialist. They take full advantage of the central and local contacts they have cultivated during their work at the Forest Department and the expertise in forest administration to oversee and guide project activities by local NGO and coordinate with relevant agencies on key issues in the project target districts.

## **4.9 Cross-cutting Issues**

Challenges in forest management and biodiversity conservation in the forest landscapes which are described in this chapter, as well as future challenges related to the use of advanced technologies and mobilization of external funds, may be directly linked to specific regional situations, the nature of the technologies introduced, and the policies of the organization. Further examination of these challenges raises cross-cutting issues in the forest sector of Bangladesh as outlined below.

### **(1) Accurate grasping of the forest resources and reflection to policy targets**

Regular grasp of forest resources which are the foundation of forest administration, and improvement of the method and accuracy is issues to be addressed. Except natural mangrove forests in the Sundarbans area, forests in Bangladesh have a serious competition with land-use expansion due to agriculture,

housing, and other development purposes. As noted at the end of Chapter 3.2.1(2), if this condition is left unattended, there is a possibility that the Reserved Forest will further be degraded and decrease its area in the future. In the Sal Forest area, it is a typical example of the rapid segmentation and fragmentation of the forest by the development.

As shown in the footnote in Chapter 4.4 (1), the area of reserved forests managed by the Forest Department may differ greatly from the area of forests identified as land cover. This means that there is a technical problem related to the identification of forest vegetation, or the fact that vegetation other than forest is spreading in the reserved forest.

"Restoring forests where they should be" is fundamental to the policy and target setting in the forest sector. To set steady targets based on actual conditions, it is important to regularly grasp forest resources using highly accurate technologies. In this sense, the use of advanced IT in the forest sector is primarily aimed at establishing highly accurate forest monitoring techniques. In addition, mechanisms and institutional arrangements are necessary to reflect those results in setting medium and long-term targets for the forest sector.

### **(2) Clear management policies and objectives based on an understanding of actual conditions in reserved forests**

As shown in (1) above, if the present trend remains unchanged in the future, the reserved forests in low-lying and hilly areas will further accelerate deforestation and forest degradation in the future. This is mainly because residents seeking land for their livelihoods tend to encroach forests managed by the Forest Department including reserved forests and change the forest into residential area or agricultural land through cultivation or continue to cut trees at a speed higher than natural regeneration. In Chattogram Hill Tracts, Google Earth photographs clearly show a mosaic-like and widespread conversion of forests into agricultural land, particularly in reserved forests.

Under this situation, the Forest Department has an intention to adopt a collaborative forest management (CFM) method and regenerate forest vegetation while securing the benefits for the livelihoods of the people. The future vision of reserved forests realized through such efforts is that forest vegetation and the livelihoods of residents living in the vicinity or in forests are maintained in harmony with each other. Based on the lessons learned from CFM pilot, it is necessary to consider what kind of policy and goal should be set and implemented in the reserved forests management in the future and what kind of viewpoints to evaluate it.

### **(3) Paradigm change in the approach and methodology of forest management: Promotion of Collaborative Forest Management**

Collaborative Forest Management (CFM) introduced by the Forest Department in SUFAL Project aims to build a more sustainable and high-quality forest management system by expanding the target to the livelihood activities of the inhabitants and improving it.

As discussed in Chapters 4.1 to 4.6, all regional forest landscape issues are fundamentally related to the livelihoods of local community. To achieve better forest management, it is fundamental to position the community people as a forest management partner with common objectives with the Forest Department.

In this sense, SUFAL project-based activities are extremely valuable in identifying challenges to the effectiveness and remediation of CFM. Standardization of implementation methods and approval by the Forest Department are required to spread CFM over a wide area based on the results of SUFAL projects.

Gender consideration is one of the key factors in CFM standardization. In addition to forest-management activities, CFM also includes activities to improve the livelihoods of the community. It covers activities for livelihoods in general and supports the establishment and operation of community funds, agricultural production and livestock rearing by inhabitant groups, and other cash income activities. In many cases, it is the women who play a substantial role in these activities. Therefore, it is necessary to promote women's participation in CFM activities, and to give consideration and methods to women's concrete participation in group-wide consultations, decision-making, and management.



**(4) Development of human resources as the foundation of sustainability**

Looking at the structure of the Forest Department concerning human resource development, five education and training facilities have been established under the Education and Training wing. Forest Academy in Chattogram and Forest Development Training Centre (FDTC), Forest Development Training Institute in Kaptai, three Forestry Science and Technology Institute (FSTI) in Sylhet, Chattogram, and Rajshahi.

These facilities provide training and education on basic forest management, watershed management, joint forest management, and wildlife management. The city of Gazipur also has Wildlife Centre which provides training specializing in wildlife management. Training to crack down on illegal practices in forests is the responsibility of the police.

Programs of the training are targeted at the staff of the Forest Department, and no training is provided to NGO or other organizations that undertake the project. In addition, the education and training provided at these facilities are basically orthodox. Therefore, there are limitations in acquiring the latest and most advanced technology from these institutes program. The Educational and Training wing is keenly aware of the needs to improve ITs of forest management operations. However, the educational materials and the content of the training remain traditional, thus it is recognized that fundamental reforms are required.

For this reason, forestry management that incorporates advanced technologies such as ICT and AI needs to be addressed in an On-the-Job Training (OJT) manner in ongoing technical assistance projects. Seen from the situation in the neighboring India, the promotion of DX in the practice of forest administration in Bangladesh should become the mainstream of technical assistance. The promotion of DX should be one of the pillars of future technical assistance, and technology transfer to the staff of the Forest Department for the purpose of solving problems is required. From the viewpoint of sustainable capacity building, it is necessary to have a mechanism in which the utilization of the various latest technologies described in Chapter 4.7 is linked to the process of career development within the officers and staff of the Forest Department.

## Chapter 5 Potential Cooperation in the Forest and Natural Resources Sector

### 5.1 Flow to Propose Outline of Cooperation in the Forest Landscape

Chapters 3 and Chapter 4 describe the status and challenges related to forest management and biodiversity conservation in the forest landscapes. The policies, roles and achievements of the Forest Department, international organizations, donors, and related organizations are also summarized. Based on those information, Chapter 5 proposes and evaluate outline of future potential cooperation in the forest landscapes as follows.

- (1) Presentation of draft cooperation to address the challenges of each forest landscape
- (2) Relationship between the strategies and objectives of major policies and the potential cooperation
- (3) Risk assessment of the potential cooperation
- (4) Prioritization of Cooperation Proposals
- (5) Priority project proposal
- (6) Expansion from priority projects to other cooperation proposals: Forest Sector Cooperation Map

### 5.2 Potential Cooperation

#### 5.2.1 Potential Cooperation for the Major Forest Landscapes

The following Table 5-1 to Table 5-6 outline the potential cooperation for the six forest landscapes.

**Table 5-1 Potential Cooperation for Chattogram Hill Tracts**

Item	Content
Potential cooperation	<p>(1) Conversion from a traditional shifting cultivation called "Jhum" to a permanent farm system that includes tree crops. Technology transfer and dissemination related to the introduction of agroforestry. *</p> <p>(2) Technological transfer and dissemination of soil conservation agriculture to maintain soil fertility on slopes.</p> <p>(3) Technology transfer and dissemination related to the installation of check dams using local materials to prevent sediment inflow into rivers.</p> <p>(4) Establishment of a monitoring system to track vegetation changes in Reserve Forest in near real time</p> <p>(5) Plan and implement of government project for forest conservation and regeneration like SUFAL Project</p> <p>*Note: In particular, technology transfer to identify areas with high sediment spills is also considered by refereeing lessons learned and experiences in "Project for Capacity Building and Technological Adaptation Cycle Building for Comprehensive River Management" is necessary.</p>
Target	Parts of Unclassified State Forests and Reserved Forests distributed in Bandarban and Ragamati districts
Potential scheme	Technical cooperation to develop technical tools and financial cooperation to utilize the tools: technical cooperation will be provided to address the issues (1) through (4) mentioned above. The projects to be implemented in (5) shall be conducted as one of the target sites of a nationwide forest project.
Effectiveness of the potential cooperation	<p>(1) Methods are established and developed to conserve sustainably the natural forests.</p> <p>(2) While continuing Jhum cultivation, methodologies that reduce soil erosion are established and disseminated.</p> <p>(3) Sediment runoff countermeasures in small rivers are systematized.</p> <p>(4) A near real-time monitoring system is established.</p> <p>(5) Financial support will be used to deploy established technologies in a wide area to improve the forest landscape in this area.</p>

