ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY II

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BANGLADESH FORESTRY OUTLOOK STUDY

by

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Abbreviations and acronyms

ADB	Asian Development Bank
ACF	Assistant Conservator of Forests
AIG	Alternate Income Generation
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corporation
BFIDC	Bangladesh Forest Industries Development Corporation
BFRI	Bangladesh Forest Research Institute
BNH	Bangladesh National Herbarium
BSCIC	Bangladesh Small Scale Cottage Industries Corporation
BWDB	Bangladesh Water Development Board
CBN	Costs of Basic Needs
CCF	Chief Conservator of Forests
CDM	Clean Development Mechanism
CF	Conservator of Forests
Cft	Cubic Feet
CGP	Coastal Green Belt Project
CHT	Chittagong Hill Tracts
CI Sheet	Corrugated Iron Sheet
CITES	Convention on International Trade in Endangered Species
Cm	Centimeter
Cu. M.	Cubic Metre
DAE	Department of Agricultural Extension
DBH	Diameter Breast Height
DC	Deputy Commissioner
DCCF	Deputy Chief Conservator of Forests
DCF	Deputy Conservator of Forests
DFO	Divisional Forest Officer
ECA	Ecological Critical Area
FAO	Food and Agriculture Organization
FD	Forest Department
FRMP	Forest Resources Management Project
FSP	Forestry Sector Project
GHG	Green House Gases
HPI	Happy Planet Index
Ha	Hectare
HIES	Household Income and Expenditure Survey
IPCC	Intergovernmental Panel on Climate Change
IUCN	The World Conservation Union
MAI	Mean Annual Increment
MOEF	Ministry of Environment and Forests
NGO	Non Government Organization
NSP	Nishargo Support Project
NTFP	Non-Timber Forest Product
PA	Protected Area
PD	Project Director
PRSP	Poverty Reduction Strategy Paper
R&H	Roads and Highways
RF	Reserved Forests
ROR	Records of Rights
RIMS	Resource Information Management System
SBCP	Sundarban Biodiversity Conservation Project

SLR	Sea Level Rise
TAR	Third Assessment Report
TFF	Tree Farming Fund
TNO	Thana Nirbahi Officer (Officer in charge of a sub-district)
UNDP	United Nations Development Program
USF	Un-classed State Forest
WB	World Bank

CONTENTS

INFORMATION NOTE ON THE ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

The Asia-Pacific Forestry Sector Outlook Study (APFSOS) is a wide-ranging initiative to gather information on, and examine, the evolution of key forestry issues as well as to review important trends in forests and forestry. The main purpose of the study is to provide a better understanding of the changing relationships between society and forests and thus to facilitate timely policy reviews and reforms in national forest sectors. The specific objectives are to:

1. Identify emerging socio-economic changes impacting on forest and forestry
2. Analyze probable scenarios for forestry developments to 2020
3. Identify priorities and strategies to address emerging opportunities and challenges

The first APFSOS was completed in 1998, with an outlook horizon to 2010. During its twenty-first session, held in Dehradun, India, in April 2006, the Asia-Pacific Forestry Commission (APFC) resolved to update the outlook extending the horizon to 2020. The study commenced in October 2006 and is expected to be completed by September 2009.

The study has been coordinated by the Food and Agriculture Organization of the United Nations (FAO), through its regional office in Bangkok and its headquarters in Rome, and implemented in close partnership with APFC member countries with support from a number of international and regional agencies. The Asian Development Bank (ADB), the International Tropical Timber Organization (ITTO), and the United Kingdom's Department for International Development (DFID) provided substantial financial support to implement the study. Partnerships with the Asia-Pacific Association of Forest Research Institutes (APAFRI) and the Secretariat of the Pacific Community (SPC) supported the organizing and implementing of national focal points' workshops and other activities, which have been crucial to the success of this initiative. The contributions of many other individuals and institutions are gratefully acknowledged in the main APFSOS report.

Working papers have been contributed or commissioned on a wide range of topics. These fall under the following categories: country profiles, sub-regional studies and thematic studies. Working papers have been prepared by individual authors or groups of authors and represent their personal views and perspectives; therefore, opinions expressed do not necessarily reflect the views of their employers, the governments of the APFC member countries or of FAO. Material from these working papers has been extracted and combined with information from a wide range of additional sources to produce the main regional outlook report.

In general, working papers are moderately edited for style and clarity and are formatted to provide a measure of uniformity, but otherwise remain the work of the authors. However in this case the contents have been heavily edited; while all care has been taken, some errors may have been introduced as a result of editing and interpretation. Copies of these working papers, as well as more information on the Asia-Pacific Forestry Sector Study, can be obtained from:

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1. INTRODUCTION

This study is undertaken at the initiative of FAO in line with the project prepared by the Forest Department (FD), Ministry of Environment and Forest, Government of Bangladesh and funded by FAO. The FD provided all the required support.

This country outlook report has been prepared as part of the Asia-Pacific Forestry Sector Outlook Study initiated by the Asia-Pacific Forestry Commission. The major objective of these outlook studies has been to provide decision makers; especially those dealing with forest and forestry; the required information, data and analyses about the prevailing trends in forestry sectors and present the best possible future projections to appraise the possible future of forestry sectors. More specifically the objectives of this study are:

1. To identify the parameters influencing the forestry sector of Bangladesh, both positive and negative.
2. To identify and assess the demands for the goods and services that are expected to be generated by the forestry sector of Bangladesh.
3. To assess the trends of these demands even if proper quantifications are not possible.
4. To make an assessment, based on the available data and information, as to how forests and forestry will look in the year 2020.
5. To provide a comprehensive set of data and/or information on historical trends and outlook scenarios for decision makers to use in their own analyses.

Scope and coverage

Though all the government forest land in Bangladesh is under the management and control of the FD in Bangladesh; this study is not confined to government forests alone.

Key questions to be addressed

The main goal is to make the best possible prediction as to how forests and forestry will look in 2020. Under this context, the following are some of the relevant questions that may be examined.

i. What will be the future of forests and forestry in Bangladesh under the existing trends of socio-economic and environmental conditions or under changed socio-economic and environmental situations?
ii. How will the future demand for wood and wood products and also non-wood forest products (NWFPs) be met?
iii. What will be the major sources of wood supply in the country? How much can the country rely on forests under government management to meet the demand?
iv. What will be the future role of forests and forestry in poverty alleviation? Where and under what circumstances could forestry play an important role in poverty alleviation?
v. Will there be continued decline in forest cover on account of the growing demand for agricultural land?
vi. What are the key forest related environmental issues and what could we expect in the next 15-20 years?
vii. What will be the direct and indirect implications of climate change on forests and forestry?

In view of the above, the important requirement is to identify the various factors influencing the forests and forestry in Bangladesh and whereever possible assess the trend of these factors to visualize the future for forests and forestry in Bangladesh.

The study process

The major steps of the process to be followed were:

- Review of relevant documents and collect all possible information and data.
- To study the linkages and impact of macro economics and social environment with the forestry sector.
- To study the relationship (dependency and impact) of the forestry sector with its closely related sectors such as Agriculture, Fisheries, Livestock, Energy, Tourism, Disaster Management, etc.
- Assess a trend and make an estimate as to "How the Forests and Forestry will look like in 2020"

In addition to reviewing various documents a number of meetings and discussions were held during the preparation of the report.

2. STATE OF FORESTS AND FORESTRY IN BANGLADESH

Forest area and tree cover

It is necessary to examine forest cover under different major categories of land, which are

- Reserved Forests (RF): These are lands under the direct control of the FD. The Forest Act is applicable for their protection. According to FD records the total Reserved Forests in Bangladesh is 1.2 million hectares (Mha). Though these lands are declared as "Reserved Forest" they do not carry good tree cover that can be designated as forests. About 0.6 Mha are under the process of reservation. These have been notified under section 4 or 6 of the Forest Act and have been under the process of reservation for a long time. These lands are however, treated almost as reserved forests for the purpose of field forestry. All these lands however, do not carry complete tree cover. Though no correct estimate of RF tree cover is available the general understanding is that 50% of these lands have fairly good tree cover.

- Un-classed State Forest Land: These are the lands that are under the control of the Ministry of Land, Government of Bangladesh. They are designated as Un-classed State Forests (USF) and/or Khash[2] lands such as newly accreted mud flats, fresh water wetlands such as haor[3], baor[4], beel[5], etc. According to the year book of statistics the total area of USF in 2001-02 was 0.7 Mha. Almost all of these lands are located in the Chittagong Hill Tracts (CHT) and are supposed to be used by the tribal people for 'slash and burn' agriculture. The tree cover on USF is very poor. No reliable estimate of USF tree cover is available. However, the general understanding is that about 20% of the USF possess fair forest cover.

- The "Khas"[6] lands: these are lands recorded in the ROR (Records of Rights) as 'khas land' in favor of the district administration (Deputy Commissioner). The Deputy Commissioners (DCs) are the managers of these lands. The ownership of these lands is vested with the government. All the newly accreted lands are treated as khas land. The DCs usually lease out khas lands to the members of the public, very often for agriculture, fisheries, house building, etc. These lands hardly possess any tree cover.

- Wetlands: These are fresh water wetlands, most of which are privately owned agricultural lands. But during the monsoon when they get inundated and converge into a big water body, all the inundated area becomes a 'fish mohal'[7] and the Government (DC) leases out these wetlands, very often on an yearly basis, mostly for fishing in lieu of an agreed amount of government revenue. Though the land underneath the water is owned by an individual, he loses his right for the time being even to catch fish on his own land. These wet lands had fairly good tree cover in the past, but on account of the increasing demand for fuel wood and expansion of agricultural land, the tree cover has drastically declined. At present barely 2% of such land possesses some tree cover.

[2] Ministry of Land, Government of Bangladesh is the owner. DC on behalf of the Government can lease out these land to the members of the public.
[3] Large natural depressions, at times extending over a few square miles, which hold huge quantities of fresh water. They harbor valuable wetland vegetation.
[4] Horseshoe lakes having wetland vegetation.
[5] Natural depressions, of reasonable size, that hold huge quantities of fresh water and carry wetland vegetation.
[6] According to the ROR the owner of this land is the DC, on behalf of the Ministry of Land, Government of Bangladesh. The DCs never manage these lands, they simply lease out to private individuals for various purposes.
[7] The whole of the inundated area is leased out by the Government for fishing, though the land underneath is privately owned that owner do not get any right on the fish or water standing on his land. This area is designated as a fishing unit or area and is termed as mohal.

- Tea Garden Land: An area of about 48,300 hectares is under 158 tea gardens in Bangladesh. Roughly about 30,000 hectares of tea garden land were under tree cover in 1971. At present there are 13,330 hectares of degraded natural forest, 2,132 hectares of forest plantation and 7,098 hectares of rubber plantation. Together they provide tree cover of about 22,561 hectares. These data indicate that over three times the area of forest plantations has been put under rubber plantations. Economics is the basic driving force for causing such drift in favor of the rubber plantations. In the forest areas of the tea gardens the forest cover is roughly 50%.

- Homesteads: There are about 15.4 million homesteads extending over an area of 0.3 Mha. Homestead size varies largely from 0.043 to 0.435 hectares. Roughly 43% of the homestead area is occupied by vegetation (Alam et al. 2005). Though fruit trees are mostly planted, in larger homesteads forest species are also planted. These homesteads meet the major supply of wood in Bangladesh. The average tree cover in homestead area is about 40%.

The extent of forest area as reported by the Forest Department (2007) is 2.53 Mha (see Table 1).

Table 1. Extent of forest area as reported by the Forest Department (2007)

Forest category	Area in million hectares (according to FD)	Area in million hectares (according to FMP)
Hill forest	1.4[8]	0.4
Sal forest	0.12	0.12
Village forest	0.27	N.a.
Mangrove forest	0.74[9]	0.48
Total	**2.53**	

Source: Forest Department, Government of Bangladesh

Out of this 2.53 Mha of forests, the FD manages 1.53 million Mha (Ishtiaq 2007). According to the FRA 2005 (FAO, 2006) the forest area in Bangladesh is 952 000 hectares, while the other wooded land is 122 000 hectares (Table 2).

Table 2. Forest area in Bangladesh

Country/region	Reference year	Total area ('000 ha)						
		Land area						Inland water
		Forest			Other wooded land		Other land	
		Closed	Open	Plantation	Shrubs/Trees	Forest fallow		
Bangladesh	1996	720	0	232	105	17	11,943	1,383
% of Bangladesh		5.0	0	1.6	0.7	0.1	82.9	9.6

Source: FRA (2000)

The FD has different categories of land under its control.

[8] Out of this 1.4 Mha, USF is 0.73 Mha (of this 0.02 Mha under the FD) and the other 0.67 Mha is RF and controlled by the FD.
[9] Out of this 0.74 Mha, Sundarbans is 0.6 Mha and mangrove afforestation 0.15 Mha.

Table 3. Different categories of land under FD control

Type of land under forest	Area in hectares
Reserved forests	1222691.441
Notified under section 4 and/or 6 of Forest Act 1927	589947.96
Protected forests	36996.71
Acquired forests	8445.21
Vested forests	3842.9
Un-classed state forests under the control & management of FD	17347.18

Source: Forest Department, Government of Bangladesh

Changes in forest cover

Forests under the management of the FD are grouped into three categories, namely Mangroves, Hill Forests and Plain Land (Sal) Forests. Mangrove forests are located in the Sundarbans and along the coast. Plain land forests are mostly degraded Sal forests, situated in the central and Northwestern part of the country. Hill forests are located in Chittagong, Chittagong Hill Tracts and Sylhet. Besides, the 1.53 Mha of government forest land under FD management (Ishtiaq 2007, there are about 761,924 hectares of government forest land, mostly in Chittagong Hill Tracts, designated as USF and tree growth in 15.4 million homesteads (see Annex 1).

The natural high forests[10] all over the country have depleted alarmingly. The National Biodiversity Strategy & Action Plan for Bangladesh (October 2006) has pointed out that the forest cover has come down to 6% from 10% of the area of the country. The fact remains that depletion of forests is an ongoing process. The Millennium Ecosystem Assessment 2005 and the Global Environmental Outlook 3 (UNEP 2002) have also highlighted the alarming rate of deforestation. Annual forest loss in Bangladesh is estimated as about 0.015 Mha. .

National forest inventory

FAO has recently conducted a national forest inventory in Bangladesh. The report is yet to be published. During this inventory it has emerged that about 48% of the country possesses vegetative cover in some form or the other. According to tree cover categories used in this inventory the distribution is (in Mha):

- No tree-cover (mostly arable land) 7.60
- Less than 5% tree-cover 2.89
- 5 to 10% tree-cover 1.43
- 10 to 30% tree-cover 1.27
- 30 to 70% tree-cover 1.23
- Over 70% tree-cover 0.33

Total 14.75

Forest area

Forest plantations

Plantations are raised both inland as well as along the coast. Table 4 shows plantation area under different planning periods.

[10] Forests of seed origin or somewhat virgin in nature.

Table 4. Plantation area according to different planning periods

Description	Area planted in ha	Average area ha per year
First Five Year Plan including two year Plan (1973-74 to 1979-80)	67912	9701.7
Second Five Year Plan (1980-81 to 1984-85)	100112	20022.4
Third Five Year Plan (1985-86 to 1989-90)	69236	13847.2
Fourth Five Year Plan (1990-91 to 1994-95)	73999	14799.8
Two Year Plan (1995-96 to 196-97)	17026	8513
Fifth Five Year Plan (1997-98 to 2001-02)	57296	11459.2
During 2002-2003	13291	13291

Source: Forest Department, Government of Bangladesh

Bangladeshi foresters are pioneers in mangrove afforestation and successfully established specialized plantation techniques for mangrove species. Initiated in 1962 following the devastating cyclone of October 1962, with the aim of creating a shelter belt type forest to protect the hinterlands from cyclones and tidal surges, the FD started a regular planting programme along the coast of Bangladesh, especially on the newly accreted mudflats; since 1967 it has been known as the "Coastal Afforestation" programme. The total area planted till 2006 is 153,404 hectares. During the eighties plantation activity was very high; since the mid eighties it has declined and the trend is still declining, mostly due to non availability of funds for such activity. Following the devastating cyclone of November 2007), it was understood that the FD would be given good funds for mangrove afforestation. At present (December 2007) the FD is preparing plans and programmes accordingly. If these planting programmes get started the plantation raising activities, especially along the coast, will increase substantially.

Growing stock in government forest land

The area of 1.53 Mha under the management and direct control of the FD is legally defined as forestland but does not necessarily carry complete tree cover. The existing growing stock can only be assessed through inventory. This sort of inventory is not a regular activity in Bangladesh, mostly because of paucity of funds and manpower. Under such situation we will be discussing the growing stock based on the available data collected from given territories during such inventories.

Natural mangroves, Sundarbans

The Sundarbans is the largest contiguous mangrove forest in the world. The total area of the Sundarbans is 601,700 hectares of which 411,234 hectares are land and 190,466 hectares are water. Out of these 411,234 hectares of land, 399,471 hectares have tree cover (RIMS, FD, GOB 1995). An area of 139,700 hectares of Sundarban forest land has been declared as a World Heritage Site under the Ramsar Convention.

The Sundarbans has 334 species of flora and 269 species of fauna (FD 2007), according to the latest inventory of 1996 and has 12.26 million m^3 of wood. The common species are Sundri (*Heritiera fomes*), Gewa (*Excoecaria agallocha*), Keora (*Sonneratia apetala*), Bain (*Avicennia officinalis*), goran (*Ceriops roxburgii*), Golpata (*Nypa fruticans*), etc. Besides this rich flora, the Sundarbans carries many important wildlife species such as the Royal Bengal Tiger (*Panthera tigris tigris*), Gangetic Dolphin (*Platanista gangetica*), Monkey (*Macaca mulatta*), Deer (*Axis axis*), Crocodile (*Crocodilus porosus*), etc.

There are three good inventory reports on the Sundarbans prepared in 1959, 1983 and 1996. Table 5 shows Sundarbans growing stocks in different inventories (Revilla et al. 1998).

Table 5. Growing stock of the Sundarbans according to different inventories

Inventory done by	Year of publication of Inventory Results	Sundri (Number of Trees per Hectare, having DBH 15 cm and above)	Gewa (Number of Trees per Hectare)	All Tree Species (Number of Trees per Hectare)
Forestal and Forestal Engineering, Vancouver, Canada.	1959	211	61	296
Overseas Development Authority, UK.	1983	125	35	180
Forest Resource Management Project (FRMP) Forest Department, Government of Bangladesh	1996	106	20	144

Source: FD, Government of Bangladesh

The FRMP inventory (1996) further indicated the following.

- There are 144 trees per hectare which are 15 cm or above at DBH, contributing 27.4 m^3/ha.
- The number of trees having 10 cm and above at DBH is 561 per hectare.
- There are more than 2,860 small poles per hectare.
- The number of saplings per hectare is 7,500.
- The number of seedlings per hectare is 33,200.

The above inventories provided us the opportunity to evaluate the trend of growing stock. Such examination revealed the following.

- The Sundri growing stock (DBH 15 cm and above) has declined by 50% in 37 years (between 1959 and 1996).
- The growing stock of Gewa has gone down by 67% during 37 years (between 1959 and 1996).
- On an overall basis for all species together the growing stock has declined by 51% (between 1959 and 1996).

Thus it can be stated without any doubt that the growing stock of the Sundarbans is continuously becoming depleted and is deteriorating. **The rate of depletion is roughly 1% per year.** The major causes of such depletion are due to.

- Overextraction: Exceeding the quantity prescribed in the management plans permitted for extraction.
- Change in edaphic and salinity conditions: Due to the Frrakka Barrage, salinity increased and that in turn exacerbated siltation. This caused the clogging of pnumatophores probably leading to the dying of Sundri tree tops.
- Climate change: Higher inundations under the influence of sea level rise, coupled with increased salinity are causing change in species composition. The Goran[11] has already started to exhibit higher proportions on the South-Southwest axis than experienced before.

This depletion of growing stock clearly indicates that the FD has failed technically to manage this valuable mangrove forest on a sustained basis. Credit however goes to the FD for protecting the territory for over 100 years. There has been no loss of land and no encroachment. This whole area has the legal backup of 'Reserved Forest' and numerous creeks and dangerous species such as tigers and crocodiles coupled with the non-availability of fresh water, act in favor of protecting the Sundarbans from encroachment.

[11] Goran is a mangrove species found in the Sundarbans at sites that receive inundation of more saline water.

Man-made mangroves, coastal afforestation

These mangrove plantations were established on newly accreted lands (mud flats) prior to formal declaration as Reserved Forest. The species used were mostly Keora (*Sonneratia apetala*), Bain (*Avicennia officinalis*) and Gewa (*Excoecarai agallocha*). Since these lands were not declared as "Reserved Forest" the Forest Act was not strictly applicable on them. Consequently the FD in most cases failed to provide the required protection because of the land litigations and poor legal back up from other government agencies such as district administrations, police, etc. Many of the good coastal plantations established in Chittagong and Noakhali were lost to shrimp farms with the direct and indirect indulgence of other government officers such as DCs and land administration agencies. Ultimately the wish of the DCs prevailed since they are the most powerful actors and highly favored by ministers, members of parliament, etc. Thus many of the coastal plantations were devastated.

Revilla (1998) during the FRMP inventory reported the following growing stock in the mangrove afforestation areas.

Table 6. FRMP inventory results of coastal afforestation divisions

Description	Noakhali Coastal Afforestation Division	Chittagong Coastal Afforestation Division	Bhola Coastal Afforestation Division	Patuakhali Coastal Afforestation Division
Area in hectares	34223	20042	12420	9848
Sample size	289	408	225	168
Number of trees with DBH 15 cm and above	172	10	58	156
Basal area in m^2 per hectare for trees with DBH 15 cm and above	5.26	0.29	1.96	5.86
Volume in m^3 per hectare contributed by trees having DBH 15 cm and above	25.69	1.02	9.31	36.40
Poles per hectare	13360	15228	641	5840
Saplings per hectare	3151	2202	185	967
Seedlings per hectare	1864	373	551	572

Source: FD, Government of Bangladesh

Besides the poles and undergrowth, the wood volume in the coastal afforestation areas is about 1.37 million m^3 over an area of 76,533 hectares, which means that the average growing stock in the mangrove afforestation area is 18.94 m^3/hectare (1996 data). The growing stock estimates are good. Patuakhali Forest Division has the highest volume of growing stock per hectare. Since results from only one inventory are available the trend cannot be estimated. However, it may be seen from these studies that natural regeneration has started in almost all places and is best in Noakhali. The next best regeneration is in Patuakhali. These are indications of the fact that **the prevailing ecosystem is in the process of accepting this human intervention of mangrove afforestation. This is an indication of a positive biological trend.** The other factors that are affecting these plantations, as described in the earlier paragraph, are not congenial towards the growth, establishment and sustainability of these plantations. Even though the rate of depletion cannot be calculated, the net impact does not appear to be positive at all. Many of these plantations have already succumbed to prawn farming (sometimes white fish) and all of these plantations are subjected to similar serious threats.

Hill forests

According to the FD's records, the total area of hill forests located in the districts of Chittagong Hill Tracts, Chittagong, Cox's Bazar and Sylhet is 0.67 Mha, which is 44% of the FD controlled forest land and 4.65% of the total area of the country. These are tropical wet evergreen and tropical semi-evergreen forests. The important species are Garjan (*Dipterocarpus* spp), Chapalish (*Artocarpus chaplasha*), Telsur (*Hopea odorata*), Tali (*Dichopsis polyantha*), Kamdev (*Calophyllum polyanthum*), Uriaam (*Mangifera Sylvatica*), Jarul (*Lagerstroemia speciosa*), Civit (*Swintonia floribunda*), Toon (*Toona ciliata*), Bandarhola (*Duabanga grandiflora*), etc. The FD in these areas has been raising plantations since 1875 under the context of production forestry. Teak was the major species used. But along with this, the other species that have been used in plantation raising are Gamar (*Gmelina arborea*), Mahogany (*Swietenia* Spp.), Sal (*Shorea robusta*), Koroi (*Albizzaia procera*), Chikrassi (*Chukrassia velutina*), Lohakat (*Xylia dolabriformis*), Kadam (*Anthocephalus chinensis*), Telsur (*Hopea odorata*), etc.

Table 7 gives the latest inventory data available with the FD for growing stocks in different forest divisions.

Table 7. FD data on growing stocks in forest divisions

Name of Forest Division	Natural Forests		Plantations		Remarks
	Area in hectares	Volume of wood in m^3 per Hectare	Area in hectares	Volume of wood in m^3 per hectare	
Sylhet	23693	53.2	17871	37.64	Total wood stock in these areas is about 5.38 million m^3
Cox's Bazar	30398	74.36	19084	19.68	
Chittagong	59679	10.87	14143	11.32	

Source: FD (1996 FRMP Inventory Results)

Though the Chittagong Hill Tracts (CHT) are included in the Hill Forest area, a forest inventory in the CHT could not be undertaken during 1996-98, due to the disturbed law and order situation.

Chittagong Hill Tracts

The areas in CHT were reserved at different times. Myani Headwaters Reserved Forest and the Sitapahar Reserved Forest were declared reserved in 1875. The Matamuhari Reserved Forest was declared reserved in 1880. The Kassalong Reserved Forest and the Sangu Reserved Forests were declared reserved in 1881 and the Rankhiang Reserved Forest was declared reserved in 1882.

Forestal Forestry and Engineering International Limited, Vancouver, Canada. (May 1964, Project No F334 under Colombo Plan, Pakistan, Canada) conducted the inventory in CHT and prepared the inventory report for Chittagong Hill Tracts. This Forest Inventory and Survey was done during 1961-1963 for Kassalong and Rankhiang Reserved Forests. This inventory was carried out through aerial photography with 8,500 sample plot checks on the ground. The main purpose of this inventory was to get a proper estimate of the timber and bamboo in the two main reserved forests of CHT namely Kassalong RF and Rankhiang RF. The sampling error for the entire forest area was ±1.7% for the timber volumes, ± 6.3% for the bamboo weights and ± 4.4% for plantation basal area, all these three figures being under a probability level of 95%. The total area of Kassalong RF was 406,542 acres (164,592 hectares) of which 391,048 acres (158,319 hectares) was productive forestland. Approximately 54% of this area had predominantly timber while the rest had predominantly bamboo. The total area of Rankhiang RF was 190,521 acres (77,134 hectares), of which 185,488 acres (75,096 hectares) was productive forestland. Approximately 39% of this area was carrying timber while the rest had mainly bamboo.

The standing timber volume (in 1963) contributed by trees over 10" DBH and air-dry bamboo weight are reported below.

Kassalong RF has 12.37 million m^3 (433 million Cft) of wood and 252.6 000 tonnes (225,559 long tons) of air-dry bamboo. **Rankhiang RF** has 5.69 million m^3 (199 million Cft) of wood and 315.8 000 tonnes (282,120 long tons) of air-dry bamboo. The total is 18.06 million m^3 (632 million Cft) of wood and 568.6 000 tonnes (507,679 long tons) of air-dry bamboo. The overall commercial volume of timber was reported as 12.68 m^3/hectare (1,096 Cft/acre). The average volume of commercial wood in 'timber strata' was 22.51 m^3 /hectare (1,946 Cft/acre) but in 'bamboo strata' it was 5.32 m^3/hectare (460 Cft/acre). The average gross weight of bamboo, air-dry, was 399.2 kg/hectare (1,972 pounds per acre). It needs to be mentioned here that all the muli (*Melocanna baccifera*) bamboos were dead during this inventory due to flowering.

This report also advised the Forest Directorate to function as a promoter and regulator of the dynamic development of these forests, rather than to maintain static custody. A large part of the revenue must be reinvested in the forests along with the enhancement of personnel and equipment.

Chakaria Sundarbans

Another natural mangrove extends over an area of 8,500 hectares in Cox's Bazar. All the forests of this area were cut down during the last 30 years and at present there is no forest cover.

Total wood volume or growing stock in Bangladesh

There is no correct information about the total wood volume or growing stock that we have in Bangladesh. ADB (1993) reported that the government forest carries a growing stock of about 30 m^3 per hectare. In 1980 there was about 71 million m^3 of wood as growing stock in the government forests, which had declined by two thirds by the year 1990 (ADB 1993). The National Forest Inventory conducted by FAO during 2006 (report yet to be published) indicated that the total wood volume in Bangladesh is about 212 million m^3 (including that on homesteads) and the total forest area is about 1.61 million hectares.

Transfer of forest land

Whenever there is a need for large chunks of land, the government takes this from forestland. Also over 46,000 hectares of land (about 75% of that was forest) was submerged and lost when the Kaptai Hydraulic Dam was built in the 1960s. ADB (1993) reported that till 1984 over 61,000 hectares of forestland had been transferred for various purposes. The FD does not have a good record of such transfer of forestland. Table 8 shows the major transfers of forestland according to FD records sionce 1971.

Table 8. Major land transfers since 1971

Year	Forestland transferred to	Area in hectares	Remarks
Since 1971 to 2007	Bangladesh Forest Industries Development Corporation (BFIDC)	17448	Most of these were used for establishing rubber plantations.
1978	Bangladesh Army	7	
1982	Bangladesh Army	741	
1986	Bangladesh Army	65	
1988	Bangladesh Army	2	
2007	Bangladesh Army	1587	Under the process of transfer

Source: FD, Government of Bangladesh

Forest ownership

Most of forestlands (about 2.52 Mha) are owned by the government, of which 1.52 Mha are under the management of the FD and the rest is under the management of the Ministry of Land through Deputy Commissioners. The ownership of the forestland has virtually remained as it was during the last couple of decades. Though the area over which the legal ownership of the government has remained unchanged, many forest areas having such government ownership have been encroached

and the ownership of such land is questionable. The Forestry Master Plan prepared by ADB (1993) mentioned that about 77,000 hectares of forestland are under encroachment involving about 12,200 families. According to the FD **89,002 hectares of FD land is under encroachment** (as of June 2006).

