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MINISTRY OF WATER RESOURCES

BANGLADESH WATER DEVELOPMENT BOARD

MEGHNA ESTUARY STUDY

DRAFT MASTER PLAN

VOLUME 7 : FORESTRY

September 1998

DHV CONSULTANTS BV

in association with

KAMPSAX INTERNATIONAL
DANISH HYDRAULIC INSTITUTE

DEVELOPMENT DESIGN CONSULTANTS
SURFACE WATER MODELLING CENTRE
AQUA CONSULTANTS AND ASS. LTD

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ABBREVIATIONS

ACCF	Assistant Chief Conservator of Forests
ADB	Asian Development Bank
BFRI	Bangladesh Forest Research Institute
BWDB	Bangladesh Water Development Board
CA	Coastal Afforestation
CCF	Chief Conservator of Forests
CERP	Coastal Embankment Rehabilitation Project
CF	Conservator of Forests
CGP	Coastal Green Belt Project
DCCF	Deputy Chief Conservator of Forests
DFO	Divisional Forest Officer
DLUPU	District Land Use Planning Units
FD	Forest Department
FRMP	Forest Resource Management Project
GIS	geographic information systems
GoB	Government of Bangladesh
LGED	Local Government Engineering Department
MES	Meghna Estuary Study
MOEF	Ministry of Environment and Forests
PWD	Public Works Department
WARPO	Water Resources Planning Organisation

1. INTRODUCTION

1.1 General

The present report on forestry forms part of the sectoral reviews pertaining to the main economic activities proposed for development in the Meghna Estuary. It gives a brief presentation of the forestry sector in Bangladesh, mainly based on the Forestry Sector Master Plan, outlining the major constraints and opportunities for forestry development in Bangladesh.

Rather than attempt to describe the whole sector in detail, it focuses on the aspects relevant to the Meghna Estuary Study area. Instead of describing the sector from an institutional point of view, a more technical approach is taken that would contribute more directly with the objectives of the MES in making forestry options available to mainly the engineering section, as this comprises the main component of the study. Institutional aspects will be dealt with in the context of the individual issues whenever they become crucial enough.

Likewise, lengthy biological/ecological description and explanations of biophysical interactions conditioning mangrove forest growth and sustainability will not be dealt with in detail, as this pertains more to natural mangroves like the Sundarbans, with their fragile ecosystems and the inherent difficulty of devising sustainable management plans in view of biodiversity issues versus the human pressure for obtaining short term benefits. We are dealing with manmade forests which presents a much greater degree of freedom for proposing management options on the one hand, more similar in nature to normal forest plantations in up-land areas. On the other hand, problems with land stability and risk of erosion (and thus for investment), provides for a special situation where forestry must go hand in hand with hydrology and morphology in order to ensure a long term development of forestry, and hence the well-being of the populations in the estuary.

2. PRESENT SITUATION

2.1 Institutional set-up

The administration of the forests of Bangladesh is carried out by the Forest Department, which falls under the Ministry of Environment and Forests (MOEF). It is one of the oldest governments organisations, which has changed a great deal in mandate, but not so much in structure.

The structure of the Forest Department is hierarchical. The Department is headed by a Chief Conservator of Forests (CCF). At FD's headquarters, the CCF is assisted by three Deputy Chief Conservators (DCCF), responsible for forest development planning, forest extension, and forest management planning, respectively.

Each DCCF is supported by an Assistant Chief Conservator of Forests (ACCF). Reporting to the CCF is also a Conservator of Forests (CF), who with the assistance of two ACCFs, is responsible for general administration and wildlife. Furthermore, the Directors, both of FD's Forest Development and Training Centre at Kaptai and the Thana (Upazila) Afforestation and Nursery Development Project, now Forestry Sector Project are directly responsible to the CCF.
FD's field operations, consisting of six Circles headed by CFs and concerned with territorial forestry, come under the CCF's direction. The CF of each Circle is in charge of several Forest Divisions, which are not normally within the boundary of an administrative district, and under the charge of a Divisional Forest Officer (DFO). There are 37 Forest Divisions. Each Division is divided into several forest ranges which are controlled by Forest Range Officers, who in turn are in charge of several beats, each under a Deputy Ranger or Forester. The total staff strength of the FD at present is about 9000. It also employs a large number of labourers on a casual basis for its field activities.

Regarding institutional changes, there have been several proposals. In the late 1970's, there was a proposal to divide the Government forestry activities into five Directorates: Forests,

Forest Plantations, Extension, Forestry Research and Training, and Forest Exploitation to be co-ordinated by an IGF. There was an IGF for several years. However, this was not followed up, although Forest Research has since come under an independent institution, Bangladesh Forest Research Institute, BFRI, located in Chittagong.

These reorganisations (as against restructuring) essentially addressed the lack of manpower for specific tasks. In contrast to this, the bureaucracy has grown to such a large size as at present, but the lack of delegation of adequate power and authority stifles the initiative and effectiveness of the organisation.

Furthermore, the mission(s) of the FD, when the policies are vague or misinterpreted. For example, the mission of serving the people is ignored in favour of the colonial policy of keeping them out of the forest (i.e. policing as the means of protecting forests), and exploiting them (i.e. through taxes and levies); and such distortions has had disastrous effects.
Combined with lack of skilled personnel in key fields, the situation merits a drastic change in institutional structure and effectiveness.

There are four Coastal Afforestation Divisions, located in Chittagong, Noakhali, Bhola and Pathaukali. (See map Figure 2.1). For the coastal areas, a special institutional arrangement is in force. A CF office at Khulna under the name Plantation Circle, was established for supervising coastal plantations relating to those four Coastal Afforestation Divisions and enforcement of prescription relating to the management of the natural mangrove forest of Sundarbans Division. In 1993, this circle was bifurcated with the creation of two Forest Circles, known as Coastal Circle with Headquarters at Dhaka and Khulna Circle with Headquarters at Khulna respectively. The former looks after the plantation activities of the four Coastal Afforestation Divisions and the later looks after the management aspect of the Sundarbans Division. A separate Division named as Plantation Trial Unit Division with Headquarters at Barisal and which is under the administrative jurisdiction of BFRI looks after the research aspects of these four Coastal Afforestation Division and another Division, known as Mangrove Silviculture Research Division with Headquarters at Khulna looks after the research activities of natural mangrove forest of the Sundarbans Division. The Divisional Forest Officers of Working Plan Divisions are under the control of DCCF Management Planning. An organogram is presented in Appendix 1.

The Management Plan Division for Khulna is charged with preparing, updating and revising forest management plans both for the Sundarbans and coastal plantations.

2.2 Forest Policy

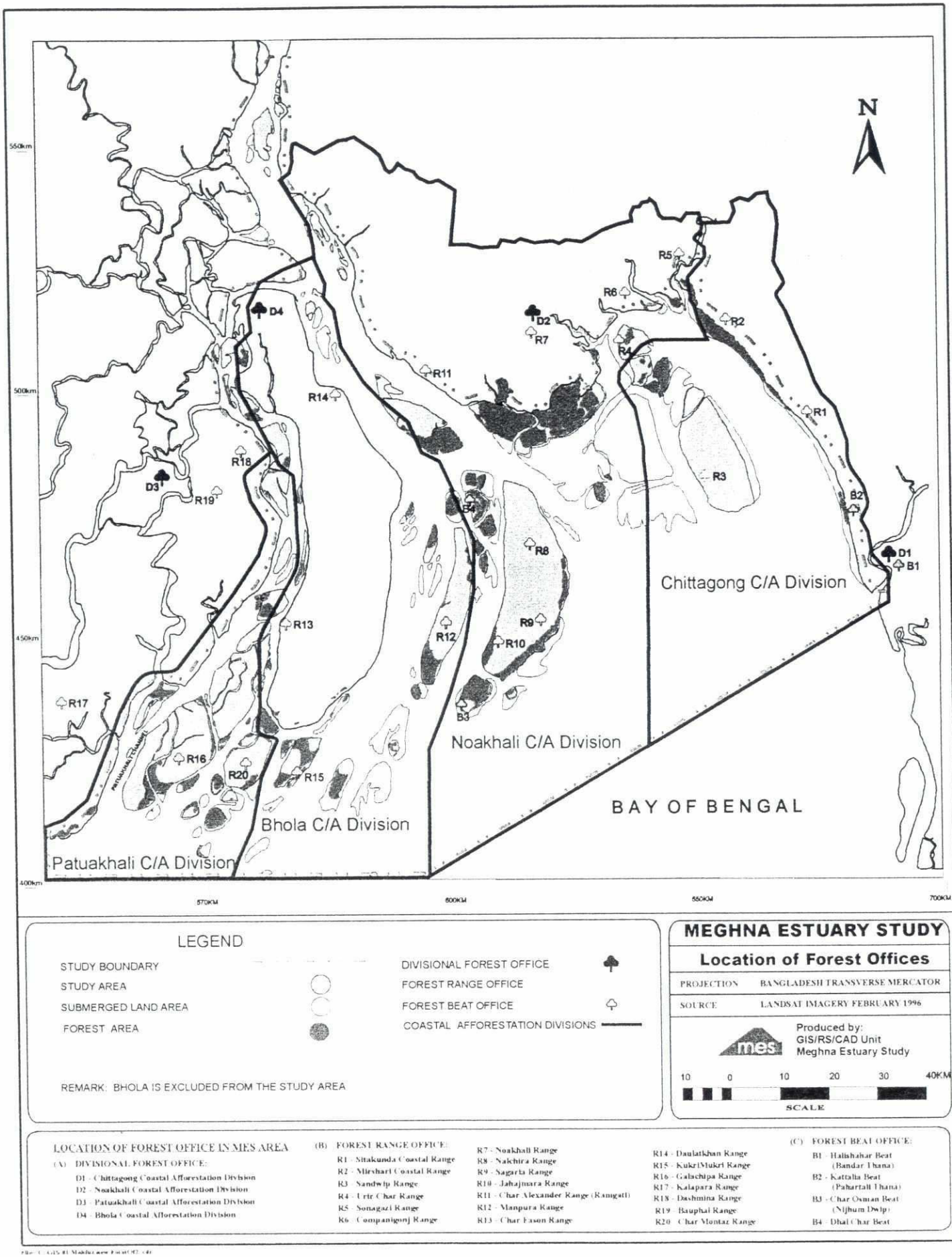
2.2.1 National Forest Policy

The principles regarding the use of Bangladesh's forest resources, is guided by the policies contained in the National Forest Policy, adopted by the GoB in 1979. Historically, it is based on the British India Forest Policy of 1894, which laid down public benefit as the sole objective of management of public forests, but demand for cultivable land was proposed to be ordinarily met by clearing forest areas.

The 1894 Forest policy was, therefore, re-oriented to give more emphasis on: extension of forests to private lands; sound management of private forests; control of land-use and soil erosion through co-ordinated programmes, awareness raising and encouraging farm forestry; improving management, creation of a forest service of fully trained personnel; organising forest research and education, and conservation of wildlife and improvements of their habitats.

A new and more pragmatic National Forest Policy was approved in 1979 which stresses the need to manage scientifically the nation's forests and prevent their conversion to other uses, the expansion of plantation forestry, research, training, institutional development and updating of the forest laws.

Figure 2.1 : Coastal Afforestation Divisions in the Study Area



This Policy was recently revised in 1994, in response to the recommendations of the Forestry Sector Master Plan from 1992. The new forest policy has among its objectives, laid greater emphasis on people-oriented forestry programmes to manage the environment, to preserve existing values and to conserve plants and animals and to maximise benefits to the local people.

The new forest policy further emphasises that in order to safeguard the future of the national forest, protected areas and plantations, the genuine and legitimate needs of the local people will have to be accommodated through appropriate participatory arrangements. Under this new forest policy, three major programmes have been formulated to realise this vision. These are people-oriented programmes, Production-Directed programmes and Institutional Strengthening programmes.

The more people-oriented programme is line with the recommendations of the of the Forestry Sector Master Plan and would promote conditions where people will benefit directly by participating actively in tree growing and forest management. Further, community forestry and socially oriented forestry will be promoted by giving priority to poorer communities and poorer members of the community in the allocation of forest land for tree plantation. The 1994 policy is included for reference in Appendix 2. It can be seen that it is a major step forward from the past, but it still seems too general in its statements and not comprehensive enough in its recommendations.

The Five Year Plans

The focus of the evolving forest policies have been reflected in the government's development plans.

During the 1st Five Year Plan (1973-1978), to the 3rd Five Year Plan.(1985-1990), major emphasis was given on exploitation of natural forest for providing increased supplies for wood and wood products, shifting towards raising the productivity of existing forest land as well as development of new forest resources in the state forest and homestead land, and introduction of forestry in the rural community development.

