

COASTAL AFFORESTATION IN NOAKHALI DISTRICT.

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INTRODUCTION :

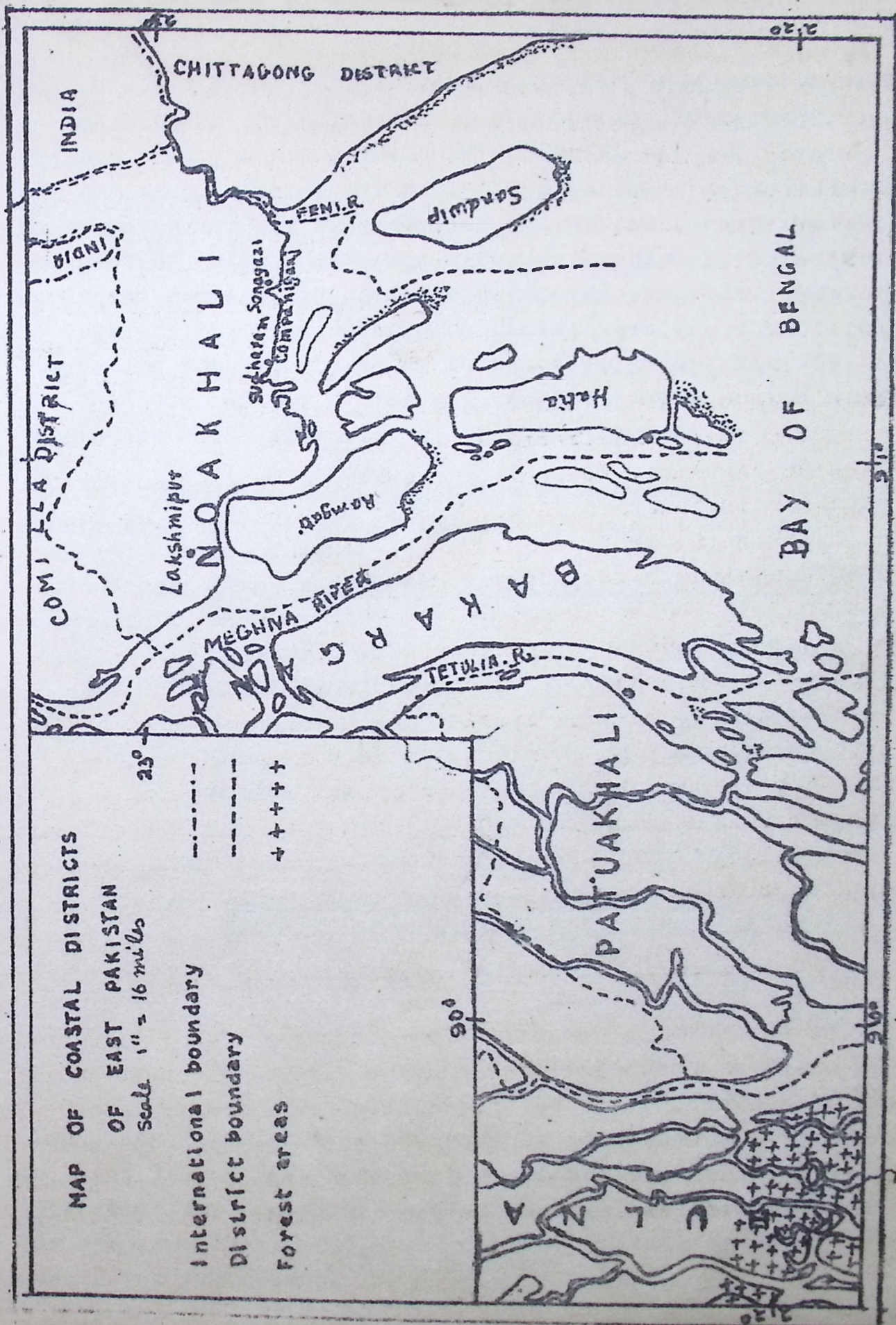
Noakhali is a non-forest district of East Pakistan. The problems of this district are many-fold of which the natural calamities such as floods, tidal waves and Cyclone are the most important. The district is located on the north of Bay of Bengal which is notoriously a Cyclonic zone. The entire district is flat, intercepted by mighty rivers and their delta. The Southern part consists of a number of islands which are continuously being silted and enlarged. New islands are being formed due to silta-tion and appear only at low tide. The general level of the district is a little above Sea level and a slight tidal wave causes destruction to houses and crops. It appears from historical records that prior to 20th century the area was fully vegetated where special efforts were made to colonize people by giving special facilities in the remission of land revenue and cash advances etc. In the beginning the Colonization was slow, most probably because of the known ravages of the climatic factor due to its location. The economic gains appear to have been so promising that in spite of the dangers of climatic ravages the colonization progressed steadily but slowly and at present this is the most heavily popula-ted district of East Pakistan.

