Forestry Department

Food and Agriculture Organization of the United Nations

BRIEF ON NATIONAL FOREST INVENTORY NFI

BANGLADESH

Forest Resources Development Service

Rome, June 2007

Strengthening Monitoring, Assessment and Reporting (MAR) on Sustainable Forest Management (SFM)

FAO initiated activities to strengthen Monitoring, Assessment and Reporting on Sustainable Forest Management in January 2006 with the objective to facilitate development of harmonized forest related national monitoring, assessment and reporting (MAR) for contributing directly to the improvement of national sustainable forest management (SFM) regimes. It also aims to catalyze national discussions, analyses, policy actions and planning that promote national SFM regimes besides clarifying the contribution of forests to global environment and to human well-being. This initiative shares the ambition of the Collaborative Partnership on Forests (CPF) about simple, harmonised, efficient and action oriented MAR systems both at international and national levels and thus provides a response to some of the key recommendations made by the CPF task force on streamlining the reporting on forests with particular focus on national capacity building.

The MAR initiative has recently updated goals include country capacity building for better, consistent and regularly updated information to facilitate implementation of non-legally binding instrument (NLBI) on SFM, adopted at UNFF 6 (2007) that aims to,

- Strengthen political commitment and action at all levels to implement effectively sustainable management of all types of forests and to achieve the shared four global objectives ((a) reverse the loss of forest cover worldwide, (b) enhance forest-based economic, social and environmental benefits, (c) increase significantly the area of protected forests worldwide, and (d) reverse the decline in official development assistance for SFM;

- Enhance the contribution of forests to the achievement of the internationally agreed development goals, including the Millennium Development Goals, in particular with respect to poverty eradication and environmental sustainability; and

- Provide a framework for national action and international cooperation.

All countries can participate in this initiative, although the actual level and intensity of their involvement may vary among them. The initiative is organized under the Forest Resources Development Service (FOMR) of FAO Forestry Department. The contact persons are:

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Brief Note on MAR-SFM Working Paper Series (AP) on NFI- Brief

The NFI – Brief for a country attempts to provide a bird's eye view of the National Forest inventories (NFI). However, some countries conduct forest inventories at sub-national and or field management unit level. Therefore, this brief presents brief information on the forest inventories in a country at national level, sub-national level and or field management level depending on the available information.

It is useful to regularly update our understanding of elements and specifications of forest inventories because the information generated by forest inventories is simply manifestation of its span, design and methods to collect and analyse the primary information during its implementation. This is important because the NFI provides information on the state and trends of forest resources, their goods and services, and other related variables that support. It also defines the policy and trade decisions, science and field initiatives, national and international reporting, and direct and indirect contribution of forests to society like poverty alleviation. Regular updates are necessary because countries do change the set of elements, their specifications, designs and methods over period of time to address new emerging demands and to take advantage of new technologies.

The purpose of developing the NFI-briefs is, therefore, to document (working paper) the current and historical span of elements (variables or fields), their specifications, sampling designs and methods used in NFI. The document may serve as data source as well as reference material.

These briefs have been initially developed on the basis of the country submission to FAO. The initial draft of this report was sent to following national focal point for review and country validation before its finalisation.

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General Information

Bangladesh, officially the People's Republic of Bangladesh, is a country in South Asia. It is surrounded by India on all sides except for a small border with Myanmar to the far southeast and the Bay of Bengal to the south. Together with the Indian state of West Bengal, it makes up the ethno-linguistic region of Bengal. Its capital and largest city is Dhaka.

Map of the Country

(Source: https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html)

Figure 1. Map of Bangladesh

Land Area and Landuse

The total area of Bangladesh is 144 000 square km and the following table presents the categorisation and projection of land use in Bangladesh for 1990, 2000 and 2005 (FRA 2005).

Table 1. Categorisation and projection of land use in Bangladesh (FRA 2005).

FRA 2005 Categories	Area (1000 hectares)		
	1990	2000	2005
Forest	882	884	871
Other wooded land	44	53	58
Other land	12091	12080	12088
Other land of which with tree cover	343	343	343
Inland water bodies	1383	1383	1383
TOTAL	**14400**	**14400**	**14400**

