FOREST SOILS OF BANGLADESH

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ABSTRACT

The forest soils of Bangladesh have been discussed under the four generalized dendro-ecological regions e. g. (i) Floodplain region, (ii) Plio-Pleistocene Terrace region, (iii) Mio-Pliocene Hill region and (iv) Anthropogenetic landtypes region. The dominant soil forming factors and their attributes on physico-chemical, mineralogical properties and the natural soil fertility in each region have been briefly narrated. In addition, major tree species of the dendro-ecological regions and the opportunity for forest production have been discussed. The limitations for tree growth on different dendro-ecological regions have been mentioned. Emphasis has been given on the role of soil moisture regime, acidity, fertility and soil depth on site specific species selection.

সারসংক্ষেপ

বাংলাদেশের বন মৃত্তিকাকে মোটামুটিভাবে চারটি ডেনড্রো-ইকোলজীক্যাল রিজিওনে ভাগ করা হয়েছে যথা (১) বন্যা বিধৌত অঞ্চল, (২) মধ্য ও উত্তর-পশ্চিমাংশের উচ্চভূমি অঞ্চল, (৩) উত্তর, পূর্ব-দক্ষিণাংশের পাহাড়ী অঞ্চল এবং সারাদেশে ছড়িয়ে থাকা মানব সৃষ্ট ভিটাভূমি অঞ্চল। এসব অঞ্চলের মৃত্তিকা গঠনে সক্রিয় কারণ এবং মৃত্তিকার গুণাগুণ, উর্বরতা ও মিনারেলজীর উপরে এর প্রভাব সম্বন্ধে আলোচনা করা হয়েছে। অধিকন্তু, বিভিন্ন ডেনড্রো-ইকোলজীক্যাল রিজিওনের প্রধান প্রধান প্রজাতিসহ বৃক্ষ উৎপাদনে সম্ভাব্যতা ও প্রতিবন্ধকতা সম্বন্ধে আলোকপাত করা হয়েছে। মৃত্তিকার আর্দ্রতা, অম্লতা, উর্বরতা ও স্তরের গভীরতাকে উৎকর্ষতা ভিত্তিক বৃক্ষ প্রজাতি নির্বাচনে সহায়ক কারণরূপে চিহ্নিত করা হয়েছে।

INTRODUCTION

Bangladesh lies on both sides of the Tropic of Cancer and the 90^0E meridian. The latitude ranges from $21^0$25' to $26^0$38' N and the longitude from $88^0$18' to $92^0$40' E. The total land area is about 14.4 M hectare. Out of this 0.29 M hectare is Estuarine Floodplain, 6.78 M hectare is Meander Floodplain, 1.34 M hectare Quaternary Terrace, 1.9 M hectare Tertiary Hill and 3.46 M hectare is covered by inland water bodies and estuaries (Richards and Hassan 1989). On the western border of Bangladesh lies the West Bengal, on the northern border lie the Himachal and Meghalaya states, on the eastern border lie the Assam, Tippera states and Mayanmer. The southern border is covered by the Bay of Bengal (Fig. 1). In this discussion an attempt has been made to through some light on the dominant factors which contribute to soil formation under the Bangladesh condition.

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Climate

According to Thornthwait's (1948) classification, Bangladesh has a moist subhumid, megathermal climate with little or no moisture deficit season. The four hydrologically different seasons (Anon 1971) recognizable are :

i) Pre-monsoon season (April-May) : it has the highest temperature and evaporation rate but low rainfall. It is the driest season of the year. The soil moisture regime in level or gently undulated land is Udic and in steeply sloping or sandy land is Ustic (Anon 1975).

ii) Monsoon season (June-September) : it has the highest rainfall, humidity and cloudiness, but remains usually sunny. Soils, during this season, remain saturated in the upland and flooded in the floodplains.

iii) Post monsoon season (October-November) : it has high humidity, temperature and night dew fall. The upland soil retains enough moisture and the floodplain soil remains still saturated.

iv) Dry season (December-March) : it has low rainfall, temperature and humidity, but remains usually sunny. Soils on the upland may become dry but the floodplain soils retain enough water in the moisture control section (Anon 1975).

Hydrology

The hydrology of the Meander Floodplain is characterized by seasonal flood and drought while the hydrology of the Estuarine Floodplain is characterised by tidal inundation. The depth and duration of both the tidal and seasonal floods regulate the use potential of the floodplain soil for agriculture and forestry. Major rivers are the Ganges, Jamuna and Meghna. The tributaries and distributories of the big rivers form a raticulated drainage pattern in the Estuarine Floodplain criss-crossed by the innumerable drainage channels.