The necessity and experience made the people to realize that the only way of successful colonization was construction of embankments along rivers and small streams to counteract frequent saline inundations. Small embbankments commensurate to the econo-mic ability of individuals were constructed which gave them protection from the daily variations of tidal levels but slightest

tidal wave resulted in considerable damage to crop, cattle and villages. Collective security was only conceived after independence when the state undertook construction of higher and bigger embankments which have resulted in greater protection from relatively higher tidal waves. The protection of these embankments from the erosive action of the fluvial and marine waves gave birth to the Coastal afforestation programme in the district. The effects of coastal afforestation have been much debated and certain exaggerated claims, giving evidence from adjoining Khulna district, have been made but it is doubtful if a small strip of afforestation can have the same effect as the vast forest areas to the south Khulna district. However it must be conceded that Coastal afforestation in Noakhali district will have certain beneficial effects such as the protection of the embankments from the erosive action of waves and rain; provide much needed fuel and other construction wood to the local population etc. provided necessary research is carried out these can become potential areas for growing trees species that produce food particularly cattle feed for which the seeds of all leguminous species appear to be most suitable. Under the peculiar circumstances such as a general shortage of food in the province, local land hunger and unemployment etc. the gains though small are a matter of life and death for the local people and all efforts regarding afforestation of these areas are justified on this account.

EMBANKMENTS IN RELATION TO AFFORESTATION.

The embankments are earthen structures 15-20' high the crest of which is about 12' wide and the slopes on either side have an angle of about 60° . The required earth was taken from both sides of the embankment which was generally a clay loam to very sticky clays. The salinity of these soils was high and consequently the embankments themselves are not devoid of saline matter. During the



MAP OF COASTAL DISTRICTS

OF EAST PAKISTAN

Scale 1" = 16 miles

- International boundary - - - - -
- District boundary - - - - -
- Forest areas +++++

COMILLA DISTRICT

NOAKHALI

Lakshmipur
Sudhara Sonogazi
Companyganj

Ramgarh

MEGHNA RIVER
BAKARGANJ

TETULIA R.

PATUAKHALI

ULNA

INDIA

INDIA

CHITTAGONG DISTRICT

FENI R.

Sandwip

Hakra

BAY OF BENGAL

23°

90°

96°

23°

91°

23°

period after their construction there has been certain amount of leaching of the salts and it appears as indicated by the grasses that are now growing on the crest and the slopes, that the salinity in these parts of the embankment is negligible. No research has yet been carried out on the upward or downward movement of salts due to the alternating high precipitation periods and extreme dry period encountered annually. However, it is apparent that the embankments themselves are capable of supporting non-halophytic or facultative halophytic vegetation and the berm and the delves will support marsh and halophytic vegetation which are known as mangrove species.

Upto date about 210 miles of embankments have been constructed in the Coastal Police Stations as follows :

1) Along sea Coast facing saline conditions all round the year.

Sudharam P.S.	45.50 miles.
Companygonj P.S.	12.50 "
Sonagazi P.S.	24.50 "
Ramgati P.S.	26.50 "
Hatiya P.S.	84.00 "

193.00 miles.

2) Along river bank facing fresh water and saline condition alternating each other during the year.

Lakshmipur P.S.	18.50 miles.
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18.50 miles.

Total : 211.50 miles.

Uptill now 24 miles of embankment on the main land and 75 miles on Hatia Island have been planted up and covers an area of 1408 acres. The experience gained during the course of this process has been invaluable and a description of this experience is recorded in the forthcoming.

for the local people and at the same time have the

CHOICE OF SPECIES.