Item	Content
Feasibility of the potential cooperation and implementation issues	<p>There is a possibility of implementation as a successor to COMPAS projects. The main issues are as follows.</p> <ul style="list-style-type: none"> <li>➤ It is necessary to formulate an activity plan by sufficiently considering the inefficiency of work due to poor access of roads and mobile network of cell phone.</li> <li>➤ Difficulty in responding due to restrictions on access by foreigners. Since it is difficult to access Reserved Forest under the management of local forest offices, the implementation methods of the project need to be changed from those of conventional technical cooperation.</li> <li>➤ Activities targeting reserved forests are handled by the regional offices of the Forest Department. On the other hand, activities targeting residents living as Forest Dependent Community need to be coordinated with Ministry of Chattogram Hill Tracts Affairs and Hill District Council. To effectively implement the potential cooperation, it is necessary to establish a system involving a wide range of stakeholders.</li> <li>➤ Based on the results and experiences of COMPAS projects, the cooperation of NGO which has national experts functioned as an effective system for the implementation of activities. In technical cooperation, it is essential to consider the structure and content of effective cooperation by international expert based on this structure.</li> <li>➤ Utilizing the results of the Preparatory Survey on Biodiversity Conservation and Forest Development Project in Mizoram, India (2023): State of Mizoram shares the international boundary with Chattogram Hill Tracts (CHT). Many of the natural, social, and cultural environments are similar to those of the hilly areas in Rangamati and Bandarban districts in CHT. The planting and restoration of vegetation in degraded forests proposed by this survey, in particular forest regeneration and biodiversity conservation plans using native tree species, livelihood improvement of residents dependent on forests, and plans for improving the administrative capacity of the Forest Department through the introduction of information technology, are useful for the concept of forest regeneration projects based on the participation of residents in the Chattogram hills.</li> </ul>

Source: JICA Survey Team

**Table 5-2 Potential Cooperation for Chattogram West Forest Zone**

Item	Content
Potential cooperation	<p>(1) Building an improved version of Collaborative Forest Management (CFM) approach based on experiences and lessons learned from the implementation of CFM in southern coastal areas</p> <p>(2) Information promotion for future project implementation for residents and administrations in the target area and awareness-raising activities related to forest ecosystem conservation</p> <p>(3) Establishment of a monitoring system to track vegetation changes in Reserved Forest in near real time</p> <p>(4) Plan and implement of government project for forest conservation and regeneration like SUFAL Project.</p>
Target	Reserved Forest distributed in mountainous areas of Chattogram and Cox's Bazar district
Potential scheme	Financial cooperation: (1) to (3) will be implemented by incorporating achievements at the central level and in other regions. The projects (4) shall be conducted as part of a nationwide forestry project similar to SUFAL. In this case, the western forest area of the Chattogram is one of the main target areas.

Item	Content
Effectiveness of the potential cooperation	<p>(1) Improved versions of empirical CFM approaches are developed.</p> <p>(2) Improve awareness of forest ecosystem conservation among the Forest Department officials and local administrations and residents by promoting information and raising awareness.</p> <p>(3) A near real-time monitoring system is built.</p> <p>(4) Reserved Forest and surrounding forest vegetation recover. The livelihoods of inhabitants are improved.</p>
Feasibility of the potential cooperation and implementation issues	<ul style="list-style-type: none"> <li>➤ Mechanism of the Forest Department at central level that implemented SUFAL Project can be utilized.</li> <li>➤ A report was prepared in 2018 to evaluate the status of Reserved Forest in the region and the potential for tree planting. It is necessary to confirm the latest situation and determine the target area when implementing the potential cooperation.</li> <li>➤ Collaboration: There is no significant cooperation with support from international organizations or donors found in the region. On the other hand, the western forest area has become a priority target area for upscaling the methodologies and approaches of SUFAL Project. Therefore, it is important to cooperate with Project Management Unit and Resource Information Management Unit in charge of forest information-management to implement the potential cooperation.</li> </ul>

Source: JICA Survey Team

**Table 5-3 Potential Cooperation for Sal Forest**

Item	Content
Potential cooperation	<p>(1) Activities to Enhance the Sustainability of Collaborative Forest Management (CFM): Identify CFM issues in SUFAL Project conducted in the Sal Forest and consider plans to enhance sustainability by technical assistance. E.g. establishment of the implementation system in the Forest Department (Deployment of community coordinators in Beat Office, follow-up of alternative livelihood creation activities, deployment of fund-management partners)</p> <p>(2) Implementation and verification of enhancement proposals for CFM in some areas subject to SUFAL Project. Dissemination and deployment in other regions.</p> <p>(3) Capacity building for forest operations: Selection of candidates for natural renewal assistance and supplementary planting of Sal Forests in CFM by satellite image analysis. Field verification and identification using drones.</p> <p>(4) Improve implementation of social forestry programs: (i), (ii) and (iii)</p> <p>(i) Establishment of methods for selecting reforestation targets (e.g., organizing necessary basic information, especially river maps and organizations responsible to manage dikes),</p> <p>(ii) Drafting a plan to promote the participation of residents in the selection of indigenous tree species and the maintenance and management of riverbanks (e.g., reviewing Social Forestry Rule of the Forest Department, developing practical Standard Operation Procedure (SOP), and introducing useful crop cultivation techniques within the forest plantation),</p> <p>(iii) Establish a system for promoting Trees Outside Forest (TOF) in collaboration with local governments, etc. and conduct pilot-based activities.</p>
Target	<p>(1) and (2): Sal Forests which were target of in SUFAL Project</p> <p>(3) Sal Forests outside of SUFAL Project targets</p> <p>(4) Non-forest land managed by the Forest Department</p>
Potential scheme	<p>Technical cooperation and financial cooperation to utilize its results: technical cooperation will address the issues (1) through (4) above. In addition, for the dissemination and deployment of (2) to other regions, forest projects in the same country as in SUFAL will be envisaged, and these projects will be conducted as one target site.</p>

Item	Content
Effectiveness of the potential cooperation	<p>(1) Strengthening the sustainability of CFM over a long period of time (continuing alternative livelihoods creation activities) will improve the livelihoods of the community. As a consequence, the community's excessive reliance on fast-growing trees is reduced, and indigenous species in Sal Forests are used to be planted in Reserved Forest. The conversion of economic forests to environmental forests in Reserved Forest progresses.</p> <p>(2) The development of CFM enhancement proposals in other regions will improve the quality of ecosystem services in Reserved Forest around the country and improve the livelihoods of the surrounding communities.</p> <p>(3) Efficiency of planning of operation in Sal Forest is improved.</p> <p>(4) The quality of social forestry programs that have been completed by the Forest Department for the distribution of seedlings will be improved, and the benefits enjoyed by the communities will be diversified and improved. Green infrastructure in the living environment is established.</p>
Feasibility of the potential cooperation and implementation issues	<ul style="list-style-type: none"> <li>➤ Assume that the implementation of the collaborative forest management (CFM) practiced in SUFAL Project is formally approved by the Ministry of Environmental, Forest and Climate Change (MoEFCC) as part of the Forest Department operations.</li> <li>➤ Assume that a staff member assigned to the Forest Department in Sal Forest and an experienced SUFAL Project is working continuously in the same place.</li> <li>➤ Collaboration: There is no significant cooperation supported by international organizations or donors found in the region. On the other hand, the Sal Forest area is one of the priority areas for SUFAL Project, so the project management unit of the Forest Department and the Resource Information Management Unit in charge of forest information-management are the key focal points.</li> </ul>

Source: JICA Survey Team

**Table 5-4 Potential Cooperation for Sundarbans**

Item	Content
Potential cooperation	<p>(1) Outside of Sundarbans Reserved Forest: Controlling storm surges and flooding through afforestation (NbS-DRR) combined with levees</p> <p>(2) Inside the Sundarbans Reserved Forest: Dissemination and awareness raising activities and monitoring activities aimed at eliminating illegal activities in natural mangrove forests</p>
Target	<p>(1) Levees in three districts (Khulna, Shatkhira, Begarhat) on public land outside of Sundarbans Reserved Forest</p> <p>(2) Ecosystems of 840 species and 334 species of wild plants and natural mangrove forests in Sundarbans Reserved Forest (about 0.6 million ha)</p>
Potential scheme	<p>Technical assistance: Regarding embankment afforestation (NbS-DRR) of (1), the existence of technical problems will be further examined. (2) Ministry of Environment, Forestry and Climate Change will respond by introducing advanced technologies to improve the quality of natural mangrove forest conservation activities by the Forest Department by providing technical cooperation focusing on human resource development.</p>
Effectiveness of the potential cooperation	<p>(1) Tree planting combined with embankments reduces damage from storm surges and floods</p> <p>(2) Conservation of biodiversity in the reserved forest of Sundarbans</p>
Feasibility of the potential cooperation and implementation issues	<p>(1) Feasibility of tree planting in embankments: around Sundarbans Reserved Forests: NbS-DRR combined with embankments (tree planting). It is assumed that there are afforestation projects associated with the construction of levees by the Water Resources Development Agency (BWBD).</p> <p>(2) Inside the Sundarbans Reserved Forests: Activities are possible by the Forest Department staff located in the offices of each site in the forest. In addition, it is</p>