The hydrology of the Quaternary Terraces is regulated by the high seasonal rainfall, fluctuating groundwater table and free surface drainage conditions. This landscape is drained out by an intricate network of valleys and creeks which ultimately converse into several local rivers. The Purnabhaba, Atrai and Karotoa occur in the north-west part (Barind tract) and Bansi, Banar and Dhaleswari occur in the central part (Bhawal-Madhupur tracts) as major rivers.

The hydrology of the Tertiary Hills is regulated by the monsoon rainfall, rock structure and local relief. These factors are related to the surface drainage system of the hilly landscape. The steepness of the hills and proximity to large water bodies (haors) in the north, north-east parts and proximity to the sea in south-east contribute to the efficient discharge of rain water in this landscape. Major rivers of the hilly region are the Karnaphuli, Sangu, Matamuhari, Banshkhali and Naf in the south-east and Surma, Kusiara, Khowai and Goyang in the north-east.

Geology

The sediments of the Estuarine and Meander Floodplains are unconsolidated, recent, materials and are homogeneous in texture and mineralogy. The mode of deposition of the sediments is riverine in the inland part and estuarine in the south. A long strip of piedmont material occurs north-south extending from Feni down to Teknaf on the west of Sitakunda range.

The Bhawal-Madhupur tract in the centre and Barind tract in the north-west part of Bangladesh are dissected, unconsolidated, unfolded upland of the Plio-Pleistocene age. The homogeneity of the sediments both in vertical and horizontal directions is indicative of their estuarine origin.

The hill sediments comprise the unconsolidated and semi-consolidated beds of siltstones, shales and clayey sandstones which have been folded into successions of pitching anticlines and synclines. The frequent change in lithology from sandstone to shale and close dissection of the hills, provide this landscape with a complex geomorphological pattern. These sediments are of Mio-Pliocene age (Anon 1971).

The unconsolidated sediments of the Dupi-Tila formations of the Pliocene age occur on the flanks of the anticlines. These are of mixed sand, clay and silt. Locally, fossil mottles may occur at variable depth. The sediments of the Tipam-Surma formations occupy the crests of the anticlines. These sediments lack the fossil mottles and quartzite pieces. The Tipam-Surma formations are of the Miocene age.

Forest types

The natural forests of Bangladesh consist of three major vegetation types occurring on the three distinctly different landtypes. The forest types are (i) coastal mangrove forests (ii) central and north-western upland forests and (iii) eastern and northern hill forests (Fig 1). The major tree species growing on different landtypes are discussed in brief.

The planted mangrove forests occupy about 0.1 M hectare in Barisal, Chittagong, Patuakhali, Noakhali and about 5.8 M hectare of natural mangrove forests occur in the Khulna, Patuakhali and Chakaria Sunderbans. Major species are sundri (*Heritiera fomes*), gewa (*Excoecaria agallocha*), keora (*Sonneratia apetala*), passur (*Xylocarpus moluccensis*) and kankra (*Bruguiera gymnorhiza*). The planted species are keora, gewa, kankra and locally sundri (Hassan 1982, Das 1960).

The sal (*Shorea robusta*) forests occupy 98,000 hectare on the Bhawal-Madhupur tract and 15,000 hectare on the Barind tract. These are low yielding, depleted coppice forests. Other common tree species in the sal forests are hargaza (*Dillenia pentagyna*), gadila (*Careya arborea*), bohera (*Terminalia bellirica*), jiga (*Lannea cormandelica*), sidha (*Lagerstroemia parviflora*), chapalish (*Artocarpus chaplasha*), koroi (*Albizia* spp), sonalu (*Cassia fistula*), etc (Champion, Seth and Khattak 1985).