Production forests

In the past all the FD managed forestland was under production forestry. All the forestland under the control of the FD used to be managed according to the prescriptions of an approved management plan (Working Plan), wherein the basic approach was "sustained yield", to generate revenue for the Government Treasury. Yields of various types of forest products including NWFPs[12] were of primary importance to achieve the set goal of revenue to be earned for the government treasury through their sale.

Since 2000 a gradual shift is being noticed where the FD is slowly inclining towards conservation forestry rather than production forestry. Though small tracts of reserved forests have been notified as game reserves, national parks, wildlife sanctuaries, etc. (broadly Protected Areas) since 1962, very little was done towards protected area management till 2000, while some conservation and management activities were initiated under the Sundarbans Biodiversity and Conservation Project (SBCP) particularly in the Sundarbans area. As the SBCP has been terminated these activities especially those in the Sundarbans also stopped.

Under the Forestry Sector Project (FSP), Management Plans for some of the Protected Areas were prepared. These are being used partly by the USAid support project, "Nishargo", while experimenting with co-management of protected areas in Bangladesh.

The Government, to comply with the covenants clamped by ADB in connection with the funding of the Forestry Sector Project, introduced the long awaited amendment to the Forest Act 1927, in 2000. Section 28A acknowledges the legal footing of the forestry participants. In the long run, this will cause a revolutionary change in the Forestry Sector of Bangladesh. The "Social Forestry Rules 2005" has already been promulgated under the said amendment of the Forest Act. Not only in principle, but also as a legal framework, the Government has accepted the benefit sharing aspect with the participants and the Tree Farming Fund (TFF), by promulgating the Social Forestry Rules 2005. In the past the Government acquired all these benefits. The Government as well as the FD has started to realize that some basic changes in forest management principles are essential, to avoid reverting back the trend of depletion and deforestation, and to retain the tree cover.

During the last few years many of the reserved forest areas have been declared as eco-parks, wildlife sanctuaries, etc.

Sustainable forest management

Forest management has been practiced for over 100 years. Until recently the basic concept of forest management was to obtain sustained yield. Thus it is important to sustain the growing stock at a given level, preferably at least (if not enhanced) at the level when the first management plan was prepared. In the case of the Sundarbans the growing stock fell from 20.3 million m^3 in 1960 to 13.2 million m^3 in 1984. In the Chittagong Hill Tracts, the growing stock decreased to 19.8 million m^3 in 1985 from 23.8 million m^3 in 1964 (ADB 1993).

The sustainability of ecosystems was of no major consideration in Bangladesh while preparing the management plans. The recent concept of sustainability in forest management is to ensure the sustainability of the ecosystem. This involves some sort of ecosystem management. Regarding biological indicators, the prescriptions cannot be rigid. This sort of management is yet to be

[12] NWFP = Non-wood forest products such as honey, golpata (leaves for roof thatching), bamboo, cane, leaves and climbers, fish, etc.

initiated in Bangladesh. Large scale, intensive and stronger capacity building of the existing FD will also be a necessary for such an approach.

Forest management plans also seek interventions, including replanting of sites. The harvest generates revenues for the government, while the set of prescriptions calls for some sort of investment as well. This involves budget allocations to the FD from the Government. In the past, the FD experienced situations where the felling was deferred for want of replanting and maintenance funds. This sort of delays triggered the chain reaction of short supply, higher demands, higher prices, illicit felling, etc. and ultimately led to the depletion of resources and degradation of sites. ADB resolved this problem through the FSP, by pressurizing the Government to accept the provisions of the TFF through the amendment of the Forest Act and promulgation of Social Forestry Rules 2005. According to these rules the harvested area will be replanted. To facilitate this, the TFF needs to be amplified from 10 to 20%. Whatever be the situation, the existing provisions ensure some replanting-fund for social forestry areas. And since there is direct involvement of participants, the labor force required for replanting is a matter of contribution. This will help secure "continuity" but may not be "sustainability", especially of the ecosystem. The emphasis of the participants will be for more benefits and this will lead to fast growing species, maybe pure plantations and more intensive forestry practices. Ecosystem sustainability is not expected to obtain the required priority under such 'continuity of plantation re-establishment' through the TFF.

The question of ecosystem sustainability needs to be pursued more rigorously in the case of Protected Areas (PA). In the past PAs used to be included with other areas of production forestry and management prescriptions used to overlap. Only recently (since 1997) attempts are being made to prepare separate management plans for the Protected Areas. During 1997 for the first time, separate management plans were prepared for each of the Protected Areas under the control of the FD.

Since then (to date) however, three sets of management plans have been written for each of the five protected areas namely Lawachara, Chunati, Rama-Kalenga, Satchari and Teknaf Game Reserve. One such set was written under the Forest Resource Management Project (FRMP), subsequent management plans were written under the Forestry Sector Project (FSP) and the latest ones were written under the Nishargo Support Project (NSP, USAID funded) in 2006. Implementation of the management plans has just been started. Sustainability of these management prescriptions cannot be evaluated at this stage. It may however, be noted that the management plans prepared by the Mandala Agricultural Development Corporation (MADCor) in 1997 were not exhaustive and the prescriptions were scanty in nature. The basic approach was conservation only. The second set was prepared by TECSULT under the Forestry Sector Project during 1999. The objectives were sustainable management by communities, poverty alleviation, etc. It suggested buffer zone planting and sharing of tangible benefits. As some activities were started according to these prescriptions, a new programme and thinking emerged, i.e. "Co-Management" of protected areas under the Nishargo Support Project that led to the preparation of the latest set of management plans for the Protected Areas. The basic difference is sharing of the responsibilities among the FD, Nishargo Support Project (NSP) and stakeholders. These management plans appear to be too ambitious to materialize and more so because of the funding constraint.

In brief sustainable forest management is yet to be initiated in Bangladesh.

Overall state of forests

Natural forests are deteriorating and their depletion is a continuous process. The health and overall structure of the forests are 'below average'. However plantations (afforestation) have a different scenario. Almost all plantations are established under some sort of development programme by projects. Reasonable funding is available from project funds for establishing the plantations. Funds are also made available from projects for the maintenance of the plantations for about three years. The maintenance and subsequent care of these plantations is generally vested with the FD from the

fourth year of establishment. By the fourth year the seedlings have reached pole size and start attracting local people. Pilferage and illicit felling starts at this stage. It is a 'Herculean task' for the FD to ensure protection with the scanty number of FD staff at the ratio of 1: 14,000 people. The resultant impact is continual depletion of the stock from the plantations, as they grow to pole size. As this continues the plantations have a "scattered tree" appearance at 15 to 20 years. The plantations that appeared promising at the initial stage, usually fail at 15 to 20 years of age. This scenario however, is not valid for the plantations that have been established under social forestry programmes involving the participants. In the case of participatory plantations the participants work as a very strong force to combat theft and pilferage. The growth rate (MAI[13]) in these participatory plantations ranges from 0.5 to 7.5 m^3/ha per year (PCR of FSP 2007). In most cases the MAI is about 4 m^3/ha/year, which is satisfactory.

In brief the overall state of forests is not good in Bangladesh. The main factors undermining the sustainability of forests and forest management in Bangladesh are listed below.

Fund crisis

The serious shortages of funds impair the materialization of the long-term visions and commitments. Though the FD is supposed to function on a long-term vision, it cannot be maintained, mostly due to non-commitment of funds. Due to funding shortages, the FD could not go ahead in accordance with the Forestry Master Plan (prepared under ADB funding) and National Forest Policy.

The FD is project oriented. In the past, during the fifties and sixties, almost 95% of the FD's budget used to come from the revenue exchequer. During the last couple of decades it has completely turned around and now over 80% of FD expenditures are met from development budget (project funding). When there is no project, there is no funding for forestry activities. The flow of development funds is discrete and cannot be the basis for a long-term vision oriented programme, required for the forestry sector. Under such a situation the FD is increasingly becoming dependent on short-term projects. Every time a project comes to an end after 4 or 5 years, all benefits are lost because of discontinuity. The funding crisis is the most serious problem for the FD in achieving sustainability.

Lowered efficiency

None of the Government Departments, except Forests, manages resources. While the FD officials are supposed to function as managers, other government officials work as 'controllers' and 'administrators'. The British realized this and had special provisions for the FD. That continued during the Pakistan period (till 1970). After liberation in 1971, in the name of ensuring justice and equity, 22 scales were promulgated for all the government officials putting all managers, controllers and administrators on an equal footing, irrespective of their duties and responsibilities. That undermined the whole forestry service and camouflaged the "Forest Managers" under "Controlling Officers" of the Government. They started to lose their managerial efficiencies and this led to visible deterioration of the service at the turn of the century. Lowered managerial efficiencies seriously jeopardized sustainability in forest management.

Serious manpower shortage

The total manpower of the FD is about 9,000. For a country with a population of 140 million this is not only too small to ensure protection of forest resources but also absolutely inadequate to induce the required awareness. The FD has 2,190 Forest Guards, which is far below the minimum and their technical capacity is low. With the passage of time it is expected that the FD's management approach should target "sustainable ecosystems". Thus technically sound and knowledgeable personnel will be essential to make on the spot management decisions. This will require Foresters,

[13] Mean Annual Increment. The volume of wood added to the plantations over an area of one hectare in cubic metres during one year.

Deputy Rangers, and Forest Rangers to be well qualified, trained and updated on latest issues so that the best management decisions are taken and implemented in a correct manner.

Mismatch of the FD with the general administrative set up

With the changed focus from 'Production Forestry' to 'People-Oriented Forestry', the FD is increasingly constrained by acute manpower shortages compared to other Government agencies e.g. Department of Agriculture Extension (DAE), Police, Civil Administration, etc. One Divisional Forest Officer at many locations does work equal to four or five Deputy Commissioners at the district level. Similarly at the *thana* level where there are over 10 'class one' gazetted officers including Thana Nirbahi Officers (TNO), the forestry sector has no gazetted officer. This highly imbalanced state does not provide the FD with platforms at important meetings.

Monitoring and accountability

Monitoring is the key to accountability. Except for routine hierarchical supervision the current institutional mechanism does not have provisions for systematic and regular monitoring of the FD's activities, especially at the field level. Though there is a CF Monitoring Officer in the office of the CCF, he can hardly undertake any monitoring of field activities, since he has no staff required for the purpose. For all practical purposes there is no systematic monitoring in the FD. In the absence of a good monitoring system, the accountability of FD personnel cannot be ensured.

Land litigations

The FD has the total responsibility for RF lands and the Forest Act (amended in 2000) is supposed to provide the necessary legal back up for their management, protection and conservation. Besides, there are about 0.6 Mha of land that have been notified under Section 4 of the Forest Act and have been under the process of reservation for a long time. This process depends on civil administrative personnel and receives the least or no priority. As a result, most of these cases have been hanging for decades. In some cases they have been pending with the Deputy Commissioners for over 50 years. Inordinate delay in completing the procedural formalities of the reservation process has diluted the FD's title to the land and has further complicated the process by giving opportunities to vested interest groups to make counter claims. The land grabbers while taking the full advantage of such situation have acquired land and filed title suits that have led to numerous cases between the FD and the members of the public. At present (2007) there are about 4,468 title suits involving about 0.13 Mha of forest land against the FD. The sub-judicial ownership for the land under title suits and questionable ownership of the land notified under Section 4 are serious hurdles in programme formulation, which in turn undermines the sustainability of forests, and forestry programmes in Bangladesh.

Decentralization

The FD administration is highly centralized. At times attempts were taken under various projects to decentralize the line of command through creation of "Wing" positioning of the DCCF but the ultimate impact was not very encouraging. Of the available types, forms and categories of decentralization, there has not been any central level effort to discuss, determine and arrive at a consensus on the appropriate form and nature of decentralization to be adopted by the FD. Centrally, no effort has been made to consider and determine the functional decision-areas (e.g. planting, harvesting) and degree of required power to discharge the responsibilities given to field level FD offices. The absence of decentralization delays the decision making which in turn undermines the sustainability of forests and forestry in Bangladesh.

Image crisis

The degree of acceptance of FD personnel is low among fellow government agencies and the community at large affecting all FD activities. This situation causes serious difficulties in sustaining the zeal and enthusiasm of FD staff. Apparently this situation has adversely affected sustained support from donor agencies as well. This adversely affects the sustainability of forestry programmes in Bangladesh.

Corruption

In all developing countries corruption is common and Bangladesh is no exception. Corruption is a common problem for the FD as well. With withdrawal of trust and benefits that the FD personnel used to enjoy as 'managers' in the past, their managerial skill gradually deteriorated and they indulged in corruption and under the instigation of Ministers and policy level personnel. Corruption has thus engulfed FD personnel and this seriously impairs the sustainability of forests and forestry in Bangladesh.

Integration at the policy level

During field implementation of forestry programmes, overlapping sectoral policies in some cases lead to contradictions, conflicts and confusion. Some policy decisions are not compatible with some set objectives and that contribute further to problems in field level forest management. Many forest divisions still do not have any social forestry management plans. Even the recently prepared management plans for some forest divisions do not have the required long term visions. The leadership of the FD is not strong enough to table these policy related problems and issues before the Government, mostly because the Chief of the directorate is never confirmed in his promotion to this position. For the last 10 or more years the position of CCF is being manned by the Government as "Current Charge". Under that situation the person holding the 'current charge' has to please his superiors to consolidate his position. The Government, especially the political elite, prefer this situation because it serves their political interest better.

Wood and wood products:

Wood products fall far below demand. Though most of the forest lands are under the control of the Government, the major portion of the country's wood supply is met from homesteads.

Wood production

About 15% of the country's land is under the control of the Government as 'forestland', as of today (2007). The products from these forest lands are of various types such as timber, fuel wood, poles, bamboo, cane, thatch leaves, fish, honey, wax etc. For the purpose of this report, timber, fuel wood and poles are treated as 'wood'.

No single source could be found for time series data of wood production in Bangladesh especially from Government forests. The wood production data has been compiled from Kibria (2000) and the records of the FD are the only data source in this regard (Table 9).

Table 9. Timber production in Bangladesh, 1986-2005

Year	Fuel Wood Million m^3	Timber Million m^3	Total Wood (Timber & Fuel Wood) in Million m^3	Remarks
1986	0.9986	0.565686	1.56	Kibria et al. (2000)
1987	0.676057	0.364686	1.04	
1988	0.746029	0.402057	1.15	
1989	0.794829	0.353057	1.15	
1990	0.3802	0.192886	0.57	
1991	1.0926	0.240543	1.33	
1992	0.371429	0.188571	0.56	
1993	0.190371	0.232057	0.42	
1994	0.270886	0.193314	0.46	
1995	0.163371	0.173286	0.34	
1996	0.1068		0.11	
1997				
1998				FD Records
1999	0.026285	0.028644	0.06	
2000	0.057174	0.062121	0.12	
2001	0.283068	0.10174	0.38	
2002	0.077661	0.17154	0.25	

Year	Fuel Wood Million m^3	Timber Million m^3	Total Wood (Timber & Fuel Wood) in Million m^3	Remarks
2003	0.109797	0.273203	0.383	
2004	0.14386	0.311996	0.46	
2005	0.206287	0.244463	0.45	

Sources: Kibria et al. 2000; FD. The original figures given in cubic feet have been converted to cubic metres

Wood production has declined seriously since 1972 with the imposition of a moratorium on the extraction of wood till about 2001, when the felling of plantations was started. The production of wood since then has been increasing, but this increase will depend largely on the availability of funds for new social forestry plantations involving participants.

Over 15.4 million households in about 88,000 villages across the country possess a huge quantity of tree growth and this is the major supplier of wood for the nation.

According to Hammermaster (1981) 12.61 Mha of rural (villages and homesteads) areas (excluding Chittagong Hill Tracts) had a growing stock of 54.8 million m^3. The same area was found to have 120.38 million m^3 in 2006 (National Forest Assessment conducted by FAO, report yet to be published). Thus it grew at 2.62 million m^3 per year. In 1993 the homestead growing stock was 86.24 million m^3. ADB (1993) reported that the village forests supply 5 million m^3 wood every year, which is 5.8% of the total growing stock. Thus it can be assumed that the village groves (homesteads) yield about 5.8% of the growing stock that they carry at any given time.

Forest industries

In general the following major categories of forest product based industries are found in Bangladesh.

1. Sawmills
2. Manufacture of wood products including furniture
3. Production of hardboards, particleboards, chipboards, etc.
4. Manufacture of pulp, paper, newsprint and paper products
5. Match factories
6. Manufacturing of packaging paper
7. Production of various products from wood, bamboo, cane, patipata[14], etc. as handicrafts (cottage industries)

There are no good and reliable statistics about the number of the forest product based industries in Bangladesh. The 'Forest Statistics of Bangladesh' is one of the important publications in this regard. The information in Table 10 is available in that publication.

[14] Patipata is the cane produced from Murta Stems. Murta is grown in wetlands under the control of private and public (Government) entities. It is used in preparing "Shitolpati" which is a very costly and attractive mat for use during the hot summer.

Table 10. Forest product-based industries in Bangladesh

Major Category	Type	Total Number in Bangladesh	Production Capacity in Thousand m^3	Remarks
Sawmills	Sawmill	11262	14712	
Manufacture of Wood Products including Furniture	Wood Seasoning Plants	6	28.32	According to Reza et al. there are 23 wood seasoning plants in Bangladesh.
	Wood Treating Plants	6	62.3 .	
	Furniture Factory Mechanical (FIDCO)	1	1.7 .	In addition to FIDCO, a couple of new such factories have been established.
	Door & Window Making Factory Mechanical	3	83.61 m^2	
	Pencil Factory	2	1940 Gross	
Production of Hardboards, Particleboards, Chipboards, etc.	Hardboard Mills	2	3132.44 m^2	
	Particleboard Plants	2	1542.14 m^2	In recent years more of the particleboard plants have been set in the country by private entrepreneurs, such as Akij, Partex, etc. They have good machinery and use modern techniques.
	Plywood Factory	8	2789.67 m^2	There many more of the ply factories now. Douglas (1981) reported the production of plywood in the country as 71812 m^2
Manufacture of Pulp, Paper & Paper Products	Pulp Mills	1	30.48 Tonnes	
	Newsprint Mills	1	50.8 Tonnes	
	Paper Mills	3	50.8 Tonnes	
	Rayon Mills	1	2.44 Tonnes Rayon & 1.02 Tonnes Dilphane	
Match Factories	Match Factories	18	113 Gross Boxes	

Source: Forest Statistics of Bangladesh 2000

Bangladesh Forest Industries Development Corporation (BFIDC) was established by the Government under Ordinance No. 67 of 1959 as an autonomous body, initially as 'East Pakistan

Forest Industries Development Corporation' and later the name was changed to BFIDC, vide Presidential Order No. 48 of 1972; headquarters are in Dhaka. BFIDC was supposed to work mostly in Chittagong Hill Tracts to under take mechanical extraction and timber processing. Since its creation, the corporation has worked over about 29,000 hectares of Reserved Forests of Kassalong, Ringkheng, Sangu and Matamuhuri of Chittagong Hill Tracts and extracted timber about 11.34 million m^3 of timber (till 2006). They have supplied a huge quantity of railway sleepers as well. A brief overview of their industrial units is given in Table 11.

Table 11. Industrial units under BFIDC

Type of industrial unit	No. of units	Location	Production capacity	Products/Services
Timber Extraction Unit	2	Kaptai and Chittagong	Round timber = 72 900 m^3 Firewood = 14 300 m^3	Round timber, size timber and fire wood
Timber Sawing, Seasoning and Treatment Unit	3	Kaptai, Chittagong and Khulna	Timber sawing =27 100 m^3 Timber seasoning = 22 900 m^3 Timber treatment = 39 100 m^3 Timber plaining = 7 100 m^3	Sawn timber, railway sleeper, electric pole, anchor log, stabilizer log, cross arm, cable-drum, etc
Timber Seasoning and Cabinet Manufacturing Unit	3	Dhaka, Chittagong and Khulna	Timber sawing = 12 900 m^3 Timber seasoning = 1 600 m^3 Door and window = 100 000 m^2 Furniture = 1 600 m^3	Sawn timber, door and window, furniture and timber seasoning
Furniture Manufacturing Unit	2	Dhaka and Chittagong	Furniture = 2 300 m^3 Flush door = 11 100 m^2	Furniture and flush door
Particle Board and Veneer Manufacturing Unit	1	Chittagong	Veneered Particleboard = 711 100 m^2 Veneer = 0.58 million m^2	Veneered particle board and veneer
Plywood/Tea-chest Manufacturing Unit	1	Chittagong	Plywood = 0.78 million m^2 Tea-chest =0.3 million pcs	Plywood and tea-chest

Source: Collected from Dhaka BFIDC Office, Dhaka.

Most of the forest product based industries in Bangladesh used to be owned by the Government through corporations such as BFIDC and Bangladesh Chemical Industries Corporation (BCIC). Recently (as of September 2007) the privatization commission is looking for buyers to sell out (Website of Privatization Commission) the following forest product based industries.

1. Chittagong Board Mills, Chittagong
2. Chittagong Cabinet Manufacturing Unit, Chittagong
3. Chittagong Chemical Complex, Patenga, Chittagong
4. Dhaka Cabinet Manufacturing Unit, Dhaka
5. Eastern Wood Works
6. Fidco Furniture Complex, Chittagong.
7. Karnafuly Rayon & Chemicals Ltd., Kaptai, Rangamati
8. Karnaphuli Timber Extraction Unit
9. Khulna Cabinet Manufacturing Unit, Khulna
10. Khulna Hardboard Mills Ltd., Khulna
11. Khulna Newsprint Mills Ltd., Khulna
12. Lumber Processing Complex

13. North Bengal Paper Mills Ltd., Pakshi, Pabna
14. Particle Board Veneering Plant
15. Sangu Matamuhuri Timber Extraction Unit
16. Sangu Velly Timber Industries
17. Sylhet Pulp and Paper Mills Ltd., Sylhet
18. Wood Treating Unit, Chittagong
19. Wood Treating Unit, Khulna

This indicates that these industries are somewhat ailing, maybe due to poor management while under Government ownership and management.

Local private entrepreneurs are emerging to establish new industries in pulp and paper, composite wood, etc mostly based on recycling of the paper and small wood from rural homesteads.

Sawmills are the principal wood user. Though furniture making has the highest number of establishments (over 34,000); there are about 10,000 sawmills (including pit saws) (Forestry Master Plan 1993). The major wood based industries recorded in the Statistical Year Book 2004 amounted to 1,642 in 1995–96. It appears that the statistical yearbook has not taken small rural carpenters into account.

Trade of forest products

The major forest products traded in Bangladesh are timber and poles, fuel-wood, bamboo, thatch grasses, cane, etc. Regarding trade of forest products generally three tiers of people, namely primary collectors/growers, intermediaries and mohajans[15], are involved. In the Sundarbans alone over 0.1 million people work as primary collectors of forest products. It is estimated that over 0.2 million people are involved as primary workers in the hill forest areas of Chittagong Hill Tracts, Chittagong and Sylhet. Roughly 0.075 million people are working as primary workers in the plain land Sal forest (Central and North-Western) areas of the country, either as participants or as intruders. Thus at least 0.4 million people are involved with the trade of forest produce in some form or the other. The big investors are few in number. In the coastal zone, Shorupkathi is the most significant timber market. Most of the mohajans of the coastal zone are at Shorupkhati, though some are stationed at Khulna. Chittagong is the seat of the forest produce trade in Bangladesh. The largest forest produce trade in Bangladesh, including imports is handled by the timber traders of Chittagong. The rest of the big timber traders are located at Dhaka. Though quality woods such as teak, garjan, sundry, etc. come from the Government forests, the majority of the wood is of rural origin.

The trade is directly related to the use of the forest products. With the increase of demand, import of timber has become a regular feature now. The Forest Department, Government of Bangladesh (DFO Utilization, Chittagong) has data on the import of timber since 1997. Since there was a moratorium on the harvest of wood from 1971 the import of timber has been increasing. From 2003 a slight decline is being noticed because harvest of wood was started in participatory plantations under the FSP. The FSP took over the older plantations of the CGP and these plantations were harvested under the FSP from 2004. The timber import is continuously increasing. About 126,000 m^3 wood was imported in 2006 (see Annex 2 for further details). If the FD fails to continue investment as it did between 2003 and 2007 in participatory forestry timber imports will increase further, maybe at a very high rate.

Besides wood, bamboo, designated as “poor-men’s timber”, is the second most important forest product used for trade. It is mostly transported by river and thus, with a few exceptions, the flow of its trade also follows stream flow, up-stream to down-stream. Bamboo is also a very important raw material for pulp making. Enhanced production of bamboo will reduce the import of pulp.

[15] Persons who invest sizable capital to buy from small traders/growers, store and at times saw, and then sell out to the intermediaries to take to the actual consumers.

Key trends in the pattern of production, trade and consumption

Though the FD is expected to manage forest resources using the "sustained yield" concept, the annual harvest is inconsistent. Moreover because of the moratorium since 1971 the management of natural forests has come to a standstill. Raising plantations mostly under development funds or "Projects" has become the key trend. Stakeholder participation has been added. Since the felling of plantations is exempted from the moratorium, such felling is being undertaken. The promulgation of Social Rules 2005 has given legal status to the Tree Farming Fund (TFF), which is pivoting replanting and thus sustainability. The participatory plantations raised so far could continue for the next rotations even if there are no specific budget allocations for plantation establishment. For raising the plantations for the first time (new participatory plantations) however, investment will be essential. The trend is to look for donor funds for such investments, and once invested (in a participatory afforestation programme), continuity is ensured through TFF. The production from the existing participatory plantations of about 0.21 million m^3 per year is expected to continue but this can be enhanced to a great extent provided there is fund to invest in the social forestry programme.

The trade of forest produce, especially wood, is slightly awkward since a Transit Pass is required from the (Government) forest department for every such transportation, even if the produce is harvested (with the exception of a few species) from the rural homesteads. Both Police and FD staff often bother such traders of wood. Thus free trade of forest produces even within the country is somewhat restrained. However, there has been a long felt need to revise the existing forest transit rules, exempting the requirement of having an "FD Transit Pass" for the movement of rural homestead wood. The FD's proposal in this respect has already been submitted to the Government. Once this is approved, the trade of rural wood will increase manyfold, which in turn will enhance employment as well as investment in this area. In future this may even bring down the price of wood from rural areas.

Trade basically depends on demand and supply. Since the supply of forest produce is far below the demand, the number of steps and involvement of traders between primary production and ultimate consumption are multiple. Because of so many tiers and multiple handlings, the prices at the consumer ends become high. The A-Class timber that used to be sold at Taka 7,000.00/m^3 in 2000 is being sold at Taka 53,000.00/m^3 now (year 2007). With the passage of time the price is skyrocketing.

Wood as a source of energy

The major areas where wood energy is used in Bangladesh are

- Domestic Cooking
- Agro-Based Industries
- Non-Agro-Based Industries and
- Commercial business.

Fuel types from natural resources have been identified by different authors in different ways. ADB (Forestry Master Plan, 1993) divided the fuel into two types namely, Fuel-wood and Residues, whereas Douglas (1981) identified fuel types as (i) Fuel-wood, (ii) Other tree fuel and (iii) Agricultural residues and bamboo.

Since the energy is often quantified in Peta Joules whereas wood, residues etc. are measured in weight (ton) or volume (m^3), it is necessary to use some relationship between the Peta Joules and the weight or volume of fuel-wood and residues. The following conversion factors, which have been used by ADB (1993), may be used in general.

- Fuel-wood 1,000 tons = 1,420 m^3 =0.0151 Peta Joules
- Residues 1,000 tons = 0.0125 Peta Joules

Extent of wood energy use

Most of the wood energy is used for domestic cooking. Table 12 shows, according to ADB (Forestry Master Plan 1993), the estimated end use in 1990.

Table 12. Estimated end use of wood energy in 1990

Type of end-use	Million tons		
	Fuel-wood	Residue	Total
Domestic Cooking			
(a) Rural	0.821	24.110	24.931
(b) Urban	3.472	2.232	5.704
Agro-Based industries	0.226	5.810	6.036
Non-Agro-Based Industries	0.846	0.095	0.941
Commercial	0.121	0.040	0.161
TOTAL	5.486	32.287	37.773

Source: ADB Forestry Master Plan 1993

This indicates that the use of fuel-wood for cooking is almost 4 times higher in urban area than in the rural area. The total use of residues is more than six times than that of fuel-wood. In 1981 the total energy consumption in Bangladesh was 574.8 PJ[16] which increased to 687.6 PJ in 1990 (ADB 1993). This is an annual increase of about 2%. The use of commercial fuel has doubled during this period (ADB 1993). Agricultural residue remains the highest contributor towards biomass energy. It has been observed that the increase of fuel-wood supply reduces the use of dung as fuel (ADB 1993). According to the FD, 65% of forest products are consumed as fuel wood.

Figure 1 shows the use of fuel-wood for different end uses.