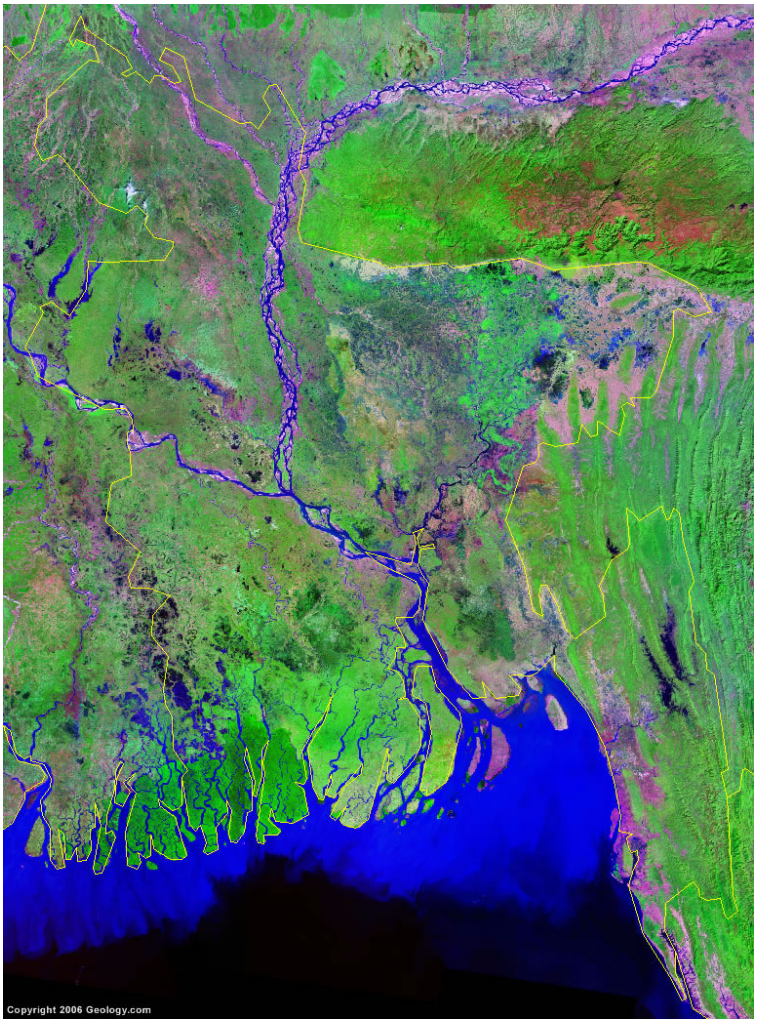
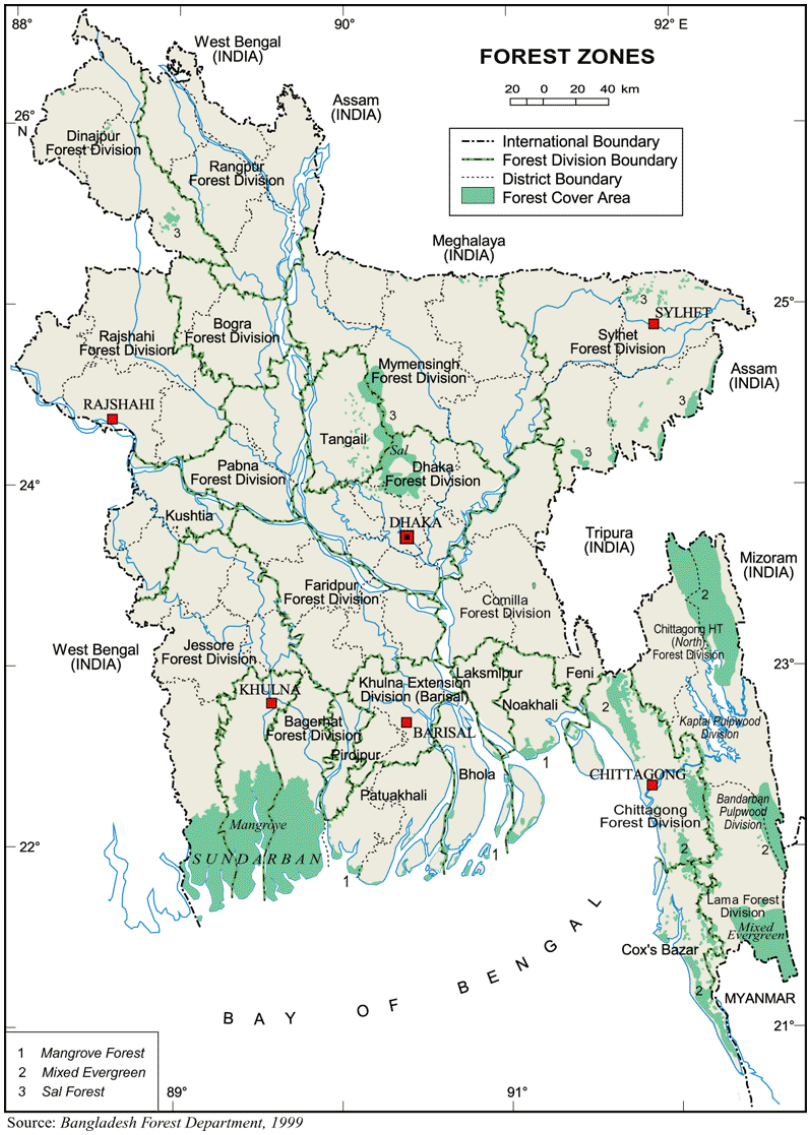


