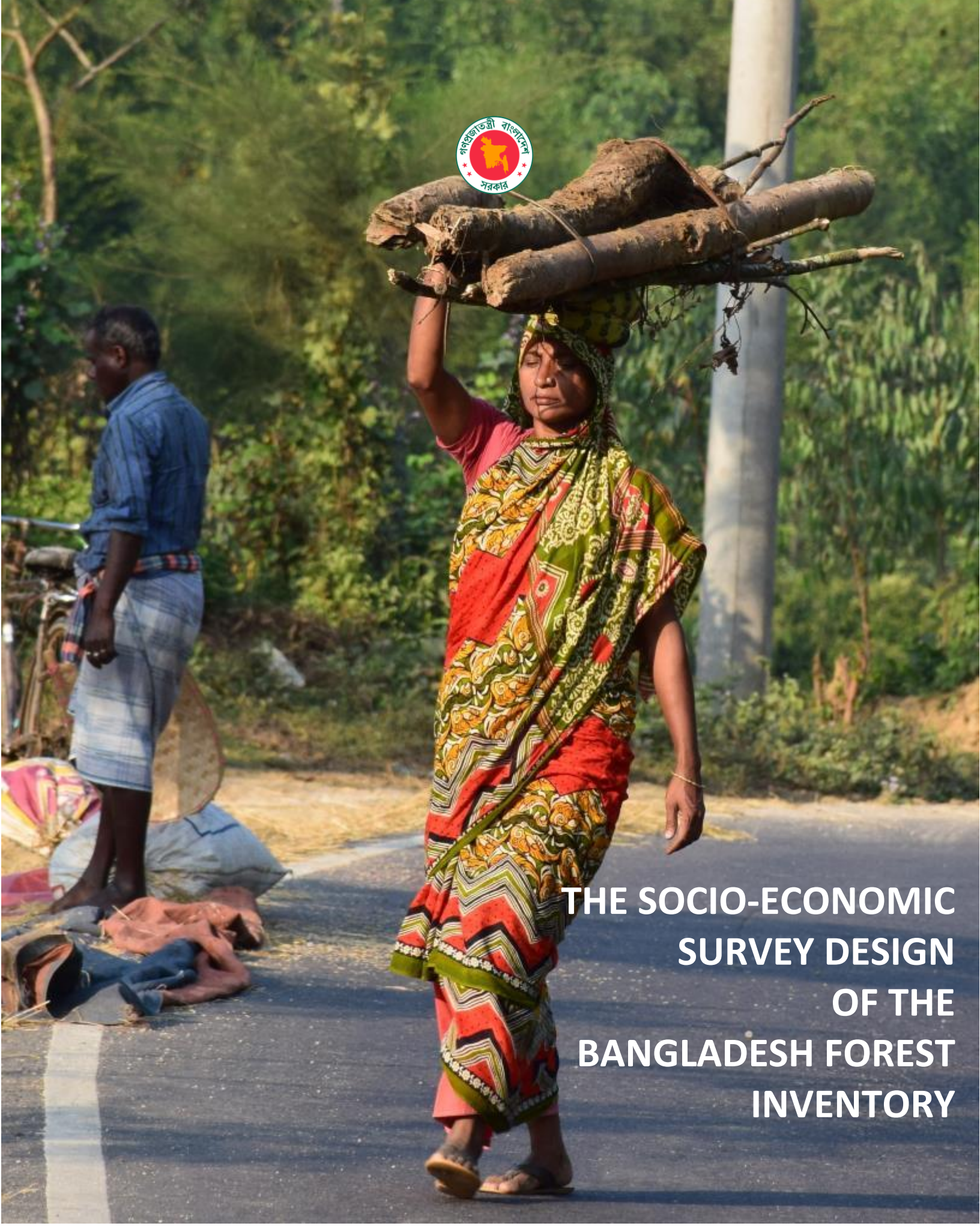

THE SOCIO-ECONOMIC SURVEY DESIGN OF THE BANGLADESH FOREST INVENTORY

The socio-economic survey design of the Bangladesh Forest Inventory

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Contact:
Forest Department
Ministry of Environment and Forest
Government of the People's Republic of Bangladesh
Bana Bhaban, Plot No- E-8, B-2
Agargaon, Sher-e-Bangla Nagar
Dhaka-1207
info@bforest.gov.bd

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Bangladesh Forest Department (BFD)
Bangladesh Bureau of Statistics (BBS)
Institute of Statistical Research and Training, Dhaka University (DU)
Institute of Forestry and Environmental Sciences, University of Chittagong (CU)
Arannayk Foundation (AF)
Food & Agriculture Organization of the United Nations (FAO)
US Forest Service

The following persons have contributed to the preparation of the design.

Abdul Khaleque	Bangladesh Bureau of Statistics	Md Zaheer Iqbal	Bangladesh Forest Department
Aminul Islam	Bangladesh Forest Department	Mohammed Jashimuddin	Institute of Forestry and Environmental Sciences, University of Chittagong
Delilah R Jaworski	US Forest Service	Nikhil Chakma	Food and Agriculture Organization
Farid Uddin Ahmed	Arannayk Foundation	Rashed Jalal	Food and Agriculture Organization
Illias Animon	Food and Agriculture Organization	Sayed Shahadat Hossain	Institute of Statistical Research and Training, University of Dhaka
Liam Costello	Food and Agriculture Organization	M. Mahfuzur Rahman	Institute of Forestry and Environmental Sciences, University of Chittagong
Matieu Henry	Food and Agriculture Organization	Luca Birigazzi	Food and Agriculture Organization

Executive summary

The Bangladesh Forest Inventory (BFI) aims at providing robust estimates of the interdependency between human activities and trees and forests through regularly assessing the status of trees and forests and human interactions. It is expected to provide forest resource related information for national policy and strategy processes and forestry planning. BFI will collect both biophysical and socioeconomic data to assess the functional relationship between people, tree and forest resources and the role of tree and forests for the livelihood of the community people. Ecosystem services will be better understood through the integration of the biophysical and socio-economic survey of the BFI.

Trees and forests play an important role for the livelihood of the people by providing food, energy, income as well as other ecosystem services to the society. The services are regulating services (e.g., climate regulation, flood regulation. water purification), supporting services (e.g., nutrient cycling, soil formation), and cultural services (e.g., aesthetic, spiritual, educational and recreational). At the current stage, the available resources and demand related to tree and forest products are not well known, and thus tree and forest related services are not properly reflected in the national statistics in Bangladesh.

To quantify the value of ecosystem services and interaction between people and tree and forest resources, a consistent, replicable and cost effective methodology is required for regular monitoring. This report presents the framework for socioeconomic monitoring of Bangladesh Forest Inventory. The framework focuses on the criteria, guiding questions, indicators, and variables to monitor the status of forest resources over time and to contribute to local livelihoods and national economy. The criteria and guiding questions (questions that will be answered from data) are selected from the national consultations held in June 2016 and February 2017 as well as published literature from Design Tool for Inventory and Monitoring (DTIM), Forest Resources Assessment (FRA), and European Forestry Institute (EFI). Indicators are developed based on information from different variables. Each of the variables is linked to the criteria via the underlying indicators. The variables have been selected in such a way that each of the criteria of the socioeconomic survey can sufficiently be met. The integration of biophysical and socioeconomic information from the Bangladesh Forest Inventory will eventually support the development of national policies, strategy processes and forestry planning.

Several combinations of variables, at union/ward level, have been considered to represent the dynamic interaction between human and tree/forest resources, and finally tree cover/number of households/union area has been selected for stratification. The samples are selected according to a two-stage stratified cluster random sampling design. The strata were constructed based on two criteria: (1) the variable: tree cover by number of households by area (tree cover/HH/ha), which was considered a good indicator of the complex interaction among humans, trees and forests and the zones adopted by the BFI, which divides the country into 5 zones, which are, as follows: Coastal, Sundarbans, Hill, Sal and Villages. The variable tree cover by household by area (tree cover/HH/ha) was calculated for each union/ward, based on the information provided by the 'Population and Household Census - 2011' dataset and Tree cover in 2014 (in ha) from Bangladesh Forest Department. The population was further divided into 4 classes of tree cover by number of households by area, the extent of each class being identified using a quartile function. The strata were constructed as a combination of the 4 classes of tree cover/number of households/area and the 5 zones. That is, each zone was divided into 4 classes of tree cover/number of households/area, with the exception of Sundarbans, which was kept as a single stratum. As a result, 17 strata were defined.

Once the strata have been identified, a random sample of unions or wards is selected from each, the selection being made independently in each stratum (first-stage sample). Within the selected unions or wards a random subsample of households is selected (second-stage sample). These households are the actual sampling units that will be surveyed. A total of 6135 households from 261 unions/wards were selected for the final socioeconomic survey to provide estimates at national scale.

A field form (survey questionnaire) is developed and tested in the field following the enumerator manual. The survey will provide information related to contribution to income from tree and forest, employment, governance (e.g. conflict management, equity), social forestry (e.g. allocation of resources), biodiversity (e.g. invasive species, wildlife), energy (e.g. fuelwood), impact of disturbances to tree and forest resources, and recreation (tourisms).

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Acronyms

BBS	Bangladesh Bureau of Statistics
BFD	Bangladesh Forest Department
BFI	Bangladesh Forest Inventory
BFRI	Bangladesh Forest Research Institute
CHT	Chittagong Hill Tracts
CRPARP	Climate Resilient Participatory Afforestation and Reforestation Project
DTIM	Design Tool for Inventory and Monitoring
EFI	European Forestry Institute
FAO	Food and Agriculture Organization of the United Nations
FRA	Forest Resources Assessment
HH	Household
ITTO	The International Tropical Timber Organization
Mha	Million hectares
NFA	National Forest and Tree Resources Assessment (2005-2007)
NFMS	National Forest Monitoring System
SFM	Sustainable Forest Management
SFNTC	Social Forestry Nursery and Training Centers
SFPC	Social Forestry Plantation center
ToF	Tree Outside of Forests
USF	Unclassed State Forest
USFS	United States Forest Service

Definitions

Code	Normally consists of one or more alphabetic, numeric or alpha/numeric characters assigned to a descriptor in a classification. Each code is unique to a property within a classification. If the property changes, then the code should also be changed.
Confidence interval	Statistical definition A confidence interval is the range in which it is believed that the true value of a quantity lies. The level of belief is expressed by the probability, whose value is related to the size of the interval. It is one of the ways in which uncertainty can be expressed (see estimation, statistical definition). In practice a confidence interval is defined by a probability value, say 95%, and confidence limits on either side of the mean value x.
Criteria	It defines the essential elements against which sustainability is assessed, with due consideration paid to the productive, protective and social roles of forests and forest ecosystems. Each criterion relates to a key element of sustainability, and may be described by one or more indicators.
Domain	A study domain is a major segment of the population for which separate statistics are needed. A domain could consist of a geographical area such as a region or major population centre. It could also comprise a specified population category, such as a major national or ethnic group. The number of domains has an important bearing on the size and distribution of the sample.
Error	Statistical definition In statistical usage, the term 'error' is a general term referring to the difference between an observed (measured) value of a quantity and its 'true' (but usually unknown) value and does not carry the (pejorative) sense of a mistake or blunder.
Focus groups and individuals	FGDs are considered user groups that relate to and use the land and resources on a frequent basis. These are people that live in or close to the sampling unit. They may be interviewed in groups (focus groups), or individually.
Forests	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than10 percent or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.
Framework	A framework is a multi-dimensional classification system that seeks to bring in a range of elements. A framework could include a combination of classifications, code lists and/or data items modules, and generally metadata.
Household	A household means *a group of persons normally living together and eating in one mess (i.e. with common arrangement of cooking) with their dependents, relatives, servants, and other members.* A household may be a one-person household or may have more persons. In case of a household with a group of persons living together and taking meals from the same kitchen generally maintain a family or family like relation. A household is usually described as *'khana'*. In some instances, there may be more than one household in a single

	house or in one dwelling arrangement. Similarly, a household may have more than one house or structure or shed.
Indicators	Indicators are parameters which can be measured and correspond to a particular criterion. They measure and help monitor the status and changes of forests in quantitative, qualitative and descriptive terms that reflect forest values as seen by those who defined each criterion.
Land Cover Classification System	LCCS is the only universally applicable classification system in operational use at present. It enables a comparison of land cover classes regardless of data source, economic sector or country. The LCCS method enhances the standardization process and minimizes the problem of dealing with a very large amount of pre-defined classes.
Land cover	The type of vegetation covering the earth's surface.
Land use	The primary type of activity being carried out on a unit of land.
Mauza	Mauza is the lowest administrative unit having a separate jurisdiction list number (J.L. No) in revenue records. Every Mauza has its well-demarcated cadastral map. Mauza should be distinguished from local village since a Mauza may consist of one or more villages.
Non-response rate	In sample surveys, the failure to obtain information from a designated individual for any reason (death, absence or refusal to reply) is often called a non-response and the proportion of such individuals of the sample aimed at is called the non-response rate.
Population	The population is the totality of items under consideration. In this case, the population for the Bangladesh Forest Inventory is all the area within the national territory. This forms the sampling frame from which to select the sample of plots.
Proportion	For a variable with n observations, of which the frequency of a particular characteristic is r, the proportion is r/n.
Quartiles	There are three quartiles. To find them, first sort the list into increasing order. The first or lower quartile of a list is a number (not necessarily in the list) such that 1/4 of the values in the sorted list are no larger than it, and at least 3/4 are no smaller than it. With n numbers, one definition is that the lower quartile is the $(n+1)/4^{th}$ observation in the sorted list.
Random sample	The sample is selected so as to give each member of the population the same probability of being chosen. Random sampling is used to obtain a representative sample of the population. Given a list of the whole population random numbers from tables or generated by computer can be used to select a random sample.
Sample	A sample is a group of units, selected from a larger group (the population). By studying the sample it is hoped to draw valid conclusions (inferences) about the population. A sample is usually used because the population is too large to study in its entirety. The sample should be representative of the population.
Sampling intensity	Refers to the proportion of the population that is been sampled.
Strata	Stratification is the process of dividing members of the population into homogeneous subgroups. The strata should be mutually exclusive every element in the population must be assigned to only one stratum. The strata

	should also be collectively exhaustive no population element can be excluded.
Sustainable Forest Management	The process of managing forest to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undue undesirable effects on the physical and social environment.
Tree	A perennial woody plant having a main trunk and usually a distinct crown. The definitions of the different types of trees are provided in the manual for biophysical aboveground measurement (e.g. live trees, Rotten trees, Seedlings, sapling).
Variable	Variable is established by data or information that enhances the specificity or the ease of assessment of an indicator. A variable is any characteristics, number, or quantity that can be measured or counted.
Zone	Zoning divides the area into smaller units based on distribution of soil, land surface and climate (Akhter, Jalal et al. 2016). The level of detail to which a zone is defined depends on the scale of the study, and sometimes on the power of the data processing facilities. The proposed zones for the Bangladesh forest inventory are (1) Hill, Sal, Sundarbans, (4) Costal and (5) Village.

1 Background

1.1 Introduction

Tree and forests play an important role in the livelihoods of rural households (Byron and Arnold 1999); (Sunderlin, Angelsen et al. 2005) by providing income, food, energy and shelter. A recent study (Angelsen, Jagger et al. 2014) conducted in 24 developing countries found that forest and environmental income contributes 28 percent of total income to households, 77% of which comes from natural forests. Forest products contribute to the shelter of at least 1.3 billion people, and about 2.4 billion cook with wood fuel (FAO 2014a). It has been estimated that more than 750 million people live in areas of low tree densities and rely on the surrounding forest and wild resources (cited at (Bakkegaard, Agrawal et al. 2016) . In Bangladesh, about 19 million people are dependent on tree and forest resources (Rahman 2016) and the forest cover is 9.88% according to the National Forest and Tree Resources assessment 2005-2007 (Bangladesh Forest Department 2007). Conversely, forest cover decreased between 1983 and 1995 at an average annual rate of 0.12%, and average stand density of the forest reduced by 87% between 1933 and 1995 (Sen 2010).