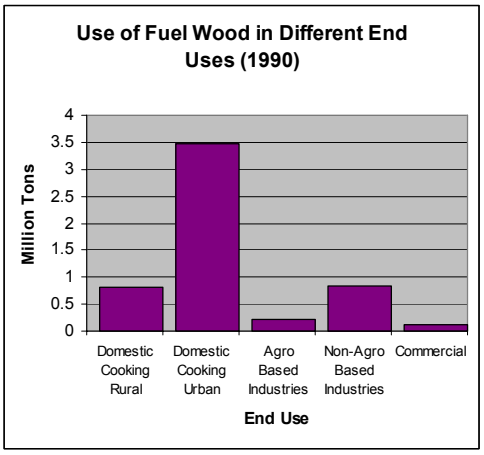


Figure 1. Fuelwood and end uses in 1990

Douglas (1981) reported region-wise per capita fuel usage as shown in Table 13.

[16] PJ = Peta Joules = 10^{15} Joules.

Table 13. Region-wise per capita fuel usage

Fuel type	Regions (Per Capita Use of Fuel in Million Calories)					
	Rajshahi, Bogra, Rangpur & Dinajpur	Kushtia, Pabne, Faridpur & Jessore	Mymensingh. Dhaka & Comilla	Barisal & Patuakhali	Khulna & Sylhet	Dhaka, Khulna Urban Fringe
Fuel-wood	188	210	201	289	495	480
Other tree fuel	338	190	291	295	249	240
Agricultural residue and Bamboo	679	307	579	295	418	539
Total	1205	706	1071	909	1162	1259

Source: Douglas 1981

This indicates that fuel-wood is used most in Khulna and Sylhet areas. These areas have comparatively easier access to forests. The next highest use of fuel-wood is found in urban fringes of Dhaka and Khulna. The highest use of agricultural residue is found in Rajshahi, Bogra, Rangpur and Dinajpur areas. In this region access to forests is limited. This indicates that the use of fuel-wood is greater in regions that have forests, whereas in regions that are devoid of forests the use of agricultural residues is higher. In the northern region (the region that does not have forests) the per capita annual domestic consumption is only 12 kg whereas in the southern region (the region that has forests nearby), it exceeds 60 kg (ADB 1993).

Region-wise per-capita fuel-wood use is showin in Figure 2.

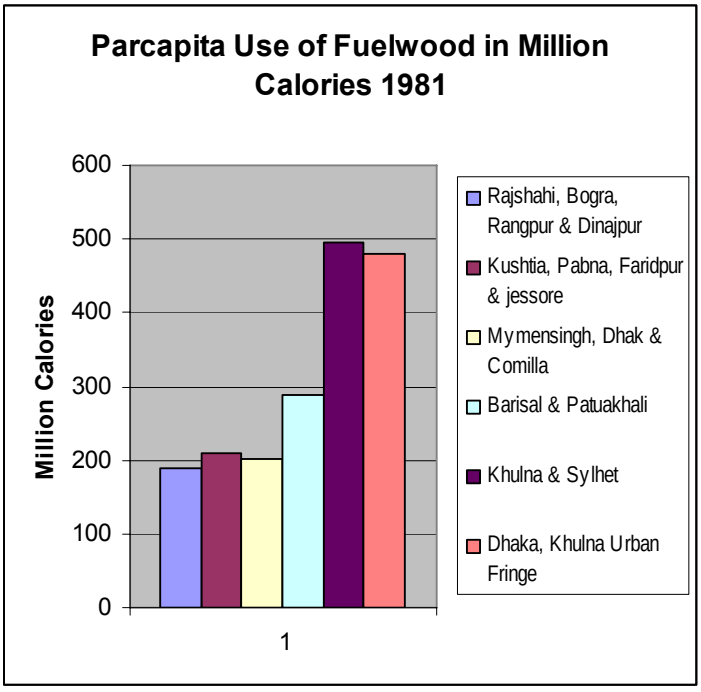


Figure 2. Region-wise per capita fuelwood consumption

Of all the traditional fuels, including firewood, agricultural residues supply the highest quantity of energy in the country. Table 14 contains data on this issue from the Bureau of Statistics, Government of Bangladesh.

Table 14. Estimates of energy supplied by traditional fuels
('000 tons of coal equivalent)

Year	Cow Dung	Firewood	Other Residues	Total
1995	2018	1113	7656	10787
1996	2008	1166	7616	10790
1997	2005	1219	7834	11058
1998	2046	1166	7907	11119
1999	2156	1113	7665	10934
2000	2441	1166	7932	11539
2001	2471	1166	8153	11790
2002	2471	1219	8343	12033
2003	2471	1219	8449	12139
2004	2502	1272	8547	12321

Source: Year Book of Statistics 2004, Government of Bangladesh

It can be seen from Figure 3 that the trends for firewood, cow-dung and other residues are increasing. Of all the three sources the rate of increase of firewood is the lowest.

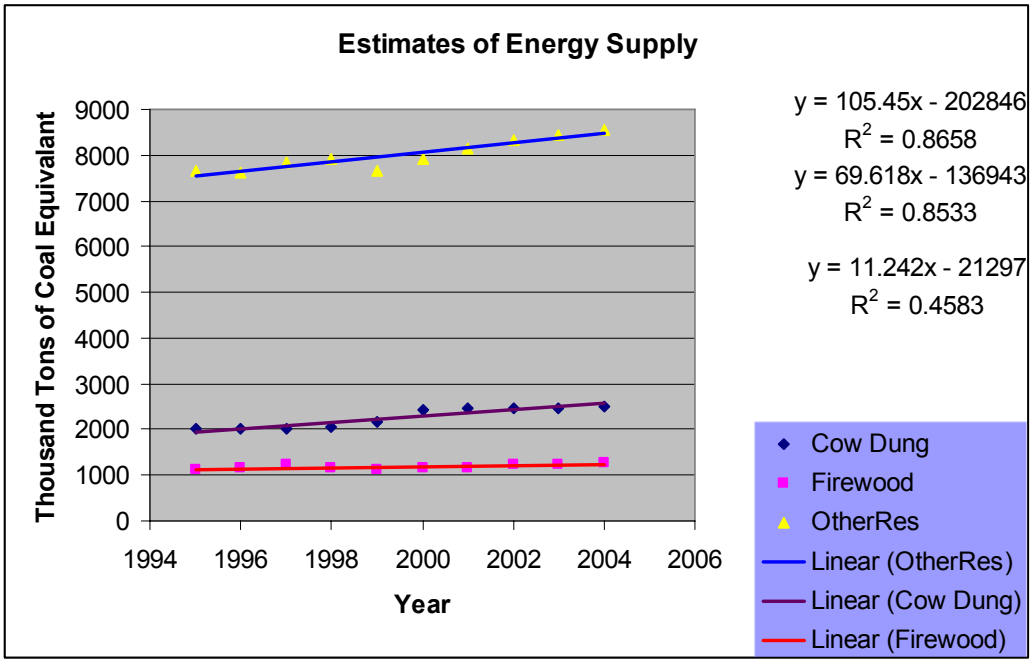


Figure 3. Estimates of energy supply in Bangladesh

Source: Year Book of Statistics 2004

Policies and regulations impacting use of wood as a source of energy

The Forest Policy promulgated in 1994 is the existing forest policy. The main thrusts of this forest policy are

- to undertake all endeavours to bring 20% of land under forest by the year 2015, to maintain the ecological balance and attain self sufficiency in forest produce.
- to extend afforestation in village areas.
- to involve NGOs and plant institutions.
- while continuing the ban on log export, encourage wood based small industries.
- to encourage people's participation and build awareness.

In fact there is no wood energy policy in the country. Fuel-wood was the most common and major energy source for brick burning in Bangladesh. Huge quantities of wood used to be burned every year in brick burning kilns such as tamarind (*Tamarindus indica*), minjiri (*Cassia siamea*). In 1989 Government of Bangladesh promulgated the "Brick Burning (Control) Act, 1989" to conserve forest resources and maintain ecological balance. Section 5 of this Act firmly prohibits the use of fuel-wood in brick burning. Coal has been suggested to be used in lieu of wood. But since the price is high and the availability of coal is low, the brick field owners still use fuel-wood. According to this Act, the Upazilla Chairman has been given the authority to issue licence for brick burning within his jurisdiction. Under section 6 of the Act, the Government constituted a three member committee in 1990 to visit the brick burning kilns and ensure the implementation of the Act. Though this Act was expected to stop the burning of fuel-wood in brick burning kilns, for aforesaid reasons, the implementation of the Act was not at all satisfactory. Hardly 22% of the coal requirement is available (ADB 1993). In the recent past big coal deposits have been identified in the country, but their mining has been complicated by politics. Unless coal is made available at a reasonable price, there is very little hope for improvement of the situation.

Economics of wood energy use

Of all the available energy sources wood is the most economical. But the price of fuel-wood is continuously increasing exceeding that of coal. In future it is expected that a time will come when the use of coal may become a price-driven phenomenon, especially for brick burning and maybe for cooking.

Trends in substitution with alternative fuels

As far as tcooking is concerned many individuals are switching to gas cylinders in place of fuel-wood. There is a high demand for gas cylinders across the country. But since production as well as the distribution system is very poor, substantial progress is not being achieved.

Recently rice husks are being processed as a substitute for fuel-wood. The production technique is very simple. Small investments of Taka 60,000 to 100,000 are enough to set up a factory to produce these semi charred rice husks for use as cooking fuel in lieu of firewood. This has become quite popular by now and is expected to gain momentum in future.

In general the substitution of fuel-wood for cooking by alternate fuel is gaining momentum. Many NGOs have "Improved Stove" programmes. These stoves use substantially lower quantities of fuel-wood and thereby enhance the efficiency of the energy source.

Recently use of biogas has been slowly growing, especially in the rural areas. A biogas plant can be established in the rural areas with an investment of about 50,000 Taka. Some NGOs are promoting this aspect.

Non-wood forest products

Important non-wood forest products (NWFPs) or 'Minor Forest Products' include Bamboo, Fish, Golpatta, Sun-grasses, Honey, Wax and Cane. Others are Phooljharoo (*Phragmitis inflorescences* for broom), lime stones, *Saccharum* spp. (nal), Murta, Hogla, Crab, fodder, leaves, stone, sand, kurujpata, climbers (lota), medicinal (barks, fruits, leaves, etc.) plant parts, etc.

Main NWFPs and their significance to the economy

Though the important NWFPs generate only about 6 to 8% of the total revenue of the FD, they have a very important impact on employment generation. Since these NWFPs are collected and traded by comparatively less affluent groups of people their number is quite high. Though there are no dependable statistics, it is possible that 60% of the total employment generated by the FD, centres around NWFPs and that too from less affluent groups of people. Thus NWFPs have a significant contribution in supporting the economic activities of at least 0.6 million people.

Bamboo

Of all the NWFPs bamboo is the most important one. Bamboo is regarded as the poor man's timber. Forestal Forestry and Engineering International Limited, Vancouver, Canada (1964) reported that

- Out of the total area of 164,592 hectares in Kassalong RF, about 46% of the area is predominantly covered with bamboo, weighing about 245.6,000 metric tons (air dry).
- Out of the total area of 77,134 hectares of Rankhiang RF, about 61% of the land is covered predominantly with bamboo, weighing about 307.2,000 metric tons (air dry).

These two RFs alone had about 552.8,000 tons of air dry bamboo. Had the muli (*Melocanna baccifera*) bamboos not been dead due to flowering during that inventory, these figures would have been at least three times higher. Besides, there were over 23.6,000 hectares of RF land under Sylhet Forest Division that had almost pure cover of bamboo. FRMP (1996) estimated that the total number of bamboo in that area was 453 million stalks of which 200 million stalks were mature.

Roughly about 6% of the total revenue (as per the FD revenue record) comes from bamboo. About 50 million bamboo stalks are produced by the FD from Government forests.

Golpatta

Golpatta is an important thatching material from the mangroves and coastal areas of Bangladesh. A large number of people are involved in its harvest, collection and trade. Generally golpatta is harvested every alternate year from a given location. There are set of rules for harvesting golpatta. These are required to be followed strictly to ensure sustainable harvest. The demand of golpatta varies directly with the price of Corrugated Iron (C.I.) Sheet in the market. In the fifties almost all the yield (all harvestable quantity) used to be collected from the forest. With the fall of the price of C.I. Sheet, the demand for golpatta declined and accordingly the harvest also declined. During the last couple of years, it has been observed that many of the golpatta growing areas are not harvested at all. The demand is declining and so is the harvest.

Honey

Honey is mostly extracted from the Sundarbans. Roughly 300 to 500 metric tons of honey are extracted every year. It is interesting to note that the honey yield follows a cyclic pattern and the cycle is about 30 years. This is an important observation and may be further looked into and investigated in detail.

Fish

Fish is an important NWFP for the FD. It brings in reasonable revenue for the Government; a large number of poor and local fishermen get employment through fishing in the Sundarbans. These fishermen pay small fees to the Government on the basis of their catch, take the product and often sell it in the open market. This generates employment locally for poor fishermen year round and is thus important for supporting local economic activities. At the same time during the winter months (December to February) fishermen from distant areas such as Chittagong, come to the Sundarbans (Dublar) for fishing, temporarily moving a few thousand people into the Dublar-Char area of the Sundarbans.

The FD (DFO Sundarbans) has kept a good record of year-wise fish harvest, along with analyses of further details. On average the yearly catch of fish from the Sundarbans is about 8,000 to 10,000 tons.

The fish catch increased substantially in 1977 but has been exhibiting a slight decline in recent years. Till 1976 fishing permits used to be issued round the year. It was a general observation that the catch was declining. The FD decided in 1976 to stop fishing during the major fish breeding season from May to June. With strict implementation of this directive, the catch was enhanced

significantly. In later years however, a decline is being noticed probably because of poor implementation of the ban during the breeding season.

State of NWFP management

All the major NWFPs are managed via sets of management prescriptions. Bamboo is harvested at an interval of four years. There are clear directives as to what can be done and what is prohibited in connection with the harvest of bamboo. Golpatta is harvested every alternate year from a given site. There are rules for harvesting the golpatta leaves. Honey is collected every year but only between mid April and mid June. There are instructions as to what portion of the honeycomb can be cut and collected to extract honey. Thus all the major NWFPs are under some sort of management and some regulations, especially those for fish, honey, etc. have been improved upon under the assistance of the Sundarban Biodiversity Conservation Project (SBCP). However they have yet to be incorporated in the approved management prescriptions of the FD.

The service functions of forests

The forests provide a number of services such as acting as carbon sinks, recreation, havens for biodiversity, etc. The forests of Bangladesh are no exception. The services that forests provide, often goes un-noticed and un-recognized.

Forest-based recreation

Due to large-scale urbanization, since 1990 forest-based recreation has gained momentum in the country. Out of the 32 protected areas so far notified, 21 were notified after 1990. In most of these locations, infrastructures such as rest houses, picnic spots, hiking trails, watch towers, boating facilities, etc. have been developed. The Bhawal National Park, being close to the capital Dhaka attracts large numbers of visitors every day. Almost all the rest houses or the picnic spots at Bhawal National Park remain booked in advance for at least a couple of months. This speaks of the high demand for such forest-based recreation. Other forest-based recreation sites accessible by road such as Lawachara, Shatchari, Dulahazara, Bashkhali, Chunati, Ramshagar, etc. attract a large number of visitors every day.

The Sundarbans, being the world's largest contiguous natural mangrove area, is a prime attraction not only to local visitors but also to foreigners. In the past, entry into the Reserved Forests of Sundarban was strictly prohibited. With the passage of time, the FD gradually yielded to the demands of tourism since 1990. The FD now allows tourists to enter the Sundarbans on payment of small entry fees. Since motor launches are required, such trips are comparatively costly. In the recent past however, private tour operating companies have started to take tourists inside Sundarbans in package tour programmes. About seven tour operators are providing such service at present. In 2002 the FD established a small 'visitor center' at Karamjal. This is a very convenient location to approach by small motor boat from Mongla Port in about half an hour. Every day a large number of visitors, especially locals, take a day trip to Karamjal to get a quick snapshot of the Sundarban Mangroves. In 2007 over 92,000 people visited the Sundarbans for the purpose of recreation. Similarly data obtained from Dhaka Forest Division indicate that visitors to Bhawal National Park are also increasing.

Urban forestry

Though establishment of small patches of forest or vegetative cover inside urban areas is yet to become popular, some parks have been established especially in Dhaka City. During 1997 to 2000, the FD launched a small project under the name 'Nagar Bonayan (City Afforestation)'. Under that project 3.3,000 seedlings were planted mostly at the institution's premises in urban areas. Similar institution-planting in urban areas has been undertaken by various social forestry projects since 1982.

Forests and water

Though two watershed areas, namely Sangoo and Matamuhari designated as "Head Water Reserves" were declared as reserved forests in the nineteenth century, neither was managed exclusively as catchments for water yield. In fact catchment management in Bangladesh to harvest water is yet to be started. But with the enhanced importance of surface water use, in view of arsenic contamination of ground water, it is expected that soon there may be some pressure to undertake catchment management (as a forestry sector activity) to enhance surface water yield.

Conservation of biodiversity

The Governing Council's decision 14/26 of the United Nations Environment Programme (UNEP) in 1987 finally led to the formulation of the Convention on Biological Diversity (CBD), which came into force on 29 December 1993. Bangladesh signed this convention on June 5, 1992 and ratified it on March 20, 1994. As a signatory to the CBD, Bangladesh is obliged to follow its core objectives which are:

- Conservation of biological diversity
- Sustainable use of its components, and
- Fair and equitable sharing of benefits arising out of the utilization of biodiversity

Forest biodiversity is one of the six thematic areas identified by the CBD. Being under the pressure of serious resource constraints, the Government of Bangladesh cannot set aside allocations, only for the conservation of biodiversity. The Government of Bangladesh has however, taken a few major decisions towards the conservation of biodiversity which are:

(i) Discourage monoculture, especially that of *Eucalyptus* and *Acacia aruculiformis*
(ii) Stop all sorts of extraction of forest produce from Protected Areas
(iii) Obligatory environmental impact assessment (EIA) for all development activities.

These decisions are in line with the implementation of the CBD.

All declared Protected Areas covering about 260,726 hectares, have the common management objective of in-situ biodiversity conservation. In addition the National Botanical Garden, Mirpur Dhaka is devoted to large scale ex-situ conservation of biodiversity. Some ex-situ conservation is also being undertaken at Shitakunda Eco-Park, Chittagong.

There is a serious lack of capacity to deal with issues in connection with the implementation of the CBD towards the conservation of forest biodiversity.

Contribution of forestry sector towards poverty alleviation

Poverty reduction is the most important goal of the Government of Bangladesh. The Government in April 2003 designated the General Economic Division of the Planning Commission as the National Poverty Focal Point and entrusted it with the responsibility to produce the detailed "Poverty Reduction Strategy Paper" (PRSP) for the Government of Bangladesh. As a result the PRSP document was tabled and published on October 2005.

Though per capita GNP growth is quite modest, the intensity of seasonal deprivation has marked a significant decline, the percentage of population going without three meals a day has substantially declined, access to basic clothes has become almost universal and the homeless population has drastically declined. The emphasis laid by the Government on education and health since 1996 has largely contributed towards poverty alleviation.

Since 1998 the Forestry Sector Project was implemented by the FD. The total allocation was finally US$35.89 million. Most of this money was spent in remote rural areas for labour payments. The FD also distributed a total of Tk 1,044,148,756 to 68,372 beneficiaries during the project period. This number will keep on increasing with the passage of time. The project has incorporated over

177,000 people, mostly the poor and landless, as participants. Each of them will receive a handsome amount at the end of each rotation. This project has generated a resource worth US$166.4 million, 50% of which will go to the poor directly. This forestry sector project alone will generate earnings for the poor participants till the end of the first rotation. Due to the Tree Farming Fund this will be sustainable and in every rotation there will be income for participants which will definitely be higher due to the increasing price of wood. Thus over 177,000 people (participants who were landless earlier) will no longer remain poor. If similar projects are taken the Forestry Sector will be able to assist poverty alleviation considerably.

Forests and climate change

The Intergovernmental Panel on Climate Change (IPCC) estimated that with a "Business-as-Usual" scenario of greenhouse gas emissions, the world should be 3.3^0C warmer by the end of the 21st century. This is alarming. Global climate change is likely to threaten the delicate ecological balance.

Bangladesh is known to possess at least seven diverse ecosystems (IUCN 2002). These are:

1. The Sundarbans mangroves,
2. The rain forest of Chittagong Hills,
3. The deciduous forests in the north-central and northeast zones,
4. The peat basins,
5. The aquatic ecosystems,
6. The coastal plains and
7. The Haor area wetlands.

IUCN (2002) anticipated various types of adverse impacts on each of these ecosystems.

Impacts of sea level rise on mangroves are shaped by a pattern of disturbance, movement of species and habitats, simplification and extinction. Under such influence there will be a rush of migration, while slow growing species will suffer more compared to fast growing invasive species. Most of the true mangrove species are slow growing. There are some species that are comparatively fast growing but mostly categorized as mangrove associates. These species are likely to dominate and the species composition in mangrove areas will drastically change with sea level rise. Again since the mangroves all over the world are patchy and fragmented, the possibility of such migration is likely to be at stake. The IPCC while studying the sensitivity of selected Asian regions to climate change projected the future scenario of Bangladesh as elaborated in Table 15.

Table 15. Future climate change scenario for Bangladesh

Change in climatic elements and sea level rise	Vulnerable region	Primary change	Primary impacts	Secondary impacts
10 to 45 cm sea level rise (0.5 to 2^0c)	Bangladesh Sundarbans	Inundation of about 15% (=750 sq. km.) increase in salinity.	Loss of plant species. Loss of wildlife species.	Economic loss. exacerbated Insecurity and loss of employment.
5 to 10% rainfall increase 10 to 45 cm sea level rise (2^0c rise)	Bangladesh lowlands	About 23 to 29% increase in inundation	Change in flood depth category. Change in monsoons. Change in rice cropping pattern.	Risk to life and property. Increased health problems. Reduction in rice yield.

Source: IPCC

There is a general awareness that with sea level rise the coastal areas of Bangladesh will be inundated and as far as forest is concerned the mangroves especially the Sundarbans will be very adversely affected. Most of the environmentalists in Bangladesh are, however, well aware of the consequence of sea level rise to Bangladesh. IUCN Bangladesh has been raising local public awareness and also at international levels since 2000, but has attained very little success to date.

There is a general understanding that the forest can play a role in ameliorating the impact of climate change, but to date no exclusive programmes have been tabled as such in Bangladesh.

Experience and studies strongly suggest that Bangladesh is highly vulnerable to climate change. Erratic climate conditions such as floods, cyclones, tidal surges, droughts, unexpected changes in monsoons, etc. are the usual threats. Bangladesh is mostly flat and approximately 20% of its land surface is below an elevation of 1 metre. While climate change will affect the flora and fauna of the country as a whole, these low elevated areas will have additional adverse impact from sea level rise. In recent decades awareness is growing about other threats i.e. long-term climate change and sea level rise.

Policy, governance and institutional framework

Some policy, governance and related issues are discussed hereunder.

General education

Environmental awareness has a significant implication on the conservation of forests. Low literacy of the general public often makes awareness raising more difficult. Thus we may examine how the literacy rate is changing in Bangladesh, especially in the rural area, to evaluate the impact of forestry related awareness programmes, especially in the future. It can be seen from Tanle 16 that the literacy rate is gradually increasing.

Table 16. Percent literacy, 7 years of age and over

Year	National	Rural	Urban
1991	32.4	21.2	40.3
1995	44.3	35.5	63.8
1997	47.3	41.0	64.1
1999	48.2	42.3	66.2
2000	48.4	43.5	66.9
2001	45.3	40.6	60.3
2002	48.8	45.3	63.1

Source: Statistical Year Book of Bangladesh 2004

Though the apparent trend of literacy is increasing this is not effectively encouraging. There are a number of NGOs in Bangladesh disseminating environmental awareness, which include forestry as well. With increased literacy these environmental awareness programmes are expected to contribute positively towards forests and forestry in Bangladesh.

Forestry education

In the past all forestry education was Government sponsored and it was not open to all. Only Government recruits had the opportunity to study forestry. The Institute of Forestry was originally established by the Government at Chittagong to provide higher level forestry education to Government recruits only. There was one forestry school at Sylhet also for Government recruits only and was under the control of the Government. Forestry education was fully under the control of the Government. In the recent past the situation has changed. Forestry education has been made open to all. The Chittagong forestry institute has been brought under the control of Chittagong University. The two other public universities, namely Khulna and Sylhet, have established schools of forestry and the environment. Besides these public universities, some private universities,

namely North South University and Independent University have started Environment Schools as well. Thus Forestry and Environment education has become open to all. The graduates from these schools are finding employment in various institutions. This has brought new dimensions in this field of forestry and environment. Now qualified forestry and environment personnel are available. This has definitely enhanced and enriched the forestry sector aspects of education. This change will produce qualified forestry and environment personnel and there will be competition, which will enable the employers to choose the best. Moreover the organizations working on forests and the environment will find adequate numbers of qualified personnel not only for regular day to day forestry and environment programmes but also for research, especially for field-oriented research. It is important to note that many of the private universities are contemplating open environment and forestry schools in the future. This situation is likely to have some say in the future of forests and forestry in Bangladesh.

As of today, forestry education is imparted by the FD, Government of Bangladesh, as well as by the universities. Diploma level education is given by the FD, though the diploma is conferred by the Technical Education Board. Degree level education is given by at least three public universities. The curricula of the educational programmes, both for the FD operated forestry schools and in public and private universities are somewhat old and not dynamic. They need considerable improvement. Academic forestry education alone is not enough for employment as forestry officials of the FD. Formal training is mandatory. The FD is thus required to have good and updated Forest Academy programmes to provide the required training, not only for fresh recruits but also for the serving personnel. The FD has serious constraints in capacity building, not with respect to education and training alone, but in handling forestry technicalities for day to day implementation; namely preparation of project proposals, evaluation and monitoring, preparation of management plans, implementation of management of management plans, maintenance and upkeep of data-bases, updating websites, etc.

Forestry research

The Bangladesh Forest Research Institute (BFRI), Chittagong is the only forestry research organization in Bangladesh. It is under the control of the Ministry of Environment and Forests. Research and development is an area that needs much funding. The BFRI suffers seriously from funding constraints and thus along with the shortage of scientists, there is acute and serious shortage of equipment and research accessories. During the last decade, the BFRI could deliver no substantial findings towards the benefit of the forestry sector of Bangladesh. But prior to that, the BFRI had formalized bamboo nursery techniques, treatment procedure of bamboo, establishment of seed orchards, etc. The BFRI, for some reason or the other, failed to maintain continuity. Besides the funding constraint there was serious lack of initiatives among scientists working at the BFRI.

Forest policies and legislation

So far four forest policies have been declared since 1894. Elaboration is given below.

Forest Policy 1894

The first formal forest policy was declared in 1894 by the then British Government (Government of India). The national forest policy of 1894 provided the basic guidelines for the formulation of acts and rules for the management of forest tracts. The salient features of the 1894 forest policy were:

1. State forests are to be administered for public benefit through regulations of rights and privileges of the people living nearby.
2. Forests are categorized as
    (a) Hill forest/protection forest
    (b) Economically important/production forest.
    (c) Minor forests.
    (d) Pasture lands.

3. Forests situated on hill slopes should be conserved to protect the cultivated plains situated down stream.
4. Valuable forests should be managed to yield state revenue.
5. Land suitable for cultivation within the forest should be made available for cultivation provided the conversion does no harm and the cultivation is not permanent in nature.
6. The local population should be allowed to exercise grazing rights in low yielding forests.

Under this policy, agriculture had a degree of priority over forestry. However the Forest Act 1927 was formulated under this forest policy. Most of the reserve forests of Bangladesh were declared under the Forest Act 1927. Most of the rules were also framed under this Act.

Forest Policy 1955

At this juncture Bangladesh was carved out of India in 1947 as East Pakistan and was a province of Pakistan. In 1955 the then Government of Pakistan announced its first National Forest Policy. The country came under the purview of this policy. The salient features of the 1955 National Forest Policy were:

1. Forestry should receive priority and increased allocations should be made available to enhance forest cover.
2. Forests should be classified on the basis of their utility.
3. Intangible benefits of forests should be recognized.
4. All forests should be scientifically managed under approved management plans.
5. Timber and fuel wood supply may be enhanced through plantations along roads and canals.
6. Sound management of private forests should be ensured through government legislation and support.
7. Control of adverse land use and soil conservation.

This policy emphasized revenue earning from the forest sector. Clear felling followed by artificial regeneration became a general practice for the country at that time. However, many forest management plans were written following the inventory of the various forest tracts under the purview of this forest policy.

Forest Policy 1979

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

1. Forest should be carefully preserved and scientifically managed.
2. Government forest shall not be used for non-forestry purposes.
3. The timber resource is to be increased by establishing large scale plantations.
4. Modern technologies shall be employed for extraction and utilization of forest produce.
5. Forest based industries shall be set up.
6. Research, education and training shall be reorganized to meet the scientific, technological and administrative needs of the country.
7. A cadre of officers shall be constituted for managing the forestry sector.
8. The forestry sector shall be recognized and relevant laws updated.
9. Steps will be taken to conserve forest and wildlife and utilize the recreational potential of the forestry sector.
10. Mass motivation shall be initiated and technical assistance extended to those interested in forestry.

The National Forestry Policy of 1979 was a little vague and was not implemented in its full perspective.

National Forest Policy 1994

The present Forest Policy of 1994 is the result of a lengthy exercise to meet present day needs. The existing Forest Policy was promulgated in 1994.