The hill forests occupy about 0.59 M hectare of which 0.29 M hectare is in Chittagong, 0.26 M hectare in Chittagong Hill Tracts, 44,000 hectare in Sylhet and 750 hectare in Comilla. In the hill forests, 75,000 hectare has been converted into teak, (*Tectona grandis*), jarul, (*Lagerstroemia speciosa*), gamar (*Gmelina arborea*), eucalyptus, acacia, garjan (*Dipterocarpus* spp.), and dhakijam (*Syzygium grande*), plantations. About 10,000 hectare of plantation forests are being raised each year. The major tree species on hill forests are chapalish, chundul (*Tetrameles nudiflora*), telsur (*Hopea odorata*), narikeli (*Pterygota alata*), pitraj (*Aphanamixis polystachya*), kanak (*Schima wallichii*), toon (*Toona ciliata*), nageswar (*Mesua ferrea*), uriam (*Mangifera sylvatica*), dhakijam, civit (*Swintonia floribunda*), garjan, tali (*Palaquium polyanthum*), kamdeb (*Calophyllum polyanthum*), champa (*Michelia champaca*), raktan (*Lophopetalum fimbriatum*), gamar, asok (*Saraca asoca*). The deciduous species are kadam (*Anthocephalus chinensis*), simul (*Bombax ceiba*), bandarhola (*Duabanga grandiflora*), koroi (*Albizia* spp.), chikrassi (*Chukrasia velutina*), amra (*Spondias pinnata*), pitali (*Trewia nudiflora*), etc (Champion, Seth and Khattak 1965).

Dominant forest bamboos are muli (*Melocanna baccifera*), mitinga (*Bambusa tulda*), duloo (*Neohouzeaua dullooa*) and orah (*Dendrocalamus longispathus*).

Trees on Anthropogenetic soils are the planted horticultural species like am (*Mangifera indica*), jam (*Syzygium cumini*), kul (*Ziziphus mauritiana*), kanthal (*Artocarpus heterophyllus*), litchi (*Litchi chinensis*), payara (*Psidium guayava*), tetul (*Tamarindus indica*), tal (*Borassas flabellifer*), khejur (*Phoenix sylvestris*), etc.

FOREST SOILS

Forest soils are infact the genetically normal soils excepting that in some cases the agricultural use of the forest soils are restricted due to one or more severe limitations. In Bangladesh, four different forest landtypes have been recognized. Their landforms are also distinctly different. Soil development in these landforms and the ecological distribution of forest vegetation related to several dominant factors are discussed chronologically.

Soils of the Floodplains

Mangrove forests in Bangladesh occupy the Sunderbans, Chakaria Sunderbans and the man-made coastal forests. The finer sediments of the Ganges, Meghna and Brahmaputra are settled down as estuarine deposit at their confluences. The sediments are well sorted both in vertical and horizontal directions. This landscape is nearly level criss-crossed by an intricate network of drainage channels forming the characteristic dendratic drainage pattern. The elevation difference between the levee tops and basin bottoms is slight in the Estuarine Floodplain (Fig. 2a).

The sediments of the clayey piedmont beach and inland Meander Floodplains are less well sorted and contain higher percentage of fine sand compared to the estuarine deposit. The newly formed charlands in inland, shore and off-shore areas are infact a thick suspension of silt and clay. These are unripened riverine or estuarine sediments and have a low bulk density (< 1.2 g/cc). On drying, they shrink irreversibly due to loss of moisture (Hassan 1984). This is the beginning of soil formation. The landscape gets uplifted gradually due to sedimentation and the parts which become seasonally dry are subjected to both pedoturbation and bioturbation processes (Buol and Hole 1961). Soil structure formation takes place in these soils through seasonal alternate shrinking and swelling (Brewer 1971).

The subsoil characters of the Estuarine Floodplain soils which occur outside the polder are grey to bluish, silty clay to clay, massive, slightly to strongly calcareous and slightly to moderately saline. These soils are classified as Typic/Hydric Fluvaquent (Hassan 1982). The soils developed in inland areas of the Meander Floodplain, inside the polder of the Estuarine Floodplain and in the piedmont clayey beach fulfil partly the requirements of a Cambic horizon (Anon 1975, Hassan 1982). The soils having a Cambic horizon are classified as Typic Haplaquept and the rest as Typic Haplaquent. The soils of the Chakaria Sunderbans are non-calcareous, loamy to clayey. On drainage improvement these soils, locally, become extremely acid (pH < 3.5) and are classified as Thionic Haplaquent (Anon 1975, Hassan 1982).

Attributes of the pedological factors in the unpoldered Estuarine Floodplain soil are not recognizable. The high water table and flat relief tend to keep these soils under reduced condition. The Estuarine Floodplain soil inside the polder and the Meander Floodplain soil may have developed prismatic or blocky structures.