The objectives of the 4th Five Year Plan.(1990-1995) were broader: emphasis was given on rehabilitation and reafforestation of degraded natural forest land, in an attempt to bring all possible public and private vacant land under tree cover, focusing on the people's basic needs for forest products integrating trees with farming in traditional land use, creation of employment opportunities through plantation programmes, albeit the quality of the plantations was poor because of lack of proper maintenance.

The main objective during the current Five Year Plan (1997-2002) is to expand the forest resources, make forests productive, institutional development and peoples participation. A goal is set to double the forest cover and to ensure a sustained yield in the state forests.

2.2.2 Coastal zone forest policy

After realising that mangrove plantations had a confirmed positive effect in reducing damages caused by cyclones, a government policy on coastal afforestation and a forestry programme was initiated. This programme accelerated during the seventies, with World Bank support (the Coastal Afforestation Programme), and is continuing today under various projects and financing organisations, targeting coastal afforestation either as a main activity or as a component in wider ranging forestry programmes.

The original objective of the mangrove afforestation was to provide initial protection to coastal communities against cyclone damage. A secondary objective has been the role of mangrove plantations in stabilising newly formed lands.

Emerging land is state land and falls under the jurisdiction of the Ministry of Land. It was decided through a ministerial memorandum of the Ministry of Land Administration & Land

Reforms dated 10.08.1976 that the land will be afforested and managed by the Forest Department for a period of 10 years after which the land will be returned to the Ministry, ostensibly for the subsequent conversion for agricultural development. Some guidelines and procedures for the legal issues concerning conversion and hand-over to farming communities were proposed. However, this period has subsequently been extended to twenty years, and no land has so far been converted (see Appendix 3).

Contemporary thought in the FD is that these lands should remain under mangrove plantation.

2.3 Coastal zone forest resource assessment

2.3.1 General

A word of caution should be said here before venturing into the realm of statistics in the forestry sector. As expressed in the Forestry Master Plan (1993, Volume 6, p.6):

The information base in the forestry sector of Bangladesh is very weak. There is a multiplicity of figures related to almost every aspect of forestry. Different figures are seen presented in different reports and often in different sections of the same report. In the absence of a system to reconcile the differences and presenting a correct, consistent and uniform statistics, one is confronted with a situation of having to make best possible generalisations and educated guesses based on incomplete, inconsistent and sometimes conflicting statistics. Therefore, the quantitative figures appearing in this report [The Forestry Master Plan] have no claim for accuracy and serves only to present broad orders of magnitude and comparisons.

However, the trends are very clear. The forests of Bangladesh are being continuously depleted in terms of area and quality of the forest resource. There are only two surviving areas of natural forests of major importance, the Chittagong Hill Tracts and the natural mangrove forests of the Sundarbans. The estimated area of land classified as forest is only 769,000 ha (1990 estimate), of which much of it is not closed forest. Changes within forest is not reflected in the estimates, although significant degradation has occurred in the Sundarbans over the past decades. Losses through deforestation (described as areas falling below 10% tree cover) in Bangladesh was estimated by the FAO as about 8,000 ha per year between 1971-80. Between 1981-90 this was up to 37,600 ha per year. The current estimate puts the total forested area below 3% of the total land area.

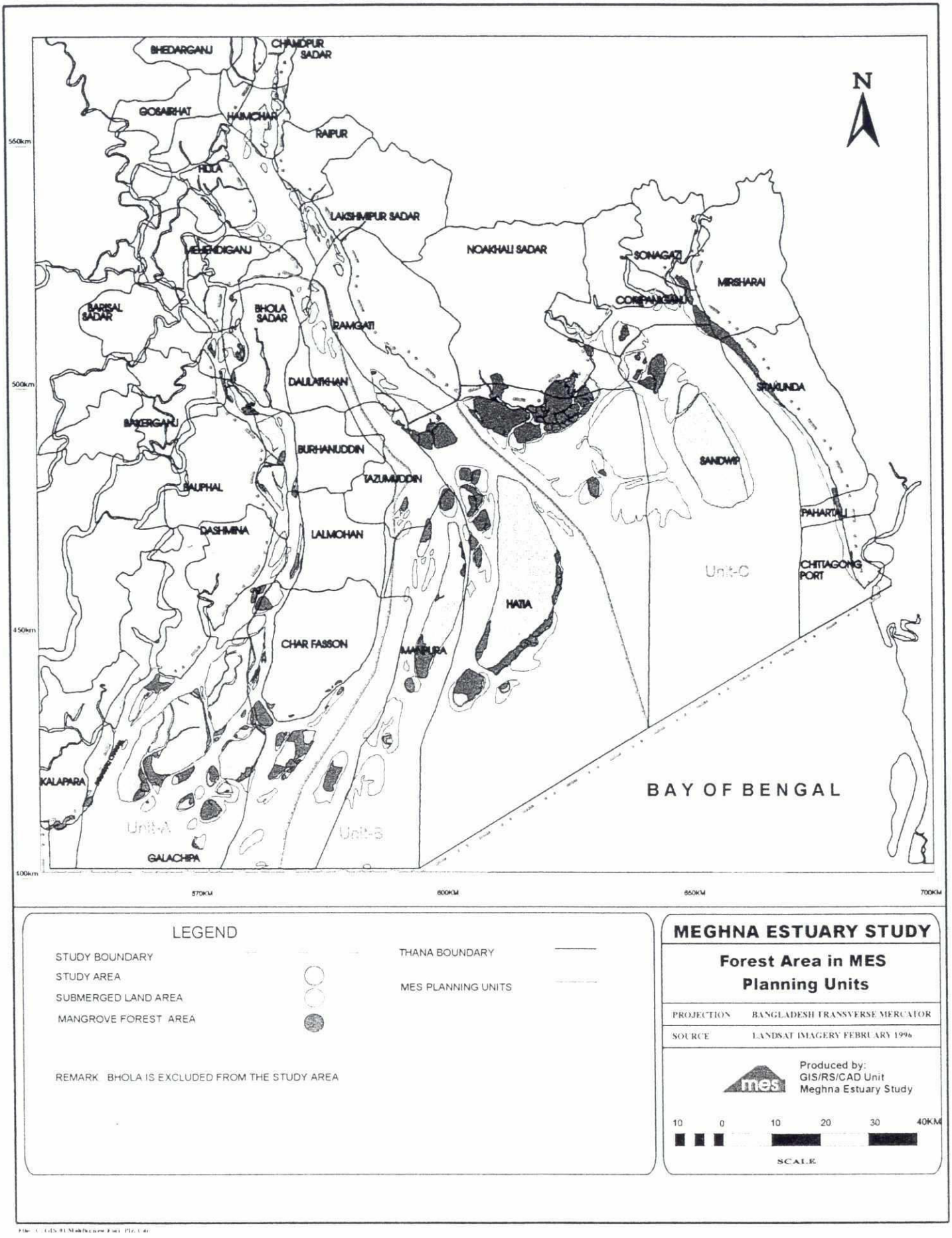
The Forestry Master Plan stated that If this trend is not contained, the forests of Bangladesh will not last through the period of the Master Plan (20 years).

In line with this catastrophic situation, the per capita consumption of wood and forest area per person ranks among the lowest in the world, due largely to the lack of supply: The consumption of wood is estimated at 0.08 m^3/year of timber, plus 0.07 of fuelwood. Average world-wide in developing countries is about ten times as much. The total forest area per capita is about 0.02 ha.

The FD indicated a total wood production of about 482,000 m^3 in 1991 (from state forests), down from three times as much only six years earlier. This was attributed to the moratorium on logging in natural forests introduced in 1990.

However, there are no data on the actual consumption broken down by sources, types or consumer preferences etc., but it is estimated at about 20 times the production. This gap is believed to be filled largely by homestead production and illicit fellings in the government forests (i.e. the felling continues in the natural forests despite the moratorium). Although this represents a disastrous future for the resource base, from a market point of view it is quite the opposite: the demand can only rise, much more so if considering the population explosion.

Figure 2.2 : Forest Area in MES Planning Units



2.3.2 Existing mangrove forest area

The last major inventory was carried out in 1986 of the maturing mangrove plantations of the Coastal Afforestation Project, covering the plantations established prior to 1980. Over 4,000 ha had been established annually since the mid-seventies. The inventory showed that at that time about 15,000 ha were established, in general of good quality. (See Drigo, R. et. al. 1987.)

The latest inventory has been carried out in 1998 under the Forest Resource Management Project, although these data have not yet been published.

In order to obtain an overview of the forested area and growing stock, the MES forestry team carried out an assessment of the mangrove forest resources in January 98 (the results have been presented in MES Technical Note No. 013). Existing research data was reviewed, particularly from the BFRI in Chittagong, and all four Coastal Afforestation Divisions (CAD) were visited and sample plots measured.

Forest Department sources indicate that more than 100,000 ha were planted from the early seventies till now (mainly compiled from reports of annual plantings per range from the respective divisions).

In the highly dynamic environment in which the plantation are established, some are bound to be lost due to different factors. The losses are mainly attributed to erosion, but heavy siltation is also a major threat. It is, therefore, evident that the mangrove coverage is difficult to assess and monitor, also considering the lack of maps and sophisticated tools in the ranges. Furthermore as mentioned earlier, data sources for forestry statistics are extremely unreliable.

In order to verify these data, the MES digitised the mangrove forest resource based on Landsat TM 96 Satellite images to reach a more accurate area estimate. A map of the mangrove forest based area is shown in Figure 2.2.

The results are shown in the following table (Table 2.1), based on MES findings (see also Table 3 of the MES Tech. Note 013). The MES data are believed to be highly accurate, as regards the total, but there may be some error in the Chittagong area estimate, which may be too low. As the estimates are based on digitising each char, it is possible that a few chars have been assigned erroneously to Noakhali division. It remains to be verified. Likewise, an area of approximately 2,000 ha west of Bhola has not been included due to interpretation difficulties.

Table 2.1: Total Forest Area per CA Division

Coastal Afforestation Division	Area (ha)
Chittagong	5,764
Noakhali	30,359
Bhola	9,428
Pathuakhali	10,779
Total Area	56,330

Source: MES

Since the time of compilation of Table 2.1, new and better estimates of the yearwise plantations have been compiled, which gives a slight change in the distribution of areas among the CA Divisions, as compared with the MES Technical Note - 013.

Table 2.2: Yearwise Plantations in Existence, 1998

Age Class	Year	Age	Chittagong	Noakhali	Bhola	Patuakhali	Total
1971-75	73	25	129	616	71	423	1,239
1976-80	78	20	980	4,059	1,740	2,844	9,623
1981-85	83	15	1,571	7,905	2,403	2,384	14,263
1986-90	88	10	1,303	6,805	2,240	1,815	12,163
1991-95	93	05	1,243	7,627	1,959	2,673	13,502
1996-00	98	01	538	3,347	1,015	640	5,540
Total			5,764	30,359	9,428	10,779	56,330

Note: Age class distribution based on revised FD data/verifed by MES

2.3.3 Growing stock and yield

The mean annual increment was determined to be between 5-10 m^3/ha/year, lowest in the east (Chittagong) and highest in the West (Patuakhali), under the inventory carried out by the FAO in 1986. (See Drigo, R. et. al. 1987.)

The MES confirmed that growth and yield varies with site quality in the estuary, and found growth rates for Keora between 2m^3/ha/yr in the eastern part of the estuary to 10 m^3/ha/year in the west.

The total standing volume under full stocking (100% tree coverage) reaches would yield 150-200 m^3/ha. (total stem volume) after 25 years (see MES Technical Note 013).

The total volumes calculated as per the MES assessments, are presented in the following table.