Forest degradation and deforestation have been attributed to manifold reasons both natural and anthropogenic. It has been estimated that forest loss in Bangladesh is about 0.015 Mha per year (Choudhury and Hossain 2011). The principal anthropogenic causes of forest destruction include, but definitely are not limited to, high dependence of a large rural population on natural forests for fuelwood, construction timber, fodder and various non-timber forest products; encroachment of forest land for agriculture or habitation by poor people living in and around forests, as well as by migrants; land grabbing by influential people for various commercial purposes; conversion of forest land into non-forest uses by the government for infrastructure or industrial development; and, commercial timber felling and the smuggling of valuable timber trees by criminals (BFD and CRPARP 2016). The natural causes include occasional landslides, cyclones, increased salinity, and diseases.

To address the issues related to socioeconomic benefits from tree and forest resources as well as drivers of deforestation and reforestation, Bangladesh Forest Department has been taking several initiatives (Appendix 1). Strengthening National Forest Inventory and Satellite Land Monitoring System in Support of REDD+ in Bangladesh (Bangladesh Forest Inventory) is one the initiatives to assess the tree and forest resources as well as assessing the interaction between human and tree/forest resources. The aim of the BFI is to support the Government´s action towards sustainable forest management through the development of regular, reliable datasets related to trees and forests. This includes reports and maps that will improve knowledge on the state, changes and trends of forests, trees outside forest and land use. This information will allow inference to be drawn between tree and forest resources and their users across multiple clients at multi-levels. It will establish a lasting programme of tree and forest resources monitoring and assessment including a system for management of geographical information, forest inventory and the socio-economic aspects within the Bangladesh Forest Department (BFD).

This report presents the design of the socioeconomic survey to be conducted as part of BFI implementation. This chapter includes the background and overview of secondary information used for survey design followed by the development of criteria, indicators and variables in Chapter 2. Chapter 3 presents the design

of the survey including the variable used for stratification, sample size calculation and allocation of sample among the strata.

1.2 Zones in Bangladesh

For the socioeconomic survey design, two approaches to zoning are considered – administrative zones and zones defined specifically for tree and forest assessment in Bangladesh. The second approach is finally used as the domain of the sampling framework considering its relative better agreement with the overall goal of BFI in providing the necessary information for different forests of interests, mainly for management purpose. In addition, it is one option to reduce the uncertainty of estimates and reduce measurement costs. The following sub-sections provide overview of the two approaches to zoning.

1.2.1 Administrative zones in Bangladesh

Administrative zones of Bangladesh are divided into eight major regions called divisions (Figure 1). The divisions are divided into 64 districts, or *zila*, which presently consists of 490 *upazilas*. An *upazila* is made up of several unions. *Mauza* is the lowest revenue collection unit of Bangladesh. Within a *mauza* there could be one or more villages. Howev er villages are not officially delineated. Bangladesh's eight official administrative zones are shown in Table 1.

Table 1: Land administrative zoning in Bangladesh

Sl. No.	Zone	Number
1	Division	8
2	District	64
3	City Corporation	11
4	Municipal Corporation	324
5	Upazila	490
6	Union Parishad	4500
7	Mauzas	56,348
8	Village	81,891

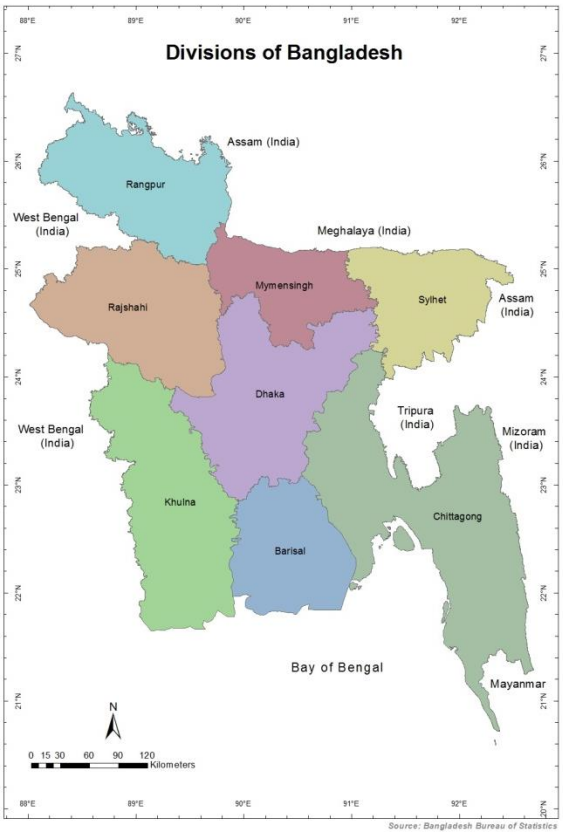

Figure 1: Administrative divisions in Bangladesh

The Forest Department maintains separate administration to manage the legal forest land which was declared as Reserved, Protected, Acquired and Vested forests by the Government. The existing forest administrations are shown in Table 2. Forest lands at the *Mauza* level is under direct supervision of forest beat. One or more Beats are under the management of Forest Range and Ranges are under the management of Forest Divisions. Nine regional forest circles control all the forest divisions allocated under those circles. There are also Social Forestry Nursery and Training Centers (SFNTC) mostly at district level. The SFNTC is headed by Forest Ranger. Under a SFNTC there are several Social Forestry Plantation center (SFPC) at upazilas level. Each SFPC is headed by a forester.

Table 2: Forest Administrative units of Bangladesh

Sl. No.	Name of administration	Number
1.	Forest Circle	9
2	Forest Division	41
3	Management Plan Division	3
4.	Forest Range/SFNTC	255
5.	Forest Beat/SFPC	672

1.2.2 The zonation of Bangladesh tree and forest areas

This zoning map has been developed based on the analysis of the distribution of forest types in different soil, climate, altitude and salinity types (Akhter, Jalal et al. 2016). Use of such zones contributes to the overall aim of delineating homogenous sub-populations that will remain constant, in terms of their defining physiographic attributes, over time. Five zones have been identified in this approach and brief descriptions of those zones are given in following sub-sections.

1.2.2.1 Sundarbans zone

This zone is the largest mangrove forest in the world. It lies on the delta of the Ganges, Brahmaputra and Meghna rivers in the Bay of Bengal. The total area of Sundarbans is 609,200 ha in which terrestrial land is 62.26% and water 37.74%. The Average precipitation is 2004 mm (minimum-1783 mm and maximum-2343 mm). The road length is 99993.07 m (33.87% extreme hard to reach (HTR) and 0.04 % very HTR). The dominant species is *Heritiera fomes* with varying proportion of *Excoecaria agallocha* (Gewa). The next most abundant species is *Xylocarpus mekongensis* (Passur), which frequently grows with *Bruguiera gymnorrhiza* (Kankra), *Avicennia officinalis* (Baen), Golpata etc. The area is known for its wide range of fauna, including 260 bird species, the Bengal tiger and other threatened species such as the estuarine crocodile and the Indian python. The detailed biophysical characteristics are provided in Appendix 2 and socioeconomic information in Appendix 7. Figure 2 present the location of Sundarbans in Bangladesh.

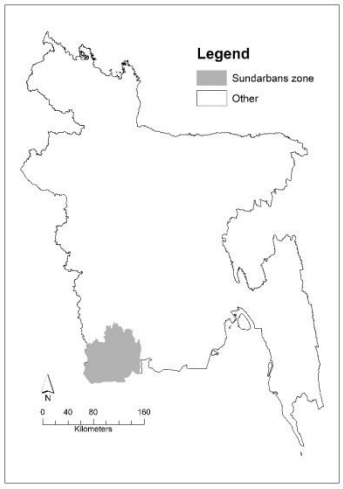

Figure 2: Location of *Sundarbans* zone

1.2.2.2 Coastal Zone

The total area of the coastal zones is 1209000 ha and the presence of terrestrial land and water is 39.04 % and 60.96% respectively. The average precipitation is 2870 mm (Min: 2267 mm, Max: 3698 mm). The road length is 4110715.723 m in which 24.31% is extreme hard to reach and 1.42% very hard to reach area. The detailed biophysical characteristics and socioeconomic information are given in Appendix 3 Appendix 7, respectively. Figure 3 present location of Coastal zone.

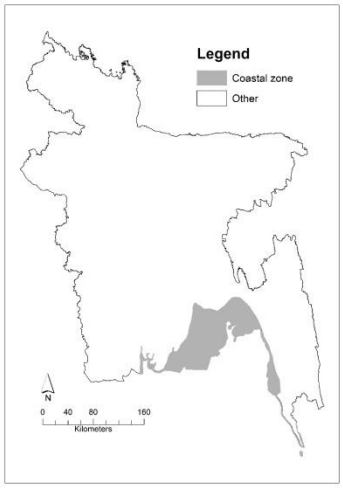

Figure 3: Location of coastal zone

1.2.2.3 Sal Zone

This zone lies in the districts of Dhaka, Tangail, Mymensingh, Rangpur, Dinajpur and Rajshahi. The dominant tree species is Sal (*Shorea rubasta*). However, *Terminalia bellerica*, *Albizzia procera*, Lagerstroemia spp and *Ficus* species are seen in the Sal zone as mixed Sal. The total land area of the Sal zone is 534800 ha in which terrestrial land 96.78% and water 3.22%. The average precipitation is 2040 mm (Min: 1804 mm, Max: 2462 mm). The road length is 2484824.10 m in which 12.01% is extreme hard to reach area (HTR), 1.26% moderate HTR and 6.26% very HTR. Appendix 4 and Appendix 7 provide the detailed biophysical characteristics and socioeconomic information, respectively. Figure 4 presents location of Sal zone in the map.

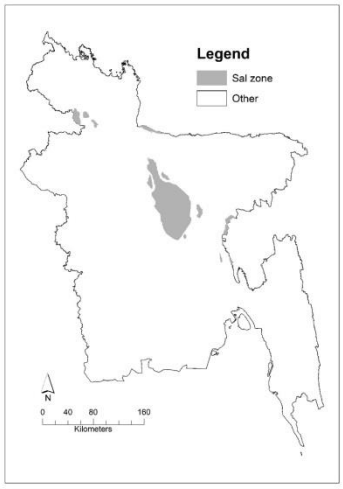

Figure 4: Location of Sal zone

1.2.2.4 Hill zone

The zone is situated mostly Chittagong Hill Tracts (Rangamati, Khagrachari and Rangamati), part of Chittagong and Cox's bazar district and low hills in Sylhet district. The main tree species are Garmar, Segun, Chapalish, Telsur, Koroi, Garjon, Champa etc. The total land area of the Hill zone is 1714000 ha in which terrestrial land 96.74% and water 3.26% respectively. About 16.16% of total land area is covered by reserved forest (276900 ha). The average precipitation is 2720 mm (Min: 2061 mm, Max: 4370 mm). About 51.60% is extreme hard to reach area and 15.46% of very hard to reach area. The detailed biophysical

characteristics are presented at Appendix 5 and socioeconomic information are provided at Appendix 7. Figure 5 shows the location of Hill zone.

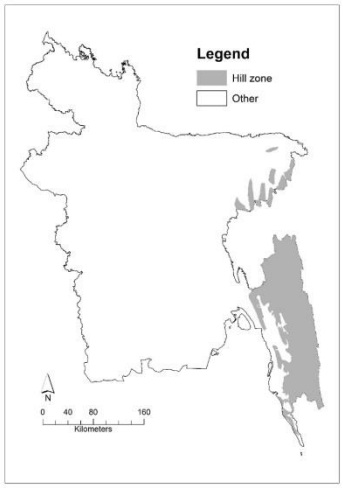

Figure 5: Location of Hill zone

1.2.2.5 Village Zone

Village zone is very important suppliers of forest products in Bangladesh. The total land area is 10890000 ha in which terrestrial land is 92.12% and water is 7.88%. According to Douglas, 1981, village forests contribute about 80 to 82% of forest products. About 50% of the total gross volume, and more than 50% of the total commercial volume can be found in the villages. The most abundant species are *Cocos nucifera, Samanea saman, Mangifera sama, Mangifera indica* and *Areca Catechu*. This zone also provides bamboo and trees including palms the main tree species are jackfruit, Tal, Khejor. The detailed biophysical characteristics are given at Appendix 6 and socioeconomic information are presented found at Appendix 7. Figure 6 presents location of village zone.

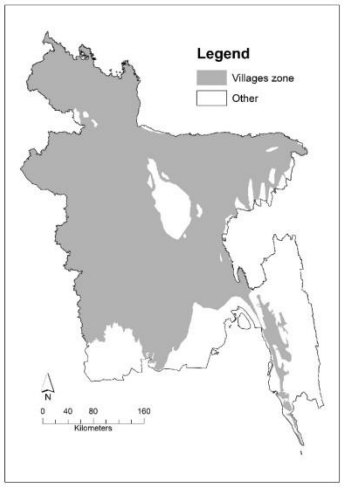

Figure 6: Location of Village zone

1.3 Stakeholder mobilization in the design process

A step-wise method was followed for the design of the socioeconomic survey. This includes development of specific criteria, questions, indicators and variables. The approach is aimed at understanding the interaction between people, trees and forest resources. The sustainability of the process was ensured by the building of adequate capacity in national institutions for long term and continuous data collection, and the processing and analysis of the information collected. Initiatives in this regard include:

- Information need assessment through national consultation including 60 participants from 14 institutions (Chowdhury and Chakma 2016)
- Literature review on tree and forest changes in Bangladesh (Chowdhury, Costello et al. 2016)
- Socioeconomic data collection from national institutions (BBS, Arannayk Foundation, FAO Rome);
- Expert group discussion with representatives from Bangladesh Bureau of Statistics (BBS), Dhaka University, Forest Department, Chittagong University, Food and Agriculture of the United Nations and Arannayk Foundation to identify the objectives, indicators and variables;
- Strengthening national capacities through capacity building activities and collaborative activities;
- National consultations on survey design including 45 participants from 15 institutions (Chakma 2017)
- Validation of socioeconomic survey design through field testing and endorsement of stakeholders (Chakma 2017, Rahman and Jashimuddin 2017)

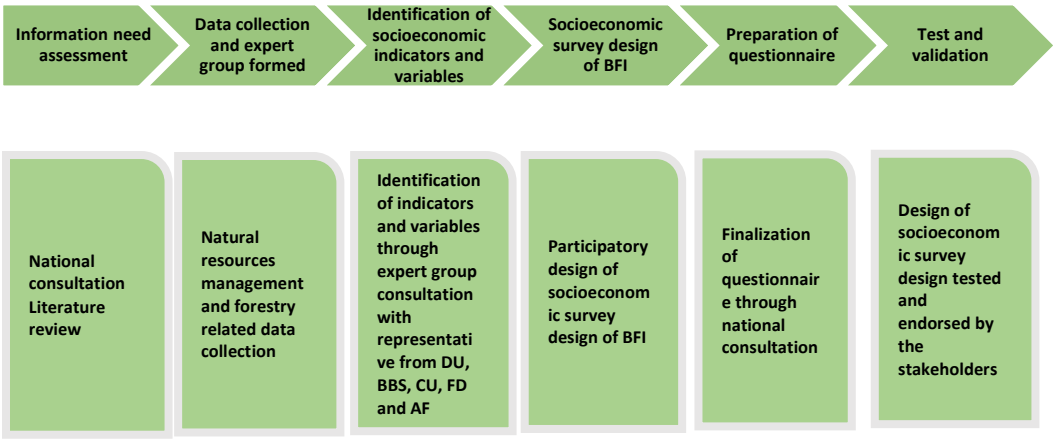

Figure 7: Process for upgrading socioeconomic monitoring of Bangladesh Forest Inventory (BFI) capacities, approaches, technologies and tools in Bangladesh Forest Department (BFD).