The generalized physico-chemical and mineralogical properties of the Estuarine Floodplain soil are alkaline or neutral, calcareous and massive. These soils have the cation exchange capacity (CEC) of 30-35 meq 100 g clay. The dominant clay minerals in the Gangetic sediments are illite and smectite with traces of kaolinite, vermiculite, chlorite and intergrade minerals. The dominant clay minerals in non-Gangetic sediments are illite and vermiculite with traces of kaolinite, chlorite and intergrade minerals. The kaolinite present in these soils is an inherited feature.

The natural fertility of the floodplain soil is high. This is due to their high content of mineral nutrients, high CEC, high base saturation per cent (BSP) and the dominance of smectitic or vermiculitic clays in the Gangetic and non-Gangetic materials, respectively. The content of weatherable primary minerals like biotite, feldspars, dolomite, amphiboles etc. are high. The Gangetic sediments contain variable quantity of calcite, in addition. The high content of total zinc (> 100 ppm), manganese (> 370 ppm), copper (> 50 ppm) and cobalt (> 33 ppm) in the Ganges floodplain soil is related with their high content of silt and clay. However, the recent works conducted by different agencies indicated that the available zinc content in these soils is low or marginal (< 1 ppm). This is due to their high pH (> 7.5) values (Hassan 1991). The mobility of zinc becomes drustically reduced at pH 6.0 or above.

The poor drainage, tidal or seasonal inundation and salinity in the unpoldered area are the limitations for agriculture and for most mesophytic tree species. However, no specific mineral defficiency symptom is observed either in the mangrove or mesophytic tree species of this region.

Soils of the Plio-Pleistocene Terraces

The soils developed on deeply weathered terrace material on closely dissected topography, are well drained and have a strongly structured, clayey, reddish to brownish (2.5YR 5/6 to 10 YR 5/4-8 dry), acid subsoil. Unlike the shallowly weathered terrace soil, the depth to the unaltered pre-weathered material in these soils may vary from one to many metres. The soils occupying the highest part of the landscape have subsoil colour of a hue redder than 5YR. Under moderately well and imperfectly drained situations, where the landscape is broadly dissected, some of these soils may have mottles with a chroma of 2 or less. Iron-manganese concretions occur at a variable depth depending on depth to the seasonally fluctuating groundwater table. Normally, these soils have an Argillic horizon, but a Cambic horizon may occur in a moderately well drained, structured, yellowish brown (10YR 5/4-8 dry), acid subsoil. The soils having an Argillic horizon are classified as Udalf or Udult depending on their base saturation per cent (BSP), while the soils with a Cambic horizon are classified as Ochrept or Aquept depending on the drainage condition. In the sub-group level they may be Oxic or Ultic in well to moderately well drained soil and Oxic, Udic or Fluventic in imperfectly or poorly drained soil.

The soil derived from terrace material weathered to a shallow depth, overlying an unaltered pre-weathered clay on level to undulating topography, have a brownish (7.5YR-2.5YR dry) clayey, acid, subsoil. Intermittent clay cutans are observed in the Cambic horizon indicating an incipient development of the Argillic characteristics. The subsoils in them rest on a pre-weathered, compact and unaltered acid clayey substratum within 1 m of the surface. In a level topography where drainage is free, the soil has a strong brown (7.5YR 5/6 dry) to reddish (2.5YR 5/6 dry) subsoil; in the poorly drained situation they may show Aquic (i.e. reduced) characteristics. On broad flats, the subsoils are imperfectly drained with olive grey (5Y 5/2 dry) to olive (5Y 5/4 dry), weakly structured, acid clays. In valleys, the soils have grey (5Y 5/1 dry) to dark grey (5Y 4/1 moist), weakly structured, clayey to loamy, acid subsoil. The well drained soils in this landform are classified as Ochrept, while the poorly drained ones are classified as Aquept. The land components on deeply and shallowly weathered landforms on the Quaternary Terraces are shown (Fig. 2b).

The subsoil colour in terrace soil as indicated earlier reflects the drainage condition and is well correlated with the topo-sequence. These soils have an Ochric (i. e. pale coloured, < 2.5% organic matter) epipedon. The colour, texture and structure of the topsoil may vary, depending on the landuse.

The pedogenic factors e. g. time, relief and to a lesser extent the parent material contribute to the profile development in these soils. These factors dominantly act in forming the structural, colour, and textural B horizon. The effect of leaching on reaction (pH) and BSP is partly neutralized by the fluctuating groundwater table. During the heavy monsoon shower the groundwater table may reach to the surface but sinks down rapidly after the rain stopes. During the pre-monsoon season (March-May) it may reach to a depth of 10 m.