Item	Content
	<p>premised that the staff are appropriately assigned to implement the cooperation plan.</p> <ul style="list-style-type: none"> <li>➤ Collaboration: UNDP has taken the initiative in the conservation of the Sundarbans, with an emphasis on collaboration with the local authorities of Khulna division (see Section 3.3.1 (1) (ii)). This has been coordinated by donors with a long history of cooperation, such as FAO, GIZ, USAID. etc. The implementation of the potential cooperation in the region requires planning and implementation based on a good coordination with UNDP's initiatives.</li> <li>➤ Utilization of the results of the Preparatory Survey on Forestation and Biodiversity Conservation Projects for Climate Change in India and West Bengal (2022): There are approximately 0.4 million hectares of natural mangrove forests in the area of the Gulf of Bengal, located west of the Sundarbans forest. Although it is separated from West Bengal by a border, its natural, social, and cultural environment are similar to those of the southwestern region of Bangladesh, including Sundarbans. The content and composition of forest development and biodiversity projects proposed by the survey as measures to combat climate change are useful in formulating a cooperative plan aimed at improving the livelihoods of mangrove ecosystems and neighboring inhabitants in Sundarbans.</li> </ul>

Source: JICA Survey Team

**Table 5-5 Potential Cooperation for Southern Coast**

Item	Content
Potential cooperation	<p>(1) Improve planning and monitoring methods for greenbelt development by applying advanced information technologies (IT)</p> <p>(2) Improved practices for collaborative forest management (CFM) based on SUFAL Project experiences and lessons learned</p> <p>(3) Implementation of afforestation projects for the purpose of creating greenbelts and zoned based on the improved methods developed in (1) and (2) above.</p>
Target	<p>Areas covered by (1) and (2): Reserved Forest and villages in four districts in Barisal division (Barguna, Bhola, Patukhali, Pirojpur)</p> <p>Areas covered in (3): Coastal areas of about 200,000 ha distributed in four districts above, and two districts i.e., Chattogram and Cox's Bazar districts in Chattogram division. It focuses (i) bare land suitable for afforestation and (ii) mangrove forests and coastal forests previously afforested, and (iii) households in the neighboring communities and farmland in coastal areas.</p>
Potential scheme	<p>Financial cooperation utilizing outputs and achievements of technical assistance: The technical assistance will be implemented in (1) and (2) above. Financial cooperation will be implemented for (3).</p>
Effectiveness of the potential cooperation	<p>(1) and (2): In the southern coastal areas, more applicable and effective methods of planning, implementation and monitoring the development of green zones will be established.</p> <p>(3): Increase in forest area and accumulation. Improvement of biodiversity by creating a forest environment. Improve livelihoods by implementing employment and collaborative management in afforestation activities. Disaster prevention and mitigation effects in green zones.</p>
Feasibility of the potential cooperation and implementation issues	<ul style="list-style-type: none"> <li>➤ Feasibility: Organizations of the Forest Department (Planning wing, Forest Management wing, Social Forestry wing, etc.) and human resources can be assigned.</li> <li>➤ Implementation Issues: The target area includes sediment, and its location and scale vary due to each year's cyclone. Therefore, it is necessary to identify, in real time, the location and size of the target area that can be identified by the above-mentioned activities (1).</li> </ul>

Item	Content
	➤ Collaboration: The World Bank, which provides financial assistance until 2024, does not plan to implement succession projects.

Source: JICA Survey Team

**Table 5-6 Potential Cooperation for Sylhet**

Item	Content
Potential cooperation	<ol style="list-style-type: none"> <li>(1) Nature-based Disaster Risk Reduction (NbS-DRR of embankments and polder areas by planting trees)</li> <li>(2) Implementation of basic surveys on reserved forests in Haor areas (Reserved Forest) and establishment of wetland protected areas (Ramsar wetlands)</li> <li>(3) Support for the administration of the Forest Department in reserved forests established in Tanguar Haor</li> <li>(4) Promotion of ecotourism in protected areas and national parks</li> </ol>
Target	<ol style="list-style-type: none"> <li>(1) Foundation of the embankment or the polder area</li> <li>(2) Haor reserved forest: mainly Sunamganj district (e.g., Chattak Haor reserved forest)</li> <li>(3) Tanguar Haor</li> <li>(4) Ecotourism in protected areas, including national parks</li> </ol>
Potential scheme	Technical assistance: In the activities described in (2) above, it is necessary to conduct an academic survey to grasp the actual conditions of wetlands.
Effectiveness of the potential cooperation	<ol style="list-style-type: none"> <li>(1) Reducing the damages of flooding (overwater damage) through the functions of NbS-DRR</li> <li>(2) Conservation of wetlands and biodiversity (mainly waterfowl and fish) in Haor, promotion of sustainable use</li> <li>(3) Implementation of biodiversity conservation, reserve management, and sustainable use under the leadership of Tanguar Haor forest office</li> <li>(4) Improvement of livelihoods of local communities by promoting ecotourism, conservation of biodiversity, raising awareness of tours and residents, and improving the management of protected areas</li> </ol>
Feasibility of the potential cooperation and implementation issues	<ol style="list-style-type: none"> <li>(1) Collaboration with the Bangladesh Water Development Board (BWDB) who is responsible for river and water management is required.</li> <li>(2) Scientific basic survey and zoning are necessary for the establishment of the wetland reserve (Ramsar wetland). Plans concerning the promotion of ecotourism based on the knowledge of the basic survey, and the sustainable utilization management of fisheries and agriculture as a measure to improve livelihoods are necessary. However, the Ramsar wetland designation and control under the regulations are the responsibility of the Department of Environment (DOE). Therefore, establishment of cooperation mechanisms between DOE and the Forest Department is an important issue to realize desirable management work.</li> <li>(3) Concerning the management of reserved forests where seasonal wetlands spread, the establishment of management methods is premised.</li> <li>(4) Based on the existing legal system, it is assumed that concrete proposals concerning the promotion of ecotourism are formulated. Regarding human resources, local government officials have completed training on ecotourism.</li> </ol> <p>Collaboration: Using Grant aid of GEF (Global Environment Facility), UNEP improves and enhance wetland control in the project titled “Ecosystem-based Adaptation in Bangladesh 2020-2024”. It is also effective to explore possibility to cooperation with this project.<sup>27</sup></p>

Source: JICA Survey Team

<sup>27</sup> <https://www.unep.org/gef/index.php/resources/factsheet/ecosystem-based-adaptation-bangladesh-2020-2024> GEF Grant: US\$5.2 million, Co-finance USD\$55million.



## 5.2.2 Potential Cooperation in Forest Information System

In addition to the potential cooperations for the forest landscapes, the following is the potential cooperation on the area of forest information system which is related to all proposals for the forest landscape.

### (1) Upgrading of the forest monitoring system

Regarding nationwide forest monitoring, data are currently updated every five years. However, the forests in Bangladesh are constantly exposed to severe competing situations with the pressures to open and use the forest land into other purposes. The actual situation and the area of forests are constantly changing.

Therefore, it is necessary to construct a method in which the monitoring interval is shortened (near-real-time system). The proposal is shown in Table 5-7. It is primarily intended for central-level officials of the Forest Department to operate and regarded as the “infrastructure” of managing the forest landscapes in various areas.

**Table 5-7 Potential Cooperation in Upgrading Forest Monitoring System**

Item	Content
Potential cooperation	(1) A near-real-time forest monitoring system using satellite-based images Sentinel-1,2 that is free and relatively high-resolution is developed and integrated into BFIS. (2) Automated in Google earth engine(GEE) and use sentinel-1 in rainy seasons. (3) To strengthen the capacities of O&M personnel and users of the system.
Target	Resource Information Management Unit of Planning wing under the Forest Department
Potential scheme	Integrated into technical assistance for each forest landscape
Effectiveness of the potential cooperation	➤ The state of the latest changes in forest cover can be reflected in the development of forest management plans. ➤ Progress monitoring system of the various plans includes forest coverage and can be used to evaluate the progress of the plans.
Feasibility of the potential cooperation and implementation issues	➤ Feasibility: It is assumed that the programmer who operates and manages the systems is employed in RIMS. Assume that the outsourcing budget is secured. Assume that current full-time staff are assured that they will also serve as programming personnel. ➤ Issues: Google Earth Engine is not free system but needs to be paid when it is used. Continuity and persistence of free access services for satellite-system images (sentinel).

Source: JICA Survey Team

In addition, the following two proposals are the ideas which utilize UAV for forestry planning and monitoring after planting.

### (2) Identification of tree planting areas using UAV

- Challenge and needs: In finding candidate sites for reforestation in reserved forests, the beat officers visually confirm canopy coverage in the field to identify "Degradation Area." Since this method has a large burden on the officers in charge of the sites, it is necessary to introduce an efficient method to identify the reforestation sites using the advanced technology.
- Activities: Based on the nationwide forest inventory and satellite-image analysis, an open/sparse/close categorization diagram showing differences in tree coverage was prepared. Establish indicators such as climate change risk and prioritize candidates for supplementary planting. Detailed plantations are identified by UAV in areas identified as open/sparse and prioritized.
- Integration into the potential cooperation: Implemented as a pilot activity in a technical cooperation project. Prepare Standard Operation Procedures (SOP) for image-analysis and UAV manipulation.