Defining objectives and planning for the socioeconomic monitoring of BFI, whether for technical, logistics and financial processes were decided under the authority of the Chief Conservator of Forests (CCFM) and the NFMS[1] (National Forest Monitoring System) group. In Bangladesh, several projects are involved in the assessment of socioeconomic benefits from the tree and forest resources. To ensure statistically reliable,

[1] The NFMS group was created in 2015 to facilitate dialogue and decision making within the forest department on the implementation of the evaluation and forest monitoring system

replicable and cost effective survey design at national level a broad set of contributions have been sought from various project stakeholders through various consultations and meetings. The events, outlined in Appendix 8, have involved over 100 participants, mostly from forest department but also from BBS, BFRI, Non-government organizations, universities and many others to finalize the documents related to the socioeconomic survey for the Bangladesh Forest Inventory.

The socioeconomic survey is built on the basis of the knowledge accumulated by the implementation of previous socioeconomic surveys related to natural resources management and forestry. Appendix 9 presents previous socioeconomic surveys related to tree and forest resources in Bangladesh at national and regional scale. In particular, data sharing between projects (e.g., CRPARP, UN-REDD) and institutions (e.g., Bangladesh Bureau of Statistics, Arannayk Foundation, FAO-Rome) have allowed for the analysis of data that are used for survey design. Stakeholders involved in decision related to the design include several national and international experts from FAO, USFS, SilvaCarbon, CRPARP projects, Dhaka University, Chittagong University, Bangladesh Bureau of Statistics (BBS), Forest Department and Arannayk Foundation. Data and software used throughout the design process are outlined in Appendix 10.

2 Criteria, indicators and variables

2.1 Criteria, indicators and variables of the survey

Criteria and indicators form parts of a hierarchy of forest assessment tools. The three levels of this hierarchy are Criteria, Indicators, and Verifiers. A **criterion** defines the essential elements against which sustainability is assessed, with due consideration paid to the productive, protective and social roles of forests and forest ecosystems (FAO 2017). Each criterion relates to a key element of sustainability, and may be described by one or more indicators. **Indicator** is a parameter which can be measured and correspond to a particular criterion (FAO 2017). They measure and help monitor the status and changes of forests in quantitative, qualitative and descriptive terms that reflect forest values as seen by those who defined each criterion. Finally, a **variable** is established by data or information that enhances the specificity or the ease of assessment of an indicator. At the third level of specificity, variables provide specific details that would indicate or reflect a desired condition of an indicator. Variables provide meaning, precision and site-specificity to an indicator (FAO 2017). Since anthropogenic pressures on forest and tree resources causes environmental deterioration impairing sustained biotic communities, it is important to link socioeconomic variables with biophysical variables.

A simple linear link among the criteria, indicators, and variables of trees and forest resource has been developed for the monitoring of biophysical and socioeconomic component of the Bangladesh Forest Inventory which are quantitatively modeled as follows:

Criteria are identified as C_l, which is a function of a number of measurable indicators, I_m. That is,

$$C_l = f(I_m) \tag{2.1}$$

However, each of the I_m is resulted from a number of socioeconomic and biophysical verifiers or variables, V_n, which are also measurable both qualitative and quantitative.

$$I_m = f(V_n) \tag{2.2}$$

Socioeconomic survey will focus on collecting socioeconomic variables which will be integrated with biophysical ones to assess the criteria through developing relevant indicators.

2.2 Identifying criteria, questions, indicators and variables

The criteria and indicators have been identified to explain the sustainability and monitoring of trees and forest resources in Bangladesh over time and space in terms of biophysical and socioeconomic aspect. To identify the criteria, questions, indicators and variables several events were organized including two national consultations, expert group meetings and expert recommendation from FAO Rome and USFS (Appendix 8 provides the list of events conducted to finalize the documents). In addition to identify the criteria, questions (guiding questions),

indicators and variables several published literatures were considered such as Design tool for Inventory and Monitoring (Scott, Bush et al. 2015), FRA (FAO 2015), (FAO 2017) and European Forest Institute (EFI 2013). The socioeconomic information is integrated with biophysical information to generate the integrated indicators. The indicators that integrate both socio-economic and biophysical information focus on defining the relationship of people of Bangladesh with tree and forest resources from economic and livelihood points of view. More precisely, these indicators aim to estimate the economic value of the traditionally-marketed and important non-marketed ecosystem services (ES)[2] provided by forests and trees across the country (GoB 2017). The list of identified criteria and indicators are presented at Appendix 11: Criteria and indicators for the Bangladesh forest Inventory.

[2] The non-marketed ones include potable water and protection from tropical storms. These are included as they are of high national importance.

3 Survey design

3.1 Domain of the sampling framework

To maintain consistency with system of the Bangladesh Bureau of Statistics (BBS) information, the national 'Population and Household Census 2011' data at union/ward level has been used to design this survey. Then the whole data has been divided into 5 zones. These zones are distinctive in terms of the type of biophysical aspects (Akhter, Jalal et al. 2016). Thus, the zones are likely to provide relevant data for the integration of the biophysical and the socioeconomic components of the Bangladesh Forest Inventory. Since the zones are distinctive, and survey design has been built on zone-specific criteria, the socioeconomic information available through this sampling design would be zone-specific.

3.2 Stratification

3.2.1 Union level attributes for stratification

The socioeconomic survey has been planned with due consideration to both forest and tree resources across the country. It has not been kept limited to forest areas. Thus, it has extended the scope of the survey to both non-forest and forest areas. This standpoint necessitates considering attributes that encompass the interaction among human, tree and forest resources. Union-level tree cover has been adopted as the proxies for the extent of forest and tree resources. The selection of this variable was made on the ground that the design is prepared for socioeconomic monitoring of the national forest inventory of the country. One important point to mention is that, the design did not consider only forest coverage; rather tree coverage. Since village forest and trees outside forest are important for the rural environment and livelihoods, the consideration of tree cover as a variable was preferred to understand the integration between tree, forests and people. Similarly, with a view to provide importance to human interaction, household density was considered. For the purpose of stratification within the zones (i.e., domain of the sampling), the variable tree cover/number of households/union area was generated by combining information about tree cover in 2014 (ha) and number of households per ha (BBS 2015, Potapov, Hansen et al. 2016). The descriptions of the variables are given below –

(1) **Tree Cover in 2014 (ha):** The tree cover of the union that the house is belonged to. At the scale of the polygons of the union/ward map, zonal statistics of the 2000-2014 tree cover data (Potapov, Hansen et al. 2016) are computed. This results in each union/ward of the map containing the number of pixels with tree cover in 2000, the number of pixels with gains and the number of pixels with tree cover loss for each year between 2000 and 2014. Based on this, tree cover area within a union/ward has been computed.

(2) **Household density (household/ha)**: The growing population is expanding its dwelling spaces over forest and agricultural lands. Thus, household density is considered to have a direct impact on forest and tree resources. Thus, household density was considered for the stratification purpose.

3.2.2 Stratification of zones

The unions were classified into four classes based on tree cover/number of household/area data. The five zones – Coastal, Hill, Sal, Sundarbans and Village were brought under splitting into homogeneous strata. Each zone-level data was first splitted into 4 strata by the variable of tree cover/ number of household / area using the quartile function. Thus the total sub-strata were 4*5=20 strata estimated across the country. Since the Sundarbans is the largest forest tract in the country, it was considered 10 kilometers (km) periphery of Sundarbans that 95 unions under Sundarbans zone. Each of the 20 strata was given a unique name as the name of the zone appended with the stratum number as shown in Figure 8.

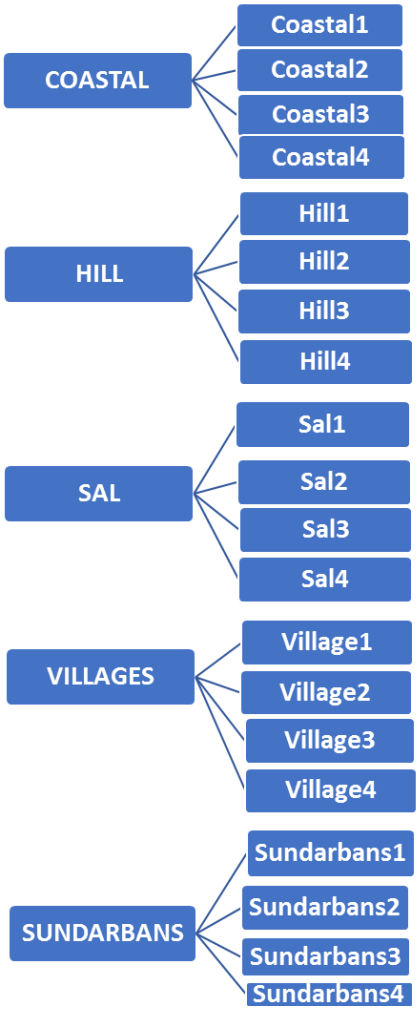

Figure 8: The stratification of the unions under each of the zones based on variable of tree cover per household per area.

3.3 Sample design for quantitative survey

The estimation of the optimal sample size in complex surveys, such as the present one, is not a trivial exercise. Especially when information on more than one item has to be collected it is necessary to focus on the item which is considered as the most relevant to the survey. One of the most relevant outcomes of the survey is the number of people depending on forest resources in each zone.

3.3.1 Sample size

Cochran (1977) formula (equation 3.1) has been used for calculating representative sample for proportion when the population is infinitive. This formula provides the optimum sample size needed to attain an estimate for each zone within an accuracy of the 5 %.

$$n_0 = \frac{z^2 pq}{e^2} \quad \text{..... (3.1)}$$

Where,

n_o = is the sample size

z = is the statistics that defines the level of confidence (at 95% confidence level the value of z =1.96)

p = is the estimated proportion of an attribute proportion that is present in the population (p = 0.5) and q is 1-p

e = Margin of error to be attained (here ±5%)

For example, to calculate the equation 3.1, the required sample size will be as follows

$n_0 = \frac{(1.96)(0.5)(0.5)}{e^2}$ =384.16= 384

To estimate these equations, the following concepts were considered:

The choice of p

A good estimate of the population proportion (here also called a priori proportion) which is the object of the survey is required for the estimation of the sample size. In practice, this information is not available before the survey. Since the value of p(1-p) increases as p moves toward 0.5, the choice of p =0.5, adopted in our estimation, provides the most conservative estimate of n_o.

Margin of Error

An uncertainty of plus/minus 5% percent (at a 95% confidence level) for each zone was chosen to estimate the sample size (e=0.05).

Confidence Interval

A 95% confidence level with 5% standard error was considered. That is, e = 0.05, and z = 1.96.

3.4 Sample allocation

3.4.1 Sample allocation among the zones

By using equation (3.1), the resulted sample size was found to be 384. It was assumed that the non-response rate (*k*) of the survey is 1.1%. Due to bigger strata compared to small sample size the design effect (*f*) is considered 3 for getting safer sample size. Assuming that the population size (number of households) in each of the 5 zones was infinite, the total number of households to be surveyed in each zone is 1268 (384*3*1.1), which corresponds to a total of 6340 (1268*5) households at a national level.

Thus, considering infinite population, a sample size of 1268 households is required in each of the 5 zones to attain a zone-wise estimate of the population proportion with an uncertainty of 5% (at a 95% level of accuracy (Table 3: Equal allocation with infinite population across the zone**Error! Reference source not found.**).

Table 3: Equal allocation with infinite population across the zone

Zones	Equal allocation of sample size
	n
Coastal	1268
Hill	1268
Sal	1268
Sundarbans	1268
Village	1268
Total	**6340**

3.4.2 Sample allocation among the strata in line with BFI biophysical survey design

The unions/wards of each zone, have been divided into 4 classes of tree cover/number of households/union area using a quartile function. That is, each class within a certain zone contains approximately the same number of union (**Table 4: Selection of unions in each stratum with equal allocation**)

The Sundarbans zone is unique for a number a reason such as, but is not limited to, (a) total forest stock is bigger than any other forest, (b) distributed comparatively to a smaller area – it has 95 unions in it, concentration of socioeconomic activities is more here compared to other zones, (4) it is healthier than all other zones, and so forth. Based on all these considerations, it is suggested to cover 10 km of periphery of Sundarbans as a zone to allocate union numbers for this survey design. Considering the 10-km boundary of Sundarbans 89 unions are found.

3.5 Selection of unions/wards in each stratum

Each stratum is homogeneous based on the variable (tree cover/number of households/area) considered. To give the equal weight of the strata the number of unions to be selected is similar. It was assumed that 20 households would be surveyed from each of the union/wards resulting in 6340/20=317 union/wards to be surveyed. To give the equal allocation of union to each stratum, the number of unions to be selected in each stratum is 317/20=15.85~16 (**Table 4**). The unions are selected randomly from each of the stratum using R software. Therefore, total number of unions to be surveyed is 320 (16*20). Similarly, total number of household to be interviewed is 6400 (**Table 4**). The spatial distribution of selected unions for the socioeconomic survey is presented at Figure 9. Lists of union/wards are provided in Appendix 12 to 16.

3.6 Selection of HH for the survey

Union wise maps will be developed and ten (odd-5 and even-5) GPS coordinates/points will be assigned to locate the rural settlement in that maps. Interviewer will choose either odd or even numbers from the map for the households' interview. Four households will be selected from each GPS point; thus a total 20 households will be interviewed in each union. It was assumed that four households will be selected from different directions i.e. North-1, South-1, East-1 and West-1 from each GPS coordinates. It is suggested to conduct one female interview out of four respondents in each GPS point.