Figure 2. Vegetation Map of Bangladesh

Forests

The forests of Bangladesh are broadly classified into three categories based on the topographic conditions (a) Hill forests (Mixed Evergreen), (b) Plain Sal forests, and (c) Mangrove Littoral forests. The Hill Forests consist of moist tropical evergreen and semi-evergreen forests, which extend from Teknaf Peninsula, north along Myanmar border to the Chittagong Hills and Hill Tracts and the low hills in Sylhet district. The forests are generally uneven-aged and multi-storied. Pure stands of single species do not occur. The majority of smaller understory trees are evergreen and most of the dominant trees are deciduous. Plain Sal forests are Tropical Moist Deciduous type of forests and are normally present in most of the lowlands and floodplains in the central and western parts of the country. These forests exist only in a number of widely scattered and degraded patches and consist of patches of Sal coppice occasionally with other tree species. The littoral forest areas consists of Sundarbans natural mangrove forests and planted coastal mangrove forests and are confined to the southern part of Bangladesh



Source: *Bangladesh Forest Department, 1999*

Figure 3. Forest Cover and Forest Zones

Brief History of Forest Inventories

The purpose of the national forest inventory (NFI) in Bangladesh is to conduct national wide assessment of forest resources and "tree resources outside forest" to provide new qualitative and quantitative information on the state, uses, management and trends of these resources. The assessment covers a large range of biophysical and socio-economic variables and thus provides a broad and holistic view of forest land use for the country as a whole.

Although Bangladesh does not have a history of national forest inventories (NFI), its history of forest inventory at sub-national level is more than 200 years old. The first inventory survey was implemented as early as 1769-1773 but it was limited to selected forest areas like Sundarbans. During 1992-94, Bangladesh updated its sub-national inventories, using models and some ground based surveys during formulation of Forestry Sector Master Plan,1995. In 1998, a management inventory was carried out for the Sundarbans, Chittagong, Cox's bazar and Sylhet Forest Divisions and four Coastal Afforestation Divisions. The technical assistance was provided by the World Bank under the "Forest Resource Management Project".

Throughout the 1900s these forest inventories covered forests in different parts of Bangladesh. In addition, inventories were carried out to assess old plantations and trees in village areas. The Forest Department supervised these inventories with the technical and or financial help from FAO, UNDP, ODA, and Asian Development Bank. The inventories were implemented by identified foreign consulting companies in collaboration with national experts or companies. Table 2 provides a brief history of the forest inventories in Bangladesh.

The first and full scale national forest inventory was implemented in the year 2005 with the help of FAO under its support to National Forest Assessments (NFA) initiative. The following sections provide brief information on its design and methodology (see details at FAO website http://www.fao.org/forestry/site/24678/en/.)

Table 2. History of Assessments

Publication Year[1]	Title[2]	Institution[3]	Ground Inv. Year(s)[4]	Remote Sensing		Estimation Level [7]	Country Coverage (Full/Partial, %)[8]	Thematic cover**
				Data Year(s)[5]	Scale of Interpretation [6]			
1773		Messrs. Ritchie, Richards and Martain	1769-1773				Sundarbans	includes waterways
1829		Lt. Prinsep, Lt. Hodges	1821-1823 and 1829				Sundarbans – produced map (scale: 0.5 inch = 1 mile)	boundaries between forest and cultivated areas
1873		Mr. Ellison	1851-55 1855-59			district	Sundarbans – 24 Parganas districts and Khulna, Begerhat, Satkhira. produced map (scale 0.25 inch=1 mile)	Revenue surveys
1909		Survey Dept. District of Bengal	1905-09				Sundarbans. produced map (scale 1 inch= 1 mile)	
1924		Mr. Curtis				local surveys	Sundarbans – map scale 1:31,380	Loss of area through erosion – Growing stock
1960		FORESTAL (Forestry and Engineering International Limited)	1958-59	1958	aerial photography		Sundarbans –set of maps (scale 2 inches = 1 mile)	wood supply for proposed newsprint mill at Khulna – forest cover maps-volume, yields, species.

Publication Year[1]	Title[2]	Institution[3]	Ground Inv. Year(s)[4]	Remote Sensing		Estimation Level [7]	Country Coverage (Full/Partial, %)[8]	Thematic cover**
				Data Year(s)[5]	Scale of Interpretation [6]			
1961	"Inventory Project of Sangu-Matamuhari reserve forests"- Timber extraction by mechanical means from Chittagong Hill Tracts		1961	1958	aerial photos		Chittagong Hill – Sangu and Matamuhuri Reserve Forests	Produced Working plan for Sangu and Matamuhuri reserve forests for the period 1967-68 to 1986-87
1964		Hunting Survey Corporation Limited of Canada – FORESTAL)	1961-63	1961	aerial photos – 1:15,840		Hill Forests – Kassalong and Rankhiang Reserve Forests	Produced stand and stock tables. Topo maps at 1:15,840 and forest cover maps
1980-81	"Village Forest Inventory" – FAO/UNDP Project BGD/78/020 and BGD/78/017	Mr. Hammermaster	1980-81				267 village units (all Districts except Chittagong Hills)	Growing sotck of village forests and bamboo, non-wood value trees
1984		Overseas Development Administration (ODA)	1983-84		aerial photography		Sundarbans – forest type maps (scale 1:50,000); incidence of top dying of Sundri species (scale 1:10,000)	main species, stems per ha., mean and total volume. Stand projections and regeneration. Soil sampling.
1984	FAO/UNDP Project BGD/79/017						Sitapahar Reserve	Forest type: plantations and natural forests
1984	FAO/UNDP BGD 75/071	FAO/UNDP		1984	aerial photographs (1:30,000)			