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For the purpose of plantations edaphic considerations appear to be the most important. The site classification and the choice of species used at present is described below. Studies and research at Bogi Research Station during 1968 and 1969 has shown that the mangrove species can generally withstand a period of submersion periods. All species can be classified according to their tolerance to submersion and three distinct classes i.e. (1) low submersion tolerant, (2) medium submersion tolerant and (3) high submersion tolerant species can be recognised. The suggestions made in this paper are based on such a classification of the species. In locations where submersion period exceeds 300 minutes or 5 hours one year old seedlings grown in polythene bags may be successful as the terminal buds will remain above water for most of the time. Some trials are necessary before this suggestion can be adopted on a large scale. The relationship between the site and choice of species has been further examined in relation to the Socio-economic and other factors and improvements have been suggested for adoption in the future plantation programme.

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Site Class 1.- Slopes of embankments : These are areas where tidal waters do not reach and apparently remains unaffected by Salinity or seasonal variation in salinity. The upward and downward movement of salts in the soil due to alternating precipitations and dry seasons is the main consideration in the selection of species. Non-halophytic or facultive halophytes appear to be the most suitable species. The species planted at present are Acacia arabica, acacia catechu, Loucenia glauca, Albizzia sp., Erythrina indica, Calophyllum inophyllum. A more detailed plantation plan needs to be evolved for this site class. The introduction of tree species yielding annual crops such as fruits,

seeds for cattle feed etc. may be more valuable than the simple timber species. It appears that for the top-most line Anacardium occidentale, Acacia arabica, acacia catechu and other fruit bearing trees may be more suitable. In the second lower line, Casuarina equisetifolia, Eucalyptus Camaldulensis, Calophyllum inophyllum etc. and in the lowest line Calophyllum inophyllum, Excaecaria agallocha may be used and are likely to play much important role in the Socio-economic development of the region.

Site Class 2. - Berms of embankment : This is the area between the delves and base of the embankment. Here the effects of high tide are seen. At present Pongamia glabra, Heritiera minor, Carpa moluceensis, Amoora Cucullata, Dalbergia Sisoo and Nipa fruticans are being used for plantation. In this site class a distinction has to be drawn between the marine embankments and the riverine embankments and the choice of species will depend on the location. In the embankments facing the sea salinity is uniform during the year but in the case of embankments on river banks the salinity is variable during monsoon and dry season. The facultative halophytes like Nipa fruticans will be limited to the riverine embankments while the other species can continue on both locations.

Site Class 3.- the higher delves : This is the area of the pits that has been silted up. The species planted are Carapa moluccensis, Amoora Cucullata, Carapa obovata, Excaecaria agallocha and Heritiera minor. In these locations all low submerSSION tolerant and medium submerSSION tolerant species can be used for plantation.

Site class 4. The lower delves : These are the areas that are the lowest and the wettest. The species planted are Sonneratia apetala, Avicennia officinalis and Bruguiera gymnorhiza. In this location all medium submerSSION tolerant and high submerSSION tolerant species can be used.

SILVICULTURE OF SPECIES USED FOR PLANTATION :

The Silviculture of species used on site class 1 does not appear to be a problem as our knowledge on these species is sufficient and nursery grown stock can be used in most cases. The Silvicultural character of species, planted on site class 2, 3 and 4 are very little known. The silvicultural requirements of these species learnt from experience during the raising of plantation in these areas and studies and nursery trials carried out at Bogi Research Station during 1968 and 1969 are recorded below. Nursery of all the species was raised on stepped nursery beds which remained submerged for varying periods of time during 24 hours and quarterly observations on survival and growth were kept. The results of these trials have been used in describing the silvicultural characters of the species. For the planting technique different methods of planting were tried in coastal afforestation area by the territorial staff and their conclusions have been used below for the description of the silvicultural characters of the species.

(1) Pongamia glabra : Seeds ripen during Jan-Feb. This species is a good seed producer. No periodicity has been observed. In nursery trials it has been observed that best germination and survival is obtained when the location remains submerged for 0-160 minutes during 24 hours and the species can be classified as low submerssion tolerant. Direct sawing of clean pregerminated seed gives the best result. Direct sawing of pods also gives good results provided washing away of pods by the tides could be checked. In case of transplanting one year old seedling the survival percentage is low.

(2) Heritiera minor : Seed ripen during June-July. The species seeds well and no periodicity has been observed. In nursery trials it has been observed that germination and survival is best when the location remains submerged for 100-200 minutes

during 24 hours or the species has been classified as medium to high submerssion tolerent. Direct sowing of seeds gives the best results. Transplanting of nursery grown stock also gives satisfactory results but it is not recommended as the survival percentage is low.