Table 4: Selection of unions in each stratum with equal allocation

Strata	Household (numbers)	No. of Union/Ward	Equal allocation		Rounded Sample union	Total number of HHs to be sampled
			Number of unions to be sampled	Number of HH to be sampled		
Coastal1	400463	62	15.85	317	16	320
Coastal2	333082	61	15.85	317	16	320
Coastal3	180531	61	15.85	317	16	320
Coastal4	26908	61	15.85	317	16	320
Hill1	363538	73	15.85	317	16	320
Hill2	268280	72	15.85	317	16	320
Hill3	164658	72	15.85	317	16	320
Hill4	73910	72	15.85	317	16	320
Sal1	1427337	99	15.85	317	16	320
Sal2	1543363	99	15.85	317	16	320
Sal3	753728	98	15.85	317	16	320
Sal4	237453	99	15.85	317	16	320
Villages1	9730970	1723	15.85	317	16	320
Villages2	9721374	1723	15.85	317	16	320
Villages3	5922459	1722	15.85	317	16	320
Villages4	1528129	1723	15.85	317	16	320
Sundarbans1	114596	23	15.85	317	16	320
Sundarbans2	103470	22	15.85	317	16	320
Sundarbans3	107197	22	15.85	317	16	320
Sundarbans4	51276	22	15.85	317	16	320
Total	**33052722**	**7909**	**317**	**6340**	**320**	**6400**

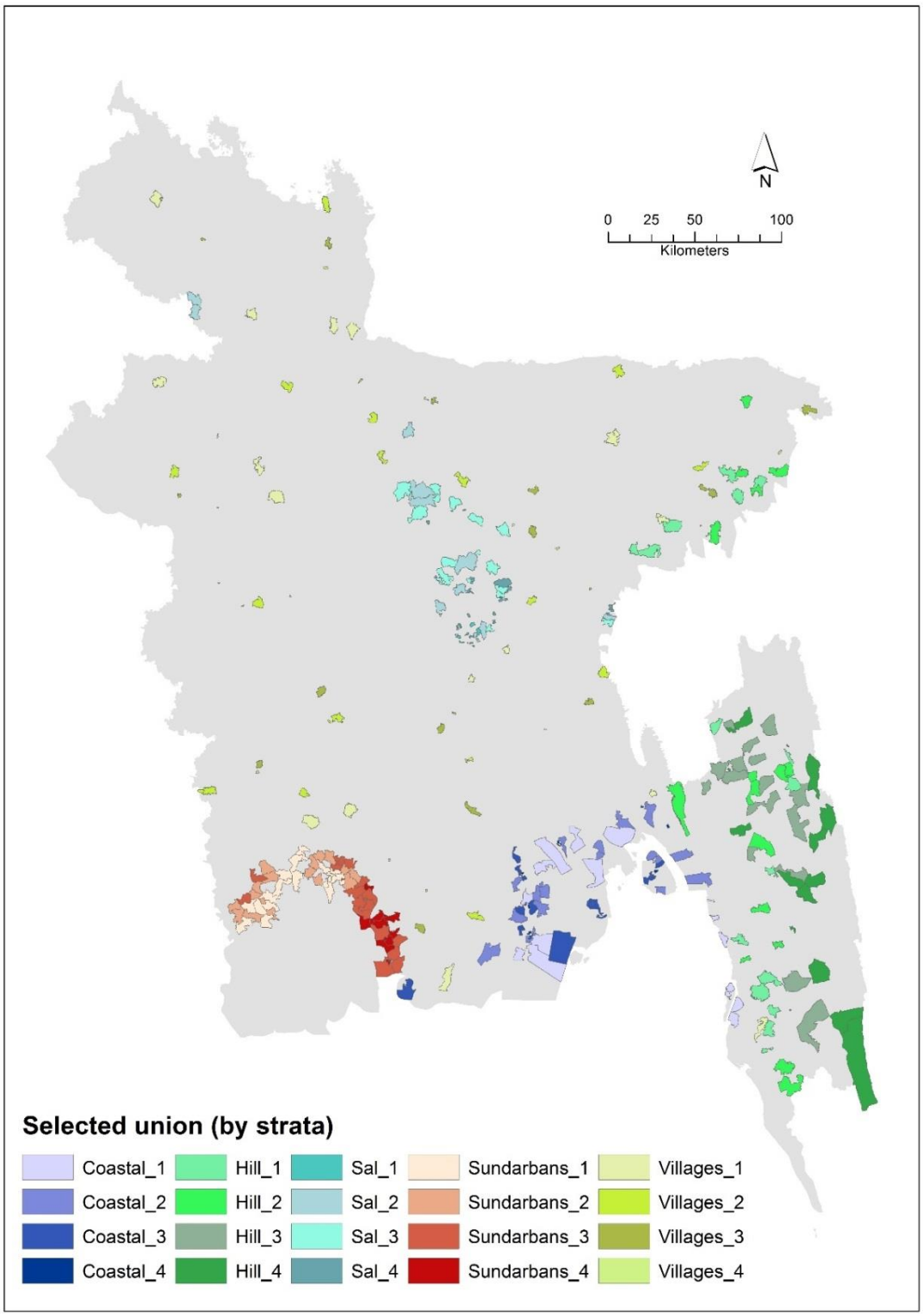

Figure 9: Spatial distribution of selected unions/Wards across the zones for socioeconomic survey

3.7 Design for qualitative survey

Beside quantitative survey, qualitative techniques are used to collect in-depth/ perceptual information on selected indicators related to the survey. To make data collection comprehensive, the target groups should include important entities (e.g., forest resource users) in the society that are believed to have important impacts on forest and tree resources of the country. However, to reduce time and other resources, Focus Group Discussions (FGDs) could be a better tool to conduct a qualitative survey (hereinafter referred as community survey) with community leaders and special forest user groups.

The FGD focuses on the socioeconomic attributes of each of the target groups in an area/union, so that the selection of the respondent ensures the representation of all in that area. The main purpose of the community survey is to collect the information related to trends of land use, access to services, tree and forest products prices based on market value, benefits from tree and forest resources. The survey will be administered among the community people using FGD methodology where 8-10 participants will be attended in the selected union or ward. A checklist (questionnaire) will be used to collect the information. A total 100 FGDs will be carried out across the country. Thus, distribution of community survey in each zone would be 20.

4 Conclusion

A national scale socio-economic survey is a complex exercise, which requires a wide range of professional skills and institutional capacities. The amount of data which will be collected in the field will provide a meaningful insight on the multifaceted interactions among people, trees and forests. This information also constitutes the basis for the development of adequate environmental policies and for national forestry planning.

This survey provides accurate and precise information both a national and a regional scale, and, particularly, for each of the 5 zones adopted by the Bangladesh Forest Inventory (BFI). Particular attention is put in the sampling design to ensure that the results are compatible and consistent with the data collected through the BFI. This allows the integration of the socio-economic variables with the biophysical information in order to have a better understanding of the relationships between human activities and tree and forests dynamics.

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6 Appendix

Appendix 1: Development initiatives undertaken by Bangladesh Forest Department (BFD 2017)

Sl. No.	Name of the Initiatives	Duration	Objectives	Location
1	Bangabandhu Sheikh Mujib Safari Park, Gazipur (3rd Phase)	March 2010 to December, 2017	1. To conserve animal and plant biodiversity of Sal forest. 2. To provide ex-situ conservation support to complement in-situ conservation of endangered and threatened wildlife of Bangladesh. 3.To promote ecotourism facilities close to Dhaka Mega City for recreation and poverty alleviation. 4.To provide recreation, education and scientific research facilities.	Sripur & Gazipur Shadar Upazila of Gazipur District
2	Bengal Tiger Conservation Activity (BAGH)	July,2014 to June,2018	Main objective of Bagh is to contribute to the conservation of Bangladesh's rich biodiversity through a focus on the protection of charismatic wildlife, specifically the Royal Bengal Tiger. This will realize "Bangladesh to become a knowledge-based, healthy, food-secure, and climate-resilient middle-income democracy" as per the USAID's Country Development Cooperation Strategy for Bangladesh under which "Responsiveness to Climate Change Improved" is one of the four Development Objectives	Sundarbans
3	Development and Extension of Bangabandhu Sheikh Mujib Safari Park, Cox's Bazar (1st Revised)	July, 2012 to June, 2017	With the major goal of serving the national need of biodiversity conservation education, research, recreation and in-situ and ex-situ conservation of the threatened, extinct and endangered animals.	Chakaria, Dulahazra Union,Cox's Bazar

4	Establishment of Botanical Garden at Lalmai Hill Areas	July, 2015 to June, 2018	1.To protect indigenous species of the Lalmai hill areas. 2.To produce, develop and conserve the gene pool of local and exotic rare plant species. 3.To protect the historic & natural heritage of the Lalmai hill. 4.To enhance carbon stock for mitigation of climate change. 5.To construct moisture content room and semi dome shaped shades to preserve orchid, cactus and other rarely found plants. 6.To conserve bio-diversity and improve wildlife habitat. 7.To raise plantation of different species of bamboo, herbs and shrubs, medicinal plant. 8.To promote eco-tourism and recreational facilities. 9.To create facilities for education and research. 10.To augment socio-economic condition of the local people through generating scope of employment.	Comilla Sadar (Sydes, Johnson et al.) at Comilla District
5	Char Development and Settlement Project-IV (CDSP-4) (FD Component)	January 2011 to December, 2018	To reduce poverty and hunger for poor people living in the newly accreted coastal chars. This would be achieved via the development of improved and more secure rural livelihoods in agriculture, provision of legal title to land, and through provision of climate resilient infrastructure.	Subarna Char, Hatia and Companigong of Noakhali District. Shandweep of Chittagong District.
6	Facilities Development of all Training Institutes of Forest Department	July 2015 to June, 2018	To create facilities for human resource development through imparting training to the FD personnel.	Chittagong, Rangamati, Sylhet & Rajshahi District
7	Afforestation in Five Coastal Districts of Bangladesh	January 2016 to December, 2020	1. Creation of greenery to combat climate change and its impact. 2.Contribute to the sustainable supply of fuel wood and industrial wood; 3. Rehabilitation of landless poor's and achieve food security and improved nutrition; 4.Create employment opportunities for poverty	Gopalganj, Pirojpur, Khulna, Bagerhat & Satkhira District

			reduction. 5. Restore and promote sustainable use of terrestrial ecosystems to combat land degradation and halt biodiversity loss 6.Strengthening local community in the management of forest resources and attain sustainable management of forest resources through community participation.	
8	Climate Resilient Ecosystem and Livelihoods (FD- Part)	July 2013 to June, 2018	Enhance organizational, financial and functional capacities of the CMCs in the CREL sites so that the PAs and the surrounding landscapes are co-managed ensuring biodiversity conservation and livelihoods in the changing climate	17 Protected Areas
9	Eco-Restoration of the Northern Region of Bangladesh	July, 2015 to June, 2019	To check desertification in the northern zone through development of water reservoirs for maintaining sustainable source of surface water and increasing tree cover.	Rajshahi, Chapai Nawabganj, Natore, Naogaon, Pabna, Sirajgonj ,Bogra, Joypurhat, Rangpur, Lalmonirhat, Kurigram & Panchagarh District.
10	Strengthening National Forest Inventory and Satellite Land Monitoring System in Support of REDD+ in Bangladesh (Bangladesh Forest Inventory Project)	July, 2015 to June, 2018	1.Strengthening of the National Forest Inventory and Satellite Land Monitoring System in support of REDD+ in Bangladesh; 2.Contributing to the production of data required for international agreements, and support to national forest policy and land management; 3.Strengthening national capacities and supporting the establishment of an appropriate institutional framework; 4.Complementing the UN-REDD programnme, the national REDD+ Readiness Preparation Plan, and the project on capacity development of the Ministry of Environment and Forests and its agencies; 5.Promoting modern methods and technologies while ensuring the necessary conditions for building	Forest Areas of Bangladesh

			innovations that are adapted, adopted and feasible.	
11	UN-REDD Bangladesh National Programme	July, 2015 to June, 2018	Support the Government of Bangladesh in initiating the implementation of its REDD+ Readiness Roadmap (i.e., R-PP) by establishing necessary REDD+ management processes, identifying strategic readiness options for completing its National REDD+ strategy, and developing the capacities required to begin implementation of REDD+	Forest Areas of Bangladesh
12	National Botanical Garden and Balda Garden, Dhaka preservation and better development	July, 2016 to June, 2019	1.To protect indigenous, rare species of both garden 2.To protect the historic & natural heritage of both garden 3.To enhance carbon stock for mitigation of climate change 4.To construct moisture content room and semi dome shaped shades to preserve orchid and cactus plants 5.To conserve bio-diversity and improve wildlife habitat 6.To maintain plantation of different species of bamboo, herbs, shrubs and ornamental plants 7.To promote eco-tourism and recreational facilities 8.To create facilities for education and research 9.To augment socio-economic condition of the local people through generating scope of employment	National Botanical Garden, Mirpur and Balda Garden, Wari, Dhaka.
13	Bangabandhu Sheikh Mujib Saphari Park, Gazipur's Approach Road Widening and Necessary Infrastructure Development Project	January,2017 to december,2019	1.To reduce traffic congestion in and outside the Safari Park 2.To ensure safety and security of wildlife and tourists 3.To provide improved recreational facilities for visitor 4.To improve habitats for wildlife and captive animals 5.To improve habitats for wildlife and captive animals	Bangabandhu Sheikh Mujib Saphari Park, Gazipur
14	Integrating Community Based Adaptation in to	July, 2016 to June, 2020	Reduce climate vulnerability of local communities in the project	Char Shubornochar of Noakhali; Golachipa &

	Afforestation and Reforestation Program in Bangladesh		areas through participatory planning, community based management, and integration of livelihood with coastal afforestation and reforestation.	Rangabali Upazila of Patuakhali Dist; Pathorghata of Barguna Dist; Monpura, Charfasion, Doulotkhan & Tomjuddin Upazila of Bhola Dist; Vandaria & Mothbaria Upazila of Pirojpur Dist.
15	Bangladesh Forest Investment Program Forest Investment Plant Preparation Project	July, 2016 to June, 2018	1.The process of Bangladesh Forest Investment Programme (FIP) Investment Plan (IP) preparation 2.Establish coordination mechanism and enable stakeholder consultation to open financing window of Climate Investment Fund (CIF) in Bangladesh.	

Appendix 2: Characteristics of Sundarbans zone

Characteristics			**References**
Presence of terrestrial land (%)		62.26	(Jalal, Vollrath et al. 2016)
Presence of water (%)		37.74	
Soil types:	Noncalcareous Grey Floodplain Soils (non-saline)	1923 ha and 0.32%	(FAO-UNDP 1988)
	Acid Sulphate Soils	333.1 ha and 0.05 %	
	Sundarbans	427100 ha and 70.11%	
	No data	179843.9 ha and 29.52%	
Precipitation		Min: 1783 mm, Max: 2343 mm, Average: 2004 mm	(Hijmans, Cameron et al. 2005)
Accessibility (%)		Extreme HTR: 33.87, Very HTR: 0.04	(Ahmed and Hassan 2012)
		Road length: 99993.07 m Road density: 0.16 m/ha	
Total Area (ha)		609200	(Akhter, Jalal et al. 2016)

Appendix 3: Characteristics of Coastal zone

Characteristics			References
Presence of terrestrial land (%)		39.04	(Jalal, Vollrath et al. 2016)
Presence of water (%)		60.96	
Soil types	Brown Hill Soils	16400 ha and 1.36% of total land area	(FAO-UNDP 1988)
	Acid Sulphate Soils	33060 ha and 2.73 % of total land area	
	Calcareous Aluvium (non-saline)	233000 ha and 19.27% of total land area	
	Calcareous Grey Floodplain Soils	75230 ha and 6.22% of total land area	
	Noncalcareous Aluvium	31600 ha and 2.61% of total land area	
	Noncalcareous Grey Floodplain Soils (non-saline)	109500 ha and 9.06% of total land area	
	No data	709565.3 ha and 58.69% of total land area	
Precipitation		Min: 2267 mm, Max: 3698 mm, Average: 2870 mm	(Hijmans, Cameron et al. 2005)
Accessibility (%)		Extreme HTR: 24.31, Very HTR: 1.42	(Ahmed and Hassan 2012)
		Road length (m): 4110715.723 Road density (m/ha): 3.40	
Total Area (ha)		1209000	(Akhter, Jalal et al. 2016)

Appendix 4: Characteristics of Sal zone

Characteristics			References
Presence of terrestrial land (%)		96.78	(Jalal, Vollrath et al. 2016)
Presence of water (%)		3.22	(FAO-UNDP 1988)
Soil types	Acid Basin Clays	16900 ha and 3.16% of total land area	

	Brown Hill Soils	14980 ha and 2.8% of total land area	
	Brown Mottled Terrace Soils	20310 ha and 3.8 % of total land area	
	Deep Red-Brown Terrace Soils	244700 ha and 45.76% of total land area	
	Shallow Grey Terrace Soils	34030 ha and 6.36% of total land area	
	Shallow Red-Brown Terrace Soils	104700 ha and 19.58% of total land area	
Precipitation		Min: 1804 mm, Max: 2462 mm, Average: 2040 mm	(Hijmans, Cameron et al. 2005)
Accessibility (%)		Extreme HTR: 12.01, Moderate HTR: 1.26, Very HTR: 6.26	(Ahmed and Hassan 2012)
		Road length: 2484824.10 m Road density: 4.65 m/ha	
Total Area (ha)		534800	(Akhter, Jalal et al. 2016)