Publication Year[1]	Title[2]	Institution[3]	Ground Inv. Year(s)[4]	Remote Sensing		Estimation Level [7]	Country Coverage (Full/Partial, %)[8]	Thematic cover**
				Data Year(s)[5]	Scale of Interpretation [6]			
1986			1984-85	1982,	aerial photos: 1:50,000; 1:15,840		High Forest: Chittagong and Cox's Bazar Forest Divisions	Area, Number of trees per ha. (dbh classes), bamboo,
1984	FAO/UNDP Project BGD/79/017 "Assistance to the Forestry Sector of Bangladesh"		none	1984	aerial photos at 1:15,000		Hill Forests – Kassalong and Rankhiang Reserve Forests	identification (of changes), from data from 1963
1984		Forest Inventory Division of the Forest Research Institute - Chittagong	1981-82			Random sampling : 1% of total area	Pulpwood Plantation: Kaptai	Area, stocking, major species.
1984	FAO/UNDP Project BGD/79/017		none	1984	aerial photos at 1:50,000		Sangu and Matamuhuri Reserve Forests	Forest type delineation: (i) shifting cultivation (ii) seemingly exploitable high forest
1985	Inventory of the mixed hardwood-teak plantations		1982-85	1982	aerial photos		Plantations: Chittagong and Cox's Bazar Forest Divisions	Area by stratum groups and age classes, stock.
1986	SPARRSO – Land Accretion and Plantation Map		1986	1984	aerial photographs (1:50,000)	Area divided into 1200 units (14 ha. per unit on average)	Mangrove Plantation – Coastal Afforestation. Produced 64 sheets at 1:10,000	Area, stocking, growth of the maturing mangrove stands

Publication Year[1]	Title[2]	Institution[3]	Ground Inv. Year(s)[4]	Remote Sensing		Estimation Level [7]	Country Coverage (Full/Partial, %)[8]	Thematic cover**
				Data Year(s)[5]	Scale of Interpretation [6]			
1987	Map series: "Forest Cover Map of the Southern part of Sylhet Forest Division" (24 sheets at 1:15,840)		1986-87	1984-87	1:50,000 (40% of plantation forests); SPOT satellite images		Sylhet Forest Division	Forest extent, plantations, bamboo.
1997	Spot Satellite Forest Cover Mapping – GOB/WB Forest Resources Management Project	Sustainable Ecosystems International, Corp. Philippines.	Field verification: 1997	1996	Spot images at 1:50,000 Bands: 1 (0.5-0.59 µm) 2 (0.61-0.69 µm) 3 (0.79-0.89 µm)	Forest Division level	2 Forest Divisions: Sylhet and Coastal Afforestation	NF, PL, Reed Forest, Non-forest areas
1998	Forest Resources Management Project (FRMP) - Forest Inventory of the Natural Forests and Forest plantations	Mandela Agricultural Development Corporation and Forest Department, Ministry of Environment and Forests.Bangladesh.	1995-1996	1996	spot satellite images and aerial photos (1:15,000)	Sub-National	8 forest division covered	NF, PL, FAC, TV, CV, FO
2001	"Forest Inventory of the Sal Forests of Bangladesh"	Forestry Dept. Ministry of Environment and Forests. Dhaka	1999-2000			5287 plots over approx. 46,000 ha.	Sal Forests of Central and Northwest Bangladesh (Dhaka, Tangail, Mymensingh Divisions)	Species, dbh, height, regeneration, management classes
2007	National Forest and Tree Resources Assessment 2005 - 2007	Forestry Dept. Ministry of Environment and Forests. Dhaka	2006					

Legend: **NF**=Natural Forest; **PL**=Plantations; **OWL**=Other Wooded land; **FAC**=Forest Area Change; **TV**=Total Volume; **TB**=Total Biomass; **CV**=Commercial Value; **PA**=Protected Areas; **BD**=Biodiversity; **FO**=Forest Ownership; **WSP**=Wood Supply Potential; **NWGS**=Non-wood Goods and services; **TOF**=Trees outside of forest; **FF**=Forest Fires

[1] Publication Year	Year in which the assessment was published
[2] Title	Title of the assessment
[3] Institution	Institution(s) responsible for the Assessment
[4] Ground Inventory Year(s)	Year or Interval of years during which the field inventory has been carried out
[5] Remote Sensing Data Year(s)	Year(s) of the Remote Sensing Images
[6] Remote Sensing Scale of Interpretation	Scale of Remote Sensing Images (e.g. 1:250,000)
[7] Estimation Level	Whether the Assessment was at National, Sub-national, District, Management Unit, etc. level
[8] Country Coverage (Full / Partial, %)	Amount of country area covered by the assessment (e.g. full, partial). If partial, indicated by % of total area.