Except for the promulgation of the Forest Policy, there are no additional declarations or directives from the Government of Bangladesh, towards proper implementation. There are no specific directives to other Government agencies for forest conservation. On the contrary, local administrations have ignored colossal destruction of forests. Examples are destruction of beautiful mangrove plantations over thousands of hectares at Boyar Char, Noakhali with indirect support of the local administration despite repeated approaches by the Forest Officials. It seems that the Government of Bangladesh is not at all serious about the forests and forestry though the policy has all the required announcements for enhancing forests. Forestry in Bangladesh is yet to get priority at the national level.

The salient features of the Forest Policy 1994 are:

1. The government shall undertake all endeavours to bring 20% of land under forest cover by the year 2015, to maintain ecological balance and attain self-sufficiency in forest produce. To achieve this objective the government shall work jointly with NGOs and ensure people's participation.
2. Since the area under Government-managed forest is very limited, the afforestation activities shall be extended to village areas; newly accreted mud-flat areas and in the denuded areas of un-classed state forests of Chittagong Hill Tracts.
3. People will be encouraged to plant trees in their own fallow and marginal land, on the bank of tanks and in homesteads, etc. Technical advice and assistance will be provided towards "Agro-Forestry" practices. While introducing agro-forestry in state owned and private land appropriate attention will be given to produce fodder and maintaining herbs and shrubs.
4. The Government will encourage people to plant trees in the premises of public institutions like union council offices, schools, idgahs, mosques, maktabs, temples, orphanages, mardasha and in their surrounding areas. Both technical and other assistance will be provided by the Government.
5. Afforestation in state owned marginal lands like roadsides, railroads sides, embankment slopes, etc. will be undertaken with peoples' participation and NGOs.
6. To combat pollution, the Government shall adopt urban forestry activities in all the municipal areas of the country. To achieve this goal, the municipalities, town development authorities and other related autonomous bodies shall help the Government in the implementation of the programmes via zoning and allotting land for tree plantation. The town planning authorities must keep provisions for tree planting in their development plans by setting aside specific areas for this purpose.
7. In the hill districts of Chittagong Hill Tracts, massive afforestation programmes will be undertaken in the Unclassed State Forests (USF) by public and private agencies. The local governments are to be encouraged to execute such afforestation programmes.
8. In order to preserve soil, water and biodiversity, the natural forests of the hilly areas and the catchments of the rivers within the country shall be declared as Protected Areas, Game Sanctuaries, and National Parks. It will be the endeavour of the government to keep 10% of the national forests as "Protected Area" by the year 2015.
9. An integrated management plan will be prepared for the Sundarbans incorporating the management of forest, water and wildlife.
10. State owned hill and sal forests will be managed as production forests, except those declared as "Protected Areas". The production forests will be managed on a commercial basis but with due consideration to the environment.
11. The critical areas like steep hill slopes, vulnerable watersheds, wetlands will be designated as 'forests' and will be managed as "Protected Areas".
12. Denuded and encroached Government forest lands will be identified and brought under afforestation programmes with peoples' participation in the benefit sharing approach preferably under agro-forestry. NGOs may be included.

13. Modern and appropriate technologies will be introduced as attempts to minimize losses in all steps of collection and processing of forest produce.
14. Emphasis will be laid on the modernization of forest-based industries to maximize the utilization of raw materials procured from forests.
15. Steps will be taken to bring in competitive and profit-oriented management to the state owned forest based industries under the purview of an open market economy.
16. Labour intensive small and cottage industries based on forest products will be encouraged in rural areas.
17. Forest transit rules will be made simpler to meet present day needs.
18. Since wood deficit exists, the ban on export of logs will continue. Processed wood products can however be exported. Import of wood and wood products will be liberalized, but reasonable import duties will be levied on forest products that are abundant in the country.
19. Due to shortage of forest area in the country, no forestland will be allowed to be used for any purpose other than afforestation, without the permission of the head of the Government.
20. In the absence of clearly defined land ownership, the tribal people inhabiting adjoining forest lands in some parts of the country cultivate the forest land. Clearly delineated forest land will be set aside for them through forest settlement operations and the rest will be brought under permanent forest management.
21. Training, technical assistance and financial support will be enhanced for private afforestation and tree based rural development programmes, from the funds received as international grants and from donors.
22. Women's participation will be encouraged more in programmes such as homestead afforestation, rural tree farming and participatory forestry.
23. Eco-tourism will be encouraged keeping in mind the carrying capacity of the forest and the nature.
24. To create massive awareness about afforestation, protection and utilization of forests and forest products, mass media campaigns shall be conducted by the Government and NGOs.
25. Under forestry programmes, fruit tree planting shall be encouraged in addition to timber, fodder, fuel wood trees and other non wood products in inhabited areas.
26. Steps will be taken to modernize the methodology of extraction of forest produce to minimize loss and increase efficiency.
27. The Forest Department will be strengthened to achieve the objectives and goals of the policy and a new social forestry department will be established.
28. The research institutions, education and training institutions related to forest will be strengthened to achieve the policy targets and their roles will be enhanced and integrated.
29. In the light of the aims, objectives and targets set up in the policy statement the acts and rules related to forestry shall be modified, amended and if necessary new Acts and Rules will be promulgated.

Bangladesh is a small country and has no regional entity such as provinces. The Government implements the policy nationwide and it has no different regional interpretation. The Forest Policy of 1994 is very elaborate and for the first time incorporated the participatory forestry concept in clear terms. This has opened up the avenue for co-operation between NGOs and Government Agencies in the area of social forestry especially under the participatory forestry concept.

Over 13 years have elapsed since the proclamation of the 1994 Forest Policy and though the policy is good, nothing very substantial has happened as yet. For example:

- No non-reserved forest area or hill forests (USF) have been declared as Protected Areas to date (2007).
- The RF land is still given away for activities other then forestry.
- The 'Transit Rules' are yet to be revised.
- The forestry programmes are yet to be designated as priority programmes of the Government, namely "Core Programmes".
- The allocations to the Forestry Sector are still absolutely inadequate.

- The Social Forestry Department has not been established as yet.
- The Forest Directorate has not yet been re-organized as a People Oriented Department of the Government with respect to its function and operations.
- The capacity building of the FD officials is still far below the requirement.
- Many of the marginal land owners, namely LGED, Municipalities, R&H, Water Development Board, etc. are not willing to join hands with the FD for afforestation of the marginal lands.

Since the FSP had a covenant to table "Social Forestry Rules", the Government under compulsion promulgated the Social Forestry Rules 2005. This is probably the only positive and appreciable action so far undertaken, in line with the many of the benefits stated in the Forest Policy 1994.

Though many of the proposals, namely sharing of gate money with the community, revision of the Forest Transit Rules, etc. have been pending action at the Ministry for a long time, the FD has also failed to act earnestly in this respect.

The Government in fact attaches very little importance to the Forestry Sector, though it enunciated a good Forest Policy in 1994.

Recent policy changes that have impacted forests and forestry

The following National Policies have direct or indirect impact on the Forestry Sector of Bangladesh.

- National Environment Policy, 1992: yet to be fully implemented. While providing wider scope for tree planting, conservation of wildlife and biodiversity, activities on erosion control to the Forest Department, this policy may eventually interfere with production forestry activities such as clear felling, raising of pure short rotation plantation etc

- National Agricultural Policy, 1997: no contradiction with forestry sector activities. In the absence of any land use policy, field implementation of this agricultural policy may however, at times lead to conflicts in fixing the priority between forestry and agriculture, with respect to fallow lands.

- National Water Policy: no contradiction with forestry activities; rather it has a favourable bias towards afforestation and tree planting.

- National Industrial Policy, 1991: no contradiction with forestry activities. But in the absence of any land use policy, industries may compete with forestry over land. It may overuse the forestry resource as well.

- National Land Use Policy, 2001: Of all the above policies, the land use policy has an important impact on the forests and forestry of Bangladesh.

There are some conflicts and compatibilities between the abovementioned policies and the national forest policy, of which the followings issues may be treated as important.

Forestry is primarily land oriented. The National Land Use Policy was enunciated only recently. But before it, various land laws and land reforms were formulated mostly with agricultural and industrial bias, which sometimes contradicted the forest policy. There is no bar in establishing industries in or adjoining forestland or in converting forestland to agricultural land or in establishing fisheries in mangroves. There is a definite lack of co-ordination between the land administrating agency of the Government and the Forest Department especially at field levels. Deputy Commissioners deal with the land on behalf of the Ministry of Land. Under the existing set up, the Deputy Commissioners are very powerful and very often ignore forestry or environmental

aspects of land use. They are more interested to lease out land to the private sector without any consideration of its capacity to withstand impacts. Thus mangroves are leased out for fisheries, hilly tracts with steep slopes are leased out for horticulture or farming etc. Such acts are against the forest policy of 1994 and often lead to conflicts with local forest officials. But since the Deputy Commissioners are far more powerful bureaucrats than the FD officials, they manage and are hardly ever questioned by the Government elite. As such much forestry land has already experienced non-forestry use, which is very much against the prevailing Forest Policy.

The recently declared National Land Use Policy has put most of its emphasis on protecting cultivable agricultural land. It has however recognized the need to conserve forest cover. With respect to coastal land it has identified afforestation as a tool to reclaim land for agriculture and has suggested a 'functional green belt'. The Land Use Policy suggests the use of new forms of rehabilitation. It has also suggested implementation of zoning. In general the National Land Use Policy does not contradict the current Forest Policy but has small loop-holes that may at times go against forestry strategy, but judicious application can take care of this.

Since the industrial policy of 1991 emphasized establishment of export oriented joint ventures, steps may be taken to use various forest products as raw materials for export oriented industries. Such co-operation between industry and forestry is possible. Similarly private fishery in the mangroves may retain 80% of its land under forest cover and derive mutual benefits in lieu of forest conservation, but such an approach has yet to be practiced. The agricultural policy is compatible with the forestry policy. Similarly the environment policy is also compatible, but provisions for establishing Ecological Critical Areas (ECA) have some contradictions with forestry activities. National water policy by laying emphasis on erosion control and afforestation has fortified the forest policy.

Rural power structure

During the last couple of decades NGO activities in Bangladesh have increased significantly. These NGOs have organized large number of groups under various labels. These groups are gradually unfolding as power groups, especially in the rural areas. They are either collaborating with the local Government power structure, namely the union-council members or are entering into conflicts with them. In the past the local Government power structure (chairpersons or members of the union council) was the only power structure in the rural areas. The community groups organized by the NGOs are now emerging as parallel power groups in the rural areas. This sort of change will have some impact on the future of forests and forestry in Bangladesh especially in the areas of social and participatory forestry. The government is aiming for more social and/or participatory forestry in the future. Social forestry rules 2005 have been promulgated. These rules use the local Government power structure, especially the UP (Union Parishad i.e. union council) chairman, in the implementation of social forestry activities. In the future where there will be a conflicting situation between the local Government power structure and the newly emerging community groups, it will be difficult to resolve these conflicts and bring both on board in implementing social forestry activities. The future forestry outlook needs to take this into consideration and the FD may think about revising the 'Social Forestry Rules' to address all the future probabilities.

Institutional arrangements for forest management

Forest management primarily is the responsibility of FD. Forest management is practiced in Government forest lands. There is no private forest land in Bangladesh except that under the ownership of Tea Gardens.

The institutional arrangement of the FD does not match the existing administrative set up of other Government agencies. The FD does not have officials of equal status of other Government agencies working in each of the upazillas and/or districts. This seriously jeopardizes handling of local problems or developing forestry programmess on par with the other programmes of the

Government. Moreover, though the FD is the only agency of the Government that manages this resource, there is no recognition as such from the Government.

To date there are no regulatory provisions on the management of privately owned forestlands especially that owned by Tea Gardens. These private owners are not required by law to manage their private forests on a scientific basis. They are largely converting the land from forestry to rubber gardens. The Tea Board is the controlling agency in this regard. The tea board has no mandate for the conservation or management of these privately owned forest lands.

Though not designated as forests, homesteads are the major suppliers of wood for the nation. The FD has no regular set up to serve or advise homestead owners in this regard. In the mean time large numbers of private nurseries have started to operate in the country. The Government (FD) has no regular mandate to provide regular support even in the form of advice to these seedlings growers. Though the local FD officials extend their advisory support when approached, there is no mandate as such and there is a tremendous shortage of FD personnel in these local field offices.

Many NGOs are now working as environmental NGOs. At times they are vocal about the management aspects of forests. Sometimes their views and opinions do not match those of the Government. At present there is no formal forum to let all the stakeholders to address problems. At present workshops and seminars are their venues and are too informal to reach consensus.

Very recently, the idea of private investments in forestry activities has started to surface. Many NGOs as well as private individuals have expressed their desire for afforestation on denuded Government RF/USF land under some sort of negotiated agreement. Since there is no provision in this respect the FD has not taken any action on this issue.

3. WHAT WILL INFLUENCE THE FUTURE STATE OF FORESTS AND FORESTRY?

In this chapter we will try to concentrate basically on the key driving forces. The major key driving forces identified are.

- Demographic changes: The land: human ratio is very narrow. The total area of the country is 14.757 million hectares. According to the 2001 census the population of the country was 129.25 million. Using the growth rate estimated in the Year Book of Statistics 2004, which is 1.48%, the population of the country in 2008 would be143.25 million.

- In 2008 the population per square kilometre was 970. Bangladesh being an overpopulated country, the population pressure on its natural resources is very high. Consequently poverty has become an important issue, though the human-poverty trends (deprivation in health, education and nutrition) have shown faster improvement than income-poverty trends (ERD, Government of Bangladesh 2005). The population boom, leading to land hunger is a serious challenge, especially with respect to forest land. The overall poor socio economic conditions of the people, have led them to harvest or collect wood especially fuel-wood, mostly for cooking, from Government forests. With the increase of population the demand on fuel-wood is increasing, which causes a definite adverse impact on the forestry sector of the country.

- Scarcity of resources: Because of the scarcity of resources, there is high demand for timber. Moreover the people in general are not well aware about 'forests and environment'. Such lack of awareness has definite impact on forests and forestry in Bangladesh. The high demand for wood coupled with the low awareness of the public results in illicit felling that cannot be addressed by the FD's insufficient staff. Moreover at times, FD staff also particpate. Thus illegal felling from Government forest land continues.

- Economic changes: Though growth is slow, both the GDP and GNP are increasing. The share of agriculture and the forestry sector is slowly decreasing, while that of construction and trade is slightly increasing. Poverty is gradually declining – the rate is slightly higher in urban areas than in rural areas. These factors may or may not have some positive impact on the forestry sector since the absolute rural population is increasing.

- Political aspects: Under the situation of serious resource constraints the Government has failed to prioritize the forestry sector. Since most development activities in Bangladesh are funded by donors such as the World Bank (WB), Asian Development Bank (ADB), Food and Agriculture Organization of United Nations (FAO), etc. the policies of these donors also affect obtaining funds for forestry projects. Forestry projects being smaller in size compared to those of road and bridge construction, the donors prefers to opt for the latter. Since the completion of the 'Forestry Sector Project' funded by ADB on June 30, 2006, the forestry sector has had no ongoing donor funded project. Recently ADB has also changed its funding strategy towards big projects. Thus in future small size forestry projects will be deprived of ADB funding as well. This will have a serious negative impact on forests and forestry in Bangladesh. Corruption among politicians often causes depletion of national forestry resources.

- Emerging environmental issues: The Government is signatory to almost all the major International Conventions and Protocols (ICTPs). The Convention on Biological Diversity (CBD) is important with respect to the forestry sector. This has caused the declaration of many important sites and locations as 'protected areas' or 'eco-parks', 'national parks', etc. The most important emerging environmental issue is climate change. Following Cyclone Sidor that devastated the southern parts of the country, even though it initially travelled through the Sundarban before affecting settlements, the general opinion has gravitated

towards afforestation especially along the sea board. Climate adaptation and mitigation measures are the two likely approaches that may influence the future planning of the country and will have some impact on the forestry sector.

- Technological changes: As the use of solid wood is becoming costlier every day, the use of composite wood is likely to dominate. This is creating investments in composite wood manufacturing industries. This in turn is expected to enhance the demand for small wood. Thus future expectations from forestry may not only be confined to timber production. Production of small wood may be a future requirement as well. This will impact future forest management aspects. Also, the fast developing Information Technology (IT) sector will create pressure on the FD to put all possible information on its website and keep it updated.

An overview of the changing characteristics of society, highlighting key trends

No major changes have been noticed in societal characteristics. But some small changes such as enhanced income, declining contribution of the agriculture sector to GDP against the slowly increasing contribution of the trade and construction sectors are being noticed. The declining contribution of agriculture will have a positive impact on the forestry sector, especially in reducing encroachment pressures on forest lands.

In 1981 the total energy consumption in Bangladesh was 574.8 PJ which increased to 687.6 PJ in 1990 (ADB 1993). This is an annual increase of about 2%. The use of commercial fuel doubled during this period (ADB 1993).

According to the FD, 65% of forest products are consumed as fuel wood. About 93% of traditional fuel is used for domestic cooking (FD Report 2007). The sources of fuel used for domestic cooking are:

- Animal residue 7.8%
- Agriculture residue 27.1%
- Tree biomass 65.1%
- Total 100%

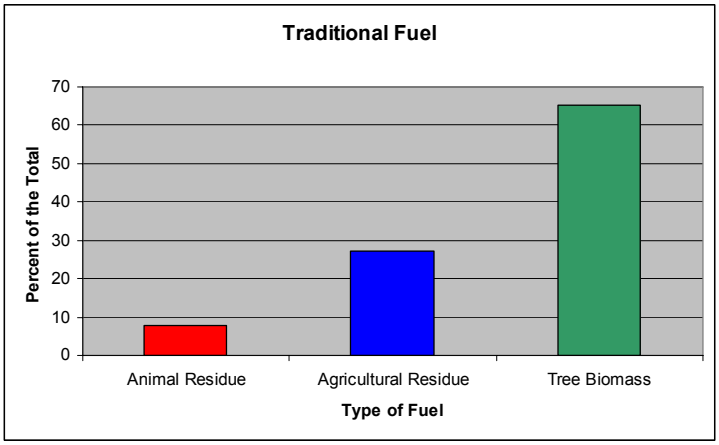


Figure 5. Traditional fuel usage in Bangladesh

The supply and demand of fuel-wood based mainly on village forest surveys by the Forestry Master Plan Project of ADB (1993) indicated an increase of fuel-wood demand at 1.98% per annum. This growth is lower than the population growth which is about 2%. This is indicative that

per-capita demand for fuel-wood is declining, probably due to the increased supply and ease in buying of natural gas in cylinders, especially in the suburban areas. Thus there is a probability that the use of gas will increase for domestic cooking and in turn less and less fuel-wood may be used for domestic cooking.

It has, however, been unveiled that in rural households the use of biomass as cooking fuel is the main cause of indoor air pollution. Many NGOs have included this as an item in their awareness raising programmes in rural areas and have conducted campaigns on the use of fuel efficient stoves, air pollution from fuel-wood use, etc. In the recent past a change is being noticed in the use of fuel-wood. It is also observed that many urban people like to have food cooked either by wood or charcoal, may be intermittently. Thus while there is a probability of declining demand for regular fuel-wood, demand for quality fuel-wood or charcoal may increase.

This shift in the context of fuel-wood will have some say on the future of forests and forestry in Bangladesh and the Government may have to encourage or develop programmes for the production of wood that will yield quality charcoal.

Demographic changes

The focus here may be on the change in population growth, ratio of the urban and rural population, percentage of poor population, population density, etc.

Changes in total population

Normally population censuses are conducted every tenth year. The population of the country at the last three censuses taken from available national data is given in Table 17.

Table 17. Bangladesh population growth 1981-2001

Year	Population in million
1981	89.91
1991	111.46
2001	129.25

Source: BBS 2004

According to the 2001 census the population of the country was 129.25 million. Using the growth rate as estimated in the Year Book of Statistics 2004, which is 1.48%, the population of the country in 2008 would be 143.25 million.

The projections and demographic studies by Rabbani et al. of the Bureau of Statistics in March 2006 contain projections under different assumptions. Their studies indicated that:

- If fertility remains constant the population in 2020 will be 184.08 million.
- With greater birth control achieved by 2021 the population in 2020 will be 174.97 million.
- With greater birth control achieved by 2016 the population in 2020 will be 172.16 million.
- With greater birth control achieved in 2011 the population in 2020 will be 169.54 Million.

According to these assumptions in 2020 the population of the country will be between 169 .5 million and 184 million. This increased population will create increased demand for forest products, though the pattern may be different than that at present.

Population growth

The growth rates as given in the Year Book of Statistics 2004 are shown in Table 18 and Figure 6.

Table 18. Population growth rates in Bangladesh 1905-1995

Year	Growth rate
1905	0.94
1915	0.6
1925	0.74
1935	1.7
1945	0.5
1955	2.26
1967	2.48
1977	2.35
1985	2.71
1995	1.48

Source: Year Book of Statistics 2004

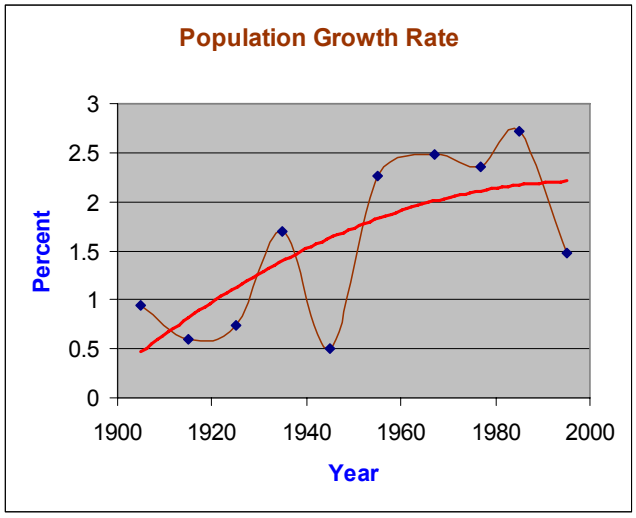


Figure 6. Population growth rate in Bangladesh 1900-2000

The growth rate was low during the early part of the 20th century. It increased to 2.7 and has declined to 1.48 between 1990 and 2000. The general trend indicates that it is going to decrease in future. This declining growth rate may have some positive impact on the forestry sector. The Government in collaboration with NGOs is working hard on health care with emphasis on cutting down the birth rate.

Table 19. Population growth rate (%) for Bangladesh. 2001-2021

Year	Population growth rate in percent
2001	1.9
2006	1.6
2011	1.1
2016	1.3
2021	1.3

Source: Rabbani et al. (2006)

Table 19 and Figure 6 indicate that the growth rate will decline till 2011 and will increase in 2016 and will continue to remain the same in 2021.

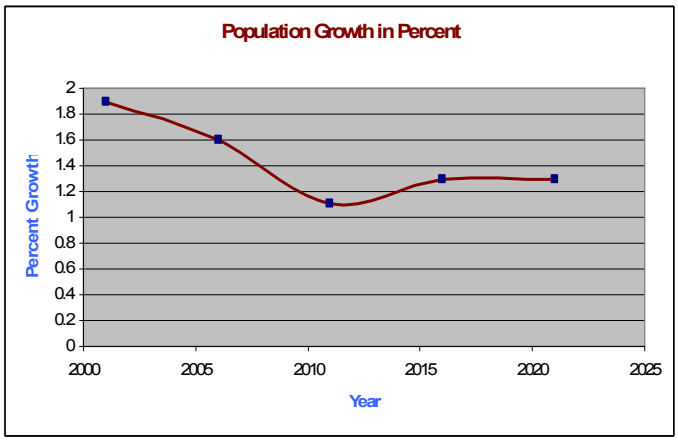


Figure 6. Population growth in percent, 2000-2025

In general the trend is declining. This may have some positive impact on forests and forestry.

Urbanization and migration

Migration overseas

The annual growth rate of the overseas migrant population increased from 1.2% in 1995 to 3% in 2000. Bangladesh is one of the highest labour exporters in the world. Sometimes the rural poor desperately try to travel overseas for work. During the process they often sell or mortgage all of their properties to pay off the recruiting agents and at times succeed in their ventures.

Since 1980 remittances sent by migrant workers have played a much greater role in sustaining the economy of the country. The steady flow of remittances has resolved the foreign exchange constraints and balance of payments. Tasneem (2005) reported that the contribution of remittances to GDP increased from 1% in 1977-78 to 5.2% in 1982-83. A yearly average flow (migration) was 214,098 during the period 1991 to 2002. The remittances sent by wage earners were US$301.33 million in 1980, which grew to US$2847.97 million in 2002. A case study indicated that the highest portion of the remittances which is about 15.02% is used for home construction and repair while the next highest portion (11.2%) is used for the purchase of agricultural land. This will increase demand for forest products and increase pressure on land which in turn is likely to enhance encroachment pressure on forest land.

Studies indicated that two thirds of all the remittances that come to Bangladesh goes to rural areas. Such remittances to the rural areas have changed the demand for forestry products mostly from fuel-wood to furniture and construction wood. Though there are no dependable data on the number of Bangladeshis working abroad, media reports indicate that over 3 million Bangladeshis work abroad, mostly as labour.

Migration from rural to urban areas

Migration especially from rural areas to cities causes some release of pressure on agricultural lands. Such release is likely to reduce the pressure on encroachment of forest land as well as on the demand for fuel-wood. On the other hand such migration will enhance the demand for furniture and construction wood, etc. Migration data in this respect from the Year Book of Statistics 2004 are given in Table 20 and Figure 7.

Table 20. Rural-urban migration data 1951-1991

Year	Migration data from previous Divisions				
	Barisal	Chittagong	Dhaka	Khulna	Rajshahi
1951	10964	-78407	-100488	59659	108272
1961	-51140	-208693	-135106	193444	201495
1974	-199018	-345155	117757	286745	139670
1981	-104802	-1378570	261827	-48369	12780
1991	-481000	-285000	642000	-298000	422000

Source: Year Book of Statistics 2004

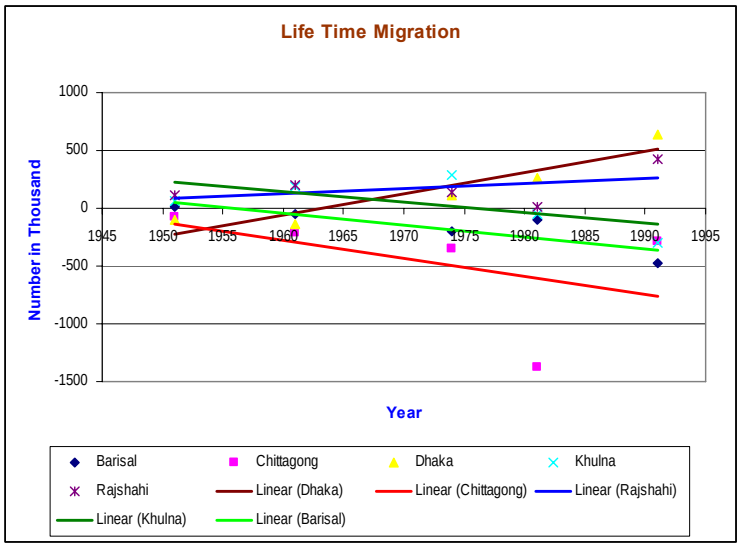


Figure 7. Rural-urban migration in Bangladesh

Figure 7 indicates more migration towards the capital of the country, Dhaka. Migration to Dhaka and Rajshahi is increasing and this trend is likely to continue. This will cause the ratio of rural to urban populations to be leaner in the case of Dhaka and Rajshahi regions and pressure on forests in these two regions may start declining earlier than in other regions.

The general tendency of the rural people is to migrate to cities, especially in search of employment. Most rural people do not possess agricultural farm land. They generally cultivate land of other land owners either through payment of lease money, or on the basis of an agreed share of the crop yield. These marginal farmers, especially in years of lowered yield or harvest suffer most from food shortage and unemployment. 'River bank erosion' sometimes causes many rural people to become homeless. Then they move to cities in search of employment.

Migration between rural areas

This type of migration is not common, but the 1976-86 government encouraged migration from rural plain districts to Chittagong Hill Tracts (CHT). Before that only indigenous tribal people used to live in the CHT and settlement of plains people in the CHT was forbidden. Since that ban was lifted and plains people were encouraged to go and settle in the CHT many rural plains people, especially in groups, moved to the CHT. These new settlers were allotted land from USF areas. The forests were cut and cleared to build homesteads and small narrow valleys and gullies were cleared and levelled for agriculture. It was reported that over 1 million people have moved to the CHT. At present however, such migration has been stopped in view of the 'Peace Treaty' signed between the Government and the 'Shanti Bahini', the revolutionary groups. This migration caused a definite negative impact on forests and forestry. Many of the forests, though depleted, were lost to settlement.

Ratio of rural to urban population

The ratio of rural to urban population has some impact on the forestry sector. If this ratio becomes leaner the demand for fuel wood and encroachment of forest land will decline. Thus it is worthwhile to examine how the rural and urban population will be growing in the future.

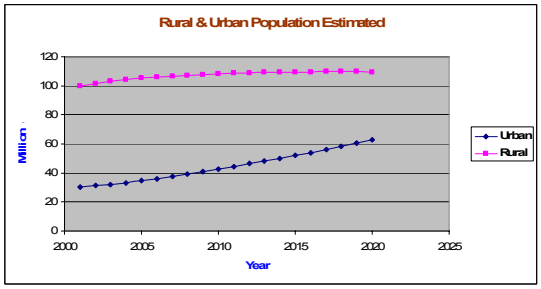
Dr. A. K. M. Ghulam Rabbani and his associates in March 2006 conducted a detailed demographic study and projected many of the population parameters based on various assumptions. Table 21 reveals data from their studies.