Table 2.3: Total Volume of Keora Mangrove Plantations in Meghna Estuary

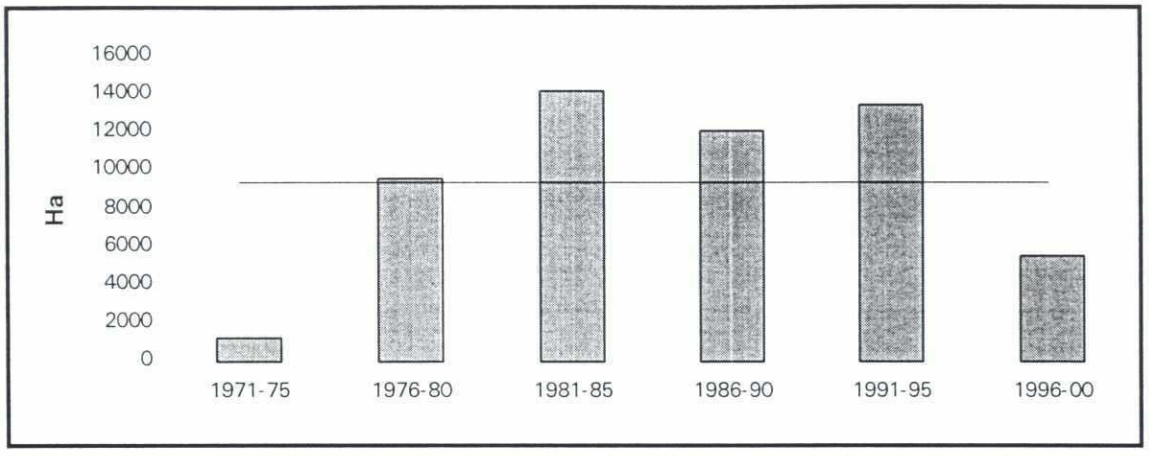
Age /Class	Total (ha)	Total Volume (m^3)
1971-75	1,338	281,930
1976-80	11,827	2,270,752
1981-85	16,476	2,899,446
1986-90	13,213	1,631,297
1991-95	9,004	332,177
1996-00	4,472	10,418
Total	56,330	7,426,020

Source: MES assessment 1998

Some caution should be exerted here. The volume figures presented in the Technical Note are based on 100% stocking. With the reduced number of sample plots measured by MES, some error is inevitable. Also, the volume figures represent total stem volume (excluding branches) not commercial volume as is normally presented. The purpose of using total volumes rather than commercial volume is due to the fact that the end uses of this species are expected to be mixed fuel wood, or pulp, where one would normally use the whole tree, as compared to the sole use for timber in saw Millioning. In all cases the standing volume is very large.

Age class distribution of the plantations is shown in the following figure, with the total area of the combined CA divisions shown in ha for each five year period since 1971.

Figure 2.3: Age class distribution of the mangrove plantations



The line shown at about 10,000 ha represents the normal situation where all age classes are equally represented, meaning that to obtain a sustained yield from the plantations over a 25 year rotation, the same area (approximately 2,000 ha per year) should be planted each year as is felled.

As can be seen, some age classes contain less, others more than the desired area. The main deviation is in the older age class, probably simply because not so many hectares were planted in those years, but is probably also due to the stagnation and breaking up of these over mature plantations.

In the youngest age class, data is not complete (up to year 2000) as they are still being planted.

The significance of an uneven age class distribution is that obviously there will be a large variation in both outputs and capital inputs over the years, requiring certain agility in adapting to different operational situations.

It is obvious also that a change in rotation length will also have a significant influence on operations and plantation economy.

2.3.4 Plantation establishment

When a grass, usually Uri (Oryza coarctata),or algae cover some 50% or more of a sediment surface it is a good indicator of stability justifying planting. This normally occurs when the sediment surface is more than 1.5 metres above the PWD (mean sea level as set by the Public Works Department). However, it varies between 0.7 and 1.5 m depending on the tidal range. As this varies from East to West, being lowest in the West, it is normally possible to start planting earlier in the West than in the East. Irrespective of this, the most certain indicator of when to plant is the appearance of Uri grass.

Factors detrimental to plantation establishment could be too high accretion levels (more than 0.5 m per year), which could cover newly established plant, erosion of the planting site or sand deposits by high tides or waves.

2.3.5 Accretion

The role of the mangrove plantations in stabilising mudflats has been recognised since the sixties and seventies.

Mangroves provide excellent check or baffles (particularly species with well developed pneumatophores or stilt root systems) which reduce the flow velocity of any sediment laden current passing through them, thus increasing sedimentation, while at the same time consolidating the newly emerging char.

It was quickly realised that mangroves enhance accretion when planted on newly emerging land, along with other accretion enhancing measures like settlement basins and cross dams, in fact, it seems afforestation with mangrove species would be highly beneficial to include as a project component and integral part of any physical intervention aiming at enhancing accretion.

2.3.6 Selection of the site and species

Site selection would thus be done where there is a high probability of stability over the life of the plantation. Species are selected according to the frequency of inundation and salinity. Keora (Sonneratia apetala) is planted on areas with daily inundation and low salinity, Baen (Avicennia sp.) on areas with higher salinity.

2.3.7 Plantation establishment and management

Planting is done utilising seedlings about 25 cm tall. The seed is sown in simple plant beds that are inundated once a day. After two months the plants are ready for planting, which is carried out during the rainy season. A spacing of approximately 1.5 x 1.5m corresponding to 4,300 trees/ha is normally used. Beating-up is necessary, often requiring a large percentage of the number of plants originally planted. The mangrove plantation does not require much weeding subsequently, but climber cutting would be carried as required.

The total cost of plantation establishment as estimated by the MES to be between 10-15,000 Taka per ha (see MES Technical Note 013) utilising approximately 3,500 plants per ha.

2.3.8 Natural regeneration of mangroves

Natural regeneration of mangroves in the coastal areas of Bangladesh would seem a viable alternative to planting. The BFRI conducted trials to test the possibility of regenerating mangrove species under natural conditions as a means to reduce establishment costs of the plantations in the coastal area. They showed that there was a significant difference in regeneration between the 12 chars studied, but in any case there were not enough seedlings per ha to ensure the establishment of sound plantations. However, the MES team has observed profuse regeneration in Nijhum Dwip and the Char Montaz, mainly of Gewa, but only sporadically throughout the plantations. There is therefore not much perspective in pursuing management prescriptions for natural regeneration as a means of ensuring a second generation in a succession management scheme on a large scale (see also Siddiqi, N.A. et. al, 1995).

2.3.9 Biological succession - under planting

Mangrove conditions at many places have changed significantly due to continuous siltation (or erosion in some cases). The coast line expands under new accretions and low chars gradually and sometimes rapidly become high chars with less frequent inundation and high salinity. These drastic changes result in the loss of growth and vigour of the mangrove trees. This also predisposes them to attack by pests and diseases, and a large area of Keora plantations has already been infested with stem borer (although this does not seem to be a major problem).

In most cases, i.e. where sedimentation has passed approximately 2 m above PWD it is not possible to continue planting Keora on a sustainable basis as the ecological conditions will have changed too much, and the problems of finding a successor for the mature Keora plantations is imminent.

It seems logical to look for species appearing normally in the biological succession of the Sundarbans. A schematic diagram of the succession is presented in Appendix 5 which shows the species succession in relation to the varying degrees of salinity in the Sundarbans.

Some of these species have been tried in the coastal area with Keora. In order to test the feasibility of introducing successor species in the older plantations, some interesting experiments with under planting have been undertaken by the Plantation Trial Unit division under the BFRI. These have shown great promise, particularly in the Western part of the estuary.

The most successful species are Gewa and Sundri, but also Passur, Khalssi, Hantal and Shingra is doing very well under thinned stands of Keora. In other stands natural regeneration of Gewa shows great promise of being able to take over after Keora in a resemblance of natural succession in Sundarbans. In other highly raised areas, non-mangrove species have shown promise.

The results of these under planting trials are shown in the following Table 2.4

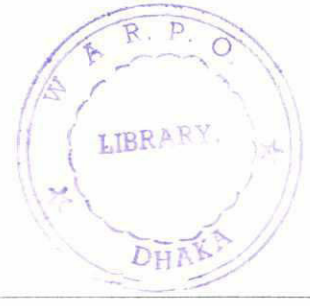
Table 2.4: Performance of mangrove species in the under planting trial at Char Kukri Mukri

Name of species	Two-year old plantation			One-year old plantation		
	Mean seedling height (cm) at planting	Annual height increment (cm)	Average survival (%)	Mean seedling height (cm) at planting	Annual height increment (cm)	Average survival (%)
Heritiera fomes	60	23	95	46	9	97
Xylocarpus mekongensis	73	4	52	84	39	99
Excoecaria agallocha	33	123	95	45	73	100
Ceriops decandra *	16	16	58	30	6	97
Bruquiera sexangula *	34	4	1	43	9	93
Aeqiceras corniculatum *	22	44	70	50	24	97
Cynometra ramiflora	40	28	71	37	9	93
Phoenix paludosa *	28	44	89	32	57	100
Xylocarpus granatum	-	-	-	86	13	97
Lumnitzera racemosa	-	-	-	-	-	-

Notes: 1. * - browsed by the spotted deer (Axis axis)
2. Siddiqi N.A. , Khan M.A.S et al, 1992

2.3.10 Wildlife - introduction of deer

On some of the Chars in the Estuary, wildlife has been introduced, in the form of the spotted deer, with the objective to enrich the biodiversity in the new areas . This has quickly become a problem for forestry, as their preferential browsing habits make growth and development difficult of precisely the most interesting successional species. This is also reflected in Table 2.4, which shows the detrimental effects of deer browsing. Only Gewa is not affected by deer. If deer were introduced in all of the Estuary, this might well pose a threat to the future of the mangroves plantations. Also, it might require fencing of new plantations, which would seriously degrade the economics of a plantation.



2.3.11 Non mangrove species in the estuary

Another possibility of regenerating the mangroves on high land, would be to plant exotic non-mangrove species in the area. Acacia nilotica and Albizzia procera were tried in several locations in the estuary, planted on raised mounds (it is generally not possible to plant on flat land due to salinity). The results showed average growth but poor form. A. procera had good growth in Char Majid in Noakhali, averaging 0.90 m in height growth per year. Others were about half that. Survival was acceptable, but grazing was a problem.(Siddiqi 1993).

2.3.12 Thinning

Thinning in Keora is dependent on the objective of the plantation. Thinning increases the diameter and thus the quality and price of the end product, especially if logs for peeling or timber is expected.

As most mangrove plantations are established for other purposes, namely protection and possibly fuelwood production, thinning may not be necessary. Furthermore, the cost of thinning could in some instances represent an effective loss from the plantation, if markets are not guaranteed, as has been the case in some thinning trials.
Rotation lengths can be as short as 6-12 years if the primary purpose is to produce firewood.

The normal spacing used by FD is 1.2 x 1.2 m to 1.5 to 1.5 m. Natural thinning (high mortality due to competition) in Keora was studied by Siddiqi (1988). He concluded that thinning would have to be carried out before the 8th year in order to have any effect.

The MES team have made similar observations (see MES Tech. Note 013, Figure 2), but instead suggest that thinning is not necessary if sufficient plant spacing is assured at the establishment, to e.g. 1.7 x 1.7 m plant spacing. This would also reduce further the costs of plantation establishment.

2.3.13 End uses and markets

Keora is normally not appreciated as having good properties for various non-destructive end uses.

It is normally used for packing boxes and furniture of low quality. It is being used locally as fuelwood, and in fact compares favourably with other species like mango and raintree, which are commonly used in the coastal area homesteads. Its calorific value is higher than that of mango and its specific gravity is 0.56, as compared with mango 0.54. It seems consumer preferences determine its low esteem in the population. Much more could be done to popularise Keora as a fuelwood source, given the acute shortage of wood in the coastal zone, this would require a change in FD policy. Presently fuel wood is only being produced in salvage operations where land is being eroded or in connection with clean-ups after cyclone damage.

Although it would be very good for charcoal production, this is not being produced traditionally in Bangladesh in great amounts.

Other obvious uses would be for pulp and hardboard manufacture and other destructive processes. The BFRI has carried out a small study of the potential for using Keora for hardboard production. It was found that the main stem portion of the trees, without bark, produced hardboards as good as Sundri (H. fomes, common in the Sundarbans), with a modulus of rupture of between 3-4,500 psi vs. 3-3,500 of Sundri. This would give boards of Class-1 quality (Khan, M.S. & Shafi, M. 1992). When bark was mixed in, the strength dropped off significantly, to a level of 50% of the unbarked. The tops and thinning of smaller dimensions could also be used, but would result in only standard quality. Branches were not usable.

Expected price levels for the end-products are not readily available. Some estimates are given in FAP 4 Final Report, indicating auction prices (1993) from FD depots and stumpage prices in Tk/m^3. Fuelwood prices from mangrove species are indicated as between 636 and 848 at the auction, whereas stumpage price is given as between Tk 247 and Tk 388/m^3. For poles, the prices are between Tk 4,237 - Tk 5,659/m^3 auctioned, and between Tk 2472 - Tk 3884/m^3 stumpage. Peeler logs are indicated as Tk 6,709/m^3 auctioned and Tk 4,237/m^3 stumpage. For saw logs, the prices are indicated as between Tk 8,300/m^3 for short rotation at auction depot to Tk 12,360/m^3 for long rotation sawlogs. Stumpage prices are indicated as Tk 5,473 and Tk 9,181/m^3 respectively.