National Forest Inventory Design 2005

The NFI 2005 uses both the ground based field inventory and survey as well as remote sensing. The former is used to provide more reliable estimates of extent of forest, its stocks and related social-economic information. The remote sensing in combination of the ground inventory provides estimation of forest cover and extent as well as integrated land use.

Remote Sensing Survey

SPARRSO, Bangladesh has used 14 imageries of June 2006 to cover the whole of Bangladesh. It has geo-rectified the June 2006 data with the help of Landsat TM mosaic of 1997. The remote sensing data gas been verified with the help of ground truthing exercise. The expected outputs are land use maps in two different scales, namely 1:1,000,000 (one sheet will cover the whole of Bangladesh) and 1:100,000. (see www.fao.org/forestry/nfa for more details).

Field Inventory

The NFI under NFA support used 267 Topo-Sheets at the scale of 1:50,000 to lay down, provide the "Lat-Long" of the sample tracts and to identify the physical location of the tracts during the field work. The hand held GPS and reading of the stored Lat-Long data from the GPS were used to reach and identify the desired location (especially the starting points of Tracts and Plots). The sampling design was systematic sampling. The sampling unit was designated as "Tract". The samples were laid systematically at the south west corner of the intersection of each 15 minutes latitude and 10 minutes longitude roughly equivalent of ~27 km N * ~17 km E. Each tract was 1 kmx1 km in size. Table 3 provides details of shape and size of tracts, plots and sub-plots. The total number of these systematically laid tracts was 299 and they cover the entire area of Bangladesh.

Table 3. Shape and size of Tracts, Plot and Sub-plots

Unit	Shape	Size and (area)	Number
Tract	Square	1000 m x 1000 m ($1km^2$)	1
Plot	Rectangle	250 m x 20 m (5000 m^2)	4/tract
Subplots	Circular	Radius r = 3,99 m (50 m^2)	3/plot
Land use/forest type section (LUS)	Variable	Variable	Variable

Plot Design and layout

Each tract "tract" (1 km x 1 km) is a cluster of 4 measurement field plots, which in turn are 250 meter long and 20 meter wide covering an area of 0.5 ha. The plots start at each corner of an inner 500 m square and are numbered clockwise from 1 to 4 as shown in Figure 4 . Table 4 provides their orientation for collecting data.