Table 21. Projected populations in millions for urban and rural areas, assuming greater birth control is achieved

Year	Urban	Rural	Total	Ratio R/U
2001	30.47	99.55	130.02	3.27
2002	31.25	101.35	132.6	3.24
2003	32.2	102.92	135.12	3.20
2004	33.33	104.21	137.54	3.13
2005	34.64	105.18	139.82	3.04
2006	36.15	105.83	141.98	2.93
2007	37.74	106.52	144.26	2.82
2008	39.38	107.14	146.52	2.72
2009	41.06	107.7	148.76	2.62
2010	42.78	108.18	150.96	2.53
2011	44.55	108.59	153.14	2.44
2012	46.36	108.93	155.29	2.35
2013	48.21	109.2	157.41	2.27
2014	50.11	109.41	159.52	2.18
2015	52.05	109.54	161.59	2.10
2016	54.03	109.59	163.62	2.03
2017	56.07	109.63	165.7	1.96
2018	58.18	109.64	167.82	1.88
2019	60.36	109.63	169.99	1.82
2020	62.59	109.57	172.16	1.75

Source: Rabbani et al. Sectoral Need-Based Projections in Bangladesh, March 2006

Figure 8 graphically reproduces the data in Table 21.



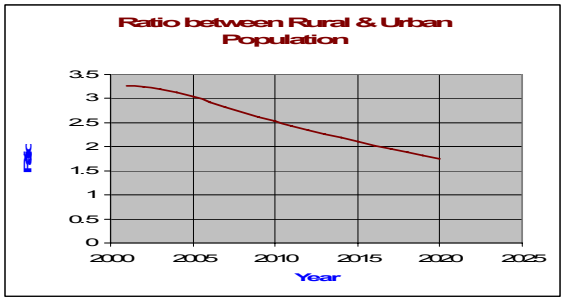


Figure 8. Projected populations for rural and urban areas

Figure 8 indicates that in future the rate of increase of urban populations will be more than rural populations. But the absolute number of rural population will be increasing. This will have a negative impact on the forestry sector. According to Rabbani (2006) the rural population will increase from 100 million in 2000 to 110 million in 2020. Whereas according to UN Population Division estimates, the rural population is expected to increase from 99.02 million in 2000 to 121.66 million in 2020. The UN the growth rate projections are given in Table 22 and Figure 9.

Table 22. UN estimates of rural and urban population growth rates

Year	Annual Growth Rate in % Rural	Annual Growth Rate in % Urban
1985	1.81	5.69
1990	1.73	4.73
1995	1.82	3.93
2000	1.59	3.56
2005	1.41	3.47
2010	1.17	3.47
2015	0.91	3.44
2020	0.62	3.39

Source: UN Web Site

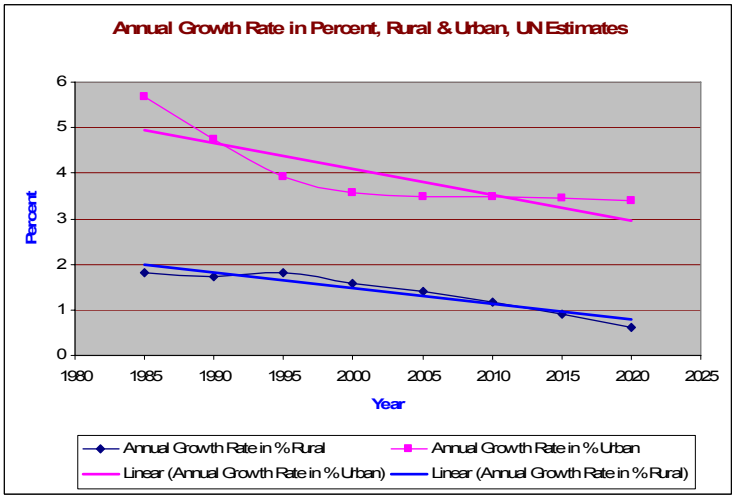


Figure 9. Annual growth rate in percent, rural and urban, UN estimates

According to Figure 9 the growth rate of rural areas is declining at a faster rate than urban areas.

It is true that the urbanization is increasing at a faster rate. Such increased urbanization will cause conversion of agricultural lands to housing. The forest lands adjoining the cities will be subjected to very high pressure as urbanization increases. This is already being noticed in the forest areas adjoining Dhaka city. The price of land has already become sky high and the FD is failing seriously to combat the tremendous encroachment on its forest land adjoining Dhaka city.

Regarding broad sectoral employment, of employed personnel 50.7% were engaged in the agriculture sector, 13.7% in the industry sector and 35.5% in the service sector in 2001. According to the projection of Dr. Rabbani (2006) in 2050 the sectoral engagement of employed personnel will be:

- Agricultural sector 30.4%
- Industrial sector 21.4%
- Service sector 48.2%

Such decline in the agricultural sector along with the enhancement in industrial and service sectors is expected to cause some positive impact in the forestry sector, but it has to be borne in mind that the forest area will remain almost the same while the absolute population will be on the increase. Thus the net impact on the forestry sector may not be positive.

The ratio of the rural to urban population will also be smaller with the passage of time (Rabbani 2006). This is likely to affect the forestry sector in future. With the narrowing of the ratio of rural to urban population there may be a shift from agriculture to industries and/or services. As a result, it is expected that the pressure for acquiring land for agriculture will decline, which in turn is likely to reduce the pressure on the encroachment of forest land. But since the absolute rural population will be on the increase, the pressure on the encroachment of forest land may not decline. The increased urban population will however, cause a shift of wood demand from 'firewood and poles' to 'timber', especially for furniture and construction wood.

Population and density

The UN Population Division's estimates indicate that Bangladesh is expected to have a population of 191.19 million by 2020 adopting median level growth. Since Dr. Rabbani's estimates are those of the government (BBS) we prefer to use them for this report.

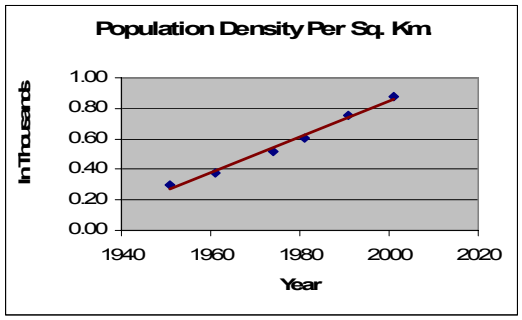
Though population growth rate is declining, the absolute population is on the increase. Using the available information in Table 23 was computed to highlight the population density and per capita forest land. Figure 10 provides the graphic view.

Table 23. Population density and per capita forestland

Year	Population in millions	Population per sq. km.	Per capita forest land (calculated using FD & BBS data)
1951	44.17	299	0.0572787
1961	55.22	374	0.0458167
1974	76.4	518	0.0331152
1981	89.91	609	0.0281393
1991	111.46	755	0.0226987
2001	129.25	876	0.0195745
2011	153.14[17]	1038	0.016521
2021	174.33[2]	1181	0.014513

Source: BBS 2004 & Rabbani's (2006) estimate

[17] Rabbani's (2006) estimate



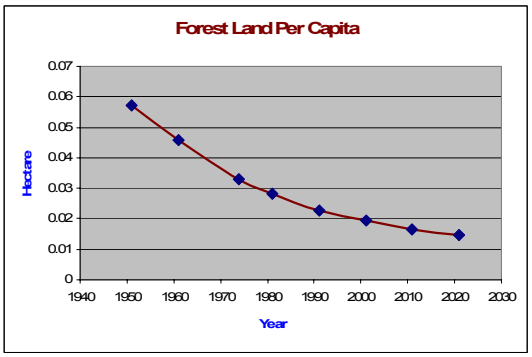


Figure 10. Population density and forestland per capita

Increased population density for forest land is declining. This is a clear indication of increased pressure on forest resources in general. In fact the pressure on forest resources is far more severe when the population either within the forest or adjoining the forest increases. In the early 20th century, while forest labour was in serious shortage, the FD established "Forest Villages" in RF areas, whereby each family was given land for homesteads and agriculture. They used to be allowed to collect all their forest product needs from the forest free of cost and in lieu thereof they used to provide free labour to the FD and every family used to establish one acre of forest plantation every year. Such forest villages were established in each of the then beat areas in Sylhet, Chittagong and Cox's Bazar Forest Divisions. Till the seventies they used to be obedient and comply with the instructions of FD personnel. With the passage of time their population grew large and the FD's control became ineffective; political motivations inspired them to become aggressive and most destructive to forests. At present most of these forest villagers are in conflict with the FD and since they live right inside the reserved forest, they cause the most severe damage to forests.

As a pressure on the resource, the trend for per capita agricultural land is important. BBS data on agricultural land is given in Table 24 and Figure 11.

Table 24. Per capita agricultural land area by decade

Year	Per capita agricultural land area in hectares
1981	0.098334162
1991	0.073964486
2001	0.063063988

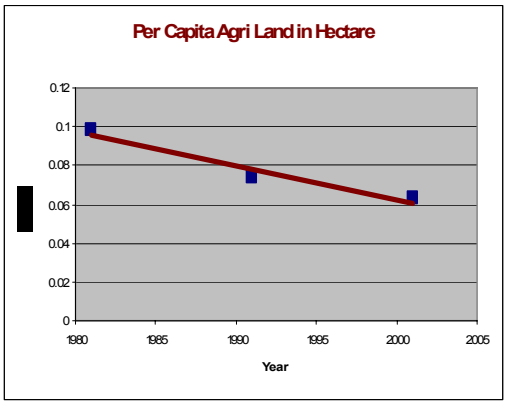


Figure 11. Decline in per capita agricultural land area

The per capita agricultural land area is declining which is going to increase encroachment on forest land.

Population per square kilometre is continuously increasing, which is causing per capita forest land as well as the agricultural land to decline very sharply. This trend is likely to continue in future. This will have definite negative impact on forests and forestry.

The political and institutional environment

The Government of Bangladesh has had a Ministry of Environment and Forests (MEF) since the eighties. There are two directorates under this Ministry. These are the Directorate of Environment (DoE) and Forest Department (FD). There are also two more institutions, namely the Bangladesh Forest Research Institute (BFRI) and Bangladesh National Herbarium (BNH) under this Ministry. Since inception, a full cabinet minister remains in charge of the MEF. Prior to the creation of the MEF, the FD was under the Ministry of Agriculture. As the new ministry came into operation the depletion of forests was exacerbated.

In the past the FD was the absolute authority on forests and forestry. No-one else had any say on issues of forests and forestry. This situation started to change gradually since the eighties due to media reports on corruption in the forestry sector, FD-initiated social forestry programmes involving participants, environmental NGOs raising concerns on depletion of forests, etc. This generated "stakeholders" in the forestry sector. Gradually these stakeholders became prominent. The Forest Act was revised to accommodate social forestry participants.

According to the provisions of the State Acquisition and Tenancy Act (Sec 62), no private individual can own any forest (any contiguous land of 10 acre or larger with tree cover), except tea garden owners. Recently general opinion has started to surface on 'private investments in forestry'. If this crystallizes in future the Government may have to revise the law further to accommodate such ideas.

Government departments exert administration and control, whereas the FD is the only department of the Government that manages resources. But the FD approach being more of the administrative and control type instead of being 'managerial' is adversely affecting the resources. While consulting with stakeholders and accommodating their ideas, the FD personnel need to build their capacity so that they can manage the resource diligently and on a scientific basis.

Though the BFRI and BNH are expected to undertake many important researches on various national forestry issues, they cannot make the desired progress mostly due to fund constraints and lack of initiative.

The Government of Bangladesh is a signatory to almost all the major International Conventions, Treaties and Protocols (ICTP) and very often participates in the international forums of these ICTPs but with very little or no contribution. Very often non-technical and non-conversant personnel are sent abroad to attend these international forums who have difficulty in contributing. Moreover there is no system in the MEF to preserve records systematically and no-one is made consistently responsible for them. Thus very often continuity is lost.

In October 2005, The Ministry of Planning, Government of Bangladesh issued a very important document called "Unlocking the Potential". This document has a detailed matrix on 'Good Governance'. The most salient features of this matrix aim at the removal some of the complexities of Government bureaucracies, involve outsiders and professionals towards a participatory concept, output based approach, etc. Thus the Government is slowly moving towards a participatory approach and attempting to establish transparency. The matrix has identified many of aspects, suggesting various measures for improvement, but has put no stress on forestry. This is an indication that the Government is not attaching importance to forests and forestry in Bangladesh. This is very unfortunate for the forestry sector, although the Government has signed and ratified most of the ICTPs.

In November 2007 the Government formulated the 'Civil Service Regulations 2007' which aim at some sort of participatory approach. The proposed rules are in the process of formalization. This is a good attempt by the Government towards participation and transparency.

The activities of the 'Environmental NGOs' are still limited. They are yet to constitute a notable 'Environmental Lobby' in the country.

Economic changes

Despite being one of the most densely populated countries in the world, Bangladesh remains largely dependent on agriculture from the economic viewpoint. Over 80% of the population are engaged with the agriculture. A very uneven distribution of resources leaves over 50 million people living below the $1 per day poverty indicator, adopted in connection with the Millennium Development Goals (MDGs).

Bangladesh is largely dependent on international aid and donor assistance. Recently (during July/August 2007) Bangladesh had a negative balance. This is reported to have created adverse impact on the economy of the country. In-spite of the generous foreign assistance since 1990 Bangladesh's achievements have not been as good as those in neighbouring India or Pakistan.

GDP

Present level of GDP

The Gross Domestic Products (GDP) is calculated using established economic procedures. Generally the GDP value of a given year is expressed either in current market prices or as the value with respect to a base year. The Ministry of Planning generates these numbers and the BBS publishes them. In Bangladesh the fiscal year starts on July 01 and ends on June 30. The actual GDP for the year 2006-07 is yet to be made public by the Government. The latest information available with the BBS has a provisional GDP for the fiscal year 2006-07, which is 4,674,973 million Taka. The GDP has contributions from various sectors. Table 25 contains the details of the GDP sector wise for the fiscal years 2003-04, 2004-05, 2005-06 and 2006-07. They indicate that the GDP is on the increase and the growth rate is also above 10%. The GDP calculated using 1996 as the base year is also available with the BBS.

Table 25. GDP at current price (in million taka[18])

Sector & Sub-Sector	2003-04	2004-05	2005-06	2006-07[19]
AGRICULTURE AND FORESTRY	524,192	561,674	622,233	678,296
a) Crops & horticulture	388,835	414,819	461,182	501,288
b) Animal Farmings	79,155	86,798	96,821	108,275
c) Forest and related services	56,202	60,057	64,231	68,733
FISHING	147,833	154,564	163,168	173,335
MINING AND QUARRYING	36,435	40,411	46,431	53,005
a) Natural gas and crude petroleum	20,854	22,948	25,683	29,163
b) Other mining & coal	15,581	17,463	20,748	23,842
MANUFACTURING	515,268	587,952	689,227	810,066
a) Large & medium scale	363,641	415,350	489,736	577,504
b) Small scale	151,627	172,602	199,491	232,562
ELECTRICITY, GAS AND WATER SUPPLY	44,245	49,090	53,915	57,680
a) Electricity	36,832	40,654	44,551	47,212
b) Gas	4,801	5,320	5,940	6,727
c) Water	2,612	3,116	3,424	3,741
CONSTRUCTION	253,966	290,608	327,970	367,701
WHOLESALE AND RETAIL TRADE	441,031	502,782	569,842	656,826
HOTEL AND RESTAURANTS	22,021	25,117	28,532	32,749
TRANSPORT, STORAGE & COMMUNICATION	344,444	382,890	432,056	484,287
a) Land Transport	268,602	293,741	328,407	363,839
b) Water transport	28,858	29,942	31,370	33,053
c) Air transport	4,385	4,669	5,003	5,398
d) Support transport services, storage	10,695	11,712	12,604	13,709
e) Post and Tele communications	31,903	42,826	54,672	68,288
FINANCIAL INTERMEDIATIONS	51,974	59,343	66,839	73,873
a) Monetary intermediation (Banks)	38,886	44,508	49,948	54,942
b) Insurance	11,109	12,590	14,296	15,980
c) Other financial intermediation	1,979	2,245	2,595	2,951
REAL ESTATE, RENTING AND BUSINESS ACTIVITIES	276,006	297,443	321,569	349,151
PUBLIC ADMINISTRATION AND DEFENCE	86,237	96,374	110,355	126,846
EDUCATION	78,733	87,882	99,345	114,251
HEALTH AND SOCIAL WORKS	71,969	81,043	90,220	100,175
COMMUNITY, SOCIAL AND PERSONAL SERVICES	300,278	338,763	382,832	435,372
GDP at current market price	3,329,731	3,707,070	4,157,279	4,674,973
Growth Rate	10.78	11.33	12.14	12.45

Change of GDP

While looking into changes in GDP, the GDP calculated at a constant price is better to use. Table 26 and Figure 12 use data from the BBS and from Prof. Enamul Haque, eminent Economist and Professor of Economics, East West University, Dhaka.

[18] Taka is the local currency. At present (Nov 2007) US$1.00 is equivalent to 68 Taka.
[19] Provisional estimate by the BBS.

Table 26. GDP change

Year	GDP at a Constant Price of the year 1995-96 in Billion Taka
1981	0.923597
1982	0.945547
1983	0.98352
1984	1.034473
1985	1.067818
1986	1.113185
1987	1.154732
1988	1.179665
1989	1.210482
1990	1.2824
1991	1.325224
1992	1.392004
1993	1.45568
1994	1.51514
1995	1.589761
1996	1.66324
1997	1.752847
1998	1.844478
1999	1.934291
2000	2.049276
2001	2.157353
2002	2.252609
2003	2.37101
2004	2.51968
2005	2.66974
2006	2.846726
2007	3.032068

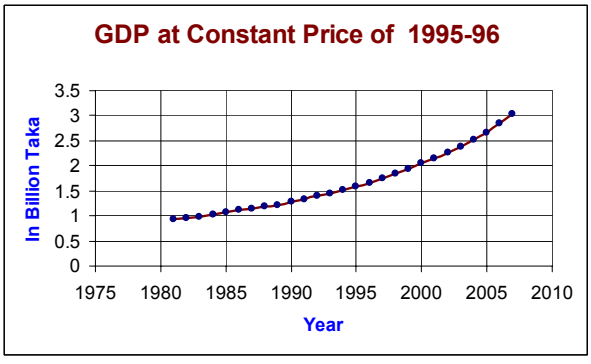


Figure 12. GDP at constant price, 1995-1996

Change in the relative share of GDP

One of the key issues relevant to the forestry sector is the change in the share of various sectors in the GDP, especially that of the agricultural sector. Table 27 provides (from the BBS) the sectoral contribution in percent towards the GDP. This table indicates that the share of agriculture sector is declining, while that of other sectors is increasing. This is a positive sign for the forestry sector.

Table 27. Sectoral share in percent of GDP at constant prices, 2003-04 to 2006-07(p[20])

Name of Sector and Sub-sectors			2003-04	2004-05	2005-06	2006-07(p)
1.	AGRICULTURE AND FORESTRY		17.97	17.27	16.98	16.38
	a)	Crops & horticulture	13.23	12.51	12.28	11.72
	b)	Animal husbandry	2.91	2.95	2.92	2.90
	c)	Forest and related services	1.83	1.82	1.79	1.76
2.	FISHING		5.11	5.00	4.86	4.73
3.	MINING AND QUARRYING		1.11	1.14	1.16	1.19
	a)	Natural gas and crude petroleum	0.68	0.69	0.71	0.74
	b)	Other mining & coal	0.43	0.44	0.45	0.46
4.	MANUFACTURING		16.16	16.51	17.08	17.79
	a)	Large & medium scale	11.41	11.66	12.14	12.68
	b)	Small scale	4.76	4.85	4.94	5.11
5.	ELECTRICITY, GAS AND WATER SUPPLY		1.59	1.64	1.65	1.63
	a)	Electricity	1.34	1.37	1.38	1.35
	b)	Gas	0.18	0.18	0.19	0.19
	c)	Water	0.08	0.08	0.08	0.09
6.	CONSTRUCTION		8.83	9.03	9.14	9.16
7.	WHOLESALE AND RETAIL TRADE		13.97	14.12	14.08	14.17
8.	HOTEL AND RESTAURANTS		0.68	0.68	0.69	0.70
9.	TRANSPORT, STORAGE & COMMUNICATION		9.79	9.98	10.07	10.21
	a)	Land transport	6.96	6.85	6.67	6.52
	b)	Water transport	0.97	0.93	0.89	0.85
	c)	Air transport	0.12	0.12	0.12	0.12
	d)	Support transport services, storage	0.33	0.32	0.31	0.32
	e)	Post and Tele communications	1.41	1.76	2.08	2.40
10.	FINANCIAL INTERMEDIATIONS		1.65	1.69	1.72	1.73
	a)	Monetary intermediation (Banks)	1.23	1.27	1.28	1.29
	b)	Insurance	0.35	0.36	0.37	0.37
	c)	Other financial intermediation	0.06	0.06	0.07	0.07
11.	REAL ESTATE, RENTING AND BUSINESS ACTIVITIES		8.30	8.12	7.87	7.65
12.	PUBLIC ADMINISTRATION AND DEFENCE		2.63	2.68	2.71	2.75
13.	EDUCATION		2.40	2.44	2.49	2.54
14.	HEALTH AND SOCIAL WORKS		2.22	2.25	2.27	2.29
15.	COMMUNITY, SOCIAL AND PERSONAL SERVICES		7.59	7.45	7.25	7.09
	GDP at constant producer price		100.00	100.00	100.00	100.00

Figure 13 exhibits clearly that the share of the agriculture sector is steadily declining. This indicates that the importance of agriculture is declining. Thus there will be less demand for agricultural land and in turn encroachment on forest land may decline.

[20] Proposed or estimated.

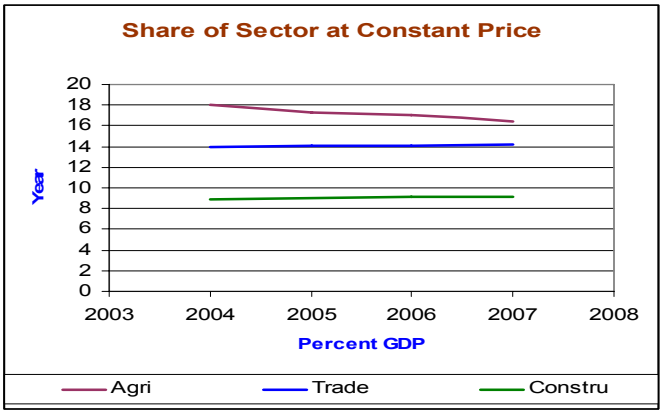


Figure 13. Sectoral shares at constant prices

Rabbani etal. (March 2006) stated that in 2001 the sector-wise percentage of employed persons was:

Agriculture sector	50.7%
Industry sector	13.7%
Services sector	35.5%

He stated that in 2050 these numbers would be:

Agriculture sector	30.4%
Industry sector	21.4%
Services sector	48.2%

Figure 14 gives graphically reproduces these data.

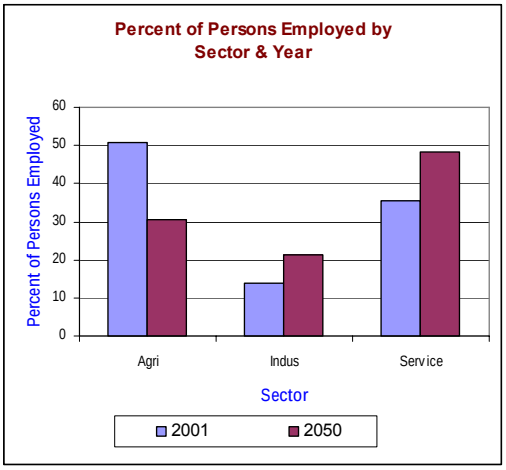


Figure 14. Percent of persons employed by sector and year

GDP growth

GDP values were obtained from the BBS and the growth rate in percent has been calculated (Table 28).

Table 28. GDP growth rate in percent

Year	GDP[21] at the Constant Price of 1995-96	GDP Growth Rate in Percent
1981	923597	
1982	945547	2.38
1983	983520	4.02
1984	1034473	5.18
1985	1067818	3.22
1986	1113185	4.25
1987	1154732	3.73
1988	1179665	2.16
1989	1210482	2.61
1990	1282400	5.94
1991	1325224	3.34
1992	1392004	5.04
1993	1455680	4.57
1994	1515140	4.08
1995	1589761	4.93
1996	1663240	4.62
1997	1752847	5.39
1998	1844478	5.23
1999	1934291	4.87
2000	2049276	5.94
2001	2157353	5.27
2002	2252609	4.42
2003	2371010	5.26
2004	2501810	5.52
2005	2634408	5.30

Growth fluctuates roughly between 2 and 6%. During the last five years it was around 5%. Thus the GDP growth rate during the next year will be between 5 and 6%. The Bangladesh country report prepared by The Economist Intelligence Unit in 2006 forecasted that (real) GDP growth in 2006 and 2007 as 6.3 and 6.0% respectively (Figure 15).

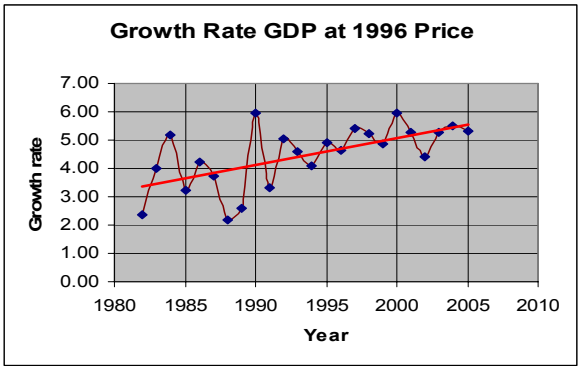


Figure 15. Growth rate of the GDP at 1996 prices

This clearly indicates that although the GDP growth rate fluctuates it has a consistent rising trend (at a constant price). This is a good sign for the forestry sector.

[21] BBS Data.

GDP, revenue and expenditure

As the GDP increases the Government should be able to mobilize more taxes for expenditure. Table 29 and Figure 16 show revenue and expenditure as percent of GDP.

Table 29. GDP, revenue and expenditure

Year[22]	Total Revenue as % of GDP	Total Expenditure as % of GDP
1996	9.2	13.9
1997	9.6	13.3
1998	9.5	12.9
1999	9	13.6
2000	8.5	14.5
2001	9.6	14.8
2002	10.2	14.9
2003	10.4	14.6
2004	10.6	14.8
2005	10.6	15
2006	10.8	14.7
2007	11.2	14.9

Source: Economic Review 2007, Bangladesh.

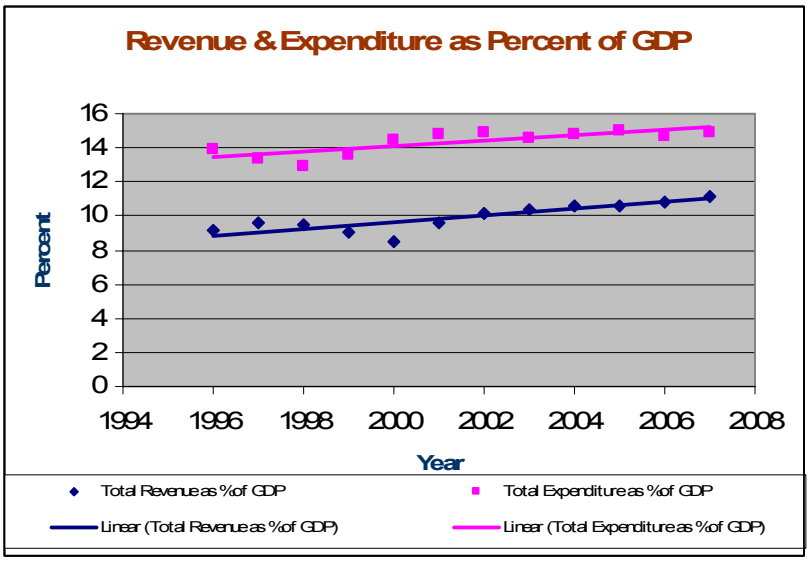


Figure 16. Revenue and expenditure as percent of GDP

Figure 16 shows that with increased GDP the rate of expenditure growth and that of revenue would be the same. The expectation was however, that the Government would collect more revenue as the GDP increased. In fact that has not happened. This indicates that the taxation system is not efficient and at the same time the rich are getting richer while the poor are getting poorer. If the Government could have earned more revenue with the enhancement of GDP there would have been some scope to spend more for the forestry sector.

Table 30 gives the revenue expenditure of the FD and the national revenue expenditure against the year.

[22] Year 1996 means 1995-96 and so forth.

Table 30. FD's revenue expenditure vs national revenue expenditure

Year[23]	Total Revenue Expenditure (National in Million Taka)[24]	Total Revenue Expenditure (FD in Million Taka)[25]	FD's Revenue Expenditure as % of National Revenue Expenditure
1988	47300	145	0.31
1989	61700	148	0.24
1990	67400	181	0.27
1991	73100	198	0.27
1992	79000	236	0.30
1993	85100	293	0.34
1994	91500	306	0.33
1995	103000	351	0.34
1996	118140	423	0.36
1997	125350	382	0.30
1998	145000	413	0.28
1999	167650	402	0.24
2000	184440	433	0.23
2001	206620	476	0.23
2002	226920	499	0.22
2003	253070	562	0.22
2004	283900	796	0.28
2005	346640	770	0.22
2006	380700	839	0.22
2007	437200	1017	0.23

Figure 17 indicates clearly that there is a declining trend in allocation to the FD. This is an undesirable scenario for the forestry sector.