(4) Amoora cucullata. Seeds ripen during May-June. The species seeds well and no periodicity has yet been observed. Nursery trials show that germination and survival is best when the location remains submerged for 0.200 minutes in 24 hours and the species can be classified as low to medium submerssion tolerent. Direct sowing by dibbling in June-July gives the best results.

(5) Nipa fruticans. Best time of seed collection is Feb-March. All fronds do not produce seed every year. There is a marked periodicity in the matter of production of seed. Out of the 5 mother fronds under observation only one produced seed in 1968 but none of them produced any seed during 1969. This is the most difficult species to grow. It appears to be more suitable for fresh water areas as in saline areas this has failed completely. All other methods excepting the pregerminated seeds have been found to be a failure. Nursery trials carried out during 1968 show that the best germination and survival percentage is obtained when seeds are shown in locations where the land remains submerged at least for 232 minutes during 24 hours or is submerged for at least 16% of the time and falls under the species classified as medium to high submerssion tolerent.

(6) Carapa obovata : Seeds ripen in Jan-Feb. It appears to be a uniform seed producing species i.e. it does not exhibit any periodicity. Five mother trees studied for seed production seeded well both during 1968 and 1969. Nursery trials carried out during 1968 showed that best germination and survival percentage

was obtained when seeds were planted in location submerged for 160-200 minutes during 24 hours or 11-14% of the time. The species has been classified as low submeression tolerant. Diring sowing of seed in June-July appears to give the best results.

(7) Excaecaria agallocha. Seed ripens during July-August. Mother trees selected for seed production studies have not yet been observed long enough to warrent comment or its seeding behavior. However all trees observed produced seed during 1969. In nursery trials carried out during 1968 best germination and survival was obtained when the planting location remained submerged for 200 minutes during 24 hours or 14% of the time. The species has been classified as medium to low submeression tolerant. In case of planting nursery grown stock failures have been very common. This appears to be mainly due to the fact that the species develops a long tap root in a short time. Injury to the tap root has to be avoided for success. This is practicably impossible in the case of nursery grown stock. Most probably the seedlings may have to be grown locally in polythene bags.

(8) Sonneratia apetala : Seeds ripen during July-August. It is a good producer of seed and does not appears to exhibit any periodicity. However collection of seed in Sunderbans is very difficult as the fruit is the favoured food of the deer. Seeds are very small and easily washed away when sown directly. Germination trials could not be carried out during 1968. However it is estimated that the species can be classified as high submeression tolerant. Direct sowing is neither advisable nor has been tried. The seeds germinate well in nursery. Best results have been obtained by transplanting current years seedlings (1.52 month old) with ball of earth. One year old seedlings also succeed but care has to be taken not to damage the tap root.

(9) Avicennia officinalis : Seeds ripen during August-September, The species exhibits a certain degree of periodicity but the causes of periodicity are not clear. Out of the 5 trees studied for seed production only one seeded during 1968 while all the five seeded during 1969. Germination trials could not be carried out during 1968 but it is estimated that the species can be classified as medium submerssion tolerant. Best results are obtained by transplanting current years (about one month old) seedling. Transplanting of one year old seedling has not give good results.

(10) Bruguiera gymnorhiza : Seeds ripen in June-July. The species produces seed well, No periodicity has been observed during the 2 years selected mother trees were under observation. In nursery trials 70-80% germination and survival was observed when the location remained submerged for 0-232 minutes during 24 hours. The species has been classified as low to medium submerssion tolerant. Direct sowing in June-July gives the best results.

SUMMARY AND CONCLUSIONS.

The coastal afforestation is an experiment on a very large scale. The silvicultural characters of the species to be used are so little known that this experiment needs a very expert handling of the choice of species. Edaphic considerations specially in relation to water are the most important. The salinity factor, though applicable every where, becomes more critical in the drier locations where depending on the salt content of the soil white crust formation of salt may appear and raising of plantations in such areas may be the most difficult part. Mangrove species vary in their response to the period of submerssion and this factor has been suggested to be used as the guiding factor for the choice of species. Site classification used for raising plantation is described and discussed in relation to choice of species for each site. A more detailed plantation plan needs to be evolved and compiled in the form of a working scheme so that the entire programme can be made more useful for the local people and at the same time have the