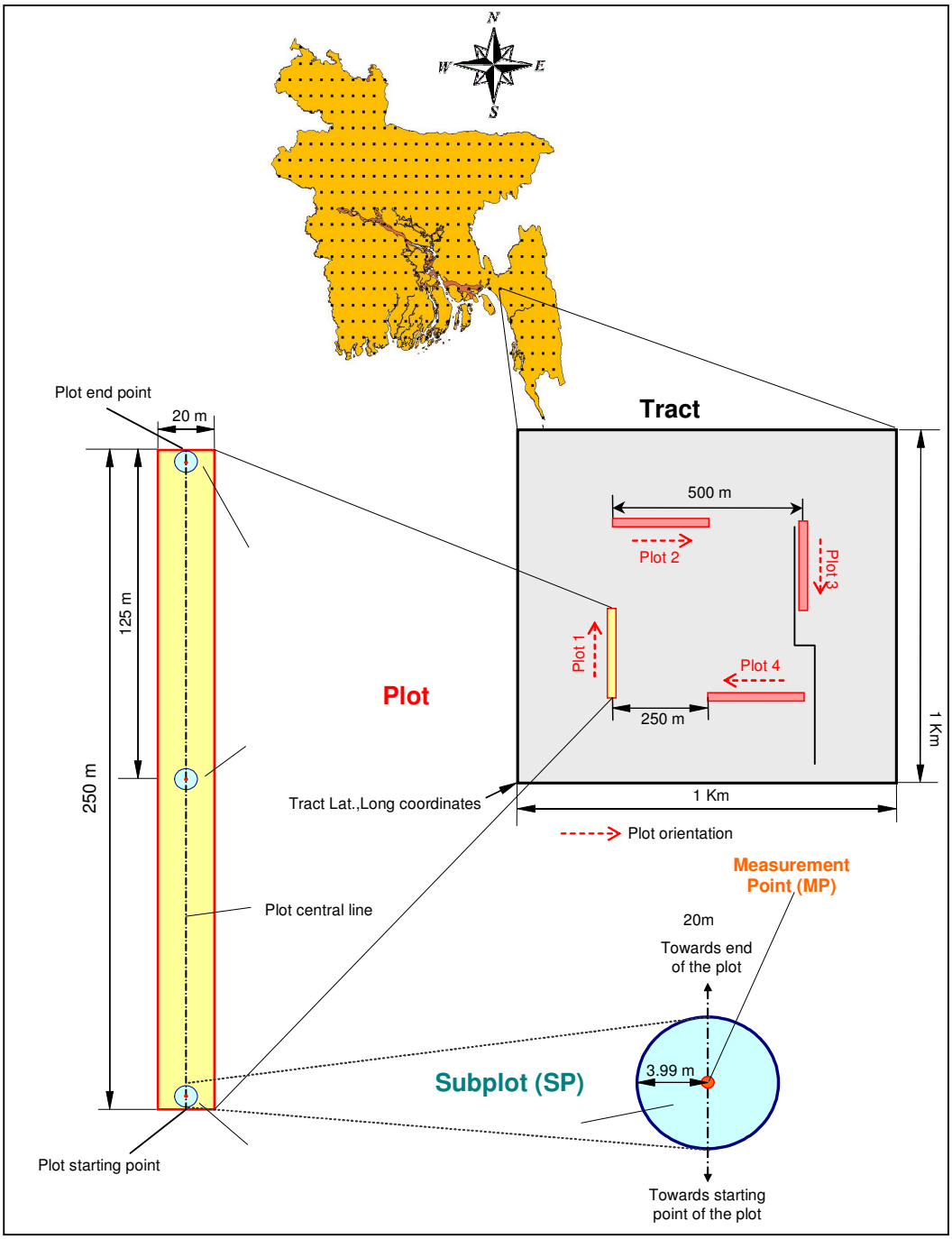


Figure 4. Tract, plot and sub-plot design

Table 4. Plot location and orientation

Plot	Location of the starting point of the plot, within the 500 m inner square	Orientation	Bearing
Plot 1	South-West corner	South-North	0 / 360 degrees
Plot 2	North-West corner	West-East	90 degrees
Plot 3	North-East corner	North-South	180 degrees
Plot 4	South-East corner	East-West	270 degrees

In case of Land Use Class "Forest", three circular subplots are required to be laid for collecting regeneration data. Each of these circular subplots was of diameter 3.99 M such that the area of each of them corroborates to 50 square meters (M2). They correspond to a different level of data collection. The subplots are numbered from 1 to 3, starting at the starting point of the plot. The subplots serve to measure tree regeneration (Dbh < 10 cm). An edaphic and topographic measurement point is established at the centre of each subplot. When the location of the subplots falls in land use classes other than forest, they must not be demarcated. The centers of these circular subplots were at 5M., 125M. and 245M. from the starting point of the Plot, along its axis.

The boundaries of alternative land uses categories on the ground within a plot is demarcated on its map (Figure 5). The following figure 3 demonstrates this in case of plot covering three categories of landuses reflected in 4 patches since two patches belong to the same landuse category.

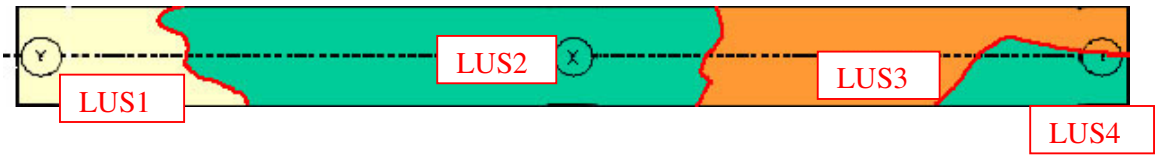


Figure 5. Example of land use sections (LUS) distribution within a plot

The land use/forest type classes are classified at following two levels. The first level corresponds to the four global classes of FRA (Forests; Other wooded land; Other land; Inland water). In order to achieve this, the terms and definitions used in national forest assessments are harmonized with global level forest assessments. The second level is country specific, and includes additional classes integrated in order to take into account national and sub-national information needs.

Measurement Process

The field manual (www.fao.org/forestry/nfa) provides complete details of the method and process of field measurements used in the last inventory. Following sections present a brief description of the same.

Permanent sample plots are were established on the ground generally at the exact location specified for each plot. The plot starting point was located on the ground with the help of a GPS receiver. A tolerance of 5 m radius, which is the maximum estimated position error (EPE) of the GPS, was allowed. When arriving at the starting point of the 1st plot, a marker (galvanized iron pipe measuring 0.5 m in length x 5 cm in diameter) was inserted on the ground. The marker was placed exactly on the starting point of the plot. However, if an obstacle hampered the operation, the marker was placed as close as possible to the plot

starting point. The distance and direction of the plot starting point from the marker were measured and recorded. Further, at least three reference points surrounding the marker were also identified and recorded.

The data collection is started at the plot starting point and continued in predefined direction (see Table 4). The measurements were taken up to 10 meters on both sides of the central line of the plot.

Data was collected at different levels (plots and subplots). At plot level, large trees and stumps (DBH ≥ 10 cm) were measured at plot level. The trees located at the border of the plot were considered as being inside the plot if at least half of the stem diameter at breast height was inside the plot. At sub-plot level, topographic and edaphic (soil) data, small diameter trees and tree regeneration data was collected (see Table 5).