The same source has calculated the economic rate of return using these inputs as 24% for mangrove plantations on accreted land.

2.4 Mangrove management planning

At present there are no clear policies and guidelines for mangrove management. In fact, there has been no management planning at all since the first establishment of plantations in the seventies until now. The FRMP has recently made a management plan for the Noakhali CA Division, which is still not published.

At the divisional level, planning has been concerned with nursery raising plantation establishment.

There is a need for the Forest Department to review the choice of species, length of rotation, management regimes, partial and final harvesting, regeneration of forest and the utilisation and marketing of forest products and to formulate clear policies and guidelines accordingly for scientific management of the mangrove forest plantations.

The harvesting of mangrove plantations was initially fixed at 10 years, then to 15 years and presently under IDA assisted Forest Resource Management Project (1991-92 to 1998-99), it has been tentatively fixed at 17 years. From these considerations, most of existing mangrove plantation have reached maturity for felling. However, actual rotation periods may be significantly different.

2.5 Protective role of the mangroves

Mangrove plantations play an important role in moderating the coastal storms at the interface between the land and the sea. Cyclones can inundate lands or overtop embankments up to an elevation of 9 to 17.5 metres should surges occur at the time of high tides.

Mangrove plantation outside the embankments is likely to reduce wave height by up to 2 metres, which was the case of the 1991 cyclone. It is generally accepted that a 0.2 - 1.5 km belt of protective mangrove vegetation along the coast will generate this effect. Economically speaking this is the equivalent of increasing the return period of embankment design from a 1 in 30 year event to a 1 in 50 year event.

The mangroves consisting of Keora have shown that although they suffer damage, they act as good windbreaks and shelter belts for the people.

Thinning will probably not improve the stabilising role as a cyclone barrier and land stabiliser.

If the plantation purpose is for protective purposes, clear cutting should be avoided, unless a new plantation is established towards the sea, or the size of the felled area should be reduced and the timing of the harvesting operations and its effect on the surrounding plantation and proximity to peoples dwellings etc. should be considered.

2.6 Socio-economic situation

This aspect has been dealt with elsewhere in detail, but some aspects pertaining to the mangrove forests are pertinent.

At present, the population in the coastal area is very dense, particularly in the Noakhali region. ESCAP (1987) estimated that the population dependent on the coastal ecosystem was at least 7 million in 35 thanas. However, human settlement inside the forested areas is generally very low, in part because newly emerged land which is inundated frequently and whose soils are saline is not considered suitable for settlements. Some encroachment occurs when the emerging land remains above the tidal levels, but in that case mostly for temporary grazing of buffaloes. Permanent settlement is rare, it seems that the people respect the fact that the mangrove forests represent a protective barrier against the cyclones and/or that they have no official rights to the land at the moment, which in combination with the Forest Department's guarding of the areas reduces the pressure on the mangrove plantations. This is very unlike the Sundarbans, which are under the pressure of more than 2 million people, mainly due to the diverse benefits these forests can provide for the population .

Thus people do not depend directly on the mangrove plantations but they do collect mainly dead wood and branches. The bulk of the demand for firewood (approximately 80%) comes from the homestead plantations. There is some trading in wood products in the char communities, but this almost entirely deals with homestead products. There is no large scale exploitation of the mangroves and no significant industrial processing of wood products in the coastal areas.

The use of the mangroves for catching fish fry and shrimps is widespread but does not influence directly the mangrove forest (although it does affect the ecosystem).

2.6.1 Encroachment

Encroachment has fortunately not been a problem in the coastal areas, on average only about 5% has been encroached. However, there is a great variation. Mangrove forests in the Chittagong CA division are under heavy pressure from the population.

2.6.2 Social forestry

Realising the importance to involve the people in the process of rural development, several social forestry programmes have been implemented. Social forestry can be described as any type of forestry that involves the beneficiaries themselves, in forestry activities based on the actual needs of the community. Social forestry in its purest form implies that the beneficiaries themselves have full access and the rights to, if not the land, then the benefits derived from its use.

Agro-forestry, strip plantations, homestead forestry and woodlot plantations have been the most common types represented in Bangladesh.

Embankment plantations , particularly relevant in the development options for the estuary, can be seen as a form of strip plantation. Several projects have implemented this type of plantation as part of a social forestry program, notably the CERP project (mentioned elsewhere). The beneficiaries receive tenure of part of the embankment in exchange of labour for planting etc. under conditions of benefit sharing with the state (see Appendix 5).

This type of plantation can obviously not be considered before embankments have been established.

Homestead plantations account for a considerable part of the wood supply in Bangladesh. Estimates vary between 48% and 80% of the total production, although the area covered is only 270,000 ha. or approximately 12% of the total forested area. More interestingly, the yield

per unit area is almost twice as high as on state land.

Homestead forestry is an integral part of the farming system and provides the bulk of the farmers' inputs such as plough yokes, cart-wheels, tools and other farm implements, as well as non-wood products. Farm forestry covers about 5% of the farm land on average. The self sufficiency in fuelwood from homestead forests is important in diverting cow dung for agricultural use. The role of trees in the rural economy is therefore significant.

Some of the constraints and opportunities of these social forestry schemes can be deduced from the past experience of the major programmes.

- land grabbers have posed serious threats to social forestry programmes in the past
- too little was done on devising management strategies for strip plantations and the technology was not adequately transferred to the beneficiaries
- lack of preparation of the affected people through awareness campaigns
- unsuitable species selection for homestead plantations (low value, low yield)
- local needs assessment is a prerequisite for successful project execution. Understanding the aspirations and enjoying the confidence of the peoples necessary for any intervening organisation.
- user group formation has proven successful in most cases, as has training in participatory land use planning
- continuous support in the form of extension services over a long period, also after a larger project ends, is fundamental for sustainability. Many strip plantations failed in the past because extension support was terminated with the project, causing the maintenance and management to fail due to weak community organisation and appropriation of the project.

3. RECENT AND ONGOING PROJECTS IN THE STUDY AREA

Several of the above mentioned projects are now addressing these issues. The forestry sector in Bangladesh has been supported by international donor projects, upon request by the GOB, since the sixties. Currently, a number of projects are being implemented through the Bangladesh Forest Department. The most important ones are

The Forest Resource Management Project, FRMP, (WB, 1992-2000)

The WB funded Forest Resource Management Project is focusing on institutional development, including training and the development of an environmental wing in FD. It also includes the elaboration of management plans and forest inventories in the coastal zone, and it focuses specifically on the Sundarbans, where management plans are being elaborated for production and nature conservation areas. It also includes the establishment and rehabilitation of about 30,000 ha of mangrove plantations in the four Coastal Afforestation Divisions of Chittagong, Noakhali, Patuakhali and Bhola.

The Coastal Green Belt Project CGP, (ADB, 1996-2002)

The primary objectives of the projects are to protect the population and the environment from damage by cyclonic storms and associated tidal surges, through stabilising of the coastal embankments and generating supplementary income opportunities by augmenting the tree cover in the coastal region, to ultimately alleviate poverty. The target of Coastal Greenbelt Project is to plant a total of 6020 km mainly roadside and embankments. However, it offers little support to those communities living out on the exposed chars.

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The Coastal Embankment Rehabilitation Project, CERP, Phase II, (EU, 1996-2000))

This programme stems from the Public Works Programme implemented up to 1995 and focuses on social development and afforestation on the embankments in 21 polders in the coastal areas. The immediate project objective is the rehabilitation of the coastal embankments and includes the settlement of landless people on the landward side toe of the embankments. These households will have the responsibility for establishing and maintaining the plantations and receive the returns from the plantations in return for free labour for embankment maintenance.

The Forestry Sector Project (ADB, 1996-2002)

This project covers the Northern, North-Eastern and Central parts of the country, complementing but excluding the areas covered under the ADB financed Coastal Green Belt Project and those financed by other donors. The project comprises several components, including institutional development, training & extension, plantation establishment (woodlot, agro-forestry plantation on 2250 ha of degraded 'sal' forest land, reforestation of char lands over an area of 2000 ha, strip plantations over 3000 km) , participatory natural forest rehabilitation and management (coppice forest rehabilitation and management over an area of 8000 ha, sedentarisation of Jhumias (shifting cultivators)), management of national parks and wildlife sanctuaries, in consultation with local people who use or inhabit these areas. The project implementation has just commenced.

Thana Afforestation and Nursery Project

The Thana Afforestation and Nursery Project began in 1989 and was extended to 1997. It is essentially the continuation of the previous ADB funded community Forestry Project with emphasis on participatory forestry, including strip planting on roadsides and railway tracks, institutional strengthening, plantations on khas land and the establishment of thana nurseries, which provide seedlings for plantations on public and private lands. A training and awareness component is also included.

4. POTENTIAL AND STRATEGIES

4.1 Forestry potential in the MES area

Through the analyses presented in Section B, it is evident that the mangrove afforestation programmes have indeed been successful in establishing a resource with the objective of protecting the people in the estuary.

A number of opportunities and constraints have been identified in the resource assessment, in summary these are:

- the financial IRR for Keora in the Western areas is about 25%, and for the Chittagong area only 3%, indicating that with the given market interest rates, and assumptions as indicated, it would not be feasible to invest in forestry for economic reasons in the Chittagong area, but much more so in the Western part of the estuary.

- financially, it is shown that it would be feasible to invest in forestry, provided the market conditions and all other assumptions were guaranteed. It would only hold for the Western part (Noakhali, Bhola, Patuakhali), not in the Chittagong area

- there is a relatively high growth potential in the estuary, larger in the west than in the east

- there is a large and mature standing stock of timber which could be utilised for industrial purposes (a volume of around 2 million cubic metres (+-25%?) in the plantations from before 1980)

- rotation lengths can be shorter (than 20-25 years) if dictated by returns to capital invested, or maximum production is desired (other issues may dictate different rotation lengths)

- there is need of urgent interventions in order to maintain productivity.

- there is need of devising management measures to ensure the transition towards other species in the more stabilised parts of the estuary, where Keora is no longer producing.

- there is an urgent need to define clear management objectives and determine which areas are to be managed for what purpose.

- there is great lack of spatial information, particularly at range and division level.

On the other hand, the stand based management system seems highly relevant for this type of plantation forest, and should be encouraged. Inventories based on stand stratification would yield very useful information at range level for management purposes, in comparison with general stratification strategies bearing on the whole estuary.

It is inevitable that GIS systems must be integrated in effective land use planning, particularly considering the highly dynamic nature of the estuary with large physical changes (erosion, cyclones etc.).

4.2 Strategies for area development

Until now, the role of the mangrove forests has been viewed solely from a narrow perspective of providing protection against cyclones. As part of a development strategy, forestry should be considered in a wider context of environment and development, and its multiple functions and uses should be taken into account.

Multiple use forestry can greatly enhance the potential for development offered by forestry in the estuary, although it increases the complexity of forestry planning.

The Interim Master Plan introduced a planning matrix summarising key interlinked components to be considered for forestry development. Reading the table from left to right gives an indication of the successional nature of possible development component strategies.

Table 4.1: Planning matrix for forestry development in the Meghna Estuary

Ownership		Management Objective	Possible Development Option	Other issues/ Considerations
State land	Production mangrove plantation	Commercial wood production, sustainable management	Maintain as forest under FD management	Ensure compliance with GOB policies, mgmt. guidelines, etc
	Protection mangrove plantation	Cyclone protection	Convert to community or private land for agriculture, protection, conservation	Clear development strategies, institutional responsibilities, tenure regulations, handing over procedures a precondition
	Conservation mangrove plantation/natural forest	Ecological stability	Maintain as conservation forest, no development	Ensure, regulation control & enforcement
	Newly accreted land	Stabilise +accrete + protect	Develop into protection forest and if desirable convert for other purposes later	Procedures and regulations in place for FD to acquire jurisdiction over land (from MLA)
Not applicable	Eroded land	Subtract from other categories	n.a.	Should be updated in natural resource registers
Community land	Production mangrove plantation	Satisfy wood product needs of community on sustainable basis	Sustainable mgmt. on basis of community needs assessment & management plans	Community participation , FD supervision/ control ensured
	Protection mangrove plantation	Grazing? Agro-forestry?	No development, but introduce other tree species later	FD supervision/ control, community participation
	Conservation mangrove forest	Ecological stability	No development	FD supervision/ control ensured
Private land	Homestead woodlot	Production of fuelwood, non wood products	Manage on sustainable basis	Value of forest products recognised by families, extension services available
	Agriculture	Agricultural production	Agricultural development	Agricultural potential ensured, extension services available

In order to formulate a resource management strategy, a planned approach to development in the estuarine area must be followed, considering the following aspects:

- land use classification and allocation of forest types is fundamental for development planning and forest management (how much land should be left under forest cover).
- implications for planning arising from the multiple role of forestry (what type of forest/species and for what purpose: protection, wood production etc.)
- land tenure issues and implications in the processing of developing newly accreted lands, including hand over procedures and a practical division of responsibilities among the involved institutions (who benefits from what and when, change in tenure)
- availability of current resource information with data on stand parameters like mangrove plantation area, stocking, growth, plantation quality (necessary for decision making)
- the successional nature both of the mangrove vegetation (change of species over time) and development based on conversion of plantations for integrated farming systems (change of land use over time).
- policy issues, regulation and control (what are the national/regional aspirations/visions for development and what are the restrictions to specific land uses)
- institutional setting (who decides what and how to implement the development activities)

4.2.1 Institutional set-up

It is evident that forestry development cannot be seen alone in the context of char development, but must be multi-sectoral and inter-institutional, and that these issues cannot be tackled in the centralised way that the line ministries have done till now. Decision authority will have to move down in order to ensure realistic land use planning at district level. One such scheme has been suggested (by MES) where District Land Use Planning Units (DLUPU) be established at district headquarters level, under the LGED.