A generalized physico-chemical and mineralogical properties of soil of the well drained deeply weathered terraces are clayey to fine loamy, acidic, brown, subangular blocky. They have the CEC of 20 meq/100 g clay. The dominant clay minerals in these soil are illite and kaolinite with traces of chlorite. The soils occurring on shallowly weathered imperfectly drained terraces are loamy, acidic, grey to olive, subangular blocky. They have the CEC of 30-35 meq/100 g clay. The subsoil rests on a strongly structured, pre-weathered clay layer within 50 cm depth. The dominant clay minerals are illite, smectite and kaolinite with traces of chlorite-vermiculite intergrades. Primary weatherable minerals present in these soil are biolite and feldspers. These minerals occur in a small quantity mainly in the sand fraction.

The available zinc (> 1.0 ppm), manganese (> 2.0 ppm) and copper (> 1.0 ppm) content in these soils are marginal, while cobalt content (> 1.3 ppm) is adequate (Hassan 1991). The total content of zinc, copper, cobalt and manganese is high in these soils. Availability of micronutrients in well drained terrace soil is higher compared to the floodplain soil. This is due to their favourable soil reaction (pH < 6.0).

The organic matter content of the well drained forest soil may range 3-5 percent. The imperfectly drained soils used for agriculture have the organic matter content of less than 2 percent. Natural fertility of these soils is low compared to the soils of the Estuarine and Meander Floodplains. This is due to their lower CEC, acid reaction and kaolinite dominant clay minerals. Well drained terrace soils are suitable for most mesophytic tree species. The shallowly weathered level terrace soils are fertile, but the poorly drained condition limit their use to planting of a limited range of tree species only.

Major limitations of the deeply weathered soils are droughtiness in the dry season, high ground water table during the monsoon and of the shallowly weathered soils are wetness during the monsoon and presence of a compact clay layer at shallow depth. The compact clay layer is impenetrable to the tree root. Deep rooted, drought resistant non-exacting tree species can grow on well drained deeply weathered soil. The imperfectly drained shallowly weathered soil can support shallow rooted tree species adaptable to the water logged condition.

Soils of the Mio-Pliocene Hills

The high hills comprise Tertiary sediments of the Tipam-Surma formations. Soils of the high hills (usually > 100 m elevation) are steeply sloping excessively drained and of shallow depth (< 1 m). They have yellowish brown (10YR 5/6-8 dry) to strong brown (7.5YR 5/6-8 dry), well structured, loamy, acid subsoil resting on consolidated or semi-consolidated siltstones, clayey sandstones or shales. Base saturation is about 50% and CEC is less than 24 meq/100 g clay. Soils developed on shales are clay loam or silty clay loam, brownish yellow (10YR 6/6 dry), while those derived from sandstones are strong brown (10 YR 5/6 dry), sandy loam to sandy clay loam.

The low hills (< 100m), occurring on the flanks of the anticlines are sediments of the Dupi-Tila formations. Soils occupying the steep slopes and ridge crests are excessively drained and have a pale coloured, acid, weakly structured subsoil. Soils on broad summits and gentle slopes have a well drained, strong brown (7.5YR 5/6 dry) to yellowish red (5YR 5/6 dry), strongly structured, acid subsoil. The flat topped low hills (< 10 m) may have localized seepage pockets where the subsoils are mottled, some of the mottles having a chroma of 2 or less.

The well drained, dissected, sloping piedmont terraces may occur locally at the outer most part of the anticlines. Morphologically, these terraces ressemble the low hills. Like soil of the Dupi-Tila formations, the piedmont terrace fans soils have deep, strong brown (7.5YR 5/6-8 dry) to yellowish brown (10YR 5/6-8 dry), loamy, acid subsoil. The terrace fan soils are more strongly leached than soils of the

Dupi-Tila formations and have a lower base saturation percent (< 35%). The soils in valley are poorly to very poorly drained, and have grey mottled, loamy to clayey, weakly structured, acid subsoil. The land components of hilly regions are shown (Fig 2C.)

Irrespective of the parent material and lithology, hill soil occurring on the excessively drained narrow ridge crests, steep slopes and cliffs have a Cambic horizon, while those occurring on well drained flat hill tops and gentle slopes have an Argillic horizon. The topsoils are usually dark greyish brown (10YR 4/2 dry) unless eroded.