Table 5. Trees and stumps measured per level

Level	**Measured trees/stumps**		**Measurements**
	Forest	**Other land uses**	
Plot	Dbh ≥ 10 cm	Dbh ≥ 10cm	Species, location, diameters, total height, health, quality
Subplot (SP)	Tree height ≥ 1.30 m and Dbh < 10 cm	None	Total number by species

The tree regeneration (tree height ≥ 1.3 m and DBH < 10 cm) by species is measured within sample sub-plots. Only tree species with a potential of reaching a minimum height of 5 m at maturity *in situ* are recorded.

In addition to collecting information on vegetation, the information on people and socio-economic variables was collected. Two major user groups were interviewed (external key informants; and forest and tree users (considered as individuals or focus groups)). The "external key informants" are external individuals with particular knowledge about the area, the forest and the people. Data on forest products and services is collected through interviews with local people or from people accompanying the field crew in the field for each land use class present in the plot.

Cross-Checking and Triangulation

Cross-checking and triangulation is also done to take care of "bias" in the interview method of data collection. It also helps to improve accuracy. Triangulation means looking at any problem or issue from as many perspectives as possible, but from at least three (Freudenberger, 1995).

Content and Methodology of data collection in NFI

Geo-Physical

Note: [N=National; SN=Sub-National; MU=Management Unit]

	N	**SN**	**MU**	**Methodology**

Geo-Coordinates	X			GPS
Altitude	X			Map, (Field Survey)
Topography	X			Field Survey
Orientation (or Aspect)	X			Field Survey
Slope	X			Field Survey
Soil	X			Field Survey, (quick visual appraisal)
Geological structure				
Rainfall				

Bio-Physical

	N	SN	MU	Methodology
Number of trees	X			Inventory: All trees with $D_{bh} \geq$ 1 cm are counted.
Diameter of trees	X			Inventory: Diameter of trees with $D_{bh} \geq 10$ cm are measured at 1.3 m height, over bark, uphill, with d-tape. Trees with D_{bh} 1-10 cm are counted by species at subplot level.
Height of trees	X			Inventory: Total tree height is measured (with Haga altimeter) for trees with $D_{bh} \geq 10$ cm.
Length of stem	X			Inventory: Commercial height (~Length of stem) is measured for trees with $D_{bh} \geq 10$ cm
Stump height	X			Inventory: Stump height and stump diameter (at stump height) are measured for stumps with $D_{sh} \geq 10$ cm
Age class				*Info not available*
Twigs				*Info not available*
Bark				*Info not available*
Leaves				*Info not available*

Forest extent

	N	SN	MU	Methodology
Forest land area	X			Field Survey and RS Survey
Area of forest canopy/crown cover	X			Field Survey and RS Survey
Area under forest management	X			Field Survey and Socioeconomic Survey (forest management plans)
Area under formal forest management plan	X			Field Survey and Socioeconomic Survey (forest management plans)
Area under sustainable forest management				*Info not available*
Forest area with certification				*Info not available*

Area under public owned forest	X			Field Survey and Socioeconomic Survey
Area under private owned forest	X			Field Survey and Socioeconomic Survey

Forest characteristics (Naturalness) and forest type

	N	SN	MU	Methodology
Primary forest				*Info not available*
Modified natural forest				*Info not available*
Semi-natural forest				*Info not available*
Productive plantation	X			Field Survey and RS Survey
Protective plantation	X			Field Survey and RS Survey
Coniferous				
Broadleaved	X			Field Survey and RS Survey
Mixed forest	X			Field Survey and RS Survey
Forest area by dominant species (bamboo, mangroves, rubber)	X			Field Survey and RS Survey: Sal forest, Bamboo forest (/mixed bamboo/broad-leaved forest), Mangrove forest Mangrove plantation, Rubber plantation. Specific measurements are made for Bamboo.
Forest area by ecological zone (tropical, subtropical, temperate, boreal, polar)	X			Map: FRA Global Ecological Zones map.

Use (designated functions) of forests

	N	SN	MU	Methodology
Area of forest under production	X			Field Survey and Socioeconomic Survey
Area of forest for protection of soil and water	X			Field Survey and Socioeconomic Survey
Area of forest for conservation of biodiversity	X			Field Survey and Socioeconomic Survey
Area of forest for social services	X			Field Survey and Socioeconomic Survey
Area of forest for multiple purpose	X			Field Survey and Socioeconomic Survey
Forest area available for wood supply	X			Field Survey and Socioeconomic Survey
Forest area within protected areas				*Info not available*

Social Services

	N	SN	MU	Methodology
Area of forest managed for recreation	X			Field Survey and Socioeconomic Survey
Area of forest managed for tourism	X			Field Survey and Socioeconomic Survey
Area of forest used for education	X			Field Survey and Socioeconomic Survey

Area of forest managed for conservation of cultural/spiritual site	X			Field Survey and Socioeconomic Survey