Appendix 5: Characteristics of Hill zone

Characteristics			**References**
Presence of terrestrial land (%)		96.74	(Jalal, Vollrath et al. 2016)
Presence of water (%)		3.26	(FAO-UNDP 1988)
Soil types	Acid Sulphate Soils	2885 ha and 0.17% of total land area	
	Brown Hill Soils	1158000 ha and 67.56 % of total land area	
	Kaptai Lake	20310 ha and 3.8 % of total land area	
	Noncalcareous Grey Flood Plain Soils (non-saline)	33490 ha and 1.95% of total land area	
	Reserved Forest	Min : 2061 mm, Max: 4370 mm, Average: 2720 mm	

Precipitation		Min: 1804 mm, Max: 2462 mm, Average: 2040 mm	(Hijmans, Cameron et al. 2005)
Accessibility (%)		Extreme HTR: Extreme HTR: 51.60, Very HTR: 15.46	(Ahmed and Hassan 2012)
		Road length: 7069806.495 m Road density: 4.12 m/ha	
Total Area (ha)		1714000	

Appendix 6: Characteristics of Village zone

Characteristics			**References**
Presence of terrestrial land (%)		92.12	(Jalal, Vollrath et al. 2016)
Presence of water (%)		7.88	
Soil types	Acid Basin Clays	310500 ha and 2.85 % of total land area	(FAO-UNDP 1988)
	Brown Hill Soils	113100 ha and 1.04% of total land area	
	Calcareous Aluvium (non-saline)	343200 ha and 3.15% of total land area	
	Calcareous Brown Floodplain Soils	300500 ha and 2.76% of total land area	
	Calcareous Dark Grey Floodplain Soils	1960000 ha and 18% of total land area	
	Deep Grey Terrace Soils	350800 ha and 3.22% of total land area	
	Grey Piedmont Soils	193000 ha and 1.77% of total land area	
	Noncalcareous Aluvium	425700 ha and 3.91% of total land area	

	Noncalcareous Brown Floodplain Soils	391900 ha and 3.6% of total land area	
	Noncalcareous Dark Grey Floodplain Soils	1802000 ha and 16.55% of total land area	
	Noncalcareous Grey Floodplain Soils (non-saline)	3457000 ha and 31.74% of total land area	
	Peat	111600 ha and 1.02% of total land area	
	Shallow Grey Terrace Soils	325100 ha and 2.99% of total land area	
	No data	482769.9857 ha and 4.43% of total land area	
Accessibility (%)		Extreme HTR: 13.07, Very HTR: 12.10, Moderate HTR: 0.52	(Ahmed and Hassan 2012)
		Road length: 100971434.5 m Road density: 10890000 m/ha	
Total Area (ha)		10890000	(Akhter, Jalal et al. 2016)

Appendix 7: Socioeconomic information for the Bangladesh Forest Inventory across the zones

Zones	Total Area *(ha)*	*Total Union*	Tree Cover[3] *(ha)*	*Household (numbers)*	*Population (numbers)*	*Population density (people per sq. km)*	*Literacy rate (%)*	*Toilet Facility with sanitary (water sealed) (%)*	*Source of Drinking water (%) Tube well*	*Housing Tenancy owned (%)*	*Ethnic minority people (%)*
Coastal	*854,955*	*249*	*76,129*	*949,778*	*4,611,242*	*539.17*	*47.26*	*16.69*	*90.25*	*88.40*	*0.12*
Hill	*1,784,919*	*290*	*911,672*	*870,386*	*4,337,277*	*243*	*47.05*	*13.03*	*62.515*	*79.90*	*23.32*
Sal	*530,649*	*395*	*113,171*	*3,961,881*	*16,882,367*	*3020*	*58.68*	*36.68*	*47.321*	*45.045*	*1*
Sundarbans	*601,285*	*5*	*379,815*	*6,577*	*26,014*	*4.33*	*33.56*	*7.60*			*0.15*
Village	*10,827,166*	*6,978*	*109,066 8*	*2,727,067 7*	*121,730,400*	*1012*	*47.05*	*24.20*	*79.17*	*77.41*	*1*
Total	***14,598,973***	***7,917***	***2,571,455***	***33,059,296***	***147,587,300***	***1011***					

Source: BBS, 2011. Population and Housing Census 2011

[3] Bangladesh Forest Department, 2014.

Appendix-8: Conducted events for the finalization of socioeconomic monitoring for the Bangladesh Forest Inventory

Dates	Name of events	Location
March 3&5th 2015	National Forest Inventory Information Needs Workshop	Dhaka
May 29th 2016	Mission of Socioeconomic Forestry Expert from FAO HQ Rome	Dhaka
June 2nd 2016	National consultation on socioeconomic monitoring of Bangladesh Forest Inventory	Dhaka
June 20th 2016	Socioeconomic expert group formed, several expert group meetings held since June 2016 for developing objectives, questions, indicators and identification of variables	Dhaka
July 31st 2016	Participation workshop to establish a National agriculture and rural survey calendar based upon integrated planning of agriculture census and surveys held in Thailand	Thailand
October 27th 2016	Participation at the book launching on Socioeconomic Surveys in Forestry-guidance and survey modules for measuring the multiple roles of forests in household welfare and livelihoods held in Italy	Italy
January 20th 2017	Development of socioeconomic survey design prepared by Arannayk Foundation in association with Institute of Forestry and Environmental Sciences, University of Chittagong	Dh\aka
February 13th 2017	Pre-test the survey design with questionnaire	Dhaka, Chittagong, Sylhet, Khulna
February 23rd 2017	Mission of Delilah, Social Scientist from USFS	Dhaka
February 25th 2017	Mission of Socioeconomic Forestry Expert from FAO HQ Rome	Dhaka
February 28th 2017	National consultation about the Socioeconomic Survey Design	Dhaka
March 6th 2017	Testing survey design with questionnaire incorporated with national consultation findings	Dhaka
July 16th 2017 :	Endorsement of the socioeconomic survey design of Bangladesh Forest Inventory	Dhaka

Appendix 9: Socioeconomic surveys related to natural resources management and forestry in Bangladesh

SL#	Name of Project	Year	Sample design and Sample size	Indicators/variables
1	National Forest and Tree Resources Assessment 2005-2007 Bangladesh	**2007**	2-km radius circle from Centre of SU. Households are selected randomly	1. Trend of population within the tract 2. Product and services type and users (with conflict and without conflict tract) 3. Product and services demand and supply at forest, cultivated and village area 4. Products and services -users rights of forestry products and services at forest, cultivated and village areas 5. Products and services -organizational balance at forest, cultivated and village areas 6. Products and services -gender balance among harvesters/users of forestry products/services at forest, cultivated and village areas 7. Products and services -frequency of harvesting at forest, cultivated and village areas 8. Products and services -trend of harvesting at forest, cultivated and village areas
2.	Households Based forestry survey	**2014**	• A two stage random sampling. • Sample size-6300 households	1. No. of households having planned forest 2. Gross output of household based forestry (HBF) sector (million Taka) 3. Intermediate consumption of HBF sector (million Taka) 4. Value added of BHF (million Taka) 5. Estimated number of fruit trees in households (million) 6. Estimated number of wood trees in households (million) 7. Estimated number of bamboo in households (million)

				8. Estimated number of other tress in households (million) 9. Average number of major tress per household (number) 10. Quantity of wood produced for own use (million cft) 11. Value of wood production for own use (million Taka) 12. Quantity of wood for sale (million cft) 13. Value of wood for sale (million Taka) 14. Total quantity of bamboo produced (million no.) 15. Total value of bamboo produced (million taka) 16. Production of firewood by the household (Metric tons) 17. Value of firewood produced (million taka) 18. Quantity of rubber latex produced (Metric tons) 19. Value of rubber latex produced (million Taka) 20. Persons engaged by gender 21. Person engaged by job status 22. Wages and salaries 23. Value of fixed assist 24. Handover/disposal (million Taka) 25. Depreciation (million Taka) 26. Percentage of households by status of forests (%) in mauzas/mahallas with operated land 5 decimal and above
3.	Socio-Economic Field Surveys at Nishorgo Pilot Sites	**2007**	A two stage random sampling Sample size: 650 households	**1. General demographic characteristics** - Population - Age-dependency ratio - Religion - Ethnicity and migration - Education and literacy - Occupation **2. Household structure and ownership** **3. Lighting facilities** **4. Health and sanitation** **5. Social institutions** **6. Economy**

				7. Resource extraction: beneficiaries - Reduced access to PA - Alternative income generating activities - Sources of fuel **8. Natural resources flow** -log flow - marketing of timber resources **9. Information at enterprise level Conservation issues** **Broad category** - Forest extent - Use of forests -Social services - Beneficiaries of forest goods and services - Economic value
4	Report of the Household Income and Expenditure Survey 2010	2010	• A two stage stratified random sampling technique. • Sample size-12240 households	**1. Household and Population characteristics** • Household size • Ownership of land • Housing condition • Occupation • Age-sex comparison • Marital status • Different demographic ration **2. Basic need indicators** • Housing structure • Access to toilet facilities • Sources of drinking water • Access to electricity, mobile/telephone, computer, email and arsenic contamination in water **3. Income and expenditure** • Level of income • Income distribution • Sources of income • level of income and expenditure by size of own land in rural areas • Food expenditure • Consumption expenditure by decile groups

				4. Consumption of food **5. Measurement of poverty** **6. Education** **7. Health** **8. Social safety nets** **9. Disability, migration, microcredit, crisis and crisis management**

Appendix 10: Data and software used throughout the design process

Year	Title	Author/Source
2011	Population and Housing Census 2011	(BBS 2015)
2016	Zoning for tree and forest assessment in Bangladesh.	(Akhter, Jalal et al. 2016)
2014	Tree cover (ha) in 2014	Bangladesh Forest Department-RIMS unit (Potapov, Hansen et al. 2016)
2015	DTIM for identification of the objectives, questions, indicators and metrics	(Scott, Bush et al. 2015)
	R software for statistical calculations	https://www.r-project.org/
	Open Foris Suite for data collection, storage and analysis	www.openforis.org

Appendix 11: Criteria and indicators for the Bangladesh forest Inventory

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
Biodiversity and Conservation	Composition of species in different dbh class	%	No. of individual species per DBH class	number
			Total no. of individual species in certain DBH class	number
			DBH class	list
			Proportion of n/N of individuals of one particular species	%
			Total number of individuals	number
			Zone	list
	Abundance of the species	number/ha	Total number of individual of species in all quadrats/plots	number
			Total number of quadrats in which the species occurred	number
			Area of sample plot	ha
	Number of seedlings	number/ha	Name of seedlings	list
			Zone	List
			Area of sample plot	ha
			Number of seedling	number
	Dominant tree species	%	Relative density	%
			Relative frequency	%
			Relative dominance	%
	Recruitment status of tree species	%	Number of stem	stem/ha
			Number of seedling	seedling/ha
			Area of land	ha
	Exotic/Invasive species in different zones	%	Total number of Exotic species	number
			Total number of species	number
	Number of tree species from the Red List whose products are traded	number/zone	Name of threatened tree species	list
			Number of threatened tree species in trade	number
	Number of animal species from the Red List whose products are traded	number/zone	Name of threatened animal species	list
			Number of threatened animal species in trade	number

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	Percentage of endangered animal species	Percentage/zone	Number of endangered animal species	number
			Total animal species	number
	Percentage of endangered tree species	Percentage/zone	Number of endangered tree species	number
			Total tree species	number
	Protected and Conservation forest area	%	Total protected area for conservation	ha
			Total land area	ha
Disturbance, Forest Degradation and Resilience	Level of severity of anthropogenic disturbances most cited by HHs in each zone	%	Frequency of HH responses on a severity level of anthropogenic disturbance	number
			Most important anthropogenic disturbances	list
	Level of severity of natural disturbances most cited by HHs in each zone	%	Frequency of HH responses on a severity level of natural disturbance	number
			Most important natural disturbances	list
	Forest area with reduced canopy cover	ha	forest land cover polygons with reduced canopy cover	ha
Economics and Livelihood	Quantity of each primary product collected in each zone per year	quantity unit/yr	Quantity collected by a member of ith HH per day	quantity unit/day/person
			Number of family members of ith HH involved in product collection per day	number
			Total number of days a month the members of the ith HH are involved in collection	number of days/month
			Total number of months the members of the ith HH are involved in collection	number of months/yr
			Total number of HH in the forest zone	number
			Total number of HH Surveyed	number
	Percentage of collected primary	%	Quantity of a particular product sold per month by ith HH	Quantity unit/month

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	products sold in each zone		Number of months a year the ith HH sell the particular products	number of months/yr
	Economic value of collected primary products collected in each zone each year	USD/ha/yr	Gross value of collected products per year	USD/yr
			Price of products	USD/unit
			Cost of collection	USD/yr
			Number of hours a member of ith HH spent per day in collecting the products	hours/day
			Wage rate	USD/day
			Total area of jth LCC	ha
	Quantity collected per year of each primary product that are important for livelihood in each zone	quantity/yr	Quantity collected by a member of ith HH per day	quantity unit/day/person
			Number of family members of ith HH involved in product collection per day	number
			Total number of days a month the members of the ith HH are involved in collection	number of days/month
			Total number of months the members of the ith HH are involved in collection	number of months/yr
			Total number of HH in the forest zone	number
			Total number of HH Surveyed	number
	Economic value per year of collected primary products collected that are important for livelihood in each zone	USD/ha/yr	Gross value of collected products per year	USD/yr
			Price of products	USD/unit
			Cost of collection	USD/yr
			Number of hours a member of ith HH spent per day in collecting the products	hours/day
			Wage rate	USD/day
			Total area of jth LCC	ha

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	Market value per year of wild meat and other animal products sold illegally by HHs in each zone	USD/yr	Quantity collected by a member of ith HH per day	quantity unit/day/person
			Number of family members of ith HH involved in product collection per day	number
			Total number of days a month the members of the ith HH are involved in collection	number of days/month
			Total number of months the members of the ith HH are involved in collection	number of months/yr
			Total number of HH in the forest zone	number
			Total number of HH Surveyed	number
			Quantity of a particular product sold per month by ith HH	Quantity unit/month
			Number of months a year the ith HH sell the particular products	number of months/yr
	Income earned by HHs by selling primary tree and forest products in each zone per year	USD/yr	Quantity collected by a member of ith HH per day	quantity unit/day/person
			Number of family members of ith HH involved in product collection per day	number
			Total number of days a month the members of the ith HH are involved in collection	number of days/month
			Total number of months the members of the ith HH are involved in collection	number of months/yr
			Total number of HH in the forest zone	number
			Total number of HH Surveyed	number
			Quantity of a particular product sold per month by ith HH	Quantity unit/month

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
			Number of months a year the ith HH sell the particular products	number of months/yr
	Income earned by HHs by selling processed tree and forest products (i.e. gross value added) in each zone per year	USD/yr	Quantity of secondary product sold per year by ith HH	unit/yr
			Price of secondary products	USD/unit
			Raw material cost of the ith HH	USD/unit
			Transportation cost per month for selling a product by the ith HH	USD/month
			Other cost per month for selling a product by the ith HH	USD/month
			cost of hired labor per month for producing a product by the ith HH	USD/month
			number of months per year the ith HH involved in production and selling	months/yr
			number of hours a day the ith HH spent in processing and selling	hours/day
			number of days a month a member of the ith HH spent in processing and selling	days/month
			number of family members of ith HH involved in processing and selling	number
	Income earned by HHs from employment in institutions or businesses related to tree and forest products in each zone each year	USD/yr	number of months per year the members ith HH employed	months/yr
			Number of family members of ith HH employed	number
			Average monthly salary	USD/month
	Percentage of total annual HH income contributed by forests and trees in each zone	%	Total income of all HH in a zone	USD/yr
	Percentages of male and female involved	%	Total number of female involved	Number