Support for approval of the Forest Department as a public technical guidance. Expansion of afforestation business.

- Note: This proposal can be used in the cooperation for forest management, especially item (3) of the Sal Forest areas.

### (3) Monitoring plantations using UAV

- Issues and needs: Main uses of UAV are for patrols and monitoring of protected areas. The Forest Department would like to utilize UAV for field inspections and periodic monitoring of afforestation sites where the burden of field staff is large.
- Activities: Conducted on-site inspections and monitoring of growing conditions after afforestation based on Site Specific Planning (SSP) by UAV
- Integration into the collaboration proposal: Introduced UAV as a pilot activity for technical assistance projects. Completion of UAV maneuvering and image-analysis capabilities and preparation of Standard Operation Procedures (SOP). Support for approval of the Forest Department as a public technical guidance.
- Note: This proposal can be used in (1) and (3) for the development of greenbelt in the southern coastal region.

## 5.3 Potential Cooperation and Schemes

Chapter 5.2 describes the scheme of cooperation for the six forest landscapes with its effectiveness and feasibility. Based on it, Table 5-8 shows the whole contents of the potential cooperation and its scheme, which are the subject to the evaluation of the scheme.

**Table 5-8 Potential Cooperation and Schemes**

Forest landscape	Potential cooperation
Chattogram Hill Tracts	Forest regeneration and conservation through comprehensive soil conservation measures and the introduction of a sustainable agricultural system Scheme: Technical and financial cooperation
Chattogram West Forest Zone	Sustainable forest management through introduction of collaborative forest management (CFM) Scheme: Financial cooperation
Sal Forest	Enhance sustainability of cooperative forest management (CFM) methods and streamline forest management by introducing information technology Scheme: Technical and financial cooperation
Sundarbans	Natural mangrove forests and biodiversity conservation by strengthening resilience to climate-change through NbS-DRR Scheme: Technical cooperation
Southern Coast	Improving methodology of planning and monitoring of greenbelt development through introducing information technologies and upscaling it in the coastal areas Scheme: Technical and financial cooperation
Sylhet	Strengthening wetland management systems both inside and outside reserved forests and promoting eco-tourism Strengthening resilience to climate-change through levees and NbS-DRR Scheme: Technical cooperation

Source: JICA Survey Team

## 5.4 Evaluation of the Impacts

This chapter evaluates the positive impacts of the potential cooperation in case it is implemented, applying the three points of view as follows.

- 1) Effects of development in the forest sector (effects of reducing deforestation and forest degradation, effects of increasing forest area and resources, effects of conservation and

improvement of biodiversity): The impact on the implementation of the potential cooperation on forest conservation and regeneration and the size of the area of the target forest.

2) Benefits for local communities and people: Describe the positive effects of activities, assuming forest-dependent community (FDC) located around forests and residents with agricultural as their main livelihoods. However, the agricultural population and percentage data are shown in Chapter 4.1 to Chapter 4.6 and are used as reference data to cover not only FDC but also the entire area of the target district.

3) Contributions to climate-change measures (mitigation and adaptation): Contributions to CO<sub>2</sub> emissions reduction/absorption (mitigation) through the conservation of declining forests or the expansion of sinks through tree planting, and to the improvement of regional residents' resilience (adaptation) through the introduction of tree planting and trees as NbS-DRR.

The results are shown in Table 5-9.

**Table 5-9 Impact of the Potential Cooperation**

Forest Landscape	Impact
Chattogram Hill Tracts	<p>Scheme: Technical and Financial Cooperation</p> <p>Effects of development in the forest field: Introduction of tree elements as soil conservation technology for slope land and introduction of tree crops for conversion from shifting cultivation to permanent farms are expected to contribute to reducing soil erosion and forest conservation. However, the forest area is basically in severe competition with traditional land use therefore, large-area plantations cannot be established.</p> <p>Reserved forest area under the jurisdiction of the Forest Department: 394,567 ha Unclassified State Forest area in which the forest is under the jurisdiction of the local government: 692,960 ha</p> <p>Benefits for local communities and residents: Many residents rely on forests for their livelihoods (Forest-dependent Community), with the highest percentage of agricultural population. Arable land extends throughout the forest. The introduction of agricultural technology and tree crops incorporating soil conservation measures on sloped land is expected to improve the livelihoods of the communities.</p> <p>Agricultural population: 510,467; percentage of agricultural population: 27.70%</p> <p>Contribution to Climate Change Measures: The tree elements introduced by the above measures contribute to soil conservation and the stability of livelihoods to some extent. It is conceivable that forest conservation will contribute to emission reductions (mitigation).</p> <p>Note: Together with the forest area on the west side of Chattogram, the hilly area is the only forest area that extends into a mountainous basin. CO<sub>2</sub> emissions from the forest sector in Bangladesh are small in the country. But if the forest sector tries to contribute to climate-change mitigation measures, attention should be paid on forest conservation and regeneration in the Chattogram hills and western forest zones.</p>
Chattogram West Forest Zone	<p>Scheme: Financial Cooperation</p> <p>Effects of Developing Forestry Sector: Regeneration of forests by cooperative forest management (CFM) method for reserved forests managed by the Forest Department. It can contribute to the increase of forest resources, the prevention of soil erosion, and the reduction of flood damage such as flash flood.</p> <p>Reserved Forest under the jurisdiction of the Forest Department: 218,087 ha</p> <p>Development effects on local communities and residents: Unlike hilly areas, the livelihoods of the agricultural population depend mainly on paddy rice cultivation in low-lying areas. Although no specific information has been collected on the residents and forests in this region, it is expected that the introduction of CFM will improve the livelihoods of residents.</p> <p>Agricultural population: 629,210; percentage of agricultural population: 5.25%</p>

Forest Landscape	Impact
	<p>Degree of contribution to climate change measures: Reserved Forests in this area have relatively more forest vegetation than those in hilly areas. Therefore, conservation through the introduction of CFM can contribute to both mitigation and adaptation.</p> <p>Note: Together with the Chattogram Hill Tracts, the reserved forests in this area extend into a mountainous basin. CO<sub>2</sub> emissions from the forest sector in Bangladesh are limited across the country, but if the forest sector tries to contribute to climate change mitigation measures, attention should be paid on forest conservation and regeneration in the Chattogram hills and western forest zones.</p>
Sal Forest	<p>Scheme: Technical and Financial Cooperation</p> <p>The potential cooperation (sustainability enhancement of CFM) can improve the stock volume of the forest and quality of reserved forests managed by the Forest Department. However, the size of the area is not so large. On the other hand, TOF, which has more than 10 times the area of reserved forests, is due to the planting of seedlings distributed in social forestry programs. Implementation of the potential cooperation for improving social forestry is expected to further increase the area of TOF.<sup>28</sup></p> <p>Reserved Forest Area under the jurisdiction of the Forest Administration: 99,955 ha</p> <p>Trees Outside Forest (TOF): 488,092 ha under the jurisdiction of the Forest Department</p> <p>Improving the sustainability of CFM is expected to improve the livelihoods of forest dependent communities. Improved social forestry practices can also improve rural green infrastructure and provide better environments as well as economic benefits.</p> <p>Agricultural population: 2,655,388; percentage of agricultural population: 15.90%</p> <p>&lt;Contribution to Climate-Change Measures&gt; Focusing on the increase in carbon sinks through tree planting, the increase in TOF in the Sal Forest area has greatly contributed to the reduction of CO<sub>2</sub> emissions (increase in sinks) in the forest sector. In addition, by planting trees on public and private land by social forestry, it is expected to reduce damage caused by flood and strengthen resilience.</p>
Sundarbans	<p>Scheme: Technical Cooperation</p> <p>Development Effects in the Forest Sector: Potential cooperation (Eradication of illegal activities in natural mangrove forests and promotion of awareness) can contribute to the maintenance of biodiversity. There is a need for tree planting in the embankment outside the reserved forest, but its size is not yet confirmed. (Note: The area of the planted forest in the three districts in Khulna division is small, so it is estimated that there are not many areas that can be planted in the future).</p> <p>Reserved forest area under the jurisdiction of the Forest Department: 600,129 ha</p> <p>Development Effects on Local Communities and Residents: According to the information collected from both the conservation of natural mangrove forests and the afforestation of levees outside the forests, the direct benefits to local communities and residents are not large.</p> <p>Agricultural population 967,570 and agricultural population ratio: 15.06%</p> <p>Contribution to climate change measures: Flood damage such as floods and storm surges can be reduced to some extent by planting trees in embankments.</p>

<sup>28</sup> As also shown in the footnote in Section 3.2.5 (1), saplings distributed by social forestry are planted on agricultural land, private land, and public land. The area is calculated using the number of saplings distributed and the standard tree planting design (e.g., 1600 trees per hectare), and is not a measured actual area.