The colour and structure of the subsoil correlate well with the topo and drainage sequences. The soils occurring on the broad summits and gentle slopes have strong brown (7.5 YR 5/6-8 dry), strongly structured, acid subsoil; those on the steep slopes have yellowish brown (10 YR 6/6-8 dry), moderately structured, acid subsoil; and valley soils have grey (5Y 5/1 dry), weakly structured subsoil. Likes soils of the Plio-Pleistocene terrace the dominant soil forming factors are relief, time and parent material. Time and relief contribute jointly to the formation of deeper profiles in gently sloping Dupi-Tila and Terrace fan soil. Flat relief of the valleys is responsible for the poor drainage of these soils. Effective total rainfall on steeply sloping hill is much lower compared to the rainfall and run-off received in level valleys. For this reason the hill tops and steep slopes are droughty and valleys are poorly drained. All types of mesophytes can grow on deep well drained soil, drought resistant species can grow on shallow soil and flood tolerant species can grow in valleys.

The generalized physico-chemical and mineralogical properties of soils of the low hills are loamy, acidic, brown, subangular blocky having CEC of 16 meq/100 g clay. The dominant clay minerals in these soil are illite and kaolinite with traces of chlorite. Soils of the high hills are loamy to clayey, acidic, yellowish brown, subangular blocky having the CEC of 20 meq/100 g.clay. The dominant clay minerals in these soils are illite and kaolinite with traces of smectite, vermiculite and chlorite. The primary weatherable minerals in hill soil are biolite feldspars and amphiboles. These minerals occur in small quantity in the sand fraction. On the high hill, these minerals may also occur in silt fraction.

The organic matter content of the hill soil is 3-5 percent under forests. The CEC and pH of the hill soil are comparable with those of the terrace soil. Despite their low CEC, strong acidity and relatively low base saturation percent (BSP < 50), they are moderately fertile for most tree species. Trace element content of the hill soil is marginal to low. Under forests due to recycling mechanism through the deep root system of trees the topsoil may contain a high quantity of trace elements.

Major limitations of the hill soil are droughtiness in dry season, steep slope and susceptibility to erosion hazard. Locally, the presence of a hard lateritic pan at a shallow depth on the low hills and semi-consolidated rock on the high hills may hinder tree growth. In valleys, saturation for a large part of the year may make the soil unsuitable for tree growth.

Anthropogenetic soils

The anthropogenetic soils occurring on man-made platform are mainly used for the homesteads. But locally, these platforms are also used for agroforestry and orchards. The man-made platforms occur scattered throughout the country on all the dendro ecological regions. The elevation of the platforms in Meander and Estuarine Floodplains depends on the flooding depth of the region. The main intention of building these platforms is to raise the land above the normal flood level to make safe heaven for rural housing, orchards and agroforestry purposes. The anthropogenetic soil on Plio-Pleistocene terraces occur either on slightly raised ridges or on slightly elevated platforms. On Quaternary hills the homesteads occur mainly on the lower slopes or on the crests. The slopes are worked out for making more or less flat yard convenient for housing. Bamboos, fruit, fodder and industrial wood species are planted on the homestead backyard on hilly land.

The physico-chemical and mineralogical properties of the Anthropogenetic soil are related to the landform to which they belong. However, the drainage condition of the raised platform soil is better compared to the soils of the floodplain area. The Anthropogenetic soils may be more droughty in the dry season. These soils do not show any profile development. An Anthropic epipedon may occur locally in these soils. These are classified as Miscellaneous landtype. Major limitations of the Anthropogenetic soil for tree growth are droughtiness in dry season and locally intermittent flood during the monsoon.

OPPORTUNITY FOR FORESTRY

Deep, well drained, brown soils of the high and low hills and terraces offer greater opportunities for traditional silviculture aimed at production of fuel and industrial wood. Imperfectly drained terraces can support flood tolerant shallow rooted tree species. Shallow soils of the high hills and exceedingly drained soils on steep slope may be suitable for some drought resistant shallow rooted tree species. Except for the mangrove forests in the Sunderbans and planted coastal littoral forests little land is available in the floodplains for tree planting. The village woodlots occurring on non-flooded or intermittently flooded land can be used for fruit, fodder and fuelwood producing trees. The seasonally flooded land may be used for planting of several specially flood tolerant species.