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	in collection of primary forest products, processing and employment		Total number of male involved	Number
	Percentage of HHs in each zone that are dependent on trees and forests for energy for cooking and heating	%	Total number of HH that use firewood and other tree biomass for energy	Number
	Level of dependence most cited by HHs in each zone on trees and forests for cooking and heating energy	%	Frequency of HH responses on a dependence level for energy on trees and forest	number
	Economic value of potable water per year in zone(s) where it is available	USD/ha/yr	Gross value of collected water	USD/yr
			number of hours a member of ith HH spent per day in collecting water	hours/day
			number of family members of ith HH involved in water collection per day	number
			total number of days a month the members of the ith HH are involved in water collection	days/month
			total number of months the members of the ith HH are involved in water collection	months/yr
			cost of water collection and treatment	USD/yr
			transportation cost per month for the ith HH for water collection	USD/month
			treat cost per liter of water by the ith HH	USD/litre
			quantity of water collected	litre/yr
			quantity water collected by a member of ith HH per day	litres/day
	Employment in forest related activities	%	People employed in forest related activities	number
			Total employment	number

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	Publict expenditure in tree and forest management	%	Expenditure in tree and forest conservation	BDT/yr
			Total expenditure	BDT/yr
	Forest sector contribution in GDP	%	Forest GDP contribution	BDT/quantity
			Total GDP	BDT/quantity
	Gap between demand and supply of fuelwood	Tonnes/yr	Supply of fuelwood	Tonnes/yr
			Demand of fuelwood	Tonnes/yr
Forest area and characteristics	Tree cover change in different land cover by zone	%	Land cover	ha
			Tree cover change	%
			Zone	list
			People perception on tree and forest cover change?	list
			Main reason for tree and forest resources changes	list
	Forest area per capita	ha	Land cover	ha
			Total population	number
			Zone	list
			Total population	number
	Land cover change by zone	ha	Land cover change area	ha
			Zone	list
	Land cover area by zone	ha	Land cover	ha
			Zone	List
	Land area under afforestation	ha	Total afforestation area	ha
			Other forest area	ha
			Total forest area	ha
	Land area under reforestation	ha	Total reforestation area	ha
			Other forest area	ha
			Total forest area	ha
	Area of forest management activities	ha	Area of forest management activities	ha
			Other forest area	ha
			Total forest area	ha
	Amount of fine woody material	Mg/ha	Volume	m^3
			Density of FWD	kg/m3
			Area	ha
		Mg/Ha	Volume	m^3

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	Amount of coarse woody debris		Density of CWD	kg/m3
			Area	ha
	Abundance of dead trees	Number/Ha	Total no. of Standing dead trees in all plots	number
			Total no. of plot where dead trees occurred	number
	Biomass in different zones	kg	Diameter breast height	cm
			Height	m
			Wood density	m3
			Zone	List
Measuring progress towards SFM	Frequency of the occurrence of conflicts associated with trees and forests in each zone per year	number/yr	number of occurrence of social conflicts per year mentioned by ith HH	number/yr
	Rate of involvement of different actors in solving conflicts in each zone	%	Frequency of HH responses on a particular actor in solving social conflicts	number
	Level of forest law enforcement cited the most by HHs in each zone	%	Frequency of HH responses on a particular level of law enforcement	number
	Income earned from involvement in social forestry each year in each zone	USD/yr	income per year from social forestry of ith HH	USD/yr
	Income earned from involvement in co-management each year (in sal zone)	USD/yr	income per year from co-managed forests of ith HH	USD/yr
	Preference for different types of supports provided	%	Frequency of HH responses on a particular support	number
	Level of involvement of different actors in terms of providing supports	%	Frequency of HH responses on a particular factor	number
	Percentage of HHs in each zone receive seedlings from the Bangladesh Forest Department	%	Frequency of HH receiving seedlings from HH	number

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
	Average number of seedlings received by HHs in each zone	Number	number of seedlings received from Bangladesh Forest Department ith HH	number
	Money paid HHs per seedling on average in each zone	USD/seedling	money paid per seedling by ith HH	USD/seedling
	Number of species of seedlings received by HH in each zone	Number	number of species of seedlings received from Bangladesh Forest Department ith HH	number
	Level of satisfaction cited the most by HHs in each zone	%	Frequency of HH responses on a particular level of satisfaction with species	number
Ownership	Percentages of value of different products shown by different land ownership types in each zone	%	Value of products collected from a particular ownership type	USD/yr
	Percentage of HHs in each zone having secure tenure right to land with trees and forests	%	Frequency of HHs having secured land tenure rights	number
Forest Productivity	Composition of species in different Height class	%	No of individual species per Height class	number
			Height class	List
			No of individual species per Height class	number
	Growing stock in different zone	m3/ha	Basal area	m2
			Height	m
			Zone	list
	Growing stock in other wooded land	m3/ha	Basal area	m2
			Height	m
			Zone	list
	Above-ground biomass forests	kg/ha	Diameter breast height	cm
			Height	m
			Wood density	m3
			Zone	List
	Above-ground other wooded land	kg/ha	Diameter breast height	cm
			Height	m
			Wood density	m3

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
			Zone	List
	Amount of below ground biomass	kg/ha	Diameter breast height	cm
			Height	m
			Wood density	m3
			Zone	List
	Amount of Below-ground biomass - other wooded land	kg/ha	Diameter breast height	cm
			Height	m
			Wood density	m3
			Zone	List
	Volume of dead wood in forest	m^3/ha	Volume of dead wood	m^3
			Area	ha
	Volume of dead wood in other wooded land	m^3/ha	Volume of dead wood in other wooded land	m^3
			Area	ha
	Carbon in above ground biomass in forest	ton/ha	Above ground biomass	kg
	Carbon in above ground biomass in ToF	ton/ha	Above ground biomass	kg
	Amount of Carbon in below-ground biomass in forest	ton/ha	Above ground biomass	kg
	Carbon in below ground biomass in ToF	ton/ha	Above ground biomass	kg
	Amount of Subtotal carbon in living trees in forest	Mg/ha	Bulk density	g.m3
			Soil depth	cm
			Organic Carbon content	%
	Amount of sub total carbon in living in other wooded land	Mg/ha	Bulk density	g.m3
			Soil depth	cm
			Organic Carbon content	%
	Amount Carbon in woody debris in forest	Mg/ha	Bulk density	g.m3
			Soil depth	cm
			Organic Carbon content	%
	Carbon in woody debris in ToF	Mg/ha	Bulk density	g.m3
			Soil depth	cm

Criteria	Indicators	Indicator Unit	Variables	Variable Unit
			Organic Carbon content	%
	Carbon in litter in forest	Mg/ha	Bulk density	g.m3
			Soil depth	cm
			Organic Carbon content	%
	Amount of Carbon in litter - ToF	Mg/ha	Bulk density	g.m3
			Soil depth	cm
			Organic Carbon content	%
	Amount of soil carbon in forests	Mg/ha	Bulk density	g/m3
			Soil depth	cm
			Organic Carbon content	%
	Amount of soil carbon in ToF	Mg/ha	Bulk density	g.m3
			Soil depth	cm
			Organic Carbon content	%
Protective Functions	Economic value of the Sundarbans and coastal plantations in terms of protection from tropical storms per year	USD/event	Damaged per event to ith control HH	USD/event
			Damaged per event to ith treatment HH	USD/event
			Number of control HH	number
			Number of treatment HH	number
			total number of control HH	number
			total number of treatment HH	number

Appendix 12: List of selected unions/wards in coastal zone in Bangladesh

Zone	Strata	DIV_ NAME	DIST_ NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST _CODE	UPZ_ CODE	UNI_CODE
Coastal	Coastal_3	Barisal	Barguna	Amtali	Sonakata	10	1004	100409	10040996
Coastal	Coastal_3	Barisal	Bhola	Burhanuddin	Kutba	10	1009	100921	10092157
Coastal	Coastal_2	Barisal	Bhola	Burhanuddin	Sachra	10	1009	100921	10092176
Coastal	Coastal_4	Barisal	Bhola	Burhanuddin	Ward No-02	10	1009	100921	10092102
Coastal	Coastal_4	Barisal	Bhola	Burhanuddin	Ward No-08	10	1009	100921	10092108
Coastal	Coastal_3	Barisal	Bhola	Char Fasson	Abu Bakarpur	10	1009	100925	10092511
Coastal	Coastal_1	Barisal	Bhola	Char Fasson	Char Madras	10	1009	100925	10092538

Zone	Strata	DIV_ NAME	DIST_ NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST _CO DE	UPZ_ CODE	UNI_COD E
Coastal	Coastal_1	Barisal	Bhola	Char Fasson	Hazariganj	10	1009	100925	10092557
Coastal	Coastal_2	Barisal	Bhola	Char Fasson	Jinnaghar	10	1009	100925	10092566
Coastal	Coastal_1	Barisal	Bhola	Char Fasson	Rasul Pur	10	1009	100925	10092588
Coastal	Coastal_4	Barisal	Bhola	Char Fasson	Ward No-01	10	1009	100925	10092501
Coastal	Coastal_4	Barisal	Bhola	Char Fasson	Ward No-04	10	1009	100925	10092504
Coastal	Coastal_4	Barisal	Bhola	Char Fasson	Ward No-06	10	1009	100925	10092506
Coastal	Coastal_4	Barisal	Bhola	Char Fasson	Ward No-08	10	1009	100925	10092508
Coastal	Coastal_3	Barisal	Bhola	Char Fasson	Ward No-09	10	1009	100925	10092509
Coastal	Coastal_3	Barisal	Bhola	Daulatkhan	Uttar Joynagar	10	1009	100929	10092976
Coastal	Coastal_3	Barisal	Bhola	Lalmohan	Char Bhuta	10	1009	100954	10095419
Coastal	Coastal_2	Barisal	Bhola	Lalmohan	Dhali Gaurnagar	10	1009	100954	10095428
Coastal	Coastal_3	Barisal	Bhola	Lalmohan	Farazganj	10	1009	100954	10095438
Coastal	Coastal_1	Barisal	Bhola	Lalmohan	Kalma	10	1009	100954	10095447
Coastal	Coastal_2	Barisal	Bhola	Lalmohan	Paschim Char Umed	10	1009	100954	10095470
Coastal	Coastal_4	Barisal	Bhola	Lalmohan	Ward No-03	10	1009	100954	10095403
Coastal	Coastal_4	Barisal	Bhola	Lalmohan	Ward No-06	10	1009	100954	10095406
Coastal	Coastal_4	Barisal	Bhola	Lalmohan	Ward No-08	10	1009	100954	10095408
Coastal	Coastal_3	Barisal	Bhola	Manpura	Dakshin Sakuchia	10	1009	100965	10096521
Coastal	Coastal_1	Barisal	Bhola	Tazumuddin	Bara Malancha	10	1009	100991	10099119
Coastal	Coastal_2	Barisal	Bhola	Tazumuddin	Chandpur	10	1009	100991	10099157
Coastal	Coastal_2	Barisal	Bhola	Tazumuddin	Shambhupur	10	1009	100991	10099185
Coastal	Coastal_1	Chittagong	Chittagong	Anowara	Roypur	20	2015	201504	20150495
Coastal	Coastal_4	Chittagong	Chittagong	Mirsharai	Ward No-02	20	2015	201553	20155312
Coastal	Coastal_1	Chittagong	Chittagong	Pahartali	Ward No-11 (part)	20	2015	201555	20155511
Coastal	Coastal_1	Chittagong	Chittagong	Patenga	Ward No-40	20	2015	201565	20156540
Coastal	Coastal_3	Chittagong	Chittagong	Sandwip	Gachhua	20	2015	201578	20157830
Coastal	Coastal_3	Chittagong	Chittagong	Sandwip	Rahmatpur	20	2015	201578	20157885
Coastal	Coastal_2	Chittagong	Chittagong	Sandwip	Santoshpur	20	2015	201578	20157890
Coastal	Coastal_2	Chittagong	Chittagong	Sandwip	Sarikait	20	2015	201578	20157892
Coastal	Coastal_3	Chittagong	Chittagong	Sandwip	Ward No-03	20	2015	201578	20157803
Coastal	Coastal_4	Chittagong	Chittagong	Sandwip	Ward No-05	20	2015	201578	20157805
Coastal	Coastal_3	Chittagong	Chittagong	Sandwip	Ward No-09	20	2015	201578	20157809
Coastal	Coastal_2	Chittagong	Chittagong	Sitakunda	Muradpur	20	2015	201586	20158657
Coastal	Coastal_2	Chittagong	Chittagong	Sitakunda	Sonaichhari	20	2015	201586	20158685
Coastal	Coastal_1	Chittagong	Cox'S Bazar	Kutubdia	Dakshin Dhurung	20	2022	202245	20224540
Coastal	Coastal_1	Chittagong	Cox'S Bazar	Kutubdia	Uttar Dhurung	20	2022	202245	20224581
Coastal	Coastal_1	Chittagong	Cox'S Bazar	Maheshkhali	Matarbari	20	2022	202249	20224971
Coastal	Coastal_1	Chittagong	Cox'S Bazar	Pekua	Magnama	20	2022	202256	20225678
Coastal	Coastal_2	Chittagong	Feni	Sonagazi	Sonagazi	20	2030	203094	20309485

Zone	Strata	DIV_ NAME	DIST_ NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST _CO DE	UPZ_ CODE	UNI_COD E
Coastal	Coastal_4	Chittagong	Feni	Sonagazi	Ward No-03	20	2030	203094	20309403
Coastal	Coastal_4	Chittagong	Feni	Sonagazi	Ward No-08	20	2030	203094	20309408
Coastal	Coastal_1	Chittagong	Lakshmipur	Ramgati	Char Abdullah	20	2051	205173	20517315
Coastal	Coastal_2	Chittagong	Lakshmipur	Ramgati	Char Algi	20	2051	205173	20517331
Coastal	Coastal_4	Chittagong	Lakshmipur	Ramgati	Ward No-05	20	2051	205173	20517305
Coastal	Coastal_4	Chittagong	Lakshmipur	Ramgati	Ward No-07	20	2051	205173	20517307
Coastal	Coastal_4	Chittagong	Lakshmipur	Ramgati	Ward No-09	20	2051	205173	20517309
Coastal	Coastal_1	Chittagong	Noakhali	Companiganj	Char Elahi	20	2075	207521	20752110
Coastal	Coastal_2	Chittagong	Noakhali	Companiganj	Char Fakira	20	2075	207521	20752111
Coastal	Coastal_1	Chittagong	Noakhali	Hatiya	Chandnandi	20	2075	207536	20753619
Coastal	Coastal_3	Chittagong	Noakhali	Hatiya	Ward No-02	20	2075	207536	20753602
Coastal	Coastal_3	Chittagong	Noakhali	Hatiya	Ward No-03	20	2075	207536	20753603
Coastal	Coastal_3	Chittagong	Noakhali	Hatiya	Ward No-04	20	2075	207536	20753604
Coastal	Coastal_3	Chittagong	Noakhali	Hatiya	Ward No-05	20	2075	207536	20753605
Coastal	Coastal_2	Chittagong	Noakhali	Subarnachar	Char Amanullah	20	2075	207585	20758529
Coastal	Coastal_1	Chittagong	Noakhali	Subarnachar	Char Wapda	20	2075	207585	20758537
Coastal	Coastal_2	Chittagong	Noakhali	Subarnachar	Purba Char Bata	20	2075	207585	20758547
Coastal	Coastal_2	Barisal	Patuakhali	Galachipa	Char Kajal	10	1078	107857	10785739