Forest Landscape	Impact
Southern Coast	<p>Scheme: Technical and Financial Cooperation</p> <p>Development effects in the forest sector: Implementation of the potential cooperation plan (afforestation in coastal areas) can be expected to increase forest resources and to have disaster prevention and mitigation effects. Notable in this region is that "candidates for reserved forests" are more than 0.3 million hectares (it reaches about 75% of the existing reserved forests) and these will be incorporated into the reserved forest in the future by the Forest Department.<sup>29</sup> In addition, it is necessary to collect information and confirm the site. However, this "candidate site" seems to be recognized as a sedimentary land or an afforestation area in coastal areas (the development of green zones). Reserved forest area under the jurisdiction of the Forest Department: 410,976 ha Among them, the area of reserved forest candidates: 307,524 ha</p> <p>Development effects on local communities and residents: SUFAL Project applied a collaborative forest management (CFM) method to the afforestation and forest management in coastal areas. Further improvement of the implementation methods is required in the future, but it is expected to improve the livelihoods of the inhabitants around the reserved forest by the application of the improved CFM. Agricultural population 1,313,037 and agricultural population ratio: 11.49%</p> <p>Contribution to Climate Change Measures: Reforestation on the southern coast aims to create a green zone for disaster prevention and mitigation. It contributes to climate change adaptation measures (strengthening resilience). It can also contribute to CO<sub>2</sub> absorbing through the growth of planted trees.</p>
Sylhet	<p>Scheme: Technical Cooperation</p> <p>Development effects in the forest sector: The reserved forests managed by the Forest Department in this area include wetlands as well as forests distributed in the hilly areas of the southeastern region. Therefore, conservation and regeneration of forests are limited, and the effect of increasing stock volume of the forest is limited. On the other hand, Tanguar Haor designated by the Ramsar Convention and the wetlands in western Sumanganji district are rare and abundant animals and plants (about 60,000 migratory birds, many resident birds, 140 or more species of fish, and natural marsh forests), and maintaining and managing their ecosystems in good condition is thought to contribute greatly to the conservation of biodiversity. Reserved forest area under the jurisdiction of the Forest Department: 65,148 ha (including wetlands)</p> <p>Development effects on local communities and residents: The promotion of eco-tourism in national parks, which was potential as one of the cooperations, may have a positive impact on the employment opportunities and economics of local community. Agricultural population 1,138,539 and agricultural population ratio: 10.32%</p> <p>Contribution to climate change measures: The planting of trees in the levees in (1) of the potential cooperation plan may be related to climate change measures, but the sense of scale and concrete relationships are unclear due to lack of information.</p>

Source: JICA Survey Team

<sup>29</sup> See the forest type "2" in Table 3-3. This is the forest that has completed the procedures under Article 4 and Article 6 of the Forest Law (1927) and is awaiting the designation of a reserved forest under Article 20.

## 5.5 Risk Analysis

This chapter analyses the socioeconomic risks (negative impacts) in case if the cooperations is not implemented thus no measures are conducted. Risk analysis is done applying the following points of view.

- 1) Data covering the whole districts located in the forest landscape described from Chapter 4.1 to Chapter 4.6 is utilized to imply that the land area, population, and scale of agricultural production are damaged or undetermined by the climate change risks and challenges.
- 2) Negative impacts of not responding to challenges are discussed in two aspects: (i) increased natural hazards and their socioeconomic impacts; (ii) daily and continuous impacts on the livelihoods of the population.
- 3) Regarding the increase in natural disasters mentioned above, the information described in JICA survey report titled, "Collection and Confirmation Survey of Disaster Prevention Sector Information in Bangladesh" (October 2022) (hereinafter referred to as "Reference Materials" when cited) is used as a reference.

Table 5-10 shows the results of the risk analysis.

**Table 5-10 Socioeconomic Risks (Negative Impacts) unless Responding to Challenges**

Forest landscape	Socioeconomic risk (negative impact)
Chattogram Hill Tracts	<p>(i) Increase in Natural Disasters and Impacts on Socioeconomic Conditions The target district of Bandarban has the area 4,479 km<sup>2</sup> with a population of 481,109 and a population density of 107 (about 10% of the national average). Khagrachari is the area 2,749 km<sup>2</sup> with a population of 714,119 and a population density of 260 (about 20% of the national average). Rangamati is the area 6,116 km<sup>2</sup> with a population of 647,587 and a population density of 106 (about 10% of the national average). These three districts are connected by rivers to the forest area on the west side of the Chattogram and are in the upstream part of the basin. If forest regeneration and conservation are not implemented through soil conservation measures and the introduction of a sustainable agricultural system, logging within the Reserved forest and unplanned conversion to agricultural land and housing land will further expand, and forest vegetation will be degraded. As a result, the water retention capacity in the upstream region decreases, and the scale and frequency of flash flood increase. Damages to the industrial activities and industrial parks located in the downstream region becomes even more serious.</p> <p>(ii) Impact on the community life The agricultural population in Bandarban is 119,960 (24.93% of the district's total), the agricultural population in Khagrachari is 173,488 (24.29% of the district's total), and the agricultural population in Rangamati is 217,019 (33.51% of the district's total). While the population density of the Chattogram Hills is extremely low compared to the national average, the percentage of agricultural population is remarkably high compared to other forest landscapes. If the problem is not addressed, unplanned cultivation will proceed within the Reserved forest and agricultural land and residential areas will expand. Looking at the medium to long term, the decline in forest vegetation and the expansion of gross agriculture leads to more soil runoff, while frequent outbreaks of flash flood destroy the foundations of agricultural production and the livelihoods of residents themselves.</p>
Chattogram West Forest Zone	<p>(i) Increase in Natural Disasters and Impacts on Socioeconomic Conditions According to the reference data, three sub-districts in Chattogram' district, Chattogram, Mirsharai, Satakunda (Karnaphuli river basin) and two sub-districts such as Anwara and Patiya (Sangu river basin), Meheshkhali, sub-district in Cox's bazar's district (Matamuhuri river basin) and Cox's bazar sub-district (Bakkali river basin) are highly vulnerable to flash flood. In Chattogram district, the area 5,283 km<sup>2</sup> has a population of 9,169,464 and a population density of 1,736 (approximately 1.5 times the national average). In Cox's</p>

Forest landscape	Socioeconomic risk (negative impact)
	<p>Bazar district, the area 2,492 km<sup>2</sup> has a population of 2,823,265 and a population density of 1,131 (almost the same as the national average).</p> <p>Chattogram district has an enormous impact on industrial activities in and near the central Chattogram region, which is one of the main industrial bases in the country. In Cox's bazar district, the effect on the industrial park which will be industrially developed in the future and the damage in the southernmost part are serious.</p> <p>Reserved forests distributed in two districts are located upstream from the midstream of the industrial and industrial basins of the region through rivers.</p> <p>Failure to implement forest conservation and regeneration projects for reserved forests in this region will lead to unplanned conversion to deforestation and agricultural and residential land, resulting in devastation of forest vegetation. The water retention capacity in the middle and upstream areas decreases and the scale and frequency of flash flood increase. As a result, the damage caused by industrial activities and industrial parks located in the downstream region becomes even more serious.</p> <p>According to the reference materials, in the event of urban flooding, which could be caused by flash flood, the total amount of damage assumed in Chattogram metropolitan area is a high 14,037 million Taka for Dhaka.</p> <p>(ii) Impact on the lives of residents</p> <p>The agricultural population of Chattogram district is 439,066 (4.79% of the total district), and the agricultural population of Cox's Bazar district is 190,144 (6.73% of the total district).</p> <p>If the problem is not addressed, unplanned cultivation will proceed within the reserved forest and agricultural land and residential areas will expand. Looking at the medium-to-long term, the decline in forest vegetation and the expansion of gross agriculture led to soil runoff, while frequent outbreaks of flash flood destroy the foundations of agricultural production and the livelihoods of residents themselves.</p>
Sal Forest	<p>(i) Increase in Natural Disasters and Impacts on Socioeconomic Conditions</p> <p>According to the reference data, Gazipur Sadar sub-district in Gazipur district, which is one of the target districts, is particularly vulnerable to the damage caused by the flooding of large rivers. Gazipur district is a densely populated area with a population of 5,263,474 and a population density of 2,914 (three times the national mean) in the area 1,806 km<sup>2</sup>. Overall, the affected population is large, and the effects on economic activities, especially on the industrial and service industries (urban areas) are enormous.</p> <p>In rural areas, failure to (1) restore the vegetation of reserved forests (Sal Forests) through collaborative management and (2) maintain and expand "forests outside the forest" and improve quality through improvements in social forestry will have the following negative impacts:</p> <p>(1) Forest vegetation in reserved forests will be degraded, and their function as green infrastructure to mitigate regional flood damage will decline. As a result, the flood damage becomes serious in wider area.</p> <p>(2) "Trees outside Forest" are converted to land use for other purposes, and the deterioration of the familiar green infrastructure progresses. As a result, the possibility of damage to cultivation of paddy rice (396,413 ton of production) and hemp (12,918 ton of production), which are central crops, increases.</p> <p>(ii) Impact on the lives of residents</p> <p>The agricultural population of Gazipur district is 223,292 (4.24% of the whole district). Since it is in the suburbs of Dhaka, there are many non-agricultural workers, and the percentage of the agricultural population is low. However, in order to maintain a sound urban environment that is resistant to disasters, environmental improvement and livelihood improvement in suburban farming villages are important issues.</p>