Mapping of forest distribution

	N	SN	MU	Methodology
Distribution of forests	X			RS Survey
Forest Characteristics	X			RS Survey
Land use	X			RS Survey
Administrative/political/legal boundaries	X			RS Survey
Designated functions of forests				*Info not available*
Other wooded land	X			RS Survey
Other land with tree cover				
Other land	X			RS Survey

Status of the forest and disturbances affecting forest health and vitality

	N	SN	MU	Methodology
Disturbance by insects	X			Field Survey
Disturbance by diseases	X			Field Survey
Disturbance by other biotic agents	X			Field Survey
Disturbance by fire	X			Field Survey
Disturbance caused by other abiotic factors	X			Field Survey

Biodiversity

	N	SN	MU	Methodology
Tree species	X			Field Survey
Shrub species	X			Field Survey
Herbs species				*Info not available*
Endangered species	X			Field Survey
Critically endangered species	X			Field Survey
Vulnerable species	X			Field Survey
Native species	X			Field Survey
Endemic species	X			Field Survey
Introduced species	X			Field Survey

Beneficiaries of forest goods and services

	N	SN	MU	Methodology
By locality of user (e.g. indigenous/local/national)?	X			Field Survey and Socioeconomic Survey

By good/service (e.g. timber, fuelwood, NWFP, bamboo/rattan, water, etc) used by them	X			Field Survey and Socioeconomic Survey
By economic class of the beneficiaries (high, medium, low income)				*Info not available*
By level of dependency on forest (as percentage of total employment)				*Info not available*
By physical accessibility to the forest (distance from forest)	X			Field Survey and Socioeconomic Survey

Economic value

	N	SN	MU	Methodology
Removal of timber	X			Field Survey and Socioeconomic Survey
Removal of fuelwood	X			Field Survey and Socioeconomic Survey
Removal of other wood products	X			Field Survey and Socioeconomic Survey
Removal of wood products derived from forest under sustainable management				*Info not available*
Removal of wood products derived from forest plantations	X			Field Survey and Socioeconomic Survey
Removal of non wood forest products	X			Field Survey and Socioeconomic Survey
Annual allowable cuts/yields				*Info not available*
Social services	X			Field Survey and Socioeconomic Survey
Environmental services				
Employment	X			Field Survey and Socioeconomic Survey
Support to livelihood of communities	X			Field Survey and Socioeconomic Survey
Market price/cost of wood in forest				*Info not available*
Market price/cost of non wood forest products				*Info not available*
Estimate of value of social services	X			Field Survey and Socioeconomic Survey
Estimate of value of environmental services	X			Field Survey and Socioeconomic Survey
Estimate of value of employment	X			Field Survey and Socioeconomic Survey
Estimate of the contribution of forest sector to national economy	X			Field Survey and Socioeconomic Survey

Policy, legal and institutions (PLI) framework

	N	SN	MU	Methodology
Forest policy	X			Records
Forest legislation	X			Records
Forest administration	X			Records
Forest education and research	X			Records

Annual outlay, expenditure, investment in forestry sector				*Info not available*

Variables

The NFI attempts to collect information on following 65 variables, if available. The field manual provides detail specification and units for measurement of each of the variable. (www.fao.org/forestry/nfa).

	Variable in NFI
1	Accessibility
2	Agro-ecological zone
3	Altitude
4	Application of forestry incentives
5	Awareness of forestry incentives
6	Awareness of legislation
7	Causative agents
8	Change reason
9	Child labour
10	Commercial height
11	Common/local species name
12	Compliance with legislation
13	Conflicts
14	Demand trend
15	Designation / Protection status
16	Diameter at Breast Height
17	Distance to nearest all-weather road
18	Distance to nearest Food Market
19	Distance to nearest Input Market
20	Distance to nearest seasonal road
21	Distance to nearest Settlement
22	Disturbances
23	End-use

24	Environmental problems
25	Fire occurrence
26	Frequency
27	Gender balance
28	Global Ecological Zone (GEZ)
29	Harvester/User
30	Harvester/User Rank
31	Health condition
32	Length of branch
33	Logging technology

	Variable in NFI
34	Management agreement
35	Management plan
36	Mean Diameter of branch
37	Organic matter
38	Organization level
39	Orientation - Aspect
40	Ownership
41	Population main activity
42	Proximity to infrastructure
43	Relief
44	Scientific species name
45	Secondary activity of Population
46	Settlement history of Population
47	Shrub coverage
48	Shrub height
49	Silviculture
50	Slope
51	Soil drainage
52	Soil texture
53	Species ranking
54	Stand structure
55	Stem quality
56	Stump - Species
57	Stump height
58	Supply trend
59	Timber exploitation
60	Total height
61	Tree Canopy cover
62	Tree origin
63	Trend
64	User rights
65	Year since cut

Database

The NFI data is stored in a dynamic relational database using MS Access software programme. It is an application with code tables and forms with "macro" written for some elementary data validation and processing (www.fao.org/forestry/nfa).

Bibliographies and References for further reading

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