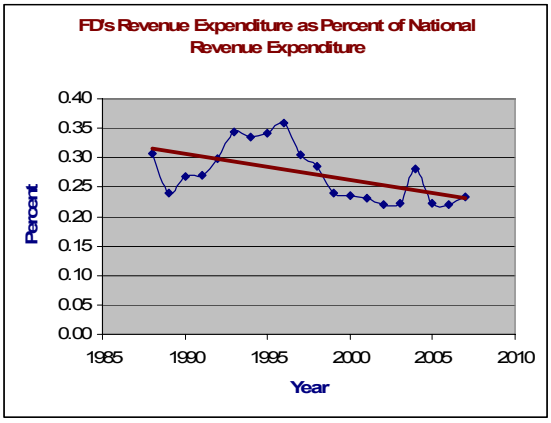


Figure 17. FD expenditure as percent of national revenue expenditure

Income

The income of people in general is the most important parameter in connection with analysing economic activities. Per capita income is calculated by dividing the GDP with the population. The sub-sector 'Forest and Related Services' has a definite contribution in this respect. Table 31 gives data available in this connection from the Year Book Statistics 2004.

[23] Year 1988 means 1987-88 and so forth.
[24] Data taken from Annexure 16.4, 16.5 and 16.6 of Economic Review 2007, Bangladesh.
[25] Data collected from the FD.

Table 31. Forest and related services: GDP and GNP 1995-2003

Year	Sub Sector Forest & Related Services			
	GDP Growth at Constant Price of 1995-96 in Percent	Share of GDP at Constant Price of Base year 1995-96 in Percent	GNP at Constant Price of Base year 1995-96 in Million Taka	Implicit GDP Deflator against Base year 1995-96 in Percent
1995	2.84	1.95	29804	97.11
1996	3.46	1.93	30836	100
1997	4.03	1.91	32079	104.49
1998	4.51	1.89	33526	109.24
1999	5.16	1.9	36257	117.75
2000	4.94	1.88	36997	119.39
2001	4.85	1.87	38792	120.5
2002	4.91	1.88	40695	122.59
2003	4.43	1.86	42497	124.73

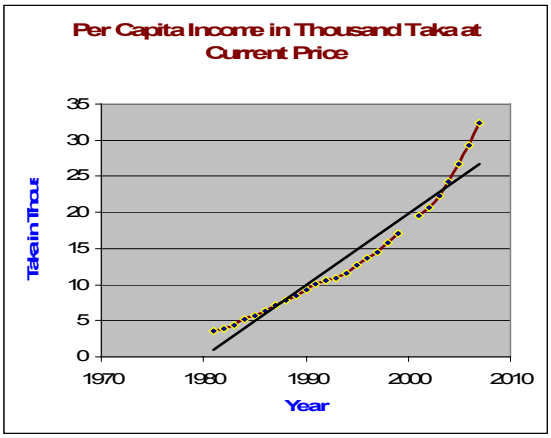
Source: Constructed from BBS 2004

Table 31 shows that the share of the Sub-Sector 'Forest & Related Services' is between 1 and 2 percent. This means that this sub-sector has very little contribution to GDP. Moreover this contribution is declining since only the tangible benefits are taken into account and the intangible benefits are not. Thus the real contribution of this sub-sector in the GDP is not well reflected. Per capita income calculated using available data is elaborated in Table 32 and Figure 18.

Table 32. Per capita income

Year	Per Capita Income in Taka at Current Price	Per Capita Income in Taka at Constant Price of 1996
1981	3583.27	10273.6
1982	3949.127	10322.57
1983	4366.93	10518.93
1984	5128.649	10832.18
1985	5763.528	10951.98
1986	6365.101	11199.04
1987	7169.567	11376.67
1988	7736.257	11408.75
1989	8441.687	11473.76
1990	9332.912	11929.3
1991	10083.77	12091.46
1992	10550.96	12286
1993	10854.5	12603.29
1994	11504.87	12872.9
1995	12720.42	13259.06
1996	13621.95	13621.95
1997	14537.51	14101.75
1998	15824.24	14580.85
1999	17137.07	15088.07
2000	Na	Na
2001	19500.57	16592.47
2002	20603.39	16988
2003	22245.41	17547.44
2004	24179.66	18189.69
2005	26710.99	18841.42
2006	29280.74	20050.19
2007	32406.58	21018.08

Source: BBS data



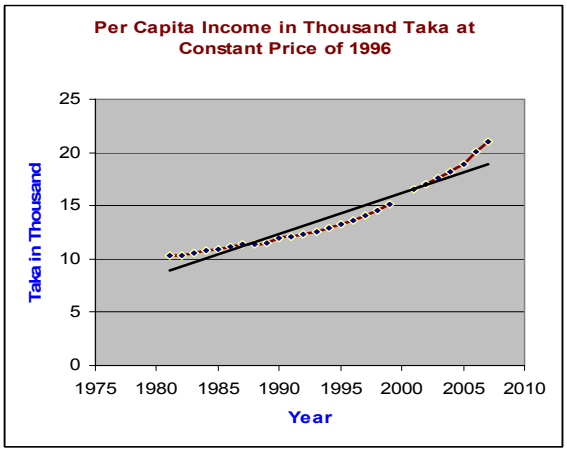


Figure 18. Per capita income in Bangladesh

In both the cases the trends are increasing. This is a good sign and will enhance the demand for wood. Increased income is likely to cause shifts in the demand for wood. The shift may be from firewood, poles, thatching material, etc. to furniture, pulp wood, quality charcoal, etc.

Poverty

Poverty is a very important issue for the Government. By most estimates, Bangladesh has witnessed a modest poverty reduction rate of around 1.5% annually since the nineties (Table 33).

Table 33. Poverty data from surveys in Bangladesh

Indicator	Estimate I[26]		Estimate II[27]	
Head Count Ratio	1992	2000	1992	2000
National	58.8	49.8	49.7	40.2
Rural	61.2	53.0	52.9	43.6
Urban	44.9	36.6	33.6	26.4

[26] BBS, Preliminary Report of Household Income and Expenditure Survey 2000, Dhaka 2001 and World Bank 2002, Poverty in Bangladesh: Building on Progress, Report No 24299-BD, World Bank, Washington D.C., June 2002.

[27] CBN estimates by Sen, B. and Mujeri, M. 2002. Poverty in Bangladesh: Trends. Profiles and Determinants, Background Paper for I-PRSP, using HIES grouped distribution data for comparability with poverty trends in the eighties and using 1983/84 non-food poverty line as the base year non food poverty line.

Both the surveys indicated a decline in the number of poor people. It is the poor, especially while living in areas adjoining forests, who collect fire wood for their own consumption or for selling in the nearby rural market. Sometimes they work as labour force for illicit operations and thus exacerbate the degradation process. Thus poverty reduction, especially in the areas adjoining the forests is likely to have a positive impact on forests and forestry in Bangladesh. The trend data on people's self-assessment available from the BIDS/PRPC 62 Village Poverty Studies evidence changes in the poverty situation (Table 34).

Table 34. Poverty self assessment, percentage of rural households

Self Assessment	1998	1995	2001	2004
Always deficit	24	18	9.9	11.6
Occasionally deficit	50	32.2	26.3	31.9
Break-Even	17.5	30.7	40.8	33.4
Surplus	8.5	19.1	23	23.1
Total	100	100	100	100

Source: 62 village survey and re-surveys: 1998, 1995: BIDS, Analyses of Poverty Trends Project, 2001, 2004: PPRC:
State of the Poor Project.

The 'always deficit' category is important with respect to hunger. There has been a continuous decline in this category since 1998. The increase of this number from 9.9% in 2001 to 11.6% in 2004 is because of the flooding disaster in 2004.

Despite the worsening of income distribution, poverty declined in the 1990s at a rate faster than that in the preceding decade. In the 1980s, the percentage of poverty stricken people did not change much. In 1983-84 the figure for poverty stricken people was 52.3% but this declined to 49.7% in 1991-92. However the rate of poverty reduction accelerated in the 1990s and by 2000 the figure for poverty stricken people was over 40%.

Table 35. Trends for poverty based on consumption expenditure data

	Codes	Year			
		1983-84	1988-89	1991-92	2000
Rural	H	53.8	49.7	52.9	43.6
	P (1)	15	13.1	14.6	11.3
	P (2)	5.9	4.8	5.6	4.0
Urban	H	40.9	35.9	33.6	26.4
	P (1)	11.4	8.7	8.4	6.7
	P (2)	4.4	2.8	2.8	2.3
National	H	52.3	47.8	49.7	39.8
	P (1)	14.5	12.5	13.6	10.3
	P (2)	5.7	4.6	5.1	3.6
Notes	National poverty estimates are population-weighted poverty measures obtained separately for rural and urban sectors. The rural population shares are 88.7% for 1983-84, 86.6% for 1988-89, 83.4% for 1991-92 and 78% for 2000. H stands for head count ratio. P (1) stands for poverty gap index. P (2) stands for squared poverty gap index.				

Source: Osmani 2005

Figure 19 gives head count data (marked as H in the above table).

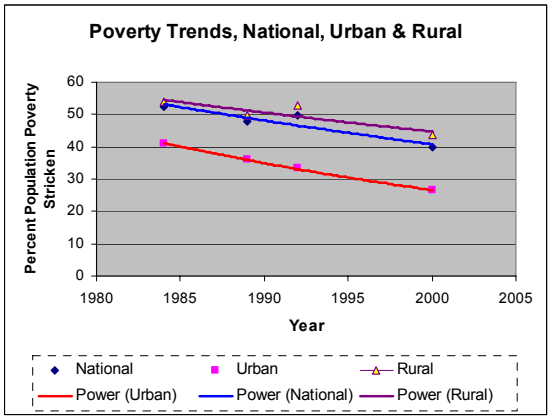


Figure 19. Poverty trends, national, urban and rural in Bangladesh

These data clearly indicate that urban poverty is steadily declining. In 1983-84 poverty stricken people comprised 40.9% which declined to 33.6% in 1991-92. In both urban and rural areas, poverty is declining, the rate of decline being faster in urban areas.

The Household Income and Expenditure Survey 2000 shows that remittances from abroad accounted for 7.5% of total rural expenditure and 4% of urban expenditure. This means that about four fifth of all foreign remittances went to the rural economy (Osmani 2005).

Acceptance of globalization by Bangladesh has induced openness to trade, brought more investments and enhanced export opportunities, especially for the labour force. This has had a positive impact on the Bangladesh economy and in poverty reduction and in turn on forests and the forestry sector. Poverty reduction in turn is likely to reduce pressure on forests and forestry.

Micro credit

The Micro-credit Summit, February 1997, defined “Micro-Credit” as a programme of extending small loans to poor people for self-employment projects that generate income, allowing them to care for themselves and their families.

Even though Bangladesh has made impressive milestones in certain human development indicators, its economic indicators are poor. When Bangladesh became independent in 1971, the then US Secretary of State, Henry Kissinger, considered Bangladesh to be a "bottomless basket”. Since the mid eighties, while half of the people of Bangladesh live below the poverty line, “micro credit” has gathered momentum for the poor. Bank loans invariably need collateral from the borrowers. The poor can never afford this. Under the micro-credit system a small loan is extended to the poor, without any need for collateral. The borrowers however, need to possess the enthusiasm for under-taking self-employment, with that small loan, so that they can pay back the instalments regularly. While most of the poor look for salaried jobs, micro-credit demands higher responsibility and an innovative self employment strategy. Thus micro-credit does not benefit the poorest of the poor but lets the rural poor sustain themselves as long as they work very hard. In 2007 there were over 6.6 million micro-credit borrowers in Bangladesh, most being women, since they are more responsible and organized than men.

BIDS (Bangladesh Institute of Development Studies) indicated that there was a 0.8% decline in rural poverty between 1991-92 and 1995-96. Such decline is no more than "a modest achievement by any standard".

Most of the NGOs in Bangladesh have become involved with micro-credit and are largely benefiting themselves financially, at the cost of the rural poor borrowers. The micro-credit system

has indirectly legalized the money lenders' approach, but under intensive supervision and guidance. The NGOs are taking full advantage of this situation.

The FD under the ADB funded SBCP, attempted to use micro credit to generate AIG to release the pressure on Sundarbans Reserved Forests through NGOs. Apparently this gained some popularity. However, since the SBCP was suspended mid-term proper monitoring information was not available. It has apparently shown good results and has started to cause a positive impact on forest and forestry. Since the micro credit is going to continue in this country, micro credit programmes in areas adjoining the forests, under proper guidance and supervision to reduce pressure on forests is likely to cause a positive impact on the forestry sector of the country, especially in distancing the poor from entering the forest to cut and collect wood.

Impact of globalization

Globalization in the broadest sense implies integration of economies and societies across the globe through flows of technology, trade and capital. Integration of production, accelerated cross-border investments and more trade are the logical outcomes of this process. While globalization brings in a range of changes in countries' and peoples' interactions, the primary focus is on the issue of openness to trade and investment and their impact in Bangladesh and forestry sector in particular.

The globalization debate revolves around its impacts on poor countries and poor people. The issues identified in this context are

- Have countries that opened their economies experienced higher growth?
- Has globalization increased the gap between rich and poor countries? And
- Have the poor benefited from the growth that has occurred during the recent globalization era?

In general globalization has benefited the poor as well. After a hesitant start in the mid eighties, Bangladesh moved decisively to embrace globalization in 1990 (Osmani 2005). Globalization in its economic dimensions carries the meaning of increasing integration of the national economy with the global economy, through exchange of goods and services, flow of capital, sharing of technological information, migration of labour, etc. During the past three decades remarkable globalization has taken place in the world economy. All the countries of the world, whether big or small, have been affected. Some of the impacts of globalization have been positive. However, some specific aspects of globalization have also raised very genuine concerns. Proponents of globalization argue that it allows poor countries and their citizens to develop economically and raise their standards of living, while opponents of globalization claim that the creation of an unfettered international free market has benefited multinational corporations in the western world at the expense of local enterprises, local cultures, and common people.

For the forestry sector, globalization has affected furniture industries. Some uncommon forestry origin items such as 'bamboo and cane made handicrafts' are entering the export market. Due to globalization many investors are growing flowers for export. Some bigger investors are growing orchids for export. This is likely to cause change in the use and trade of some forest products such as medicinal plants and herbs, grasses, leaves, fruits from wild flora, etc. which may enter the export market as well.

Due to globalization, wood carving is becoming popular and many investors are contemplating the export market. Globalization has relaxed the import of wood. Competitive pricing may have some impact on the local (quality) wood which is higher in price than imported wood at present. This will discourage the theft of quality wood from government forests and wood imports may increase. Under globalization the prices of agricultural inputs will gradually become higher. This may cause shifts from agriculture to other sectors such as trade, industries, services, etc. Thus it is expected that globalization will ultimately favour the forestry sector.

Globalization is likely to reduce the number of poor people, which will indirectly benefit the forests and forestry, especially when the number of poor people in areas adjoining the forests declines. But at the same time we must not forget the risk, since globalization favours the rich and makes the poor vulnerable to competition and increases the gap between the rich and the poor. The critics of globalization favour use of the Happy Planet Index (HPI) instead of the conventional GDP. In the HPI, Bangladesh has secured 41st position scoring 53.26.

Technological changes outside the forestry sector

Many technological changes have occurred during the last couple of decades such as in:

- Use of computers
- Use of mobile phones
- Composite wood
- Furniture making
- Enhanced accessibility
- Brick burning by natural gas

The use of computer has increased in all areas. The forestry education and research section has largely been benefited from this. Storing and processing of forestry data especially in the FD has also benefited in this respect. Large scale use of computers will save the use of ordinary paper but shall create increased demand for quality paper. Thus this aspect will cause a demand shift especially with respect to pulp and paper.

With the increased use of computers the use of web sites is increasing. At present Bangladesh has only one submarine cable connection. It is already being realized that this is not enough. At least two more connections will be necessary. The FD will have to build its web site capacity accordingly in future.

During the last six years the use of mobile phone has spread all over the country. This has enhanced communication at all levels. It has caused both advantages as well as disadvantages to the FD especially in connection with the protection of the forests. Both the FD as well the illegal collectors of wood from the Government forest can communicate better than before to their own advantage.

Since the prices of solid wood increased with the shortfall of supply, a number of composite wood manufacturing companies have started to surface. The small wood used for burning in the past is channelled to composite wood factories as raw material. This has caused more intensive use of this natural resource. Moreover particle boards and veneer boards are being produced in the country now.

Furniture making has increased in the recent past. Previously furniture use was not very common among rural people. At present it is observed that the use of wooden furniture has increased manyfolds, especially in rural areas. This is an indication of the enhanced standard of living. Because of this increased demand for furniture wood in rural areas, most homestead owners are now planting species that can yield furniture wood. Since timber from *Acacia auriculiformis* has the look of teak but is far cheaper, it is in high demand in the rural areas of Bangladesh. People are now interested in planting *Acacia auriculiformis* in their homesteads.

During the last couple of decades many rural roads have been built and/or rebuilt. In some areas this has introduced more tree planting along the road sides. Such roadside planting has enhanced tree cover. At the same time while the roads are built through Government forest or tree covered areas, this is likely to enhance accessibility to these forests by illicit operations. There are many examples of such degradation of forests in Bangladesh as the accessibility has increased. Examples are the forests of Chittagong Hill Tracts, Chittagong and Cox's Bazar.

In the past wood used to be the main fuel for brick burning. With the promulgation of the 'Brick Burning (Control & Amendment) Act' in 1992, prohibiting the use of wood in brick burning, brick burning companies sought alternatives. Coal was the common option. Since coal is an imported item, many of brick burning companies switched to natural gas for burning bricks. This has not only reduced the pressure on the collection of wood illegally but also has succeeded in producing quality bricks.

Environmental issues and policies and their impact on the forestry sector

Of the ICTPs that have been signed/ratified by the Government of Bangladesh CBD, CITES, Cartagena Protocol, UNCCD, UNFCC, etc. are going make some impression, especially in the near future, on the decision making process of the Government. These in turn are likely to cause some positive impact on the forestry sector of Bangladesh.

CBD

Bangladesh signed and ratified the Convention on Biological Diversity (CBD) in 1992 and 1994 respectively. Article-6 of the CBD requires that each contracting party in accordance with particular conditions and capabilities to formulate "The National Biodiversity Strategy and Action Plan" (NBSAP) for the country. The Government formulated the NBSAP for Bangladesh in 2005 which is an important national document. This document has identified a set of priority actions that are likely to cause some positive impacts on the forestry sector, especially in establishing conservation areas such as parks, game sanctuaries, etc.

Cartagena Protocol on biosafety

This is an outcome of the CBD. Bangladesh signed the Cartagena Protocol on biosafety on May 24, 2000 and ratified it on May 5, 2004. The Protocol seeks to protect biological diversity from the potential risks posed by Living Modified Organisms (LMOs) resulting from modern biotechnology. The issue of biosafety is gradually crystallizing in Bangladesh and the Government has just formulated the 'Biosafety Guidelines'. In the near future, a Biosafety Act is likely to be promulgated. Though this issue is more closely related to genetically modified organisms (GMO/LMO); forestry being a bioscience, any future forestry programme especially when related to 'tissue culture' or import of seeds and propagules etc. will be affected. This aspect of biosafety has to be borne in mind, while planning forestry activities in future.

CITES

The Convention on International Trade in Endangered Species (CITES) tabled in March 1973 was ratified by Bangladesh in 1981. This action of the Government has barred the free trade of endangered species. Bangladesh has over 5000 flowering plants and over 1500 species of fauna. According to IUCN the following is the status of higher vertebrates in Bangladesh.

Table 36. Status of the higher vertebrates of Bangladesh

Group	Total no. of Living species	Threatened				Not Threatened
		Critically Endangered (EN)	EN	Vulnerable	Total	
Fishes	708	12	29	17	58	584
Amphibians	22	0	3	5	8	7
Reptiles	126	13	28	27	63	24
Birds	628	19	20	8	47	413
Mammals	113	21	15	7	43	17
Total	1,597	65	94	59	219	1,045

Source: IUCN Bangladesh, 2000 (after Ainun Nishat et al)

This in an indirect manner significantly contributes towards the protection and conservation of biodiversity. Recently entrepreneurs have been exhibiting interest in flowers (especially orchids and uncommon leafy vegetation for use in flower bouquet), crocodiles, lizards, deer, etc. for trade. This trend is expected to continue and intensify in future. As they gain importance, FD personnel will need to build up their capability to handle these issues in accordance with the provisions of CITES. As a matter of obligation, future forestry planning should not contradict the CITES provisions and build capacity of the forestry professionals in this regard. The growing environmental NGOs are likely to function as watch dogs on Government actions as well.

UNCCD

The United Nations Convention to Combat Desertification (UNCCD) was adopted in Paris on 17 June 1994. Bangladesh signed and ratified this convention. Since the Government of Bangladesh is attaching importance to it, under pressures created by NGOs, tree planting is often used at the policy level in this connection. This convention is likely to cause some positive impact on the forestry sector of Bangladesh.

UNFCC

The United Nations Framework Convention on Climate Change, entered into force in March 1994. Bangladesh is a signatory of this convention.

There is scientific speculation that this region was originally beneath the sea, and still is in a process of elevation due to tectonic changes as well as sedimentation. IPCC consensus assumes that in spite of all efforts to contain Green House Gases (GHG), Global Warming will cause sea level to rise in future, and the rise will offset whatever elevation Bangladesh land mass gains from sedimentation and tectonic changes.

The fourth IPCC report indicated that icecaps are declining at the rate of 7.4% per decade. This is one of the major causes of sea level rise. The fourth IPCC report has documented sea level rise aspects (Figure 20).

All IPCC reports identify Bangladesh as one of the most susceptible regions exposed to the negative impacts of Sea Level Rise (SLR). Bangladesh is mostly flat and approximately 20% of its land surface is below an elevation of one metre. While climate change will affect the flora and fauna of the country as a whole, these low elevations will be seriously impacted by sea level rise.

The Third Assessment Report (TAR) of the IPCC, Climate Change 2001, in its Technical Summary of the WG-II, asserted with high confidence that the “large deltas and low-lying coastal areas of Asia would be inundated by sea-level rise.” TAR also asserted with medium confidence that with a “1m rise in sea level, the Sundarbans (the largest mangrove ecosystem in the world) of Bangladesh will completely disappear.”

While estimating the potential threat of SLR on the ecosystems of Bangladesh, the World Bank Report projected 10cm SLR inundates 15%, 25cm SLR inundates 40%, 45cm SLR inundates 75% of the Sundarbans. At 1m SLR the Sundarbans would be lost, which is the largest contiguous mangrove forest of the world and recognized as a world heritage site. (World Bank, 2000).

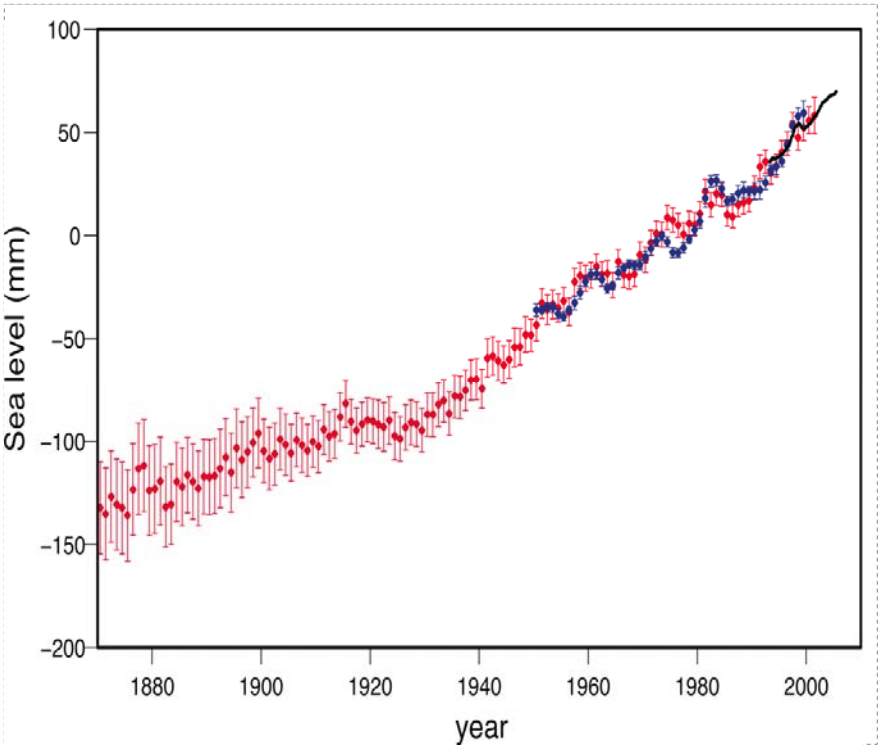


Figure 20. Annual averages of the global mean sea level
Note: The red curve shows reconstructed sea level fields since 1870 (updated from Church and White, 2006); the blue curve shows coastal tide gauge measurements since 1950 (from Holgate and Woodworth, 2004) and the black curve is based on satellite altimetry (Leuliette et al., 2004). The red and blue curves are deviations from their averages for 1961 to 1990, and the black curve is the deviation from the average of the red curve for the period 1993 to 2001. Error bars show 90% confidence intervals.

Experience and studies strongly suggest that Bangladesh is highly vulnerable to climate change. Erratic climate conditions such as floods, cyclones, tidal surges, droughts, unexpected changes in monsoons, etc. are the usual sources of vulnerabilities. The Fourth IPCC report used 21 models to predict the future rainfall situation. Six out of the 21 models used in the IPCC report, indicated that the precipitation in this region (including Bangladesh) will increase due to climate change.

Bangladesh is known to possess at least seven diverse ecosystems. These are the Sundarbans, the rain forest of Chittagong Hills bordering Myanmar; deciduous forests in the north-central and northeast zones; peat basins; aquatic ecosystems; coastal plains and Haor wetlands. (DOE-CZMC-BACS, 1994).

Much of its low-lying coastal plains is still within 1m from sea level, and thus is extremely vulnerable to storm surges, erosion, saltwater intrusion and water-logging. In addition, the country has been under increased stress due to decreasing flow of fresh water in the dry season since India built the Farraka Barrage across the border upstream on the Ganges. This has caused intrusion of saline water further inland. The construction of polders in the southern areas of the country has added further to aggravate the salinity intrusion issue.

With sea level rise the Sundarban may eventually get lost in the long run, but in the near future with the higher tides and increased salinity the structure and composition of the vegetation is likely to change substantially. This forest is already exhibiting top dying of Sundri (*Herieteria fomes*).

This will intensify further. The ecosystem is changing. Under such situation the proportion of Goran (*Ceriops* spp) and Jhana (*Rhizophora* spp) will continue to increase.

Climate change will change the rainfall pattern, which may intensify as predicted in the fourth IPCC report. There may be some seasonal change with respect to summer, spring, winter, etc. Such changes are likely to affect the phenology of the trees. The flowering and fruiting seasons may change. Thus seed collection timing may change, consequently the nursery and afforestation schedules will have to be reformulated. The honey collecting seasons may have to be rescheduled. Except for saline water intrusion most of the other factors will also have impact on other forests in Bangladesh. These factors need to be borne in mind and some methods of integrating these parameters to develop guidelines should be undertaken so as to assist the future planning of the forestry sector in Bangladesh.

Other environmental issues

Other environmental issues in Bangladesh that may have some impact on the forestry sector are described below.

Air pollution

Air pollution is a serious environmental problem in Bangladesh especially in four major cities namely Dhaka, Chittagong, Khulna and Rajshahi. The Carbon Monoxide concentration in Dhaka air is about 11ppm whereas the standard is 9 ppm. Similarly the lead concentration in Dhaka Air is 4.63 ug/m^3 ppm whereas the standard is 0.5 -1 ug/m^3 ppm. The concentration of Sulfur Dioxide in Dhaka commercial and residential areas is 472.9 ug/m^3 and 63.5 ug/m^3 respectively, whereas the standard is 40-60 ug/m^3.

General awareness about air pollution has triggered tree planting by the public in and around their residences. There will be a demand for specialized species that can serve different situations better. This in future may require the FD to look for or undertake research to identify specialized species of plants that are suitable to meet the context.

Water pollution

Water is considered polluted when its physical, chemical and microbiological state is altered from its natural state and it becomes unsuitable or less suitable for any safe use or consumption. The signs of water pollution are bad taste, odours, turbidity, etc. Besides these obvious signs, there are other kinds of pollution, which are not so visible. There are basically two types of pollution, namely natural and man made.

The common natural water pollution in Bangladesh is the presence of arsenic in ground water. The Government in the past had large scale programmes for sinking tube wells for supplying safe drinking water to rural people. Now these have turned out to be dangerous and are being painted red. The human engineered water pollution in Bangladesh is considerable such as waste water from urban areas released into rivers and streams; industrial wastes drained into the rivers and streams; the runoff from crop fields and tea gardens that is often heavily loaded with toxic components of insecticides, fertilizers used in excess, etc. Indiscriminate use of fertilizers and pesticides, mostly in agricultural fields is a source of serious water pollution, especially for river and flood water.

Polluted water adversely affects vegetation especially sensitive species such as *Anisopter glabra*, *Alstonia scholaris*, etc. Polluted water very seriously affects ground flora. Sometimes water loaded with industrial effluent very adversely affects the growth of the trees and even causes the death of many saplings.

Since ground water in many of the areas of Bangladesh is arsenic impregnated, the present bias is for “Rain Water Harvest”. Emphasis is gradually increasing on surface water use. It is well

speculated that this search for surface water, will lead to catchment management for water supply. Forestry is the key to catchment management. In future this is going to be an added dimension to the forestry sector. In the near future this water pollution problem is very likely to create a new demand for catchment management under the forestry sector.