Forest landscape	Socioeconomic risk (negative impact)
	<p>If the problem is not dealt with, the above-mentioned agricultural production base becomes vulnerable to floods, and the living conditions of the residents' livelihoods deteriorate. Moreover, the degradation of the green infrastructure exacerbates the everyday problem of fuel.</p>
Sundarbans	<p>(i) Increase in Natural Disasters and Impacts on Socioeconomic conditions According to the reference data, storm surge risks are assessed as the third from the seven-stage assessment in the inland area of Khulna district, which is distant from the Sundarbans Reserved Forest. Khulna district has an area 4,394 km<sup>2</sup> with a population of 2,613,385 and a population density of 528 (about half of the national averages). Storm surges have a major impact on urban areas, which are the economic hubs of the region, and on rural areas where the population is concentrated.</p> <p>(ii) Effects of the spread of illegal conduct The neglect of illegal acts such as poaching and theft in the Sundarbans reserved forest reduces the ecosystem functions of the natural mangrove forest of about 0.6 million hectares and reduces the disaster reduction functions against typhoons and storm surges.</p> <p>(iii) Impact on the lives of residents The agricultural population of Khulna district is 443,230 (16.56% of the whole district). The storm surge is caused by a typhoon that occurs almost every year. If the challenge is not addressed, the decline in function due to the devastation of the natural mangrove forest in Sundarbans Reserved Forest and storm surges in inland areas will lead to an increase in damage to local industries centered on rice cultivation (production volume 514,398 ton/year).</p>
Southern Coast	<p>(i) Increase in Natural Disasters and Impacts on Socioeconomic conditions According to the reference data, the southern region of Noakhali district (Hatiya sub-district) and Bhola district (Bhola Sadar sub-district), which are the target district, are highly vulnerable to high tide damage. Noakhali district has a population of 3,625,252 and a population density of 984 in area 3,686 km<sup>2</sup> (about 90% of the national averages). Overall, in addition to the increasing concentration of population in recent years, economic damage in the agriculture and service sectors is significant. Bhola district has a population of 1,932,514 and a population density of 694 (about half of the national averages) in terms of area 2,785 km<sup>2</sup>. It is a representative economic base of the region and has a large impact of economic damage. In rural areas, the following negative impacts will spread if it will be failed to develop and implement a plan for the development of green zones, which is a bill for cooperation, to improve and strengthen monitoring methods, and to undertake an extended afforestation project in coastal areas. While settlement and population-growth in coastal areas and sedimentary areas (Char) are advancing, the storm surges caused by cyclones that occur almost every year can seriously damage agricultural lands and crops that are the foundations of housing and living. Although the main crop is paddy rice, Bhola district is the center of the production of potatoes (119,387 ton) in this region, and food self-sufficiency in the region is also seriously damaged. Life is also at risk.</p> <p>(ii) Impact on the lives of residents The agricultural population of Noakhali district is 218,110 (6.02% of the total district), and the agricultural population of Bhola district is 512,063 (26.50% of the total district). There is a danger that the living foundation of the inhabitants will collapse from the root due to the influence of the salt water when it is directly damaged by the storm surge without implementing the cooperation proposal. The people settled in the southern coast and sediment is due to inflows from inland and neighboring areas.</p>

Forest landscape	Socioeconomic risk (negative impact)
	There is a risk of becoming an even greater social instability factor when living in this region is no longer established due to natural disasters.
Sylhet	<p>(i) Increase in Natural Disasters and Impacts on Socioeconomic Conditions According to the reference data, Sylhet Sadar sub-district in Sylhet district is rated as having the highest risk of flash flood. In addition, Sylhet Sadar and Chhatak sub-district in Sunamganj district are evaluated as the second to seven levels of risk of flooding in large rivers. Sylhet district has 3,452 km<sup>2</sup> area with a population of 3,857,037, and Sunamganj is a 3,747 km<sup>2</sup> area with a population of 2,695,495. The total population density is 873 people per km<sup>2</sup> (approximately 80% of the national mean). These natural disasters have a profound impact on the livelihoods of residents in local center and on economic activities, especially agriculture and services.</p> <p>(ii) Impact of expanding commercial tourism and lack of controlling over-tourism and management Waste problems and deterioration of water quality becomes serious in the place which is not designated as protected wetland thus over-tourism, or tourism under weak management spread.</p> <p>(iii) Impact on the community life and production The agricultural population of Sylhet district is 241,529 (6.26% of the total district), and the agricultural population of Sunamganj district is 370,200 (13.37% of the total district). Flash flood and large river floods will increase damage to local industries, especially rice cultivation, with annual production of 0.6 million to 0.8 million ton. Over-tourism in wetlands also adversely affects the livelihoods of residents engaged in small fisheries.</p>

Source: JICA Survey Team

## 5.6 Evaluation of the Potential Cooperations

In addition to impact assessment and risk analysis, the potential forest landscape cooperation will be evaluated from three perspectives: The conceptual positioning of the potential cooperation is "relevance to the policies", "feasibility", and "consistency with the cooperation policy".

### (1) Relevance to the major policies

Table 5-11 shows contents of the major policies which are linked to the potential cooperation for the forest landscape.<sup>30</sup>

**Table 5-11 Relevance to the Major Policies**

Forest landscape	Strategies and plans for relevant key policies
Chattogram Hill Tracts	<p>(1) Nationally Determined Contributions 2021 (NDCs 2021): (i) Expanding forest cover to 24% in 2020, (ii) Restoring 137,800 ha, vegetation in hilly areas and Sal Forests 200,000</p> <p>(2) Perspective Plan of Bangladesh 2021-2041 (PP2041): Numerical Target Forest Coverage Ratio 15% (2018) ⇒ 20% (2040)</p> <p>(3) 8<sup>th</sup> 5-Years Plan July 2020 – June 2025: (i) Assuming 25% tree coverage by 2025, (ii) biodiversity improvement and ecosystem conservation; (iii) living improvement for the poor; and (iv) forest conservation in the Chattogram Hill Tracts</p>
Chattogram West Forest Zone	<p>(1) Nationally Determined Contributions 2021 (NDCs 2021): (i) Expand forest cover to 24% in 2020</p> <p>(2) Perspective Plan of Bangladesh 2021-2041 (PP2041): Numerical Target Forest Coverage Ratio 15% (2018) ⇒ 20% (2040)</p>

<sup>30</sup> It is obvious that the potential cooperation for forest landscapes is relevant to the policy objectives and strategies of the forest sector. Here, we focused on key government-level policies to understand how the potential cooperations are consistent with the national level challenges in the country.

Forest landscape	Strategies and plans for relevant key policies
	(3) 8 <sup>th</sup> 5-Years Plan July 2020 – June 2025:(i) Reduce tree coverage to 25% by 2025 (ii) to improve living conditions for the poor
Sal Forest	(1) Nationally Determined Contributions 2021 (NDCs 2021): (i) Expanding forest cover to 24% in 2020, (ii) Rehabilitation 200,000 ha for 137,800 ha, vegetation in hilly areas and Sal Forests (2) National Adaptation Plan of Bangladesh (NAP): Strategy 4.3: Promotion of citizen-led afforestation (3) Perspective Plan of Bangladesh 2021-2041 (PP2041): Numerical Target Forest Coverage Ratio 15% (2018) ⇒ 20% (2040) (4) 8 <sup>th</sup> 5-Years Plan July 2020 – June 2025:(i) Reduce tree coverage to 25% by 2025 (ii) to improve living conditions for the poor
Sundarbans	(1) National Adaptation Plan of Bangladesh (NAP): Strategy 4.2 Restoration and conservation of animal and plant habitats, ecosystems, and biodiversity (2) Implementation of Perspective Plan of Bangladesh 2021-2041 (PP2041): Delta Plan and numerical targets: The lowest 5% ⇒ the highest 30% for conservation of animal and plant habitats and biodiversity (3) 8 <sup>th</sup> 5-Years Plan July 2020 – June 2025: conservation of biodiversity, restoration of ecosystems, conservation of natural mangrove forests in the Sundarbans region
Southern Coast	(1) Nationally Determined Contributions 2021 (NDCs 2021): (i) Expanding forest cover to 24% in 2020, (ii) forestation 150,000ha in coastal areas and islands (2) Perspective Plan of Bangladesh 2021-2041 (PP2041): Numerical Target Forest Coverage Ratio 15% (2018) ⇒ 20% (2040) (3) 8 <sup>th</sup> 5-Years Plan July 2020 – June 2025:(i) Assuming 25% tree coverage by 2025 (ii) capacity building, (iii) coastal afforestation and green belt installation
Sylhet	(1) Bangladesh Delta Plan 2011: Judicious use of marshes (2) National Adaptation Plan of Bangladesh (NAP): Strategy 4.1 Implementation of Ecosystem-Based Adaptation for Wetland Conservation Strategy 4.2 Restoration and conservation of animal and plant habitats, ecosystems, and biodiversity (3) Implementation of Perspective Plan of Bangladesh 2021-2041 (PP2041): Delta Plan and numerical targets: The lowest 5% ⇒ the highest 30% for conservation of animal and plant habitats and biodiversity (4) 8 <sup>th</sup> 5-Years Plan July 2020 – June 2025: Biodiversity Conservation and Ecosystem Restoration