Land capability for a particular piece of land can be assessed according to the FAO Framework for Land Evaluation (1976) following the methodology suggested by Sys (1978). The principle was applied in Bangladesh by Stevens (1988) for site specific species selection on the hilly terrain, Hassan (1986) for land capability assessment for oilpalm (1986) cultivation and Hassan and Emdad (1993) for site specific planting of several tree species in all the dendro-ecological regions. In these attempts, the authors tried to apply the FAO Framework (1976) for the assessment of land capability for trees in a simplified form. The growth factors like the (i) land components, (ii) effective soil depth, (iii) soil texture, (iv) soil moisture regime, (v) soil reaction and (vi) soil fertility were interpretated combinedly for this purpose. These growth factors were arranged in a logical sequence, (Hassan and Emdad 1993).

These growth factors were rated numerically for a particular tree species and the combined ratings were calculated using a formulla (Hassan and Emdad 1993). This generalized rules used may apply for whole Bangladesh for the purpose of site specific species selection. The following general comments may apply under the Bangladesh conditions.

- The acid upland soils are suitable for most mesophytic tree species except for the ipil-ipil (*Luceuna leucocephala*).
- The shallow soils on the high hills are suitable for drought resistant and shallow rooted tree species.
- The intermittently flooded soils are suitable for most mesophytic tree species excepting the jack fruit (*Artocarpus heterophylla*).
- The soils of the Meander Flood plain can be used for flood tolerant tree species.
- The tidally flooded coastal saline soils are suitable for mangrove species, which are specially adaptable to the site conditions.

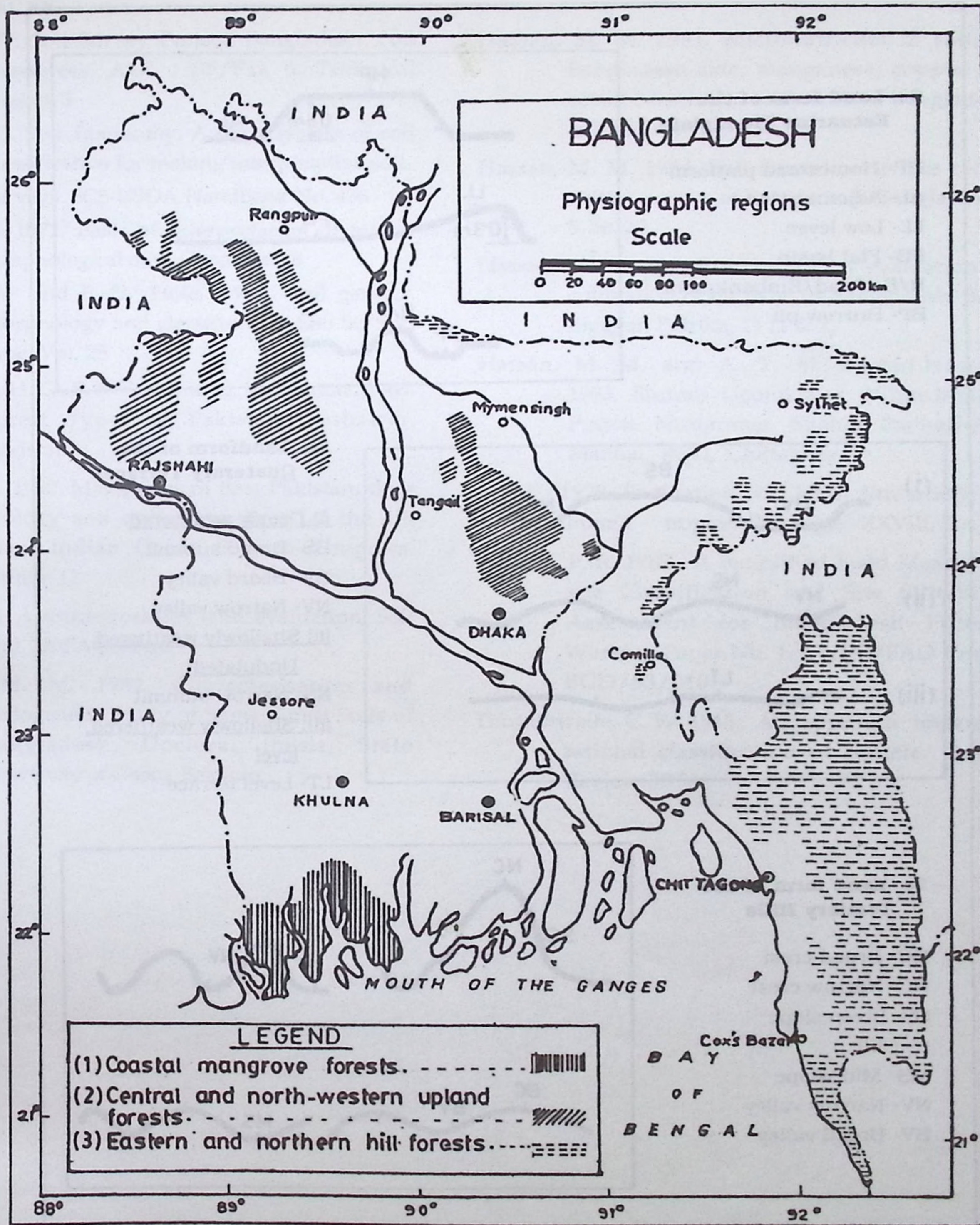
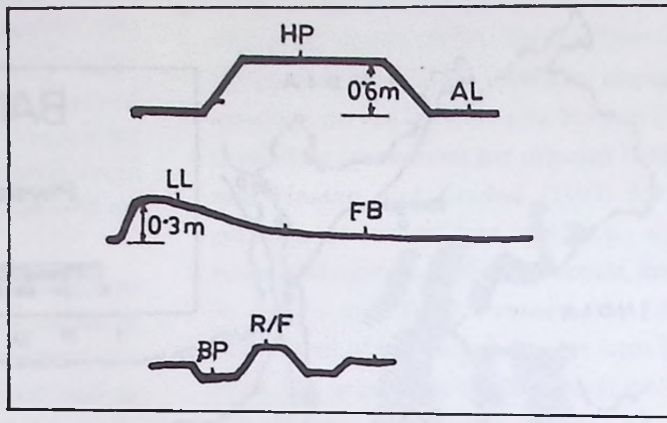
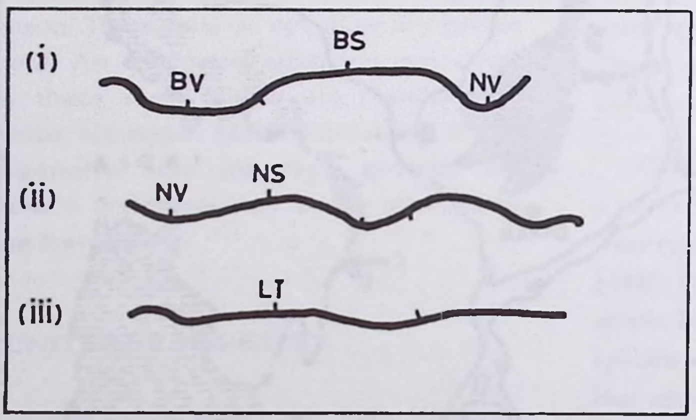