Degrading forests and shrinking green landscapes

Degrading forests and the shrinking of green landscapes has become a concern among the public. This will have a positive impact on the forestry sector in the near future. This may be in the form of a public demand asking the Government to cater for more and more of such sites such as city parks, community parks, etc.

Exotic species

The present trend in plantations is for fast growing species which are mostly exotic. Species such as *Acacia auriculiformis*, *Acacia mangium*, *Eucalyptus* spp, etc. are commonly used. Already planting of such exotic species is being questioned. During the last couple of years the FD has been criticized for raising pure plantations of single species, especially along the highways in Bangladesh. It is envisaged that this will grow still stronger and the FD may have to face serious criticisms if the existing trends continue. However participants under the Social Forestry Programme are interested in fast growing high yielding species. In the near future the FD will have to look for some sort of compromise limiting the use of fast growing high yielding exotic species in plantation establishment.

Outdoor recreation

With increased urbanization, outdoor recreation has become very popular. No doubt this change is bringing more and more revenue for the government but it has the impact of littering of parks and natural ecosystems. This will impact future forestry planning to increase recreation sites as well as to combat littering and pollution of these recreational sites.

Soil degradation

Overharvesting or depletion of vegetation is the root cause of soil degradation. It is established that the soils in most of the hill forests and Sal forest areas are degrading. Soil degradation is very serious in the case of USF lands in Chittagong Hill tracts. In future the forestry sector will have to address this issue.

Waste disposal

Since waste disposal can generate bio-gas it may have some impact on the forestry sector by reducing the pressure on fuel-wood. In rural areas bio-gas plants are gradually becoming popular. Some NGOs are promoting the establishment of small scale bio-gas plants by providing technical assistance and sometimes by extending small loans. Such endeavours being mostly in the rural areas have a direct impact on cutting back the demand on fuel-wood. Since these small scale bio-gas plants are closely associated with cow-dung and cattle, with the enhancing trend of house hold cattle rearing, there is every possibility that fodder demand will increase. In this situation fuel-wood demand is expected to fall and in turn illegal collection fuel-wood from the forests especially from the Government forests may decline. With larger cattle populations the demand for forages especially from the adjoining Government forest will increase. This will have a definite impact on the forestry sector. Since this is an emerging phenomenon, it needs to be borne in mind while planning future forestry activities.

These key factors are highly likely to influence and impact forests and forestry in Bangladesh. Proper planning and action may reduce negative impacts and will assist the forestry sector in moving in a positive direction.

4. PROBABLE SCENARIOS AND THEIR IMPLICATIONS

The key driving forces affecting forests and forestry in Bangladesh are:

1. Land hunger, poverty and population boom.
2. Very high demand for wood resulting in illicit felling from government forest land.
3. Socio economics, especially more recreational demand on forests.
4. Enhanced importance of surface water.
5. Climate change.
6. Lack of awareness of the general public.
7. Importance, or lack of it, attached to forestry by the government.
8. Growing pressure on the FD to deliver participatory forestry programmes on a larger scale.
9. Views of development partners in funding forestry programmes.

The two major dimensions are:

(a) Very low income and high level of poverty, and
(b) Weak political and institutional structures.

Very low income and high level of poverty

Per capita income is about 21,000 taka per annum (in 2007, at constant price of 1996) which is about US$313. This is the average; the yearly income of most people is far below this number. As the poor are closely associated with natural resources which are in short supply, their only option is agriculture or land-based activities and this exacerbates the situation. Very little effort is made to create alternative occupations although some NGOs recently have started to promote off-farm AIG (Alternate Income Generation) activities. This is yet to gain the desired momentum.

Weak political and institutional structures

The bureaucratic approach of administrating the people instead of serving them, coupled with the common political desire to acquire wealth and get richer, has aggravated the situation. This is again linked with the low incomes. Poor governance prevails leading to corruption and weakening of institutional structures.

Thes factors will affect the forestry sector. The following 4 scenarios examine the outcome in this context.

- Scenario I: Improving economy and decline in poverty with improvement of policies and institutions,
- Scenario II: Weak economies (including increasing poverty) and declining state of politics and institutions,
- Scenario III: Improving institutions, but economy remaining stagnant and
- Scenario IV: Improving economies, but politics and institutions continue to remain weak.

Scenario 1: Improving economy and decline in poverty with improvement of policies and institutions

This is probably one of the most likely scenarios for Bangladesh. With improvement of the economy land dependent income will decrease, while diverse employment will be there. Such a situation will reduce the pressure on land and in turn encroachment pressure on forest land will decline. Concomitantly while there will be improvement of policies and institutions, governance will improve. Transparency will be enhanced and in turn corruption will decline. Such a situation will definitely cause a positive impact on the forestry sector of Bangladesh.

The climate change impact will however, continue. Under this scenario attempts on mitigations and adaptations will be there. In such a situation afforestation activities will increase. Global warming followed by sea level rise will continue to affect the ecosystems of the country. The good governance and better transparency will let the people be aware of the current situation and may even motivate the public in favour of forestry at large.

Scenario 2: Weak economies (including increasing poverty) and declining state of politics and institutions

This is probably one of the most unwanted scenarios. In this situation the GNP as well the GDP will be declining. The people will become poorer. Such a situation will generate tremendously high pressure on natural resources, especially on the forests of the country. The forest resources will decline to a minimum and may even be completely exhausted. Along with this if the values and morals of politicians decline further the situation will deteriorate likewise. Governance will deteriorate, corruption will increase leading to the draining of national resources. Under such a situation the forestry sector will be the hardest hit one and there will be a serious negative impact on the forestry sector of the country.

The climate change phenomenon will continue and will further aggravate the situation very seriously. Since the political and institutional contribution will be declining, no effective move will be there to seek proper global assistance as well.

Scenario 3: Improving institutions but economy remaining stagnant

In this scenario it is assumed that the institutions such as those of political and Government administrative agencies will be improving. There will be better governance, improved transparency and very little or no corruption. Under such a situation it is expected that the Government will take the right decisions. But since the economy will be stagnant the achievements will be very few or zero. The employment opportunities will not be enhanced much, since the economy will remain stagnant. The pressure on land will continue and that will create higher encroachment on forests since the population especially in the rural areas will keep on increasing at a faster rate. The pressure on natural resources will continue to increase. Under this scenario the forestry sector of the country will not gain anything positive rather the increasing population will have some negative impact on the forestry sector of the country.

The climate change impact will continue irrespective of any change in the economy. The improved governance and responsible politics will alleviate adverse situations arising out of climate change. Global appraisal of the climate change impacts may be there but the stagnant economic situation will not permit the required interventions as regards the mitigation and adaptation programmes.

Scenario 4: Improving economy, but politics and institutions continue to remain weak.

Under such a situation the people will have more employment opportunities in off-farm activities. The pressure on land will continue to decline and thereby encroachment on forest land in general will decline. Industries will grow faster generating pressure on forest land adjoining the big cites, to bring them under industries. The Government may have to release these city adjoining forest lands in favour of the growing industries. But since the politics and institutions will continue to remain weak, corruption will be rampant. Most of the development budgets will be drained. Only a small portion will be used properly which will keep the economy improving, but at a pace much low than what is expected.

The climate change issue will continue and under the said scenario the impact of sea level rise and adverse impact of climate will not be addressed by the Government since the politics and institutions will be weak. They will not be able to take the situation to the international arena in the right way to secure the required global assistance in this regard. With the improving economy it is expected that individual or group efforts may be there in connection with the mitigation and adaptation activities.

Impact of scenarios on key forestry elements

A short description of the trends of impacts on the key elements (or characteristics) of forestry under each of the aforesaid scenarios is given in Table 37.

Table 37. Key forestry elements of scenarios 1-4

Key Forestry Elements	Scenario			
	1	2	3	4
Forest cover	↑	↓	→	↑
Degradation	→	↑	↑	→
Implementation of sustainable forest management	↑	↓	→	↑
Demand for industrial wood and wood products	↑	↑	↑	↑
Wood energy : Supply/ demand balance	↑	↓	↓	↑
Supply/ demand balance of industrial wood	↑	↓	↓	↑
State of biodiversity	↑	↓	↓	↑
State of watershed protection	↑	↓	↓	→
Desertification and degradation	→	↑	↑	→
Forest based eco-tourism	↑	→	→	↑
Conservation and management of wildlife	↑	→	→	↑
Forestry's role in poverty alleviation	↑	→	→	↑
State of public sector forestry institutions	↑	→	↑	→
Role of private sector	↑	→	→	↑
Community involvement	↑	→	→	↑
Role of civil society organizations	↑	→	↑	→

↑ = Increase ↓ = Decrease → = Remain as it is

5. WHAT WE MAY SEE IN 2020

Under the globally declining trend of natural resources, there is no reason to believe that the forests in Bangladesh will be increasing. To date the Government is the sole authority to look after the forests. It is however a fact that the major wood demand of the nation is met not from the Government forests but from the homesteads. The forests in Bangladesh are declining and in the near future nothing will happen that will drastically change the situation as a whole. The trend of depletion in the Government managed forests may slow down slightly provided some serious efforts are taken. With enhanced tree planting adopted by the public in recent past, homestead gardens may become richer in tree resources.

Forest resources in the next two decades

Forest area

The FD manages about 1.53 million hectares but most of this area does not carry good tree cover. The tree cover on these lands is declining. A general understanding is that about 50% of the FD managed lands is almost denuded. There are about 0.7 million hectares of USF. About 80% of these USF lands are without tree cover. There are some tree covered areas of about 22.6 000 hectares in the tea garden area. There are about 0.3 million hectares under homesteads. The homestead areas have a fairly good tree growth.

With the increase of the total population of the country there is very little scope for Government managed forest area to expand, but there is enough scope for bringing many of the degraded Government forest land under good tree cover. But this will depend on the availability of funding and launching of forestry projects. But there is very little hope of getting such funding in the near future. The total USF land cannot be increased but the denuded areas of the USF many be brought under afforestation. In the past, large USF areas were leased out to individuals for establishing rubber plantations. The lessees felled the existing natural tree growth and most of them did not establish plantations. Public pressure is crystallizing against this so the Government in future may need to compel these lessees to plant. This may enhance the tree cover of the USF area in future. In the tea garden area the natural forest may decline while more of these areas are converted to rubber plantations. In future the total homestead area may increase but their size is likely to be smaller. The forest species in the homesteads decreases as their sizes become smaller (Motiur et al. 2006). Planting of trees in the homesteads is based on economic reasons (Salam et al. 2000). Under this context, in future it is expected that forest species may decline but wood from horticultural trees such as Jack fruit, Mango, Eugenia, etc. may continue to increase.

Forest resources

The forest resources may be grouped as (i) Wood and (ii) NWFPs. Harvest of wood from the Government (FD managed) natural forests has been halted by the Government since 1973. Wood from Government forest, at present is harvested from plantations only. This situation is likely to continue during the next couple of decades. Thus the wood yield from the Government forests will come from the plantations (Annex 3) only. Since the plantation raising activity of the FD is project dependent, and since the FD has no such project at present (2007), the FD has very little plantation raising activity at present. Moreover, the major donors (namely ADB & World Bank) are not interested any more in smaller funding (such as forestry projects). Thus there is little chance for the FD to get sizable project funding for plantation establishment in the near future. Thus in the near future the FD's plantation raising activity will be limited. Consequently the harvest from plantations is likely to remain almost static during next couple of decades.

Harvest and collection of NWFPs is labour intensive and generates small benefits. As the economy grows, and the income level increases, the number of the rural poor NWFP collectors is likely to decline slowly. Moreover the competitive price of CI Sheets against NWFPs such as thatching materials reduces the demand on the latter. Bamboo is an important non timber forest resource in

Bangladesh. The forest resources in general are declining and this declining trend is likely to continue during the next couple of decades.

Critical scrutiny of the available inventory data from the Sundarbans indicates a continuous decline of the growing stock. Table 38 shows the consequences if this rate of decline continues.

Table 38. Growing stock and decline by 2020

Species	Number of trees per Hectare			
	Inventory by Forestal and Forestal Engineering, Vancouver, Canada in 1959.	Inventory by Overseas Development Authority, UK in 1983	Inventory by the FRMP in 1996	2020 (Estimated, if the decline continues)
All species together	296	180	144	109
Sundri	211	125	106	80
Gewa	61	35	20	7
Others	24	20	18	22

Assuming an average depletion rate of 1% per year Table 39 indicates the quantity of wood that may be available from Government forests in 2020.

Table 39. Quantity of wood available from government forests in 2020

Area	Year of Inventory	Growing Stock of Wood in Million m^3	Quantity of wood in million m^3 in 2020 assuming an average depletion rate of 1% per year
Mangroves from Sundarbans & Coastal Divisions	1996	13.63	**10.71**
Chittagong Hill Tracts	1963	25.07	**14.14**
Sylhet Chittagong & Cox's Bazar	1996	5.38	**4.23**

In 2020 we may be left with barely 29.08 million m^3 of wood in the major Government Reserved Forests in Bangladesh. This number is probably on the higher side. Tree growth in the home gardens is likely to increase from 120 million m^3 in 2006 to 183 million m^3 in 2020.

Wood

The major supply of wood comes from homesteads. When the 'Revised Forest Transit Rules' (now lying with the ministry for approval) come under operation, the restrictions on the movement of homestead grown wood will be relaxed, which will enhance the trade of homestead wood and encourage rural homestead tree growers. The yield from homesteads in 2020 (Annex 3) may be about 10.62 million m^3.

If no more new social forestry plantations are established (Annex 3) the yield from the already existing social forestry plantations will increase to an estimated 0.21 million m^3 per year and continue at this level. According to the FD if social forestry plantations continue at the existing pace, in 2020 wood yield would be about 3.62 million m^3 (inclusive of the above stated 0.21 million m^3) in 2020.

All these factors indicate that forest resources in Government forests land will decline substantially in the next two decades, while tree growth in home gardens will increase.

Wood and wood products

Since the supply of wood will decline the use of solid wood will decline substantially. In urban areas, use of composite wood such as chip board, particle board, veneer board, etc. will increase in future. In rural areas however, due to income enhancement the use of furniture is likely to be increasing. The poor quality timber especially from homesteads areas will find a substantial market for village furniture. The use of thatching materials produced from the forest will decline. The use of paper will increase. Thus the demand for small wood as raw material for manufacturing composite wood will increase. Similarly the demand for pulp producing forest products will also increase. If the FD (Government) fails to produce substantial quantity of pulp wood (which is very likely), the pressure will shift to bamboo from the forests (mostly muli bamboo) first and ultimately on home grown bamboos and soft wood. The demand on cane will increase initially as the price of wooden furniture increase. Since the supply for cane will decline as because natural cane forests have deteriorated and the natural wetland areas (rural) that used to supply cane are sharply declining, the total supply of cane will decline. Though the FD has established some cane plantations in the recent past, their management prescriptions are yet to be finalized and yearly yields are not yet ascertained. The supply is not expected to be very high either. Thus the price of cane is expected to increase in future.

Wood and wood products will become more expensive and the supply will be far below the demand. Bangladesh will have to depend heavily on home gardens and may have to import higher quantity of wood products in future decades.

Wood as a source of energy

There are three traditional fuels, namely cow-dung, firewood and other (agricultural) residues. Of these three, use of firewood is the lowest. The trends for all three sources are increasing.

The trend for firewood use will depend on the availability of substitutes and competitive prices. In the mean time the use of 'charred rice husk billets' and biogas is increasing. Since the use of firewood in brick kilns has been banned by law, with stricter implementation of these rules the use of firewood will decline further. Charcoal is becoming popular in urban areas. This is likely to increase, which in turn is expected to create a demand for quality charcoal in future. Recently the use of LPG is becoming popular, especially in semi urban areas. But the supply of LPG cylinders is inadequate. It is expected that the supply of LPG will increase in future. It is expected that in future with enhanced supply of LPG cylinders the demand on firewood may decline to some extent.

The increasing trend of firewood use may not continue in the next two decades.

Future of non wood forest products

In general the major users of NWFPs are the lower income groups of people of the country. With enhanced income, as is being observed, the use of thatching materials such as golpatta and sungrass is expected to decline. Coupled with the decline in the price of CI sheets, the demand for these thatching materials will decline further in future. Among the NWFPs obtained from the forests, the demand for cane and honey is likely to increase in future. The demand for cane will increase because of the anticipated shortage of furniture wood.
The total supply of honey is likely to increase in future. In 2020 honey production will be about 360 metric tons[28].

The National Forest Assessment conducted by FAO in 2004-2005 indicates that Bangladesh has about 22.83 million m^3 of bamboo, of which 66% is in the villages, 16% is Government forest and

[28] Based on author's calculations.

17% is on cultivable land. If the existing trend continues, in 2020 the yield of bamboo will be about 66 million pieces from government forests[29].

Fish are another important NWFP mostly harvested from the Sundarbans Reserved Forests. On average 8 to 10,000 tons of fish are harvested almost every year from the Sundarbans. DFO Sundarbans data indicate that the yield is now declining. This may continue in future unless closure during the breeding season is strictly enforced. If this declining trend continues fish production in 2020 will be about 4 000 metric tons only[30].

The direct collection of important medicinal plants from Government forest is likely to decline in future. At the same time the cultivation of medicinal plants in homesteads is likely to increase. Madhab Karki (2007) estimated that around 12,000 tonnes of dried medicinal plants are sold every year from rural collection and other production areas, worth about US$4.5 million. Table 40 anticipates the future for NWFPs in Bangladesh.

Table 40. Anticipated future of NWFPs

NWFP	Average existing supply per year	Anticipated future supply	Remarks
Bamboo	4.5 million m^3	↑	Assuming the yield to be 1/5th of the total growing stock
Cane	3.5 Million Feet	↑	Due to a recent planting programme by the FD yield may increase but will be limited
Golpatta	40,000 metric tons	↓	Enhanced income will cut back the use of thatching material
Honey	350 metric tons	↑	Honey yield from reared bees is expected to increase
Fish	7,000 metric tons	↑	Fish yield from FD areas will increase provided closure during the breeding season is strictly enforced
Medicinal herbs	12,0000 tons of dried medicinal herbs	↑	This production is worth US$4.5 million. In addition medicinal herbs worth US$8 million are imported every year.

Service functions of forests

The major service-functions that may be provided by the forests of Bangladesh are

- Recreation
- Urban parks
- Coastal area protection
- Biodiversity conservation and
- Watershed management.

Recreation

Of all the services that are provided by the forests of Bangladesh 'recreation' is the most important. FD records on the number of visitors to the Sundarbans and Bhawal National Park indicate that visitors are continuously increasing. Such increase is expected to continue in future as well. With urban growth the demand for recreation is very likely to increase very rapidly increasing fourfold in the next two decades.

Such demand will enhance the revenue generation for the Government. Regarding protected areas and recreation, the main objective is to share the benefits from the protected areas with the adjoining communities in lieu of their contribution towards the protection and maintenance of the

[29] Based on author's calculations.
[30] Based on author's calculations.

protected areas. As of today this concept seems to work well. In this context, the Government is yet to accede to the sharing of the gate money with the participants. But it is expected that the Government will finally accept in due course. In the next couple of decades, there is strong probability that the FD will be more interested in the management of Protected Areas for recreation with peoples' participation.

Urban parks

Although public demand for urban parks is increasing, due to high population density and the high price of land in urban areas, establishment of urban parks often lacks priority. Though the demand for urban parks is on the increase, there are serious limitations to deliver them.

Coastal area protection

Bangladesh, especially the coastal areas, being a cyclone prone zone has a serious need of protection from such calamities. The creation of a shelter belt along the coastline is probably the most practical and affordable proposition for Bangladesh.

Following the devastating cyclone of 1962, the Government decided to initiate coastal afforestation along the sea front. Thus the FD initiated the artificial regeneration of mangroves and pioneered mangrove afforestation techniques. The creation of a shelter belt, as wide as that of the Sundarbans (which is over 40 miles in width), all along the sea front of Bangladesh is impossible, due to serious land scarcity. Finding available land for establishing plantations for the protection of coastal area is the basic dilemma.

Climate change phenomenon will aggravate the situation further. With the passage of time the frequency of cyclones and tidal surges is going to be more frequent and intense. Sea level rise could inundate 1/3rd of the country. The only practical proposition is establishing shelter belt type plantations provided funding, especially from donors, is available.

Biodiversity conservation

Bangladesh ratified the CBD on March 20, 1994, but to date no substantial achievement has been attained, except the formulation of the NBSAP in 2006. Once the Government starts to implement the action programme outlined in the NBSAP, the situation will improve in favour of the forestry sector. It is expected that the Government will act upon it in the near future since biodiversity conservation is being voiced at present mostly by the environmental lobbies in Bangladesh. It is anticipated that this voice will get stronger in future and the Government, especially the FD may have to switch over completely from the clear felling system to the selection felling system. At the same time planting of high yielding exotic species such as *Acacia*, *Eucalyptus*, *Tectona*, etc. may have to be foregone. But this will lead to a conflicting situation because of those interested in fast growing high yielding exotic species. In future it will be the responsibility of the FD to find a reasonable compromise.

It is expected that biodiversity conservation will gradually gain importance in the next couple of decades which in turn will influence the management and operational aspects of forests and forestry in Bangladesh.

Watershed management

The services of Bangladesh forests as catchments are poorly recognized. In fact the FD has no programme for catchment management in any of its reserved forests though Sangoo and Matmuhuri Reserved Forests are designated as 'Head Water Reserves'. Generally the water from most of the perennial streams flowing out of the forest areas in Chittagong, Cox's Bazar and Sylhet areas are temporarily closed by earthen dams during winter (dry) seasons for irrigating the adjoining agricultural fields. That the upstream forests on the catchments have a major role to play in the quality and quantity of water that can be fetched by the said process is barely acknowledged by the rural farmers using the water. It is anticipated that in the near future communities using these

waters will become aware and then effective measures towards catchment management may be voiced by these users.

Moreover, because ground water in many parts of the country is arsenic impregnated, use of surface water is being advocated. As the use of surface water gains popularity, watershed management will come under serious consideration and the Government may have to opt for large scale watershed management programmes in future.

It appears that in the next two decades the following will result:

- ***The demand for recreational facilities from the forest will increase tremendously.***
- ***The demand for urban parks will increase.***
- ***Activities towards the protection of coastal areas shall increase but will have to be formulated by keeping in view climate change perspectives.***
- ***The biodiversity conservation lobby may force the FD to switch from the clear felling system to the selection felling system and may also force the FD to stop the propagation of exotic species, such as Acacia, Eucalyptus, Teak, etc.***
- ***The demand for surface water will crystallize further and may require the FD to undertake water management projects to ensure a least variable perennial stream flow.***

Social functions of forests

Though some of the tangible benefits from the forests are social, most of the intangible benefits relate to social aspects. Clean air and other contributions of the forests towards the environment are social in nature.

The forests of Bangladesh have high potential for poverty alleviation. The FSP has demonstrated this. This will also lead to women's empowerment. The FD needs to take the decision. The FD is gradually getting accustomed to NGOs and may find them comfortable to work with in the near future. Thus the social functions of forests will be better explored. The FD needs to implement large scale programmes of social forestry to explore forest potentials and thereby not only conserve them but also enhance tree cover to serve the people and derive mutual benefits.

Probable scenario

Of the four scenarios that have been envisaged, scenario 1 (improving economy and decline in poverty with improvement of policies and institutions) is the most likely. The degree of improvement of the economy, policies and institutions is the important aspect to watch.

6. HOW TO CREATE A BETTER FUTURE

The following thrusts will create a brighter future for the forestry sector.

- To establish a national level forestry forum for wider participation.
- To initiate mass awareness programmes on forestry and the environment.
- To bring USF under proper management.
- To strengthen the Forest Department.

National level forestry forum

Since many people are gradually getting interested in the forestry sector, it is necessary to create a common forum for all the stakeholders wherein they can express their opinions towards on key operational principles. This forum should meet at least twice a year and substantially contribute to the improvement of the forestry sector. The Ministry of Environment and Forests (MOEF) should take the lead in preparing the details in this regard and develop a 'National Level Forestry Forum'. The theme of the recent 'Policy Matrix for Good Governance' enunciated by the Government backstops this recommendation.

Mass awareness

Unless the people in general have greater awareness about forestry and the environment it will never be possible to secure mass positive support for the forestry sector. The forestry resources are managed in areas that are not fenced. Access to many such sites is prohibited by law but this will never be effective unless people in general, especially the adjoining communities understand the reasons and overall benefits of such prohibitions. Unless the communities, especially those living in the adjoining areas realize and are aware of the adversities and consequences of illegal logging and destruction of forest habitat, the protection of these forests will be unattainable. Once such awareness is created, the protection problem will be lowered considerably. The Government thus needs to view the issue with the utmost seriousness and launch massive public awareness programmes to appraise people in general about the contribution of the forestry sector towards the environment. NGOs can play a very important role in this context. Though most of the NGOs in Bangladesh, in some form or the other, are involved in "micro-credit" often under the banner of 'poverty alleviation' and 'alternate income generation' (AIG), they may assist by converging their AIG activities in favour of the conservation and protection of forest habitats. Such NGOs may be designated as 'environmental NGOs' and may initially be approached to take up appropriate awareness programmes in this direction. The initiative however, has to come from the Government. The Forest Department as well as the Agriculture Extension Department (especially in connection with homestead tree growth) may come forward jointly to assist such initiatives. Forestry research organizations can assist such programmes, especially by developing and disseminating information. Universities with environmental and forestry programmes may arrange seminars, workshops and training programmes regularly on environmental issues with bias towards the forestry sector. An integrated afford can achieve the desired goal. It will however be the responsibility of the Ministry of Environment and Forests to kick-start this activity.

USF management

Land is a very scare resource in Bangladesh. Currently over 0.7 million hectares of land still exist as USF although in a degraded state. This land can be restored and it is possible to establish good tree cover. However this is constrained by conflicts among district administration, local government councils and the forest department to secure authoritative control of these lands. Local government councils are public bodies, while the district administrations possess the legal authority and the FD has the technical expertise in this regard. Moreover the Bangladesh Army has significant influence since these areas are located in the Chittagong Hill Tracts. In the meantime tree resources are continuously being depleted. The existing 'tug of war type' situation is only

fanning the depletion process. It is high time for the Government of Bangladesh to think about this issue at its topmost level.
Under the given situation it is broadly recommended that in each of the hill districts an "USF Management Committee" be established as follows.

- Chair: chairperson of the district council (a public representative).
- Member secretary: deputy commissioner of the district.
- Technical expert: local district forest officer (divisional forest officer as of today).
- Law and order support: the local army head of the district.
- Members: seven in number from various government, semi government and non government organizations.

The decisions adopted by this committee regarding the management of USF shall be binding on all concerned as long as the land is USF.

It is broadly recommended that all USF lands should be brought under some sort of community management system so that the steep slopes are forested and continue to remain under such vegetative cover for the benefit of the communities and harness benefits for the nation at large. Necessary rules and regulations may be formulated if so required.

Unless some effective approach is taken, soon all the 0.71 million hectares of USF lands will be completely denuded and it may not be possible to retreat and restore desirable vegetative cover. The Government should view the degradation of USF very seriously and step in before it is too late.

Strengthening of the FD is a must

Though some changes are being noticed in recent years; the activities of FD personnel still centre around 'Reserved Forest'. Much effort is needed to create a better future for the forestry sector. The following specific actions may help:

- Drastic institutional reorganization
- Major improvement of FD financial management
- Capacity building of FD personnel
- Strengthen the FD's management information system
- Introduce a very intensive and meaningful monitoring and evaluation system
- Undertake large scale social forestry programmes
- Enhancement of governance, accountability and transparency
- More funds for the FD

Drastic institutional reorganization required

The institutional organization of the FD is different than that of the other departments of the Government. The FD has no district and upazilla level officers. The existing arrangement of DFOs in some of the districts was based on the distribution of reserved forests. The homesteads are the major suppliers of the country's wood but the FD has no orientation or responsibility towards these homesteads. As well as reserved forests, the FD needs to focus on assisting the homestead tree growers and other members of the public. Under this context, it is absolutely necessary to reorganize the FD so that it places its officers in each of the districts and upazillas. The rank and status of these officers should be on par with other Government agencies especially with those of the administrative and agriculture departments. To do this the FD shall have to have a massive reshufflings of its officers and staff and re-designate the positions (name of the post) of Divisional Forest Officers, Range Forest Officers, etc. to District Forest Officers, Upazilla Forest Officers, etc. Special subject related officers such as wildlife officers, working plan officers, database specialists (Resource Information Management System Officers), etc. may be placed in the office of the district forest officer as "Subject Matter Specialists" according to the requirements. The

organizational format of Agriculture Extension Department of the Government may be consulted while formulating the details of the institutional reorganization of the FD.
The reorganization of the Forest Directorate may in principle be as under.

- An ACF should be in charge of a range, looking after all the forestry functions such as wildlife, forest management, social forestry, etc.
- In each Upazilla at least one SDFO will be in charge of the Upazilla Forest Office.
- In each district there should be a District Forest Office and at least one DCF will remain in charge of the District Forest Office. Subject Matter Specialists may be posted in the district office as and when required.
- For every 4-5 districts there should be one CF.
- In each of the 6 (existing) Divisions there should be one DCCF in charge of the Divisional (political division) Forest Office.
- Head of the directorate, the Chief Conservator of Forests should be made responsible for all sorts of forestry activities of the country irrespective of the designation.
- At the office of the CCF there should be at least three Additional CCFs looking after (1) Monitoring & Training (2) Planning and (3) Management (among others).