Source: JICA Survey Team

As Table 3-11 shows, each of the potential cooperation is associated with important policy content, in particular, the relevance of Sundarbans and Sylhet to the policies on biodiversity conservation and ecosystem conservation, and the other four cooperation are associated with climate change measures such as conservation and restoration through afforestation, reforestation, tree planting and poverty reduction through income generating activities in communities.

## (2) Feasibility

The feasibility of implementation was evaluated by focusing on 1) organizational structure and 2) government budget, and 3) access to the target area and safety.

- 1) Organizational Structure: Are departments and staff with the necessary expertise and experience (to be empowered) assigned to implement the potential cooperation in the Forest Department?

2) Government budget: Are sufficient government budgets (counterpart budgets) allocated to implement the potential draft cooperation? This is also related to the forest department's need for cooperation proposals.

3) Target area: Is there any problem in the operation of the potential cooperation that could hinder access to the target area, local safety, or implementation?

The above three items were evaluated in three stages: high, medium, and low. The results are provided in Table 5-12.

**Table 5-12 Evaluation of Feasibility**

Forest landscape	Organizational structure	Government budget	Target area
Chattogram Hill Tracts	Low	Low	Low
Chattogram West Forest Zone	Medium	High	Medium
Sal Forest	High	Medium	High
Sundarbans	Medium	Medium	High
Southern Coast	High	High	High
Sylhet	Low	Low	Medium

Source: JICA Survey Team

### (3) Consistency with the cooperation policy

To date, JICA has not cooperated with the forest sector in Bangladesh. On the other hand, cooperation by international organizations and donor organizations has already had a history and accumulation of decades. Taking this situation into consideration, it is necessary to clarify the cooperation policy first, and the details are shown in Table 5-13.

**Table 5-13 Cooperation Policy**

Item	Cooperative policy
(1) Position and perspective	It is vital to effectively demonstrate presence. To address the most important issues recognized by the Government and the fundamental issues of the forest sector.
(2) Climate change adaptation	The Ministry of Foreign Affairs of Japan's National Development Cooperation Policy (2018) sets out "overcoming social vulnerabilities" as one main pillar of the policy. Nature-based Solutions for DRR can provide effective measures against negative impacts of climate change.
(3) Target and Period	A wide range of the issues in the forestry sector should be addressed with a medium-to-long term strategy.
(4) Use of strategic schemes	1) Produce first outputs in a shorter period through implementing technical assistance(TA) project. 2) Upgrading the TA outputs at national level in a medium to long term scale through financial assistance.
(5) Human resource development	Capacity development of human resources both central and local offices of the Forest Department.
(6) Collaboration	Actively collaborate with international organizations and donors with experiences of cooperation in the forest sector with central and local government agencies related to the forest sector.

Source: JICA Survey Team

Regarding the six items representing the cooperation policies shown in Table 5-13, the consistency of the potential cooperations for forest landscapes in each region was evaluated as high, medium, and low. The results are provided in Table 5-14.

**Table 5-14 Consistency of the Potential Cooperation with the Cooperation Policy**

Item	Six items (1) to (6) listed in Table 5-13						Total
	(1)	(2)	(3)	(4)	(5)	(6)	
Chattogram Hill Tracts	Medium	Medium	High	High	High	High	Medium

Item	Six items (1) to (6) listed in Table 5-13						Total
	(1)	(2)	(3)	(4)	(5)	(6)	
Chattogram West Forest Zone	High	Medium	Medium	Medium	High	Medium	Medium
Sal Forest	Medium	High	High	High	High	Medium	Medium
Sundarbans	Medium	High	Medium	Low	High	High	Low
Southern Coast	High	High	High	High	High	High	High
Sylhet	Medium	Medium	Low	Low	Medium	Medium	Low

Source: JICA Survey Team

### 5.7 Evaluation of Priority for Implementation of the Potential Cooperations

To link the potential cooperation for the six forest landscapes to the development of concrete cooperation projects in the future, it is necessary to consider which proposals should be prioritized.

To this end, the six potential cooperations are evaluated applying the items described in Chapter 5.4, 5.5 and 5.6. These are (1) Impact, (2) Risks, (3) Policy relevance, (4) Implementation potential, and (5) Consistency with the cooperation policy. Based on the detailed evaluation results of each item described in Chapter 5.4 to Chapter 5.6, the evaluation was conducted in three levels: high, medium, and low. Adding to the five items, overall evaluation is added to show the result.

**Table 5-15 Evaluation Results of the Potential Cooperation**

Forest landscape/ Evaluation items	Impact	Risk	Policy relevance	Feasibility	Consistency	Overall evaluation
Chattogram Hii Tracts	High	High	High	Low	Medium	Medium
Chattogram West Forest Zone	Medium	Medium	High	Medium	Medium	Medium
Sal Forest	Medium	Medium	High	High	Medium	Medium
Sundarbans	Medium	Low	High	Medium	Low	Low
<b>Southern Coast</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>	<b>High</b>
Sylhet	Medium	Medium	High	Low	Low	Low

Source: JICA Survey Team

As shown in the overall evaluation in Table 5-15, the potential cooperation on the southern coast is given the highest priority.

### 5.8 Outline of the Priority Cooperation Plan

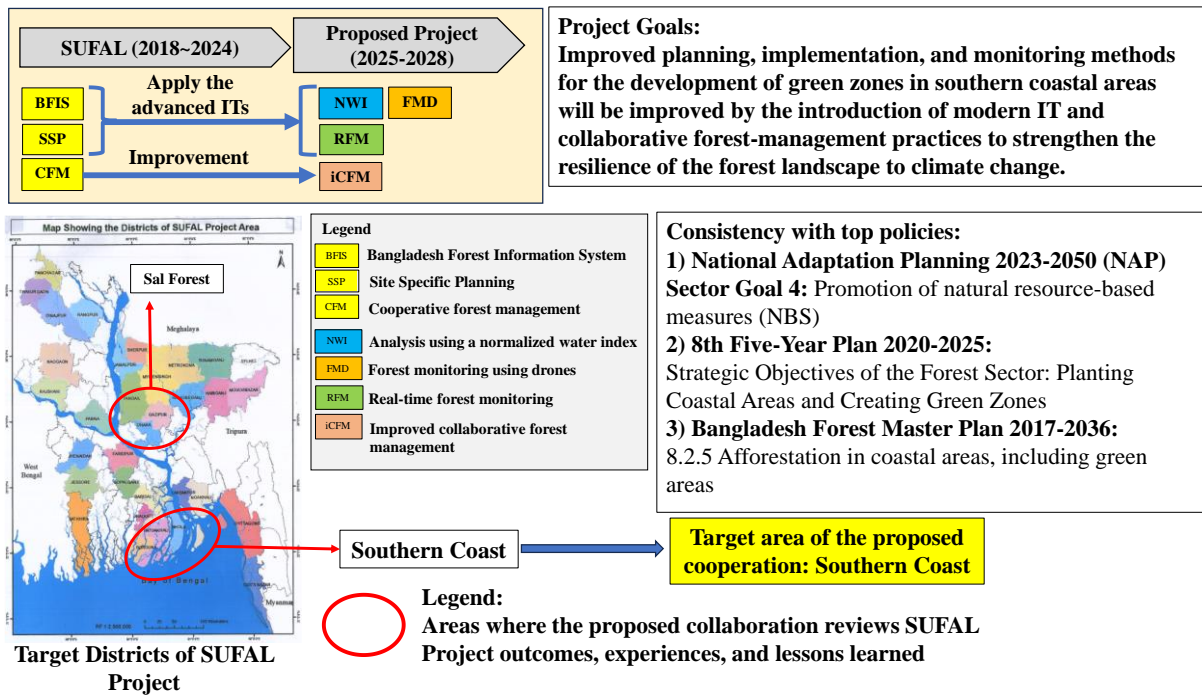
In the evaluation of the potential cooperation described in Chapter 5.7, "Improving methodology of planning and monitoring of greenbelt development through introducing information technologies and upscaling it in the coastal areas" was selected as the priority cooperation plan.