The purpose of the Unit would be to prioritise land use and decide on the best sequence of development activities and co-ordination of development activities in the char areas. Its main activities would be to supply information for the Master Planning of Meghna Estuary (under WARPO/BWDB) . It would also produce plans for specific planning units and concentrate on data collection and data analysis.

The LGED is in charge of small scale rural infrastructure and planning and implementation and administration of many physical aspects of rural infrastructure, however it would be new to this institution to tackle multi-sectoral planning, which would have to be strengthened.

A Char Development committee would provide support and feed back to the DLUPU, and ensure a bottom up functioning. This committee would be headed by the DC or senior representative (Chairman), with representatives from various departments (XEN (LGED), BWDB Engineer, District Forest Officer, District Fisheries Officer, District Livestock Officer ,District Health Officer etc.

For forestry such an institutional construction would enable the CA divisions to participate and contribute in formulating land use plans essential for forest management planning.

This would require transfer of management responsibility from the FD level to the CA Division level for decisions regarding land use within theirs jurisdiction, and for the CA Divisions to suggest land classification compatible with the bio-physical condition present. This could be combined with the socio-economic information available at from District level organisations and other institutions in order to prescribe an effective resource management acceptable to the

people, in accordance with overall national policies, for the benefit of the future sustainability and development.

Once an efficient land use planning has been established, technical/ecological aspects can be solved for each forest category to be considered and management prescriptions formulated for protection forest, production forest, and conservation forest

4.2.2 Overall planning considerations

For the overall MES area forestry development planning, the potential land for development purposes can be summarised as in Table 5:

Table 4.2: Potential land available for development

Unit: ha

Type	Planning Unit A	Planting Unit B	Planting Unit C	Total Land
Total land 1)	89,205	86,031	50,521	225,757
Land inside embankment (polders)	31,220	55,190	13,110	99,520
Total outside embankment	57,985	30,841	37,411	126,237
Forested land outside embankment	13,732	19,359	23,239	56,330
Non-forested outside embankment	44,253	11,482	14,172	69,906
Submerged	9,522	26,970	61,029	97,521
Total potential land	53,775	38,452	75,200	167,427

Source: MES

Note: Island A26,49,50 and B 37,48,49,50,51,54 were subtracted from Planning Units A and B, as falling outside MES area.

The focus for mangrove forest development planning is in the land outside the embankments, as mangroves cannot exist inside the embankments. Added to this is the area presently submerged during high tides, which is accreting and at some stage may be available for mangrove plantation. The locations of these formations are indicated in the engineering section.

In total there are almost 100,000 ha submerged land, which potentially could be brought under mangrove, plus another 70,000 ha land outside embankments. Rather than speculate whether this is desirable or possible, it does indicate the potential for continued expansion of the mangrove resource, if so desired.

The criteria for where to plant and for which purpose can be derived from estimates of where most accretion has occurred, which would be the basis for determining the erosion risk and the most stable areas for forest plantations (and other activities). This gives a good idea also where most accretions would be expected during the coming 25 years. Based on these preliminary criteria, some indications for where the different management options would be better can be given. A distinction should be made between the already established existing resource and the proposed plantations, with respect to forest management options.

This would served as an indicator of probable stability for forest plantations, i.e., indicate where forestry would be most likely to succeed over the whole rotation period, and also indicate where engineer works would benefit the most from forestry.

In addition to the above general principles and on the basis of regular and effective monitoring, mature plantations in erosion risk areas of each of the four CA Divisions should be felled for salvage of the timber and firewood.

4.2.3 Planning Unit considerations

For Planning Unit A and B, production potential and stability indicates a good basis assigning a larger proportion of land for managing the plantations in the CA Divisions Patuakhali and Bhola for Commercial Production because of the high economic potential and only in connection with

embankment projects focus on the protection objective Natural regeneration is possible in some areas and these may be kept as Conservation forests in these Divisions, if so desired. A shift towards other more valuable species and longer rotations is also possible here.

Only in connection with embankment projects focus on the protection objective, with possible conversion to agriculture inside the embankments.

Underplanting with more important mangrove species like Sundri, Passur, Gewa, Khalshi etc. can also be carried out in these areas on areas which no longer can support Keora plantation because of ecological factors. Bhola is more unstable, and would lend itself more to Protection forests.

Stable char areas such as Jahajjar char, Killar char, Char Montaz etc. where most of the accretions are expected during the coming 25 years should be allocated for raising new mangrove plantation. These will generate employment opportunities in the estuary area and will thus help in improving the socio-economic condition of the local people.

For Planning Unit C, the entire belt of plantations along the coast starting from Halishahar under Bandar thana of Chittagong district to Sitakunda and Mirsharai thanas of the said district should be managed as Protection and Community forests, as these present low economic potential and low yield/poor form. The comparatively old plantations should be managed under the concept of participatory (community/ social) forestry and the younger plantation along this belt facing the sea should be managed as Protection and Conservation forests. On the same analogy, part of older plantation particularly that around Char Bata and the whole of the younger plantations from Sonagazi belt to Ramgati coast should be managed as Participatory forest and Conservation forest (Protection) respectively.

In addition to the above general principles and on the basis of regular and effective monitoring, mature plantations along erosion risk areas of each of the 4 CA Divisions should be felled for salvage of the timber and firewood.

This would serve as an indicator of probable stability for forest plantation i.e. indicate where forestry would be most likely to succeed over the whole rotation period, and also indicate where engineering works would benefit the most from forestry.

4.2.4 Community forestry perspectives

Serious conflicts over land have erupted when the FD has tried to keep encroachers out of state forest land, and in many cases the FD has been seen as an adversary by the people, also compounded by the traditional enforcement role of the FD.

This has led to a shift in focus on behalf of the FD and led to more support, not without pressure from international donors, by the FD to private and community forestry programmes, following the change in the more people oriented Forest Policy from 1994. This type of programme is seen as a tool to conserve forest resources and to build up private forest resources to cover the beneficiaries basic needs for wood products.

To avoid conflicts over land in the Chittagong coastal areas, it is important to involve the people in the process of rural development.

A truly participatory approach would imply that the real responsibility for decision making has been allocated to communities regarding the planning and management of the (forest) resource throughout its productive cycle. Local needs assessment is a prerequisite for successful project execution. User group formation and training of local capacities and leadership by committed people with a vision is important. Continuous support in the form of extension services over a long period, also after a larger project ends, is fundamental for sustainability. Many strip plantations failed in the past because extension support was terminated with the project, causing the maintenance and management to fail due to weak community organisation and appropriation of the project.

4.3 Component-wise considerations

4.3.1 Component 1: Commercial wood production

The objective of commercial production forestry is to satisfy the demand of roundwood and sawlogs. This has been the traditional objective of forest management in Bangladesh from the inland forests, both natural and plantations.

At national level, the supply (approximately 8 million m^3) is now only about half the demand, due to the chronic reduction in forest area, and the low stocking and yield of these forests. The yield of natural hill forests is only 0.5 to 1.5 m^3/ha/yr, and that of teak plantations has fallen to only 2.5 m^3/ha/yr, a four times drop compared to the past.

Under this scenario, there is a potential to alleviate the wood shortage through mangrove plantation forests, as these have shown yields of up to 10 m^3/ha/yr (Keora), and a good internal rate of return. Production forests could be established in designated areas utilising adequate species (or a succession of different species) under some form of sustainable management, which traditionally the FD has directed on state land.

The FD would have to involve the private sector for such an endeavour. A possibility would be for the FD to maintain control of management, but to contract out the harvesting operations. Judging from the potential for developing commercial forestry, there would be scope to determine the feasibility of installing a hardboard manufacturing plant or pulping facility using keora.

A reduction in rotation length would make almost 2 million m^3 available as raw material. However, a reduction to say 15 years, maintaining the total forest area as it is today, would require an almost doubling in planting area from today. From about 2,000 ha per year to 4,000 ha per year, plus a reserve for losses due to erosion etc. From Table 4.2 it does not seem to pose a problem finding these areas.

The Forestry Master Plan within the plan period of 20 years (from 1993 to 2013), assumes that a maximum area of about 60,000 ha can be planted up with mangrove species on newly accreted land as well as on harvested plantation. Out of this, an area of about 27000 ha will be planted on new accretion by the year 2000 through FRMP (1992-93 to 1999-2000) leaving a balance area of about 33,000 ha. This area can be planted up within the Master Plan period of 25 years beginning from the year 2001 at the rate of 6,600 ha per five year period.

The main constraints or risks foreseen for this component are the market conditions, which are little known. More studies are needed in order to determine the market possibilities.

4.3.2 Component 2: Protection forest

In the Meghna estuary, protection of people and property against damage caused by cyclones was the main reason for initiating the mangrove plantation programmes of the last decades. The cyclone damage was proven to be mitigated due to the dense vegetation cover offered by mangroves in the areas affected, prompting a series of donor assisted afforestation programmes.

This plantation objective gives very tangible benefits (protection of the coastal population), and a one-time economic income upon converting the forests to agriculture after a period of time. The general land development sequence recommended by MES for newly accreted land is for it first to be planted in mangroves. The basic sequence of land development on newly accreted land would be as follows:

- all newly accreted land reaching +0.7-1.5 m PWD planted in mangroves as it accretes and is left in forest for 15 years;

- existing forest which will be inside the proposed new polders will be cleared for agriculture after construction of the embankments.

- a 1 km depth of mangrove forest is retained on the foreshore outside embankments along all coasts at all times;

- land not in forest and not under cultivation may be used for the grazing of livestock - this includes cultivated land when it is not under crops;

A 1 km belt was shown to have a positive effect on wind- and wave breaking action after the cyclone of 1991, where thousands of people were saved in the Chittagong area due to the forests. It was then estimated that the forest had reduced the wave action by approximately two metres. It is generally accepted that a 200 - 1,000 metre belt is sufficient.

This helps to stabilise the land, promotes further accretion and the development of the soils and provides protection from tides and cyclones. After 15 years, forest may be cleared for agriculture provided a coastal belt is retained for protective purposes.

Although the protection offered by the mangroves is widely accepted, some constraints to this management objective are similar to the ones presented for commercial wood production, namely a weak government resource planning and management.

The strategy proposed involves the handing back of FD land and subsequent titling for landless. The newly accreted land is state land, falling under the Ministry of Lands. Originally there was an agreement between the Ministry of Lands and the Forest Department that the latter would acquire the accreted land for tree planting for a period of 10 years (with the purpose of enhancing accretion), after which it would be handed back to the Lands Department for conversion and allocation to agriculture. This period was later extended to 20 years, but so far no land has been handed over.

The reason for this apparent failure and the constraints for pursuing this management objective seem to be related to the lack of clear institutional responsibilities and development strategies, including a total lack of land use planning in the estuary.

Any conversion of existing forest resources (whether they are derived from protection, production or conservation forests) requires a change in tenure over the land. This in turn must follow a firm set of handing over procedures, which should be formulated by the FD . Such procedures would involve practical issues to be dealt with in the DLUPU, who would play a major role in the handing over procedures.

4.3.3 Component 3: Conservation forest

There has been a shifting tendency in Government policy regarding the destiny of the mangrove plantations, the current trend being that the mangrove plantations shall be retained (not converted to other uses) and that a probable end situation would be a Sundarbans like multi-species multi-storey ecosystem.