Appendix 13: List of selected unions/wards in Sal zone in Bangladesh

Zone	Strata	DIV_NAME	DIST_ NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST_ CODE	UPZ_ CODE	UNI_CODE
Sal	Sal_1	Dhaka	Dhaka	Badda	Bhatara	30	3026	302604	30260457
Sal	Sal_1	Dhaka	Dhaka	Gendaria	Ward No-81	30	3026	302624	30262481
Sal	Sal_1	Dhaka	Dhaka	Hazaribagh	Ward No-48(part)	30	3026	302628	30262848
Sal	Sal_1	Dhaka	Dhaka	Jatrabari	Ward No-86	30	3026	302629	30262986
Sal	Sal_1	Dhaka	Dhaka	Kadamtali	Ward No-89	30	3026	302632	30263289
Sal	Sal_1	Dhaka	Dhaka	Kamrangir Char	Sultanganj	30	3026	302634	30263451
Sal	Sal_1	Dhaka	Dhaka	Khilgaon	Nasirabad	30	3026	302636	30263685
Sal	Sal_1	Dhaka	Dhaka	Kotwali	Ward No-73	30	3026	302640	30264073
Sal	Sal_1	Dhaka	Dhaka	Mirpur	Ward No-07 (part)	30	3026	302648	30264807
Sal	Sal_1	Dhaka	Dhaka	Mirpur	Ward No-13	30	3026	302648	30264813
Sal	Sal_1	Dhaka	Dhaka	Mirpur	Ward No-14 (part)	30	3026	302648	30264814
Sal	Sal_1	Dhaka	Dhaka	Motijheel	Ward No-33	30	3026	302654	30265433
Sal	Sal_1	Dhaka	Dhaka	Motijheel	Ward No-34	30	3026	302654	30265434
Sal	Sal_1	Dhaka	Dhaka	Ramna	Ward No-54	30	3026	302666	30266654
Sal	Sal_1	Dhaka	Dhaka	Ramna	Ward No-55	30	3026	302666	30266655

Zone	Strata	DIV_NAME	DIST_ NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST_ CODE	UPZ_ CODE	UNI_CODE
Sal	Sal_1	Dhaka	Dhaka	Sabujbagh	Ward No-27	30	3026	302668	30266827
Sal	Sal_2	Chittagong	Brahamanbaria	Akhaura	Mogra	20	2012	201202	20120285
Sal	Sal_2	Dhaka	Dhaka	Darus Salam	Ward No-10	30	3026	302611	30261110
Sal	Sal_2	Dhaka	Dhaka	Demra	Matuail (part)	30	3026	302612	30261280
Sal	Sal_2	Dhaka	Dhaka	Hazaribagh	Ward No-46 (part)	30	3026	302628	30262846
Sal	Sal_2	Dhaka	Dhaka	Khilgaon	Dakshingaon (part)	30	3026	302636	30263660
Sal	Sal_2	Dhaka	Dhaka	Mirpur	Ward No-12	30	3026	302648	30264812
Sal	Sal_2	Dhaka	Dhaka	Savar	Pathalia	30	3026	302672	30267272
Sal	Sal_2	Dhaka	Dhaka	Savar	Ward No-03	30	3026	302672	30267203
Sal	Sal_2	Rangpur	Dinajpur	Fulbari	Eluary	55	5527	552738	55273847
Sal	Sal_2	Rangpur	Dinajpur	Fulbari	Kazihal	55	5527	552738	55273866
Sal	Sal_2	Dhaka	Gazipur	Gazipur Sadar	Basan	30	3033	303330	30333023
Sal	Sal_2	Dhaka	Gazipur	Gazipur Sadar	Mirzapur	30	3033	303330	30333067
Sal	Sal_2	Mymensingh	Jamalpur	Jamalpur Sadar	Banshchara	35	3539	353936	35393613
Sal	Sal_2	Dhaka	Narayanganj	Rupganj	Kayet Para	30	3067	306768	30676855
Sal	Sal_2	Dhaka	Tangail	Ghatail	Dhala Para	30	3093	309328	30932834
Sal	Sal_2	Dhaka	Tangail	Ghatail	Rasulpur	30	3093	309328	30932886
Sal	Sal_3	Chittagong	Brahamanbaria	Akhaura	Maniand	20	2012	201202	20120276
Sal	Sal_3	Dhaka	Gazipur	Gazipur Sadar	Gazipur Cant.	30	3033	303330	30333098
Sal	Sal_3	Dhaka	Gazipur	Kaliakair	Boali	30	3033	303332	30333219
Sal	Sal_3	Dhaka	Gazipur	Kaliakair	Mouchak	30	3033	303332	30333266
Sal	Sal_3	Dhaka	Gazipur	Kaliakair	Ward No-07	30	3033	303332	30333207
Sal	Sal_3	Dhaka	Gazipur	Kaliganj	Bahadursadi	30	3033	303334	30333415
Sal	Sal_3	Dhaka	Gazipur	Kaliganj	Jamalpur	30	3033	303334	30333460
Sal	Sal_3	Dhaka	Gazipur	Kapasia	Kapasia	30	3033	303336	30333643
Sal	Sal_3	Dhaka	Gazipur	Sreepur	Ward No-03	30	3033	303386	30338603
Sal	Sal_3	Mymensingh	Mymensingh	Bhaluka	Meduary	35	3561	356113	35611377
Sal	Sal_3	Mymensingh	Mymensingh	Bhaluka	Rajai	35	3561	356113	35611386
Sal	Sal_3	Mymensingh	Mymensingh	Fulbaria	Enayetpur	35	3561	356120	35612041
Sal	Sal_3	Mymensingh	Mymensingh	Gaffargaon	Tengaba	35	3561	356122	35612288
Sal	Sal_3	Dhaka	Narayanganj	Rupganj	Mura Para	30	3067	306768	30676863
Sal	Sal_3	Dhaka	Tangail	Ghatail	Sandhanpur	30	3093	309328	30932894
Sal	Sal_3	Dhaka	Tangail	Sakhipur	Kakrajan	30	3093	309385	30938567
Sal	Sal_4	Chittagong	Brahamanbaria	Akhaura	Uttar Akhaura	20	2012	201202	20120290
Sal	Sal_4	Chittagong	Brahamanbaria	Akhaura	Ward No-01	20	2012	201202	20120201
Sal	Sal_4	Chittagong	Brahamanbaria	Akhaura	Ward No-08	20	2012	201202	20120208
Sal	Sal_4	Dhaka	Dhaka	Biman Bandar	Dakshinkhan(part)	30	3026	302606	30260638
Sal	Sal_4	Dhaka	Gazipur	Gazipur Sadar	Ward No-02	30	3033	303330	30333002
Sal	Sal_4	Dhaka	Gazipur	Gazipur Sadar	Ward No-08	30	3033	303330	30333008
Sal	Sal_4	Dhaka	Gazipur	Kaliakair	Ward No-05	30	3033	303332	30333205

Zone	Strata	DIV_NAME	DIST_ NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST_ CODE	UPZ_ CODE	UNI_CODE
Sal	Sal_4	Dhaka	Gazipur	Kaliganj	Moktarpur	30	3033	303334	30333494
Sal	Sal_4	Dhaka	Gazipur	Kaliganj	Ward No-08	30	3033	303334	30333408
Sal	Sal_4	Mymensingh	Mymensingh	Bhaluka	Ward No-07	35	3561	356113	35611307
Sal	Sal_4	Dhaka	Narayanganj	Rupganj	Ward No-02	30	3067	306768	30676802
Sal	Sal_4	Dhaka	Narayanganj	Rupganj	Ward No-09	30	3067	306768	30676809
Sal	Sal_4	Dhaka	Narsingdi	Palash	Ward No-01	30	3068	306863	30686301
Sal	Sal_4	Dhaka	Narsingdi	Palash	Ward No-03	30	3068	306863	30686303
Sal	Sal_4	Dhaka	Narsingdi	Palash	Ward No-07	30	3068	306863	30686307
Sal	Sal_4	Dhaka	Tangail	Sakhipur	Ward No-02	30	3093	309385	30938502

Appendix 14: List of selected unions/wards in Hill zone in Bangladesh

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_CODE	DIST_CODE	UPZ_CODE	UNI_CODE
Hill	Hill_1	Chittagong	Chittagong	Banshkhali	Pukuria	20	2015	201508	20150869
Hill	Hill_1	Chittagong	Chittagong	Lohagara	Chunati	20	2015	201547	20154732
Hill	Hill_1	Chittagong	Chittagong	Rangunia	Hosnabad	20	2015	201570	20157025
Hill	Hill_1	Chittagong	Cox'S Bazar	Chakaria	Dulahazara	20	2022	202216	20221633
Hill	Hill_1	Chittagong	Cox'S Bazar	Chakaria	Harbang	20	2022	202216	20221650
Hill	Hill_1	Chittagong	Cox'S Bazar	Chakaria	Kakhara	20	2022	202216	20221655
Hill	Hill_1	Chittagong	Cox'S Bazar	Cox'S Bazar Sadar	Islamabad	20	2022	202224	20222442
Hill	Hill_1	Sylhet	Habiganj	Bahubal	Bhadeshwar	60	6036	603605	60360523
Hill	Hill_1	Sylhet	Habiganj	Chunarughat	Paik Para	60	6036	603626	60362657
Hill	Hill_1	Sylhet	Habiganj	Madhabpur	Noapara	60	6036	603671	60367186
Hill	Hill_1	Chittagong	Khagrachhari	Matiranga	Tubalchhari	20	2046	204670	20467076
Hill	Hill_1	Sylhet	Maulvibazar	Kulaura	Joychandi	60	6058	605865	60586541
Hill	Hill_1	Sylhet	Maulvibazar	Kulaura	Tilagaon	60	6058	605865	60586595
Hill	Hill_1	Sylhet	Maulvibazar	Rajnagar	Munshi Bazar	60	6058	605880	60588042
Hill	Hill_1	Chittagong	Rangamati	Baghai Chhari	Kedarmara	20	2084	208407	20840747
Hill	Hill_1	Chittagong	Rangamati	Langadu	Bagachatar	20	2084	208458	20845840
Hill	Hill_2	Chittagong	Bandarban	Naikhongchhari	Naikhongchhari	20	2003	200373	20037376
Hill	Hill_2	Chittagong	Chittagong	Banshkhali	Bailchhari	20	2015	201508	20150812
Hill	Hill_2	Chittagong	Chittagong	Mirsharai	Karerhat	20	2015	201553	20155335
Hill	Hill_2	Chittagong	Chittagong	Patiya	Haidgaon	20	2015	201561	20156142
Hill	Hill_2	Chittagong	Chittagong	Satkania	Bazalia	20	2015	201582	20158221
Hill	Hill_2	Chittagong	Cox'S Bazar	Ramu	Garjania	20	2022	202266	20226619
Hill	Hill_2	Chittagong	Khagrachhari	Mahalchhari	Mahalchhari	20	2046	204665	20466531
Hill	Hill_2	Chittagong	Khagrachhari	Mahalchhari	Maschhari	20	2046	204665	20466547
Hill	Hill_2	Sylhet	Maulvibazar	Juri	Purba Juri	60	6058	605835	60583567

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_CODE	DIST_CODE	UPZ_CODE	UNI_CODE
Hill	Hill_2	Sylhet	Maulvibazar	Kamalganj	Madhabpur	60	6058	605856	60585647
Hill	Hill_2	Sylhet	Maulvibazar	Kulaura	Baramchal	60	6058	605865	60586511
Hill	Hill_2	Sylhet	Maulvibazar	Kulaura	Kulaura	60	6058	605865	60586565
Hill	Hill_2	Chittagong	Rangamati	Kawkhali (Betbunia)	Ghagra	20	2084	208425	20842557
Hill	Hill_2	Chittagong	Rangamati	Langadu	Kalapakurjya	20	2084	208458	20845860
Hill	Hill_2	Chittagong	Rangamati	Langadu	Mayanimukh	20	2084	208458	20845881
Hill	Hill_2	Sylhet	Sylhet	Jaintiapur	Chiknagul	60	6091	609153	60915329
Hill	Hill_3	Chittagong	Bandarban	Alikadam	Chokhyong	20	2003	200304	20030463
Hill	Hill_3	Chittagong	Bandarban	Lama	Sarai	20	2003	200351	20035179
Hill	Hill_3	Chittagong	Khagrachhari	Dighinala	Kabakhali	20	2046	204643	20464363
Hill	Hill_3	Chittagong	Khagrachhari	Khagrachhari Sadar	Kamalchhari	20	2046	204649	20464947
Hill	Hill_3	Chittagong	Khagrachhari	Khagrachhari Sadar	Perachhara	20	2046	204649	20464975
Hill	Hill_3	Chittagong	Khagrachhari	Mahalchhari	Mubachhari	20	2046	204665	20466563
Hill	Hill_3	Chittagong	Khagrachhari	Matiranga	Guimara	20	2046	204670	20467035
Hill	Hill_3	Chittagong	Khagrachhari	Matiranga	Matiranga	20	2046	204670	20467059
Hill	Hill_3	Chittagong	Khagrachhari	Panchhari	Ulta Chari	20	2046	204677	20467789
Hill	Hill_3	Chittagong	Khagrachhari	Ramgarh	Ramgarh	20	2046	204680	20468076
Hill	Hill_3	Chittagong	Rangamati	Barkal	Shublong	20	2084	208421	20842179
Hill	Hill_3	Chittagong	Rangamati	Kaptai	Chandraghona	20	2084	208436	20843619
Hill	Hill_3	Chittagong	Rangamati	Kaptai	Kaptai	20	2084	208436	20843657
Hill	Hill_3	Chittagong	Rangamati	Kawkhali (Betbunia)	Kalampati	20	2084	208425	20842576
Hill	Hill_3	Chittagong	Rangamati	Langadu	Bhasanya Adam	20	2084	208458	20845827
Hill	Hill_3	Chittagong	Rangamati	Naniarchar	Naniarchar	20	2084	208475	20847557
Hill	Hill_4	Chittagong	Bandarban	Bandarban Sadar	Ward No-02	20	2003	200314	20031402
Hill	Hill_4	Chittagong	Bandarban	Bandarban Sadar	Ward No-03	20	2003	200314	20031403
Hill	Hill_4	Chittagong	Bandarban	Lama	Ward No-04	20	2003	200351	20035104
Hill	Hill_4	Chittagong	Bandarban	Ruma	Ghalangya	20	2003	200391	20039119
Hill	Hill_4	Chittagong	Bandarban	Thanchi	Remakry	20	2003	200395	20039538
Hill	Hill_4	Chittagong	Bandarban	Thanchi	Tindu	20	2003	200395	20039576
Hill	Hill_4	Chittagong	Khagrachhari	Lakshmichhari	Barmachhari	20	2046	204661	20466123
Hill	Hill_4	Chittagong	Khagrachhari	Matiranga	Ward No-04	20	2046	204670	20467004
Hill	Hill_4	Chittagong	Khagrachhari	Panchhari	Latiban	20	2046	204677	20467738
Hill	Hill_4	Chittagong	Rangamati	Baghai Chhari	Ward No-08	20	2084	208407	20840708
Hill	Hill_4	Chittagong	Rangamati	Barkal	Aima Chhara	20	2084	208421	20842115
Hill	Hill_4	Chittagong	Rangamati	Barkal	Bara Harina	20	2084	208421	20842131
Hill	Hill_4	Chittagong	Rangamati	Belai Chhari	Belai Chhari	20	2084	208429	20842923
Hill	Hill_4	Chittagong	Rangamati	Jurai Chhari	Banjugi Chhara	20	2084	208447	20844719
Hill	Hill_4	Chittagong	Rangamati	Kaptai	Chitmaram	20	2084	208436	20843638