Improvement of financial management required

The financial management system followed by the FD differs from other Government Departments. It is relatively simple. The office assistants (clerks), though have no formal professional accounting background; they used to be trained 'on the job' to handle record keeping, while the senior FD personnel (DFOs and above), trained in specialized forestry accounts, would remain in charge of accounts. The FD's accounting was a simple double entry system, post audit type and submitted to the Accountant General every month.

Till the early sixties the FD had no development budget. As the development budget started to flow in, the fund under the DFO's control became larger and larger, but continued with the old accounting system. With the passage of time non-specialized personnel started facing serious difficulties to do justice to the whole process. In the past no officer used to be posted as a DFO, unless he had passed the Departmental Examinations including 'Forest Accounts and Procedures'. Moreover experienced trustworthy personnel used to be placed in charge of a Forest Divisions as DFOs. As these norms deviated the complexities became serious.

In the meantime the Government, to improve the overall financial management of the public exchequer, initially declared rules in 2003 and finally enacted "The Public Procurement Act (PPA) 2006" (Act 24 of 2006). This applies to the following areas.

- Procurement of goods and services by using public funds,
- Procurement of goods and services by any government, semi-government or any statutory body established under any law,
- Procurement of goods and services using public funds by a company registered under the Companies Act, 1994 (Act No. 18 of 1994).

As such the FD is required to follow these rules. But to date (2007) the FD has been following a mixed approach by undertaking some of activities through a "Forest Advance[31]", while the procurement of equipment, vehicles, building construction etc. is done according to the Public Procurement Act.

[31] This was a term used in Forest Accounting. Cash money is drawn from the government treasury by the DFO and given to FD staff, mostly Range Officers, under his control and authorized to maintain a cashbook and can incur expenditures to procure goods and services on behalf of the Government by paying cash. Such Forest Advance (FA) is recorded in the 'Contractors and Disbursers Ledger' at DFO's office against the name of the staff. The incumbent pays back the advance taken, through vouchers submitted while submitting his accounts to the DFO every month. The recovery as such is shown in the Contractors and Disbursers Ledger against the FA given earlier.

That the financial management of the FD urgently needs some rearrangement is strongly felt by many national and international experts. Most of the FD senior personnel also feel the necessity. Briefly the following provisions need to be incorporated in the PPA as a matter of revision of the Act.

1. If no bidder is found for a contract after proper circulation etc. (because of its being too small, remote, diverse, etc.) the FD will be entitled to undertake the work departmentally through the 'Forest Advance'.
2. There will be no need to invite any tender for some work of the FD (list to be prepared by the FD and examined by the Ministry) that is emergent (perishable goods, biologically time-bound, etc.) in nature.

A small committee may be formed in the office of the CCF with personnel from the Ministry of Environment and Forests and specialists on Forestry, Finance, Economics, Marketing, etc. to set rates not only for plantation raising but also for other tasks (other than construction, since in the case of construction the Chief Engineer's Schedule may be followed) such as management of seized produce, fire fighting, boundary demarcation, survey work, coupe marking etc. These rates should be fixed for a given financial year. This may however be used in later years or till the next revision by incorporating a financial increment at a reasonable rate.

The FD's accounting system is completely dependent on lower level clerical staff. Accounting is no longer the job of office assistants. Qualified professional personnel in accounting need to be involved in the accounting set up of the FD. Every Divisional Forest Office (District Forest Office) must have a qualified Accounts Officer. Similarly qualified accounts should be positioned in the offices of the CF, DCCF and CCF. At present cheques are signed by one officer, this should be changed to two signatories.

No officer (of the Forestry Cadre or not) should be put in charge of a position, which has the involvement of accounting, unless he/she has passed the departmental examination on "Accounts and Procedures". This would be the responsibility of the Ministry of Environment and Forests.

With implementation of the above, it is expected that the FD accounting system will definitely improve and become transparent. With the incorporation of professional accounting personnel it is expected that the old 'Double Entry Cash Book' writing system will change to a computer based professional accounting system. The bottom line however, revolves around the sincerity of the FD personnel, earnest desire of the Ministry of Environment and Forests to act for the improvement of the financial system of the FD.

Capacity building of FD personnel required

Though foresters claim that forestry activities are technical in nature, their capacity to handle technical issues has declined sharply. Previously the forest officers of the directorate used to write the management plans. Now they have become highly dependent on foreign consultants since the FD staff lack training.

At present there are permanent sample plots (PSP measuring 2 x 20 metres) established in the following forest divisions.

- Sundarbans 120 PSP
- Chittagong 26 PSP
- Cox's Bazar 26 PSP
- Sylhet 26 PSP

They are required to be visited at least once a year, data collected and entered into the data base. But in fact the data base is almost empty. The FD staff cannot do this because they do not have the adequate training.

In this age of computers and IT, the expectation in general is to have easy access to all the forestry related information on a website. A very good database and updated website is a must. This will require skilled personnel that the FD lacks. Capacity has to be built in this field.

There must be regular training programmes, home and abroad, so that the technical capabilities of the FD staff are kept updated. The Forest Academy needs to hold regular refresher training courses on various forestry topics and for various tiers of FD staff. Every promotion to higher position should be based on the results of the training programmes.

Strengthening of the management information system required

At present FD has a section of the Resource Information Management System (RIMS) at its headquarters. This section basically needs to maintain and update the entire forestry database. All the information related to forests and forestry in Bangladesh is to be conserved and regularly updated by this section. The shortage of trained manpower is a serious problem in achieving the desired goals. By now this section has acquired some equipment but manpower is a serious constraint. The creation of a complete data base, its regular updating and maintenance is a must to feed the planning section of the forestry sector, so that appropriate plans are developed in time. The Government shall have to pay serious attention, so that the FD can develop its RIMS to meet the present day needs. Once this is done forestry planning will improve, which in turn will enhance forestry activities by inducing forestry programmes in the future.

The RIMS section will have to shoulder the responsibility of launching and updating the website of the forestry sector. All possible information related to the forestry sector of Bangladesh should be available at this website.

Strengthening of monitoring and evaluation required

Without an intensive monitoring system, no programme will achieve the desired benefits. The FD has a monitoring cell at its head office. But it is ineffective. The monitoring system has to be improved. A well thought out monitoring structure has to be placed under the FD.

One additional CCF at headquarters should be in charge of monitoring. Adequate staff and officers may be placed under him to assist the process of monitoring. Analogous to an 'Audit Team' the monitoring team from the FD headquarters need to target field offices under a routine programme, assess and examine all the field activities for the purpose of ensuring effective monitoring. Well trained personnel must be deputed to discharge these duties of monitoring and evaluation. The related monitoring reports should be one of the components to be given due consideration while conferring promotion to an officer. It will also be the responsibility of this unit to prepare and publish the Annual Report of Bangladesh forestry sector.

Large scale social forestry programmes required

It is established by now, that participatory afforestation enhances the tree cover. More over with the promulgation of the "social forestry rules 2005", the TFF will be functional and that will ensure replanting following a felling and will ensure continuity of the tree cover at that site. However, it is strongly felt that the TFF be enhanced from 10% to at least 20% so that the programme is truly effective. But for establishing new social forestry plantations involving the participants, an initial fund will be needed. This 'kick off fund' must be made available to the FD so that large scale social forestry programmes can be undertaken. However, this type of afforestation programme will not be feasible for protected areas. Thus for the protected areas co-management may be put into practice. One of the major hurdles to date is the acceptance of sharing the gate money by the Government with the participants. Once this is agreed to, co-management may largely be practiced in the case of protected areas.

Small investors are expressing interest in investing in tree planting in denuded Government forest lands. The existing principles of incorporating participants may be moderated to accommodate and

encourage such small investors as social forestry participants for enhancing tree cover. There is another concept of collecting investment (money that may be equivalent to the amount required for planting and maintaining 1 hectare of Government owned degraded forest land) from the general public for establishing plantations of valuable species such as *Tectona*, *Mahogany*, *Gmelina*, etc. with a commitment of returning the money equivalent to 40% of the sale proceeds at the end of the rotation (maybe 40 to 60 years).

Enhancement of governance, accountability and transparency required

At present there is a serious image crisis for the FD. It is extremely necessary for the FD to enhance governance and ensure accountability and transparency. The existing centralization of all the administrative powers in the hands of the minister is the root cause of poor governance. Enhancement of governance in the forestry sector alone may be difficult; however, attempts towards the decentralization of power by the MOEF may be an honest and expected approach in this regard. Once proper monitoring is in place, accountability will surface automatically. Thus effective monitoring is the precondition for ensuring accountability. Transparency, especially in the form of exposing all the internal details of the FD activities to the members of the public may be somewhat limited. At present however, the Government is attempting to be as transparent as possible.

Enhancement of allocations of funds to FD required

At present the FD has become almost a project based organization. When there are projects it gets the funds to meet its needs. Sometimes infrastructures are developed incurring loans from projects. Examples are construction of buildings, procurement of equipment, etc. At the close of the project, the FD has no funds to operate even at the minimum level. Thus many things are decaying at many of the FD's locations. Since all the activities of the FD have recently been project based, even core forestry activities, namely plantation establishment, maintenance of plantations, nursery raising, etc. come to a standstill as soon as the project is over. This is not an acceptable proposition in dealing with natural resources.

The reasonable approach would have been to examine if the government could accommodate all its subsequent operational costs including the continuation of the staff recruited under the project, as obligatory revenue expenditures; if that would have been possible, only then the project would have been launched and at its closure, all the liabilities of the project would have been met from the revenue budget. But unfortunately this was never done. Projects were taken one after another, thereby not only huge wastage has been caused, but also programme continuity was lost. Low revenue budget allocations to FD are the problem. The allocations to the FD from the revenue budget since 1996 are given in Table 41.

Table 41. Allocations to the FD from the revenue budget since 1996

Year	Rev Expenditure in Million Taka (Current)	Rev Expenditure in Million Taka (discounted to 1996 value using 12% interest rate)
1996	423.40	423.40
1997	381.83	340.92
1998	413.05	329.28
1999	401.68	285.91
2000	432.98	275.17
2001	475.59	269.86
2002	498.87	252.74
2003	561.68	254.08
2004	795.43	321.26
2005	770.18	277.73
2006	839.34	270.24
2007	1015.13	291.82

Source: FD, Government of Bangladesh

In real terms the allocation from the revenue budget is declining. With salary enhancements expenditures on work will decline further. Unless this is reversed and higher allocations are given, it would be foolish to expect improvement in the forestry sector.

7. SUMMARY AND CONCLUSIONS

Where are we now?

Forest resources in Government forests are declining. The trend observed from the last few inventories conducted in the major government forests of Bangladesh is summarized in Table 42.

Table 42. Trends in forest area of Bangladesh

Forest Area	Natural Forest	Plantation Area	Trees 30Cm+ at DBH	Poles	Volume of Teak
Sylhet Forest Division	↓	↑	↓	↓↓	
Chittagong Forest Division	↓↓↓	↑	↓↓↓	↓↓↓	↓↓↓
Cox's Bazar Forest Division	↓↓	↑	↓↓	↑	↓↓↓
Chittagong Hill Tracts[32]	↓	↓	↓↓	↑	↓
Sundarbans	↓↓↓	Not applicable	↓↓↓	↓↓↓	Not applicable

Note: ↓ Declining ↑ Increasing

Of all the Government forestry activities the coastal afforestation and social forestry programmes are the success stories.

Homestead tree growth increased at 2.62 million m^3 per year between 1981 and 2006.

Under the declining supply of big logs, the lumber industries are shrinking. With the increasing demand for furniture in the rural areas, sawmills and small carpenters there are increasing. Private entrepreneurs are establishing industries related to composite wood, pulp and paper, etc.

Firewood demand is increasing very slowly. In future firewood use may gradually decline but the demand for charcoal may surface slowly.

Of all the NWFPs bamboo is the most important. The supply of bamboo is gradually increasing. Homestead bamboo may increase. Demand for thatching material is declining. Honey is an important NWFP and its production varies from 300 to 500 tons per year.

The demand for recreation in the forests of Bangladesh has been increasing significantly during the last seven years. This trend is likely to intensify in future with enhanced per capita income. With more emphasis on the use of surface water, the demand on forests to supply water, leading to catchment management, will be a future issue for the forestry sector. Concomitantly the demand on forests for biodiversity conservation, climate change mitigation, etc. will increase.

As forestry education has become open to all, forest academy programmes need to be strong enough to meet the future requirements of the sector. The 1994 Forest Policy is good but to date it has achieved little. Recently NGOs have established a large number of groups in rural areas. These groups are going to function as a power structure in addition to the local Government leadership in rural areas. In future especially in connection with the social forestry programme this aspect has to be taken into account.

[32] No inventory has been done in Sangoo and Matamuhuri RFs to date. Only one inventory was done in 1963 in Kassalong and Rankhiang RFs. The information given here with respect to CHT is the personal observation of the author since he has been frequently visiting the forest in CHT since 1956.

What will influence the future?

The future of the forestry sector will be highly influenced by demographics since Bangladesh is an overpopulated country with over 970 people per square kilometre. The scarcity of resources coupled with the increasing population is continuously generating pressure. Such increased pressure will continue degradation of the forests, especially on Government lands. The poor manpower and weak morale of the Government FD personnel is aggravating the situation further.

Both the GDP and GNP are increasing but at a slower pace. Though the share of the agriculture and forestry sector is decreasing, poverty is declining and the ratio of the rural to urban population is getting leaner; the gross rural population is on the increase. The probability of having a positive impact on the forestry sector in the near future is very small.

Under serious resource constraints the Government cannot but treat the forestry sector as a low priority sector. Forestry sector activities have been project based for a long time. Recently the major donor agencies such as ADB and World Bank have decided to fund big projects only and since forestry sector projects are small projects and spread widely (often all of Bangladesh), such forestry projects will not receive funds as before. This will cause a serious adverse impact on forestry sector of Bangladesh.

Till recently the FD has had the only say in all the issues of the forestry sector. With the implementation of social forestry activities this approach has started to change. The involvement of other stakeholders is gradually starting. This will let others influence the issues of the forestry sector.

In view of the short supply of lumber, composite wood industries will develop creating a demand for small wood. Such demand shift will call for the production of small wood. The FD thus in future may have to manage Government forests for the production of small wood, along with teak and gorjon lumber.

Poverty being an important issue for the Government, the role of forestry in poverty reduction shall receive general appreciation. The implementation of the FSP has demonstrated that participatory forestry can assist in poverty reduction and in view of this the demand for large scale social forestry programmes may increase in future.

Globalization may cause a small direct impact on the forestry sector, but its positive impact on poverty reduction will bring indirect benefits to the forestry sector by reducing illegal removal of forest products. Globalization may enhance wood imports to Bangladesh.

The demand for furniture in rural areas will continue to increase and this will affect the forestry sector especially the production of wood from homesteads.

Of the ICTPs to which Bangladesh is a signatory, the CBD is the most important one for the forestry sector. The NBSAP prepared under the CBD has clear proposals for afforestation and biodiversity conservation. Under its influence the number and areas under Protected Areas are already increasing. Since all the IPCC reports have identified Bangladesh as one of the most vulnerable countries to sea level rise, activities on mitigation and adaptation measures may increase.

Probable scenarios and implications

The four scenarios envisaged are:

Scenario I: Improving economy and decline in poverty with improvement of policies and institutions,

Scenario II: Weak economy (including increasing poverty) and declining state of politics and institutions,

Scenario III: Improving institutions, but the economy remaining stagnant and
Scenario IV: Improving economy, but politics and institutions continue to remain weak.

A brief matrix evaluating these scenarios is given in Table 43

Table 43. Evaluation of scenario situations for Bangladesh

Key Forestry Elements	Scenario 1	2	3	4
Forest cover	↑	↓	→	↑
Degradation	→	↑	↑	→
Implementation of sustainable forest management	↑	↓	→	↑
Demand for industrial wood and wood products	↑	↑	↑	↑
Wood energy : Supply/ demand balance	↑	↓	↓	↑
Supply/ demand balance of industrial wood	↑	↓	↓	↑
State of biodiversity	↑	↓	↓	↑
State of watershed protection	↑	↓	↓	→
Desertification and degradation	→	↑	↑	→
Forest based eco-tourism	↑	→	→	↑
Conservation and management of wildlife	↑	→	→	↑
Forestry's role in poverty alleviation	↑	→	→	↑
State of public sector forestry institutions	↑	→	↑	→
Role of private sector	↑	→	→	↑
Community involvement	↑	→	→	↑
Role of civil society organizations	↑	→	↑	→

↑ = Increase ↓ = Decrease → = Remain as it is

Of these four scenarios, scenario 1 seems to be the best.

What we may see in 2020

The wood resources in Government forest will be declining. The homestead wood supply will not satisfy the demand and in 2020 more wood may be imported from abroad.

Consumption of firewood, agricultural residues and cow-dung will be increasing, but the rate of growth of firewood use is the lowest. In 2020 the use of fire wood may not increase very much but the use of charcoal may increase slowly.

The use and harvest of thatching materials will decline. The supply of bamboo and cane will increase slowly. The yield of fish may decline. Though the yield of honey from the Government forests will remain constant honey production from reared honey bees may increase. The yield of medicinal plants may increase mostly from cultivation in rural areas.

Of all the service functions of forests the demand for recreation will increase tremendously. The demand for urban parks will also increase. Demand for surface water supply through catchment management by the FD is likely to grow substantially. With increased awareness, the demand on the FD for better environmental parameters is likely to increase substantially by 2020. The need to provide forestry sector information on the FD web site will be very important by 2020.

With the available information it is predicted that in 2020, (Annex 3) against the speculated demand of 28.89 million m^3 of wood the total speculated supply will be only about 14.45 million m^3. Thus there will be a gap of about 15 million m^3.

Conclusions

- This study in general reflected that the "Forests and Forestry in Bangladesh" (Forestry Sector) is experiencing problems. The existing trends are in no way favourable for the overall development of the sector. By 2020 there may be a big gap between the demand and supply of wood. Peoples' expectations from the FD will increase manyfold, especially for forest based recreation, small wood supply, environmental parameters, peoples' participation, etc.

- Though most of the forest lands are managed by the FD the major supply of wood comes from homesteads. All possible lands especially the USF should be brought under proper management. The process of degradation should be stopped.

- The FD should be drastically reorganized on par with other Government administrative set ups. At the same time the Government should allocate adequate funds for the forestry sector and encourage large scale social forestry programmes.

- A national level forestry forum should be put in place to provide guidance to the forestry sector of the country. Of the four scenarios indicated the Government should aim for the first scenario.

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Annex 1. Map of Bangladesh showing the forests and the locations of Protected Areas

Annex 2. Import of wood and its trend

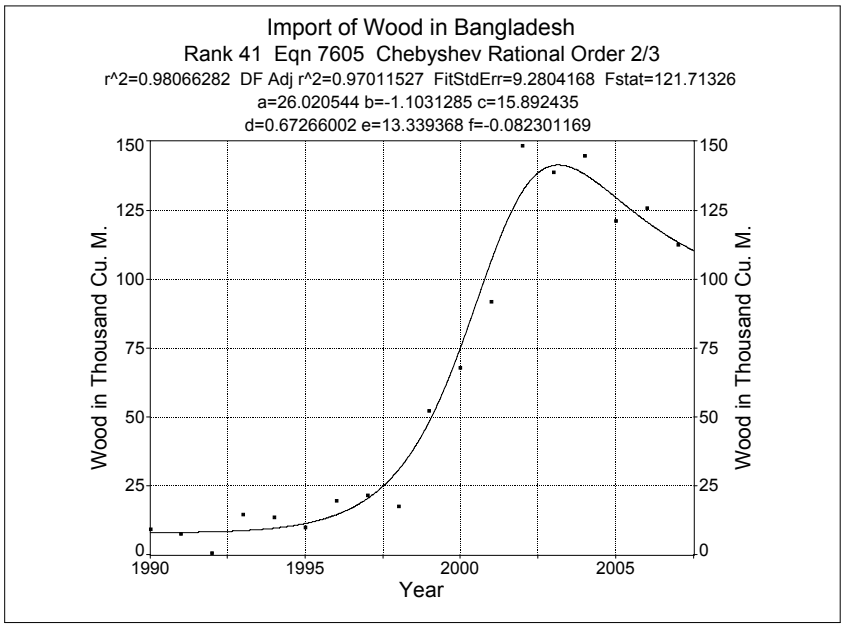
According to government records the year wise import of timber since 1997 is shown in Table A1.

Table A1

Year	Wood Imported from Abroad (in 000 m^3)
1990	9.5
1991	7.7
1992	0.9
1993	14.7
1994	13.9
1995	10.2
1996	19.9
1997	21.65
1998	17.85
1999	52.47
2000	68.12
2001	91.87
2002	148.48
2003	138.88
2004	144.82
2005	121.26
2006	125.94
2007	112.57

Source: Forest Utilization Division, FD, Government of Bangladesh

The best model that may be obtained using these data to project future imports is given below.

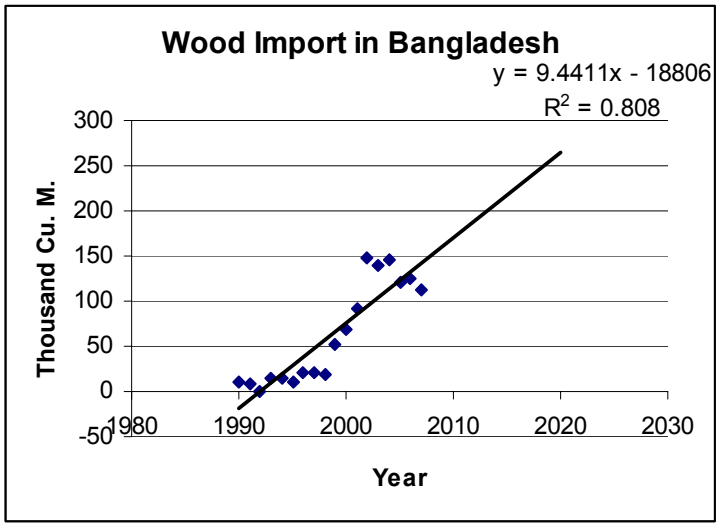


This model fits the real situation on this issue. This model indicates that in 2020 about 155 000 m^3 of wood will be imported by Bangladesh, provided that the FD keeps on raising more and more participatory plantations involving more (new) participants. This will however, need more funds. If such investments are not available to FD the predicted timber import will be much higher (Table A2).

Table A2

Year	Estimated Wood Import in 000 m^3	95 Pred -	95 Pred +
1990	8.2108959	-17.27703	33.698822
2000	75.425025	52.192371	98.657679
2010	101.71304	-2.6410859	206.06716
2020	155.11184	-2164.2416	2474.4652

If a straight line fit is used to project wood imports the graph below will be the result. This does not take into consideration that there will be import reduction due to continued investment in plantation raising.



Annex 3. Supply-demand projections for wood

According to the village forest inventory conducted by Hammermaster in 1981, the rural wood volume, except Chittagong Hill Tracts was 54.8 million m^3 (Table A3)

Table A3

Strata	Total Volume of (8"+ DBH Over Bark) in million m^3 according to the Village Forest Inventory in 1981	Area in Million Hectares
1(Rajshahi)	13.11	3.40
2 (Dhaka)	8.51	2.26
3 (Jassore)	10.08	2.09
4 (Barisal)	9.07	1.64
5 (Chittagong)	10.52	1.50
6 (Sylhet)	3.51	1.72
TOTAL	**54.8**	

This indicates that the total volume of wood in the homesteads of the country (except Chittagong Hill Tracts) was 54.8 million m^3. in 1981. ADB (Forestry Master Plan, 1993) reported that the village groves of Bangladesh supplies about 5 million m^3 every year of which 4 million m^3 is fuel-wood. According to the National Forestry Inventory report prepared by FAO during 2006 (yet to be published) the volume of wood in the corresponding area (the village forest inventory area) was 120.38 million m^3 (Table A4).

Table A4

Strata	Area (of Strata) in Hectares	Gross Volume in m^3 per Hectare as per the NFA Inventory 2006	Volume in Million Cu. M. in 2006
1(Rajshahi)	3402367.5	5.01	17.03
2 (Dhaka)	2260684.4	5.48	12.38
3 (Jassore)	2090012.1	14.39	30.08
4 (Barisal)	1636261.1	20.31	33.31
5 (Chittagong)	1502924.4	13.64	20.46
6 (Sylhet)	1720926.1	4.14	7.12
Total			**120.38**

This means that the wood in the homesteads grew from 54.8 million m^3 in 1981 (Hammermaster's Report) to 120.38 million m^3 (National Forest Assessment done by FAO) in 2006. This means that it grew at of 2.62 million m^3 per year. Using this growth rate the following may be derived.

Table A5

Year	Corresponding Volume of wood in the homesteads in million m^3 using the growth rate of 2.62 million m^3 per year.
1981	54.8 (Hammermaster Fig)
1993	86.24 (Projected)
2000	104.58 (estimated)
2006	120.38 (NFA Inventory)
2020	183.18 (Projected)

ADB (1993) reported that in 1993 homesteads produced 5 million m^3 of wood, which is almost 5.8% of the then growing stocks. If the harvest is done at this ratio of the growing stock, then **in**

2020 the yield from village forests (homesteads) would be about 10.62 million m^3 **excluding Chittagong Hill Tracts.**

It is important to note that the production of wood from the government forest was seriously declining till 2001. With the implementation of the Forestry Sector Project (FSP) the production of wood from the government forests has started to increase and it is estimated that if initial funding required for raising new plantations could be arranged, the production will continue to yield higher quantity of wood.

In the absence of adequate data it is very difficult to get a good picture of the demand and supply position for timber and fuel wood. However, according to the Development Planning Division of the Forest Department, in 2003 the demand and supply of timber was **3.2 and 1.2** million m^3 respectively. The same source indicated that the demand and supply of fuel wood in 2003 was **8.7 and 3.5** million m^3 respectively. These figures however seem to be on the lower side.

ADB (1993) indicated (Forestry Master Plan) the requirement of wood in 1993 as **1.8** million m^3. With assumed GDP growth of 5%, the requirement of wood in any given year may be computed.

Douglas (1981) reported the per capita use of wood was as shown in Table A6.

Table A6

Item	Per capita use in m^3
Furniture	0.062
Implements	0.010
Boats	0.007
Others	0.006
Total	0.085

In 1981 the population of the country was 87.12 million. Thus the total demand in 1981 was **7.41** million m^3. If we project this, using GDP growth of 5%, the **demand for wood in 2007 comes to 16.18 million m^3.**

Under the recently completed Forestry Sector Project; between 2001 and 2006, plantations over an area of **42085** effective hectares were established. The growth rate (MAI[33]) in these plantations ranges from 0.5 to 9.97 m^3. Using an average MAI of 5 m^3 pre hectare per year, at maturity (ten year rotation) each hectare will yield about 50 m^3. of wood. Roughly about one tenth (ten year rotation) of the effective area will be felled every year and thus every year about 4,200 hectares (since 42,085 effective hectares of plantations were raised) will yield about 0.21 million m^3 of wood. Since the plantations raised under the Coastal Greenbelt Project (CGP) have been taken over under the FSP, the CGP plantations (area) are not considered separately. These plantations will continue to be sustainable due to participatory activities and there are the legal provisions of the Tree Farming Fund (TFF). If no new plantations are raised **every year these FSP plantations will yield about 0.21 million m^3 of wood.**

Table A7 summarizes the demand-supply situation.

[33] Mean Annual Increment.

Table A7

	Item	Million m^3 against the given year					Remarks
		1981	1993	2003	2007	2020	
					Projected using 5% GDP Growth		
DEMAND	Demand of Timber in million m^3		1.8[34]		3.56	6.72	ADB Data.
	Demand of Timber in million m^3			3.2[35]	3.89	7.33	FD Data.
	Demand of Fuel-wood in million m^3			8.75	10.58	19.94	FD Data
	Demand of Timber + Fuel-wood in million m^3	7.41[36]			16.18	**30.51**	After Douglas. In 1981 Demand/capita was 0.085 Cu. M. Population was 87.12 Million.
	Demand of Timber + Fuel-wood in million m^3			11.95	14.46	**27.27**	According to FD Data.
SUPPLY	Supply of Timber in million m^3			1.25			According to FD
	Supply of Fuel-wood in million m^3			3.55			According to FD
	Supply of Timber + Fuel-wood in million m^3					**14.45**	Homestead = 10.62[37] FSP Area = 0.21[38] FD Area = 3.62 Provided Social Forestry planting continues at the existing rate.

Thus in 2020, against the speculated demand of 28.89 million m^3 the total speculated supply (excluding[39] CHT) will be only about 14.45 million m^3 of which

a) 10.62 million m^3 will come from the village groves,
b) 0.21 million m^3 will come from the Forestry Sector Project Areas, and

3.62 million m^3 will be available from government forest land, only if the FD gets the funding and goes for new social forestry plantations.

Thus:
Speculated demand in 2020 = 29 million m^3
Speculated supply in 2020 = 14 million m^3

Thus there will be huge gap of about 15 million m^3 between demand and supply in 2020.

[34] From ADB report 1993
[35] FD Report
[36] Computed from the report of Douglas 1981
[37] Projected 10.62 million m^3
[38] Computed assuming that every hectare of FSP plantation will yield 50 m^3 and 4,200 hectares will be felled every year
[39] Since no major afforestation program has been initiated in CHT and since there is a moratorium on the harvest from natural forests, as of today, there is no expectation of getting any additional yield from CHT in year 2020.