Bangladesh has one of the world's largest contiguous area of natural mangrove forests, the Sundarbans, representing a major proportion of the country's biodiversity. The vegetation represents a climax vegetation type as a result of a long evolution into a relatively stable ecosystem capable of sustaining a large variety of plant and animal species. The Sundarbans have long been exploited for their wood and non-wood products.

The absence of this climax vegetation type in the Meghna estuary is probably due to the rapidly changing environment caused by the continuous erosion/accretion phenomenon. However, it can be assumed that the final successional stage of the vegetation type here would be very similar to the Sundarbans, if the conditions were more stable.

The changing objectives of the established mangrove plantations in the estuary (see above), have led the government to suggest maintaining the mangrove plantations permanently. However, constraints to this type of forest category is related to bio-physical and ecological features, as mentioned above, and severe limitations for the establishment of a stable climax type mangrove ecosystem exist, first as this would require several hundred years, and secondly it would not be feasible particularly in the central part of the estuary where the rapidly changing hydro-morphological conditions would not permit it. A careful survey of likely stable areas would be needed in order to specify probable suitable areas.

The benefits expected from this type of forest would of course be similar those of the Sundarbans, which in comparison with other forest types and management options present a much wider range of wood and non-wood products. The economic benefits are also substantially more diversified, but more difficult to estimate, as the ecosystem has far reaching effects on people living nearby and to a large degree are dependent on these forest types. although the benefits are more intangible, such as maintenance of biodiversity, and can often not be translated to short term gains, it would have a decidedly positive impact on long term national income and ecological stability.

5. CONCLUSIONS

Any kind of forest development planning in the estuary must take into account the extremely dynamic nature of the rapidly changing coastal environment caused by the continuous erosion/accretion phenomenon, with special focus on the areas outside the embankments

The overall effect of sedimentation is the expansion of the land area in the estuary. This implies a continuous outward movement of the habitable areas in correspondence with the rising accreting land. The effect of this on the mangrove plantations is a change in the bio-physical conditions for the plantations leading to a succession towards other species.

From a forestry perspective, eventually other than mangrove species, implying the necessity to develop dynamic management schemes capable of responding to the successional nature of the bio-physical environment and ecological conditions with special focus on the areas outside the embankments.

From a rural development perspective it is essential that coastal land areas at all stages of development between accretion and empoldering must be brought under management, implying a successional change in the potential uses of the land, and the potential farming systems applicable.

The Development Plan should include land use planning as an essential tool for developing farming systems and forest management.

Classification and allocation of land use categories must respond to the successional nature of the estuary development. Criteria for the land use categories should be suggested/developed.

Resource assessments must be frequent and utilise modern information processing methods to ensure timely information, as an integral part of the resource management strategy. An institutional strengthening project should be proposed at the CA Division level, which would target the weaknesses of information management and planning skills at divisional levels. This would include the training in GIS and operational planning useful in connection with the working of the DLUPU.

As land tenure would change over time, from state or 'khas' land initially, as land emerges, to other tenure forms, this issue must form a cornerstone in the planning process.

Objective and democratic benefit sharing mechanisms must be revised and improved, ensuring long term lease arrangement where land tenure is not transferred directly to the beneficiaries in line with the GoB policy under the Land Reform Circular No. 1.

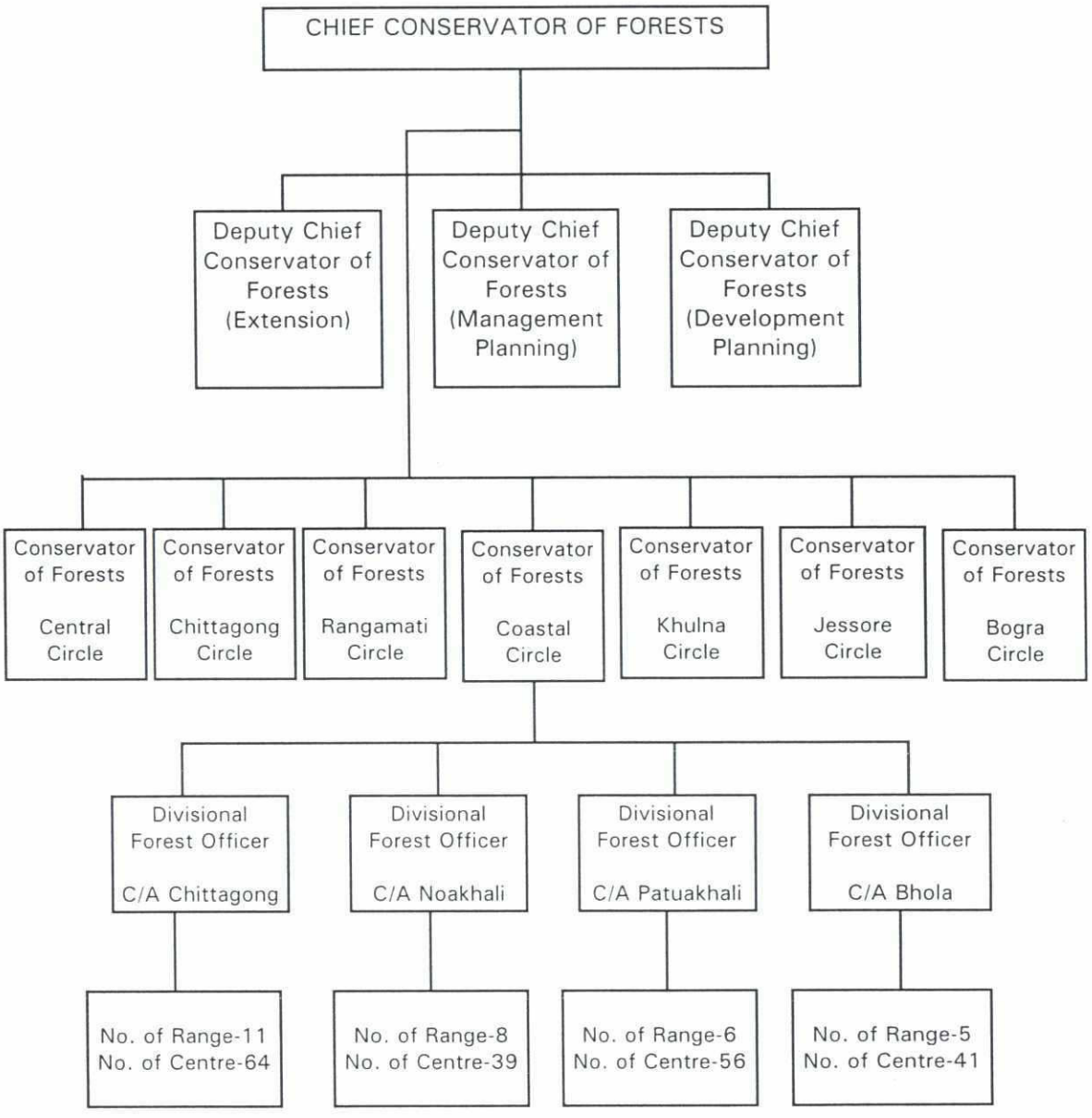
Developing training programmes for the participants on land use planning and project preparation, including the strengthening local organisations in support and implementation of social forestry projects is a prerequisite.

FD's traditional functions focused on enforcement must change to one of extension and participation, in view of the past experience of the management of state forests. Any programme must include strengthening of the national institutions, calling for investment in human resources.

At the local level, development of proper institutional and organisational arrangements to involve the people in the execution of such programmes, with focus on devising and implementing integrated land use systems with forestry playing a major role must be emphasised.

APPENDICES

ORGANOGRAM OF THE FOREST DEPARTMENT
(showing the four Coastal Afforestation Divisions)



NATIONAL FORESTRY POLICY, 1994

The Bangladesh Government formulated the National Forestry Policy for the first time on July 8, 1979 after the independence of the country. In the meantime, initiatives have been taken to orient the policies to meet demand of the time, particularly in consideration of the task of tackling the natural and undesired hindrances arising out of abnormal and quick depletion of forestry resources owing to numerous socio-economic factors. As apart of this attempt, the Government has undertaken the formulation of National Forestry Master Plan for a period of 20 years, the draft of which has recently been prepared.

In the above mentioned draft Forestry Master Plan proposals / suggestions have been putforth to amend the National Forestry Policy, 1979 after detailed examination and evaluation of it in the light of demand of the time and overall prevailing conditions in the sector.

After amendment of the forestry policy, 1979 in the light of the above mentioned proposals and suggestions National Forestry Policy 1994 has been formulated.

In the formulation of the Forestry Policy, 1994 the following issues have been brought into special consideration;

a. Peoples welfare principles inscribed in the constitution of the people's Republic of Bangladesh;

b. Long term and specific roles of the forest sector in the overall socio-economic development of the country including the environment;

c. National policies for the development of agriculture, cottage industries and other sectors;

d. Decisions and recommendations taken in different international conferences and conventions (wherein Bangladesh has taken part or identified with the decisions / recommendations) particularly the envisaged programs on afforestation cited in the Agenda 21 of the Earth Summit in Brazil in 1992.

For the preservation of climate and natural condition of the country and recognition of the long-term and very important role of forest sector to ensure balanced economic development.

Realizing the need for massive and planned tree plantation, maintenance and preservation in the coastal areas including the embankments on rivers and canals to protect forests, soil and related natural resources, to reduce the velocity and intensity of cyclone, tornado and tidal bore so that air, water and others get less polluted and ecological balance remain undisturbed.

Apart from the production of forest, wood and fuel materials, oil seeds, spices, fibre, rubber, medicine ingredients, and other goods for the economic development of the country.

Alongside the prevailing afforestation activities involving the poor and concerned people of the society in countrywide social and agro forestry through share mechanism and the provision of the incentives, considering the necessity of the afforestation at the Government and Non-government levels, application of scientific management techniques in forest studies, increasing requirement of establishing safe shelter for wildlife, birds and animals, also realizing the necessity of having a specific amount of land of the country for forest coverage, and above all.

In the interest of the total development and ecological balance of the country facilitating afforestation, tree plantation, nursery establishment, development, maintenance and preservation through involving, encouraging and extending cooperation to the people of different sections of the society, the government has expressed desire to adopt the following things as a part of National forestry policy, 1994 upon the amendment of the forestry policy, 1979.

a. Pre-condition for the forestry development,

b. Objective of the national forest policy,

c. Statement of the national forest policy,

The main features of the Forest Policy, 1994 in terms of the above mentioned captions will be the following:

Preconditions for the Development of the Forestry Sector

1. The forestry sector provides several commodities and services which are essential for fulfillment of the basic needs of the people. Basic needs fulfillment will be ensured by providing timber for the construction of houses and boats, firewood for cooking, fodder, for animal, medicinal herbs for health care and services for conservation of the environment and bio-diversity.

2. Benefits of forestry sector development will be equitably distributed among the people, especially whose livelihood depends on trees and forests.

3. Scope for the peoples participation in afforestation programs required for the development of forestry sector will be created and in the planning and decision making process, the opinions and suggestions of the planters, user of forest and whose livelihood depends on forestry resources and forest lands will be incorporated.

4. Long term political commitment of the government will be continued in the development of the forestry sector since afforestation is a long term program.

5. Attempts will be made to ensure the effective use and the conservation of bio-ecology and bio-diversity by installing sound management of forestry resources and conserving the production capacity of these resources. This will be done s as to ensure their contribution in the rural and national development.

Objectives of the National Forestry Policy

1. The meet the basic needs of the present and future generations and also to ensure greater contribution of the forestry sector in the economic development, about 20% of the total area of the country will be afforested by taking up various afforestation programs. Side by side, fallow lands, lands not useful for the purposes of the agriculture, hinter lands and in other possible areas, Government sponsored afforestation programs will be implemented. Moreover, appropriate measures will be taken to encourage afforestation on private land and technical support and services regarding the production of forest crops has to be ensured.

2. By creating employment opportunities, strengthening the rural and national economy, the scope for poverty alleviation and trees and forest based rural development sectors will be extended and consolidated,

3. Bio-diversity of the existing degraded forests will be enriched by the conserving of the remaining natural habital of the birds and animals,

4. Agriculture sector will be strengthened by extending assistance to the sectors related with forest development, especially by conserving the land and water resources,

5. National responsibilities and commitments will be fulfilled by implementing various international efforts and government ratified agreements relating to global warming, desertification and control of trade and commerce of wild birds and animals,

6. Through the participation of the local people, illegal occupation of the forest lands, illegal tree felling and hunting of the wild animals will be prevented,

7. Effective use and utilization of the forest goods at various stages of processing will be encouraged, and

8. Implementation of the afforestation programs - on both public and private lands will be provided with encouragement and assistance.