#### (1) Basic policy to formulate project based on the priority cooperation plan

To design a project based on the priority cooperation plan in the southern coastal area, the following policies are identified based on the data/information collected and their analysis described in the previous chapters.

- 1) The purpose of the project is to improve the planning, implementation, and monitoring methods based on the results of the afforestation project by the government.
- 2) Technology transfer and guidance will be provided to central and local forest department officials.
- 3) Create technical deliverables assuming their application to other forest landscapes in the country.

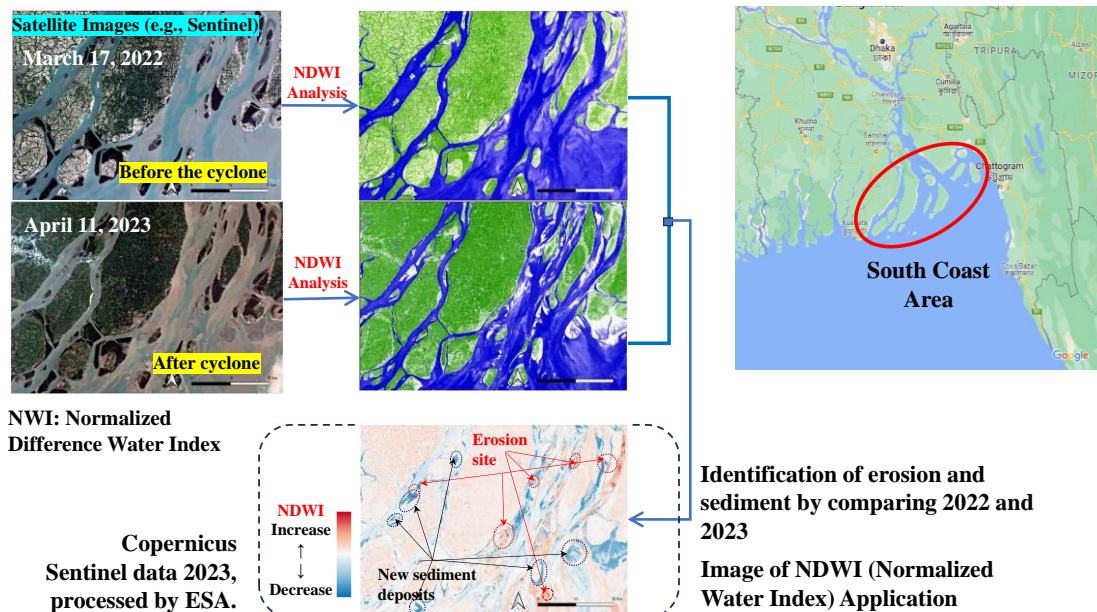
The "government-funded afforestation project" mentioned in 1) is SUFAL Project of the World Bank's loans. Considering the relevance and consistency with the SUFAL project and the government policy, the potential project is placed in the conceptual frame as shown in Figure 5-1.



Source: JICA Survey Team

Figure 5-1 Priority Cooperation

As indicated in Figure 5-1, technical elements included in the potential projects are NWI (Normalized Water Index), FMD (Forest Monitoring using Drone), RFM (Real-time Forest Monitoring<sup>31</sup>), and iCFM (Improved Collaborative Forest Management). Rough image of NWI applied to the coastal area are shown in Figure 5-2. It is open-source tool using satellite image data of Sentinel. Through applying NDWI analysis to more than two satellite images with one year interval, erosion and sediment can be identified.



Source: JICA Survey Team

Figure 5-2 Images of Identifying Erosion and Sediment in Southern Coasts Using NWI

<sup>31</sup> More precisely it is “Near-real-time forest monitoring” which sets time interval of about one year.

## 5.9 Concept for Implementation of Overall Cooperation Plan

### (1) Positioning of the plan

The potential cooperations for the six forest landscapes were evaluated from five perspectives. As a result, the establishment of greenbelts in the southern coastal region has been evaluated as the highest priority project. Thus, it is regarded as the potential project.

At the same time, it is necessary to consider how cooperation for other forest landscapes should be positioned in the future medium-to-long term cooperation policy for the Bangladesh forestry sector.

It is assumed that the potential project in the southern coastal region will be implemented first then produce several technical outputs and achievements.

As the final part of this report, the technical relevance between the outputs of the potential project in southern coast and other potential cooperation in other forest landscapes.

### (2) Linkage and from Priority Cooperation Plan to Overall Cooperation Plan

Figure 5-3 shows the application of the technical outputs produced in the project in southern coastal regions to other forest landscapes in the country.

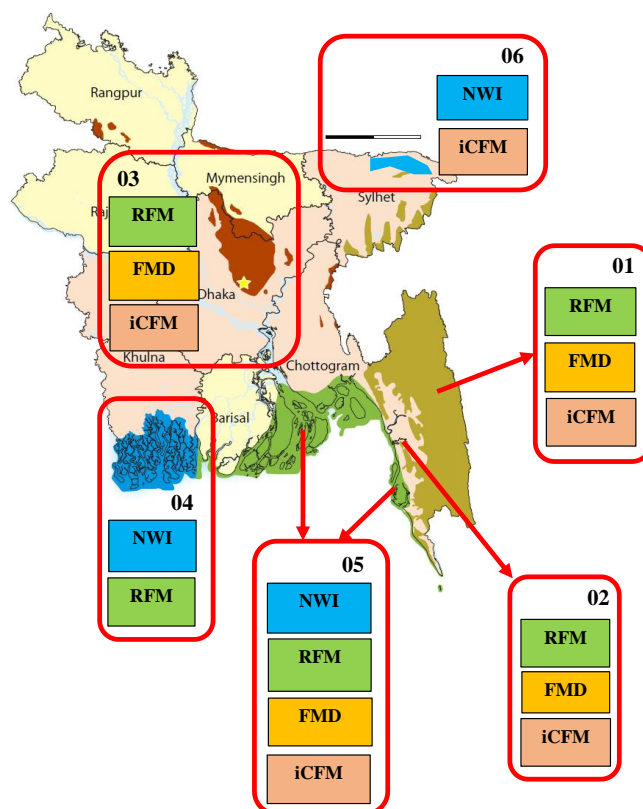
- 01: Chattogram Hill Tracts
- 02: Chattogram West Forest Zone
- 03: Sal Forest
- 04: Sundarbans
- 05: Southern Coast
- 06: Sylhet

The "RFM" is the "Real Time Forest Monitoring," which is a central-level activity in a priority co-operation proposal for the southern coast. Therefore, it can be applied to forest areas all over the country.

The methodology of "FMD" (Forest Monitoring by Drone) can be applied in the areas where afforestation and forest conservation are carried out. "NWI" is a "Normalized Water Index" and the methodology established in the preferred co-operation proposal may be applicable to Sundarbans and Sylhet, which have waters as well as southern coasts.

"iCFM" is an "Improved Collaborative Forest Management" which will be developed in the potential project and can be applied to the socio-economic and cultural context of other forest landscapes.

The word of "applicable" or "application" in this chapter means that essence of technical results (core methodology) can be useful to conduct activities in the potential cooperations in other forest landscapes. In practice, additional improvements and modifications of those outputs are necessary.



Source: JICA Survey Team

**Figure 5-3 Application of Technical Outputs to the Forest Landscapes in Bangladesh**

End

## **Attachment**



Attachment 1: Photo Album

1. Chattogram Hill Tract (CHT)	
	
<p>Banana planting in fallow land of “Jhum” cultivation, Oct. 2023</p>	<p>Slope collapse on roadside, Oct. 2023</p>
	
<p>Water scarcity situation at waterfall, Oct 2023</p>	<p>Typical type of mixed forest, Oct 2023</p>
2. Sal Forest in Gazipur District	
	
<p>Restoration site with associated tree species, Sept. 2023</p>	<p>Nursery owned and managed by local people participated in collaboration forest management, Sept. 2023</p>
	
<p>Forest restoration site with associated species,</p>	<p>Nursery at Dhaka Forest Division office,</p>



Sept. 2023	Sept. 2023
3. Southern Coast: Kuakata Beach in Patuakhali District	
	
Abandoned Eco-park entrance, June 2023	Degraded coastal plantation, June 2023
4. Sundarbans: Reserved Forest of Natural Mangrove	
	
Mangrove forest, June 2023	Wild spotted deer in mangrove forest, June 2023
5. Sylhet: Swamp Forest	
	
Ratargul Swamp Forest, Sept. 2023	A View of the Swamp from Observation Tower in Sunamganj District, Sept. 2023
	

Plantation of Chhatak Reserved Forest in  
Sunamganj District, Sept. 2023

*Trachypithecus pileatus* (Capped Langur) in  
Khadimnagar National Park in Sylhet District,  
Sept. 2023