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_CODE	DIST_CODE	UPZ_CODE	UNI_CODE
Hill	Hill_4	Chittagong	Rangamati	Rajasthali	Ghila Chhari	20	2084	208478	20847846

Appendix 15: List of selected unions/wards in Village zone in Bangladesh

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_CODE	DIST_CODE	UPZ_CODE	UNI_CODE
Villages	Villages_1	Khulna	Bagerhat	Mollahat	Gaola	40	4001	400156	40015647
Villages	Villages_3	Barisal	Barguna	Barguna Sadar	Phuljhury	10	1004	100428	10042857
Villages	Villages_4	Barisal	Barguna	Betagi	Ward No-02	10	1004	100447	10044702
Villages	Villages_3	Barisal	Barisal	Mehendiganj	Bidyanandapur	10	1006	100662	10066231
Villages	Villages_4	Rajshahi	Bogra	Adamdighi	Ward No-09	50	5010	501006	50100609
Villages	Villages_1	Rajshahi	Bogra	Nandigram	Nandigram	50	5010	501067	50106773
Villages	Villages_2	Rajshahi	Bogra	Shibganj	Deuli	50	5010	501094	50109431
Villages	Villages_3	Chittagong	Brahamanbaria	Brahmanbaria Sadar	Ward No-01	20	2012	201213	20121301
Villages	Villages_4	Chittagong	Chandpur	Hajiganj	Ward No-04	20	2013	201349	20134904
Villages	Villages_3	Chittagong	Comilla	Barura	Bhabanipur	20	2019	201909	20190925
Villages	Villages_2	Chittagong	Comilla	Burichang	Baksimail	20	2019	201918	20191811
Villages	Villages_1	Chittagong	Cox'S Bazar	Chakaria	Chiringa	20	2022	202216	20221627
Villages	Villages_1	Rangpur	Dinajpur	Birganj	Palashbari	55	5527	552712	55271251
Villages	Villages_2	Dhaka	Faridpur	Alfadanga	Buraich	30	3029	302903	30290331
Villages	Villages_1	Chittagong	Feni	Sonagazi	Nawabpur	20	2030	203094	20309476
Villages	Villages_1	Rangpur	Gaibandha	Gaibandha Sadar	Kamarjani	55	5532	553224	55322451
Villages	Villages_1	Sylhet	Habiganj	Bahubal	Bahubal	60	6036	603605	60360511
Villages	Villages_1	Mymensingh	Jamalpur	Dewanganj	Char Aomkhaoa	35	3539	353915	35391529
Villages	Villages_4	Mymensingh	Jamalpur	Islampur	Ward No-01	35	3539	353929	35392901
Villages	Villages_2	Mymensingh	Jamalpur	Melandaha	Jhaugara	35	3539	353961	35396157
Villages	Villages_3	Khulna	Jessore	Manirampur	Bhojgati	40	4041	404161	40416110
Villages	Villages_4	Khulna	Jessore	Manirampur	Ward No-01	40	4041	404161	40416101
Villages	Villages_2	Khulna	Jessore	Sharsha	Kayba	40	4041	404190	40419051
Villages	Villages_1	Khulna	Khulna	Batiaghata	Jalma	40	4047	404712	40471271
Villages	Villages_2	Khulna	Khulna	Khan Jahan Ali	Atra Gilatala	40	4047	404748	40474819
Villages	Villages_4	Dhaka	Kishoreganj	Bajitpur	Ward No-06	30	3048	304806	30480606
Villages	Villages_3	Dhaka	Kishoreganj	Katiadi	Achmita	30	3048	304845	30484513
Villages	Villages_3	Dhaka	Kishoreganj	Kishoreganj Sadar	Maij Khapan	30	3048	304849	30484977
Villages	Villages_4	Dhaka	Kishoreganj	Pakundia	Ward No-06	30	3048	304879	30487906
Villages	Villages_3	Rangpur	Kurigram	Kurigram Sadar	Belgachha	55	5549	554952	55495217
Villages	Villages_2	Rangpur	Kurigram	Phulbari	Kashipur	55	5549	554918	55491854
Villages	Villages_4	Rangpur	Kurigram	Ulipur	Ward No-04	55	5549	554994	55499404

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST_ CODE	UPZ_ CODE	UNI_CODE
Villages	Villages_4	Khulna	Kushtia	Bheramara	Ward No-04	40	4050	405015	40501504
Villages	Villages_2	Khulna	Kushtia	Kumarkhali	Shelaidaha	40	4050	405071	40507194
Villages	Villages_3	Khulna	Kushtia	Kushtia Sadar	Ward No-09	40	4050	405079	40507909
Villages	Villages_3	Khulna	Magura	Mohammadpur	Digha	40	4055	405566	40556642
Villages	Villages_4	Sylhet	Maulvibazar	Barlekha	Ward No-09	60	6058	605814	60581409
Villages	Villages_3	Sylhet	Maulvibazar	Maulvi Bazar Sadar	Chandighat	60	6058	605874	60587421
Villages	Villages_4	Sylhet	Maulvibazar	Sreemangal	Ward No-06	60	6058	605883	60588306
Villages	Villages_1	Dhaka	Munshiganj	Tongibari	Autshahi	30	3059	305994	30599423
Villages	Villages_2	Mymensingh	Mymensingh	Trishal	Trishal	35	3561	356194	35619485
Villages	Villages_1	Rajshahi	Naogaon	Patnitala	Akbarpur	50	5064	506475	50647512
Villages	Villages_1	Dhaka	Narayanganj	Sonargaon	Baidyer Bazar	30	3067	306704	30670424
Villages	Villages_2	Dhaka	Narsingdi	Roypura	Amirganj	30	3068	306864	30686410
Villages	Villages_4	Rajshahi	Natore	Natore Sadar	Ward No-04	50	5069	506963	50696304
Villages	Villages_3	Rangpur	Nilphamari	Saidpur	Ward No-01	55	5573	557385	55738501
Villages	Villages_4	Rajshahi	Pabna	Sujanagar	Ward No-03	50	5076	507683	50768303
Villages	Villages_2	Barisal	Patuakhali	Galachipa	Kalagachhia	10	1078	107857	10785775
Villages	Villages_1	Barisal	Patuakhali	Kala Para	Lalua	10	1078	107866	10786635
Villages	Villages_4	Barisal	Pirojpur	Pirojpur Sadar	Ward No-05	10	1079	107980	10798005
Villages	Villages_2	Rajshahi	Rajshahi	Baghmara	Subhadanga	50	5081	508112	50811294
Villages	Villages_3	Rajshahi	Rajshahi	Durgapur	Ward No-01	50	5081	508131	50813101
Villages	Villages_1	Rangpur	Rangpur	Pirganj	Tukuria	55	5585	558576	55857695
Villages	Villages_2	Dhaka	Shariatpur	Gosairhat	Samantasar	30	3086	308636	30863683
Villages	Villages_3	Dhaka	Shariatpur	Shariatpur Sadar	Chandrapur	30	3086	308669	30866928
Villages	Villages_4	Dhaka	Shariatpur	Zanjira	Ward No-05	30	3086	308694	30869405
Villages	Villages_3	Mymensingh	Sherpur	Nakla	Gourdwar	35	3589	358967	35896747
Villages	Villages_4	Mymensingh	Sherpur	Nakla	Ward No-01	35	3589	358967	35896701
Villages	Villages_1	Rajshahi	Sirajganj	Tarash	Baruhas	50	5088	508889	50888910
Villages	Villages_2	Sylhet	Sunamganj	Bishwambarpur	Dakshin Badaghat	60	6090	609018	60901817
Villages	Villages_1	Sylhet	Sunamganj	Derai	Charnar Char	60	6090	609029	60902919
Villages	Villages_2	Sylhet	Sylhet	Balaganj	Purba Pailanpur	60	6091	609108	60910867
Villages	Villages_3	Sylhet	Sylhet	Zakiganj	Kholachhara	60	6091	609194	60919457
Villages	Villages_2	Dhaka	Tangail	Dhanbari	Paiska	30	3093	309325	30932585

Appendix 16: List of selected unions/wards in Sundarbans zone in Bangladesh

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_ CODE	DIST_ CODE	UPZ_CODE	UNI_CODE
Sundarbans	Sundarbans_1	Khulna	Bagerhat	Mongla	Burirdanga	40	4001	400158	40015827
Sundarbans	Sundarbans_1	Khulna	Bagerhat	Mongla	Chandpi	40	4001	400158	40015823
Sundarbans	Sundarbans_1	Khulna	Bagerhat	Mongla	Chila	40	4001	400158	40015829

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_CODE	DIST_CODE	UPZ_CODE	UNI_CODE
Sundarbans	Sundarbans_1	Khulna	Bagerhat	Mongla	Mithakhali	40	4001	400158	40015859
Sundarbans	Sundarbans_1	Khulna	Bagerhat	Mongla	Suniltala	40	4001	400158	40015883
Sundarbans	Sundarbans_4	Khulna	Bagerhat	Mongla	Ward No-03	40	4001	400158	40015803
Sundarbans	Sundarbans_2	Khulna	Bagerhat	Morrelganj	Baharbunia	40	4001	400160	40016010
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Morrelganj	Baraikhali	40	4001	400160	40016023
Sundarbans	Sundarbans_2	Khulna	Bagerhat	Morrelganj	Jiudhara	40	4001	400160	40016053
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Morrelganj	Khuolia	40	4001	400160	40016059
Sundarbans	Sundarbans_4	Khulna	Bagerhat	Morrelganj	Morrelganj	40	4001	400160	40016065
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Morrelganj	Nishanbaria	40	4001	400160	40016071
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Rampal	Banshtali	40	4001	400173	40017311
Sundarbans	Sundarbans_2	Khulna	Bagerhat	Rampal	Bhojpatia	40	4001	400173	40017317
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Rampal	Malliker Ber	40	4001	400173	40017353
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Rampal	Perikhali	40	4001	400173	40017371
Sundarbans	Sundarbans_2	Khulna	Bagerhat	Rampal	Rajnagar	40	4001	400173	40017377
Sundarbans	Sundarbans_2	Khulna	Bagerhat	Rampal	Rampal	40	4001	400173	40017383
Sundarbans	Sundarbans_4	Khulna	Bagerhat	Sarankhola	Dakhin Khali	40	4001	400177	40017776
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Sarankhola	Dhansagar	40	4001	400177	40017719
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Sarankhola	Khontakata	40	4001	400177	40017738
Sundarbans	Sundarbans_3	Khulna	Bagerhat	Sarankhola	Royenda	40	4001	400177	40017757
Sundarbans	Sundarbans_3	Barisal	Barguna	Barguna Sadar	Naltona	10	1004	100428	10042895
Sundarbans	Sundarbans_3	Barisal	Barguna	Patharghata	Kakchira	10	1004	100485	10048523
Sundarbans	Sundarbans_3	Barisal	Barguna	Patharghata	Kalmegha	10	1004	100485	10048535
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Kanthaltali	10	1004	100485	10048547
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Nachna Para	10	1004	100485	10048559
Sundarbans	Sundarbans_3	Barisal	Barguna	Patharghata	Patharghata	10	1004	100485	10048571
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Raihanpur	10	1004	100485	10048583
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Ward No-02	10	1004	100485	10048502
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Ward No-04	10	1004	100485	10048504
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Ward No-05	10	1004	100485	10048505
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Ward No-06	10	1004	100485	10048506
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Ward No-07	10	1004	100485	10048507
Sundarbans	Sundarbans_4	Barisal	Barguna	Patharghata	Ward No-08	10	1004	100485	10048508
Sundarbans	Sundarbans_2	Khulna	Khulna	Dacope	Bajua	40	4047	404717	40471710
Sundarbans	Sundarbans_2	Khulna	Khulna	Dacope	Banishanta	40	4047	404717	40471713
Sundarbans	Sundarbans_2	Khulna	Khulna	Dacope	Kailasganj	40	4047	404717	40471752
Sundarbans	Sundarbans_1	Khulna	Khulna	Dacope	Pankhali	40	4047	404717	40471769
Sundarbans	Sundarbans_1	Khulna	Khulna	Dacope	Sutarkhali	40	4047	404717	40471773
Sundarbans	Sundarbans_1	Khulna	Khulna	Dacope	Tildanga	40	4047	404717	40471784
Sundarbans	Sundarbans_2	Khulna	Khulna	Koyra	Amadi	40	4047	404753	40475310
Sundarbans	Sundarbans_1	Khulna	Khulna	Koyra	Koyra	40	4047	404753	40475355

Zone	Strata	DIV_NAME	DIST_NAME	UPZ_NAME	UNI_NAME	DIV_CODE	DIST_CODE	UPZ_CODE	UNI_CODE
Sundarbans	Sundarbans_1	Khulna	Khulna	Koyra	Maharajpur	40	4047	404753	40475372
Sundarbans	Sundarbans_1	Khulna	Khulna	Koyra	Maheshwaripur	40	4047	404753	40475378
Sundarbans	Sundarbans_2	Khulna	Khulna	Koyra	Uttar Bedkashi	40	4047	404753	40475394
Sundarbans	Sundarbans_2	Khulna	Khulna	Paikgachha	Chandkhali	40	4047	404764	40476416
Sundarbans	Sundarbans_1	Khulna	Khulna	Paikgachha	Garuikhali	40	4047	404764	40476439
Sundarbans	Sundarbans_4	Barisal	Pirojpur	Mathbaria	Amragachhia	10	1079	107958	10795815
Sundarbans	Sundarbans_4	Barisal	Pirojpur	Mathbaria	Betmore Rajpara	10	1079	107958	10795825
Sundarbans	Sundarbans_3	Barisal	Pirojpur	Mathbaria	Sapleza	10	1079	107958	10795877
Sundarbans	Sundarbans_4	Barisal	Pirojpur	Mathbaria	Tikikata	10	1079	107958	10795886
Sundarbans	Sundarbans_4	Barisal	Pirojpur	Mathbaria	Ward No-03	10	1079	107958	10795803
Sundarbans	Sundarbans_2	Khulna	Satkhira	Assasuni	Anulia	40	4087	408704	40870415
Sundarbans	Sundarbans_3	Khulna	Satkhira	Assasuni	Khajra	40	4087	408704	40870460
Sundarbans	Sundarbans_2	Khulna	Satkhira	Assasuni	Pratap Nagar	40	4087	408704	40870477
Sundarbans	Sundarbans_1	Khulna	Satkhira	Shyamnagar	Atulia	40	4087	408786	40878611
Sundarbans	Sundarbans_2	Khulna	Satkhira	Shyamnagar	Buri Goalini	40	4087	408786	40878623
Sundarbans	Sundarbans_1	Khulna	Satkhira	Shyamnagar	Gabura	40	4087	408786	40878631
Sundarbans	Sundarbans_2	Khulna	Satkhira	Shyamnagar	Ishwaripur	40	4087	408786	40878639
Sundarbans	Sundarbans_3	Khulna	Satkhira	Shyamnagar	Kashimari	40	4087	408786	40878655
Sundarbans	Sundarbans_1	Khulna	Satkhira	Shyamnagar	Munshiganj	40	4087	408786	40878663
Sundarbans	Sundarbans_1	Khulna	Satkhira	Shyamnagar	Padma Pukur	40	4087	408786	40878679
Sundarbans	Sundarbans_2	Khulna	Satkhira	Shyamnagar	Shyamnagar	40	4087	408786	40878694