Statements of the National Forestry Policy

1. Attempts will be made to bring about 20% of the country's land under the afforestation programs of the government and private sector by year 2015 by accelerating the pace of the program through the coordinated efforts of the government and NGOs and active participation of the people in order to achieve self reliance in forest products and maintenance of ecological balance.

2. Because of limited amount of forest land, effective measures will be taken for afforestation in rural areas, in the newly accreted char in the coastal areas and in the denuded unclassed state forest areas of CHT and northern zone of the country including the Barind tract.

3. Private initiatives will be encouraged to implement programs of tree plantation and afforestation on fallow and hinter land, the bank of the pond and homestead land which are under private ownership, Technical and other support services will be extended for introducing agro-forestry on privately owned fallow and hinter land to keep intact the production of grass and herb which is grown on government and privately owned forests and fallow lands.

4. Tree plantation on the courtyards of rural organization such as Union Parishad, school, eidgah, mosque-moktob, temple, club, orphanage, home, madrassa etc. and other fallow lands around can be initiated. The government will encourage this type of initiative and extend technical and other supports.

5. Massive afforestation on either side of land surrounding road, rail dam and khas tank through the partnership of the local people and the NGOs will be commenced. Side by side, rubber plantation will be encouraged in all suitable areas of the country including Chittagong Hill Tracts, Sylhet and Modhupur.

6. Special afforestation programs will be taken in every city of the country under the auspices of the government in order to prevent pollution of environment in the densely populated area. Municipal and town and other relevant authorities will take concerted efforts in implementing this program. Attempts will also be taken to ensure tree plantation/ afforestation while plans are made in respect of residential areas.

7. Massive afforestation programs in the denuded hilly areas of Unclassed State Forests areas of Rangamati, Khagrachari and Bandarban will be taken under the auspices of the government and private initiatives. The participation and rehabilitation of the local Jhum cultivators will be ensured while implementing this program. This will be done under the auspices of the Ministry of land in cooperation with the local government by keeping the land ownership rights intact.

8. The priority protection areas are the habitats which encompass representative samples of flora and fauna in the core area of National Parks, Wildlife Sanctuaries and Game Reserves. Attempts will be made to increase the amount of this protected area by 10 percent of the reserved forest land by the year 2015.

9. Multiple use of forest, water and fish of Sundarbans through sustained management will be ensured keeping the bio-environment of the area intact.

10. All state owned forests of natural origin and the plantations of the Hills and Sal forest will be used for producing forest resources keeping aside the areas earmarked for conserving soil and water resources, and maintaining the bio-diversity. Keeping in view the ecology, the management of forest lands will be brought under profit-oriented business.

11. Inaccessible areas such as slopes of the hills, fragile watershed, swamp etc. will be identified and kept as protected forests.

12. The areas under the reserved forest which have been denuded or encroached, will be identified. Afforestation in these lands will be done through peoples participation. In this regard, the use of agro-forestry will be encouraged. NGOs will have opportunities to participate in this program. Side by side, the lands in Chittagong and Sylhet which were allocated to different persons and institutions for the developing the tea gardens still remain uncultivated will be identified and used for tree plantation and afforestation.

13. Initiatives will be taken to reduce wastage by using modern and appropriate technology at all stages of extracting and processing forest products.

14. Emphasis will be imparted on modernization of forest-based industries to ensure effective utilization of the forest raw materials.

15. Steps will be taken to bring state owned forest-based industries to competitive and profit-oriented management system under the free market economy.

16. Forest resources based labor intensive small and cottage industries will be encouraged in the rural areas.

17. Rules and procedures regarding transportation of forest produces in the country will be simplified and made up-to-date.

18. Export of log will remain banned given the scarcity of wood in the country. But processed forest products can be exported. Import policy on wood and wood-based products will be liberalized, but import tariffs, for the wood products which are abundant in the country, will be levied appropriately.

19. Because of the scarcity of forest land, state-owned reserved forest cannot be used for no-forestry purposes without the permission of the Head of the Government.

20. A large number of tribal people live around a few forest zones. Since the ownership of land under their disposal is not determined, they grab the forest land at will. They will be imparted ownership of certain amount of land through the forest settlement process. The rest of the forest land will be brought under permanent protection.

21. Funds from different donors including International Aid Organizations will be used to promote private forestry organizations and tree farming, and for such programs like training, technical and financial supports will be imparted at an increasing rate.

22. Women will be encouraged to participate in homestead and farm forestry, and participatory afforestation programs.

23. Ecotourism, related to forest and wildlife, is recognized as forestry related activity, which will be promoted taking into consideration the carrying capacity of nature.

24. There will be massive campaign through the government and non-government medias for raising consciousness among the people regarding afforestation and conservation, and use of forest resources.

25. Encouragement will be extended, to grow fruit trees for producing more fruits along will the production of timber, fuelwood and non-wood forest products under the afforestation program.

26. Initiatives will be taken to reduce wastage by increasing efficiency and modernizing the technology for extracting forest resources.

27. Forest department will be strengthened in order to achieve the goal and objectives of National Forestry Policy. A new department called "Department of Social Forestry" will be established.

28. The implementation of National Forestry Policy will be supported by strengthening educational, training and research organizations. This will contribute to forestry sector development.

29. Laws, rules and regulations relating to the forestry sector will be amended and if necessary, new law and rules will be promulgated in consonance with goals and objectives of National Forestry Policy.

NOTIFICATION OF TRANSFER OF NEWLY ACCRETED LAND

Government of the People's Republic of Bangladesh Ministry of Land Administration, Autonomy, Rural Development & Co-operatives (Land Administration & Land Reforms Div.).

Section - V
Memo : 344 (4)-5-136/76-LS dated 10.8.76.

To : Deputy Commissioner
Chittagong/Noakhali/Barisal/Patuakhali.

Sub. : Proposal for transferring newly accreted char land in the estuaries and on the confluences of rivers and sea for afforestation to the Ministry of Forest, Fisheries and Livestock.

Ref. : This office memo no. 208(11)-5-136/76-LS. dated 14.05.76.

As directed by the authority allotment is hereby accorded to the Ministry of Forests, Fisheries and Livestock for afforestation without any encumbrance for 10 (ten) years, the following 12,30,000 acres of newly accreted char land in the estuaries of rivers and sea of the district of Chittagong, Noakhali, Barisal and Patuakhali for the purpose of stabilisation, consolidation and conservation with a view to making them suitable for agriculture under the following schedule.

Schedule

Name of District	Area (acres)	Location	
		Latitude	Longitude
1. Chittagong	1,95,000	22^0 45'N 20^0 30'N	91^0 15'E 92^0 30'E
2. Noakhali	4,50,000	22^0 30'N 21^0 30'N	91^0 00'E 91^0 30'E
3. Barisal	3,60,000	22^0 30'N 21^0 30'N	90^0 10'E 90^0 00'E
4. Patuakhlai	2,25,000	22^0 00'N 21^0 00'N	90^0 00'E 90^0 20'E
Total	12,30,000		

Ministry of Forest, Fisheries and Livestock will release this land after dereservation to this Division after the land has become consolidated and fit for giving settlement as per Government rule after 10 (ten) years.

You are requested to transfer the possession of the land to the local officer of the Ministry of Forest, Fisheries and Livestock.

Sd/- Abdul Motalib,
14.8.76
Section Chief No. V.
Land Administrational
Land Reforms Division
Phone: 282300

Hand over demarcated land for 20 years for afforestation purposes.

No. 12/Bon/1/14/84/712 dated 14-8-85.

In a meeting under the chairmanship of Minister of Land Administration and Land Reform, it had been decided that the committee will develop rules and regulations in connection with coastal afforestation:

The committee is formed as below:

Agriculture Minister	- Chairman
Secretary, Agri. Ministry	- Member
Secretary, Land Admin. & Reform Ministry	- Member
Secretary, Finance Ministry	- Member
Secretary, Local Govt.	- Member
RD & Coop. Ministry	- Member
Secretary, Irrigation & Flood Control Ministry	- Member
Chief Conservator of Forest	- Member/Sec.

This committee will develop the rules and regulations and will modify and materialise the same whenever is necessary.

No. 12/Bon/1/14/84/711

In a meeting held on the 14th August, 1985 under the chairmanship of Minister of Land & Land Reform a decision was taken that 1 lakh acres of newly accreted land in the coastal area would be transferred to the Forest Department of 20 years for carryingout plantation work only under the coastal afforestation project, aided by the IDA. For the demarcation as well as for quick and smooth transfer a three members committee was formed in the coastal Districts chaired by the Deputy Commissioners. The notification was gazetted on 13th Oct., 1985 in the Bangladesh Gazette. The committee comprises of the following officials.

CHITTAGONG DISTRICT

Deputy Commissioner, Chittagong	- Chairman
Police Superintendent, Chittagong	- Member
Deputy Director, Agri. Extn. Chittagong Zone, Chittagong	- Member
DFO, CA, Chittagong	- Member/Sec.

COX'S BAZAR DISTRICT

Deputy Commissioner, Cox's Bazar	- Chairman
Police Superintendent, Cox's Bazar	- Member
Deputy Director, Agri. Extn. Cox's Bazar Zone, Cox's Bazar	- Member
DFO, CA, Cox's Bazar	- Member/Sec.

NOAKHALI DISTRICT

Deputy Commissioner, Noakhali	- Chairman
Police Superintendent, Noakhali	- Member
Deputy Director, Agri. Extn. Noakhali Zone, Noakhali	- Member
DFO, CA, Noakhali	- Member/Sec.

LAXIPUR DISTRICT

Deputy Commissioner, Laxipur	- Chairman
Police Superintendent, Laxipur	- Member
Deputy Director, Agri. Extn. Laxipur Zone, Laxipur	- Member
DFO, CA, Laxipur	- Member/Sec.

FENI DISTRICT

Deputy Commissioner, Feni	- Chairman
Police Superintendent, Feni	- Member
Deputy Director, Agri. Extn. Feni Zone, Feni	- Member
DFO, CA, Feni	- Member/Sec.

BARISAL DISTRICT

Deputy Commissioner, Barisal	- Chairman
Police Superintendent, Barisal	- Member
Deputy Director, Agri. Extn. Barisal Zone, Barisal	- Member
DFO, CA, Barisal	- Member/Sec.

PIROZPUR DISTRICT

Deputy Commissioner, Pirozpur	- Chairman
Police Superintendent, Pirozpur	- Member
Deputy Director, Agri. Extn. Pirozpur Zone, Pirozpur	- Member
DFO, CA, Pirozpur	- Member/Sec.

BHOLA DISTRICT

Deputy Commissioner, Bhola	- Chairman
Police Superintendent, Bhola	- Member
Deputy Director, Agri. Extn. Bhola Zone, Bhola	- Member
DFO, CA, Bhola	- Member/Sec.