Fig. 1. Location of three physiographic regions and the supporting forest types

2a. Land form of the Estuarine Floodplain

HP- Homestead platform
AL- Adjoining land
LL- Low levee
FB- Flat basin
R/E- Road/Embankment
BP- Burrow pit



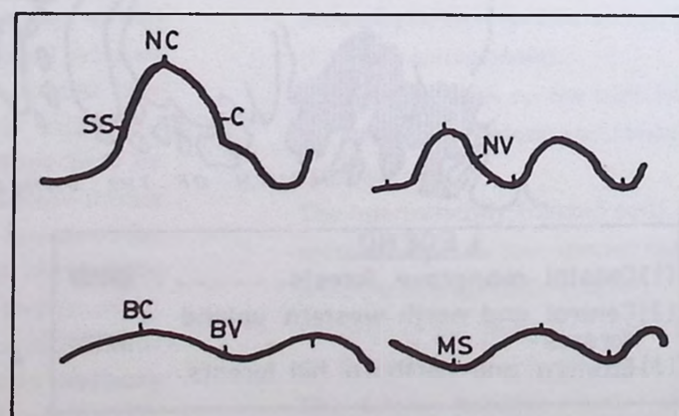


2b. Landform of the Quaterary Terraces

(i) Deeply weathered
BS- Broad summit
BV- Board valley
NV- Narrow valley
(ii) Shallowly weathered Undulated
NS- Narrow summit
(iii) Shallowly weathered, level
LT- Level terrace

2c. Land form of the Tertiary Hills

BC- Broad crest
NC- Narrow crest
SS- Steep slope
C- Cliff
MS- Mid. slope
NV- Narrow valley
BV- Broad valley



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