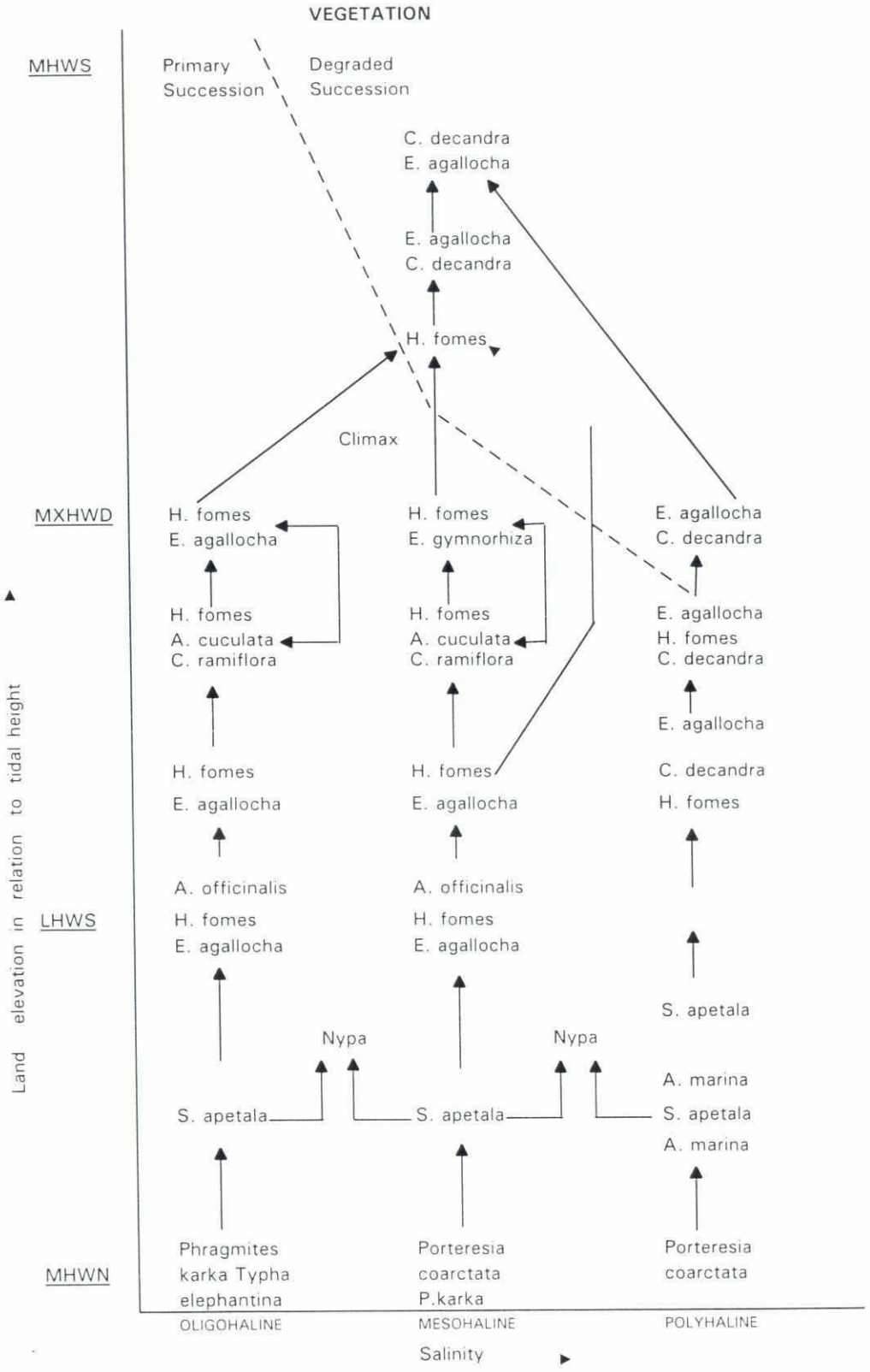
PATUAKHALI DISTRICT

Deputy Commissioner, Patuakhali	- Chairman
Police Superintendent, Patuakhali	- Member
Deputy Director, Agri. Extn. Patuakhali Zone, Patuakhali	- Member
DFO, CA, Patuakhali	- Member/Sec.

BARGUNA DISTRICT

Deputy Commissioner, Barguna	- Chairman
Police Superintendent, Barguna	- Member
Deputy Director, Agri. Extn. Barguna Zone, Barguna	- Member
DFO, CA, Barguna	- Member/Sec.

NATURAL SPECIES SUCCESSION IN THE SUNDARBANS



Succession in the three salinity zones of natural mangrove forests of Sundarbans

MHWS = Mean High water of spring tides
MHXWD = Maximum high water of spring tides during dry season.
LHWS = Law high water of spring tides during dry season.
MHWN = Mean high water of neap tides.

BENEFIT SHARING AGREEMENT
(excerpt)

Agreement under the Coastal Greenbelt Project between Forest Department (FD), acting on behalf of the Government of the People's Republic of Bangladesh and land owing agency, group of selected local beneficiaries and Non Government Organization (NGO) for raising plantation of various fruits and tree species by the sides of roads, highways, railways, feeder roads/council roads, flood control and coastal embankments and on their adjacent lands, and cyclone shelters, and for growing crops and fodder in the vacant land and their protection on the basis of partnership under social forestry concept.

Whereas the Government of Bangladesh has taken up an afforestation programme under the "Coastal Greenbelt Project" as described in a Project Proforma (hereinafter referred to as the "Project Document". to be implemented by the Forest Department by the sides of roads under the Roads and Highways Department (RHD) and Bangladesh Railways (BR), Feeder Roads, Flood Control and Coastal Embankments under the Bangladesh Water Development Board (BWDB) and their adjacent lands and District, Thana and Union Council roads, therefore, today the _____ day of _____ one thousand nine hundred _____ this Agreement is entered into among the following parties to plant, manage and protect trees planted on the land described in the schedule to this Agreement (hereafter referred to as "the said land), and to grow crops/fodder's in any vacant space on the said land and to distribute the final harvest among them.

Name Parties:

1. Forest Department, acting on behalf of the Government of the People's Republic of Bangladesh. *First Party;*

2. Land Owning Agencies (Roads and Highways Department (RHD)/Bangladesh Railways (BR) / Bangladesh Water Development Board BWDB / District / Thana / Council / LGED, *Second Party;*

3. Group of local participants (selected beneficiaries), *Third Party.*

List of Local Participation:

Name: _____ Father's Name: _____

Village:_____ Thana: _____ District: _____

3.1

3.2

3.3

3.5

3.6

4. Concerned Non Government Organization (NGO): _____ *Fourth Party.*

Feeder road means various roads of District, Thana, Union Council and the under the management of LGED.

GENERAL PROVISIONS

This Agreement will : (I) provide the necessary long-term security for local participants in the utilization of the said Land for the purpose of improving and protecting the coastal environment based on the concept of social forestry and partnership among the Government, the group of local participants, NGOs and other parties concerned; and (ii) specify short-term and long-term incentives including the sole and exclusive rights for the local participants to raise and protect coconuts and other plantations of fruits (including coconuts, other palms etc. preferably on embankments) and tree species under the Project to harvest intermediate crops and other products.

B. TERMS AND CONDITIONS

The parties to this Agreement shall be bound to abide by the following terms and conditions:

1. This Agreement shall remain in force for twenty (20) years with effect from (date) _____ if, during this period, the Third Party is in substantial compliance with the terms and conditions of this Agreement, then this Agreement will automatically be the First Party, may be suspended immediately at any time if the Third Party commits a substantial breach of the terms and conditions of this Agreement. In the event of the suspension of this Agreement, the First Party may consult with the Fourth Party and if necessary, terminate this Agreement and replace the Third Party with a new group of similarly composed local participants. In the event of death or incapacity of any member of the Third Party, he/she shall, with the consent of the First and Fourth Parties, be replaced by his/her heir or legitimate successor. The Second Party agrees to grant the Third Party the right to use the said Land on the terms and conditions set out in this Agreement.

2. Under the project, the First Party shall prepare and afforestation programme and arrange to implement the programme in accordance with a management plan to be drawn up by the First Party for planning, protection and management of plantations. The Second Party will be consulted in selecting species of trees on their land.

3. The Third Party comprises persons belonging to the local landless agricultural workers community ("landless" meaning anyone owning less than 50 decimals (0.5 acres) land including homestead). However, owners of land adjacent to the plantations forming part of the Programme may also be included in the Third Party. Distressed women folk may be given preference during selection of participants.

4. The Third Party shall be selected jointly by the First and Fourth Parties. The Third Party can be formed into a group of workers according to the organizational rules of the Fourth Party.

5. Third Party be responsible for maintenance of the palm and tree plantations and for growing crops/ fodder's by the side of various roads/ railways/ embankments, under the direction and supervision of the First Party in accordance with the Programme. The Fourth Party shall arrange proper organization of the Third Party and protection of the plantations, crops and fodder's according to the programme. Where necessary the Third Party shall be paid an allowance of [Tk. .....] by the First Party for the maintenance of the plantations. Such allowances will be paid in full for the first year from the date of this Agreement in accordance with GOB financial rules laid down in the project document. The amount of allowances will be reduced to 50% in the Second year. Thereafter, the Third Party shall be bound to maintain and protect the plantations free of charge.

6. In establishing the programme the First Party shall fix the model and place for intermediary crops to be grown by the Third Party. The Third Party agrees not to use plough's or other tools to till land on embankments / RHD / Railways for the production of valuable produce and agrees to grow produce site as bean, gourd, pumpkin, papaya, maize, chili, brinjal, lady's finger, cotton, pigeon pea, mashkalai, napier grass and para grass on embankments.

No bananas can be planted on embankments. The Third Party can harvest food produce and fodder from the said Land free of charge for their own use and sale.

7. The Third Party, organized by the Fourth Party and under the technical direction of the First Party, shall be engaged in nursery operations, planting of trees, protecting them and grow crops on the said Land in accordance with the planning model prepared by the first Party. The First Party shall provide necessary funds, technical support and other assistance to the Third Party in a timely manner for the above- mentioned work/activities to be duly certified by the Fourth Party. Provision of funds by the First Party shall be in accordance with Government financial rules. The Fourth Party under the technical guidance of First Party shall arrange proper training for the Third Party for cultivation and nursing of plantations until established and for their protection and maintenance thereafter.

8. If, at any stage during the period of this Agreement any member of the Third Party commits a substantial beach of the terms and conditions of this Agreement, then the First Party can exercise the remedy in clause 1 of this Agreement. As soon as this then the Agreement is terminated, the Third Party shall be bound to vacate the land described in the schedule. The Third Party will not be entitled to claim any compensation from the First Party or the Fourth Party, nor file a suit in any court or arbitration against any party to this Agreement.

9. The Third Party shall not construct any house or shed on embankments. roads, railway, tracts etc., in the project area(s) and the character of the land shall not be changed.

10. The Third Party shall not be liable to pay any tax or rent for using the said Land.

11. During the time of crop cultivation and thereafter the Third Party shall have to repair the embankments free of charge if it is damaged in any way by rats or other animals and the Fourth Party shall ensure that this repairing work takes place immediately.

12. If in the public interest, the Second Party wants to undertake any major expansion or rehabilitation of embankments, roads, railways or waterways on the said Land, the First, Third and Fourth Parties shall be bound to vacate any part of the said Land affected by such expansion or rehabilitation provided that the Second Party informs the First Party in writing giving two months notice so that the First, Third and Fourth Parties can sell or recover the planted trees/cultivated crops in due time. Nothing in this Agreement shall affect the right of the Second Party to immediate access upon the said Land in order the effect essential repairs at the expense of the Second Party.

13. No tree plantation or crop production can be carried out in locations such as close to sharp turns in roads, railway signal points, the abutment of bridges and any other locations which could impede movement of vehicles along roads, waterways or railways.

14. The Third Party, in conjunction with the Fourth Party shall ensure saplings planted on the said Land are not damaged or destroyed by livestock or human beings and shall remain bound to protect the plantations. If the plantations are damaged or destroyed by any miscreant then the Third and the Fourth Parties shall take immediate necessary legal action and inform the First Party. If, due to the negligence of the Third and Fourth Parties, the established plantations are damaged or destroyed, the Third and Fourth Parties shall be bound to restore the plantations free of charge.

15. In order to ensure scientifically-based afforestation, the Fourth Party shall employ, in its own organization, officials qualified in forestry and through them, shall discharge their responsibilities.

16. All parties shall follow the management plan prescribed by the First Party in the Programme for the protection and management of plantations. When the trees of the plantation are harvested, the division of sale proceeds of these trees/wood produced shall be as follows:

Roads and Highways Department

1.	Forest Department	20%
2.	Roads and Highways Department	15%
3.	Beneficiary Group	50%
4.	NGO	15%
		100%

Water Development Board

1.	Forest Department	20%
2.	Water Development Board	15%
3.	Beneficiary Group	50%
4.	NGO	15%
		100%

Local Government

1.	Forest Department	20%
2.	LGED/District Council/Thana Council/Union Council	15%
3.	Beneficiary Group	50%
4.	NGO	15%
		100%

Bangladesh Railways

1.	Forest Department	20%
2.	Bangladesh Railways	15%
3.	Beneficiary Group	50%
4.	NGO	15%
		100%

17. At the time of harvesting of forestry crops grown on the said land the First Party shall take steps for disposal in consultation with Second, Third and the Fourth Parties. The Fourth Party shall collect the statistics of such crops and send it to the First Party. The Third Party shall fully cooperate at the time of collecting the statistics.

18. If the Third or Fourth party does not perform their duties of establishing, nursing and protecting plantations according to the technical prescription of the First Party, the First Party may cancel the share or final proceeds for that Party in full or in part.

19. This Agreement will be signed on a stamped format with a non judicial stamp (Tk.)

20. All disputes arising under this Agreement shall be settled by the Secretary, Ministry of Environment and Forests of his nominated represented. For the purpose of resolving the dispute, his decision shall be considered as final and all the parties shall be bound by it. Before giving a decision in this matter, the parties concerned shall be given the opportunity to submit their cases.

Schedule of Land

_____

_____

_____

Subject to the above mentioned terms and conditions with a view to accomplishing the Agreement all the parties before the following witnesses put their signatures with seat if any respectively at their own will and knowledge on this agreed document.

Witnesses **Signature**

1. _____
(First Party)

2. _____
(Second Party)

3. _____
(Third Party)

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(Fourth Party)

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