Management of the Principal Littoral Tree Species of the Sundarbans

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1. INTRODUCTION

The numerous islands constituting the littoral forests of the Sundarbans have been formed by river-borne silts of the Ganges and the Brahmaputra, the two main rivers of Bangladesh. The forests lie between latitudes 21°30′N and 22°31′N and between longitudes 89°E and 90°E.

The productive forest lands of 939820 acres of the Sundarbans produce only 15 million cubic feet of wood per annum at the present (1971)-one acre produces only 16 cft of timber per acre per annum. This poor yield is perhaps due to the inclusion of varied crops under one management plan, an improper management system, ill supervision and the complete reliance on nature for regeneration. The present (1971) poor yield of 16 cft of timber per acre per annum may still go down if proper attention is not given to restocking the forests under an efficient system of management instead of the current selection system.

At least two of the main littoral species, sundri and gewa can be managed in even-aged stands.

2. THE PRINCIPAL SPECIES OF THE SUNDARBANS

The principal timber yielding species of the Sundarbans are listed below :—

A. **Littoral species other than mangroves :**

1. *Heritiera minor* syn. *H. fomes* (Sundri)
2. *Excoecaria agallocha* (Gewa)
3. *Carapa mouluccensis* (Passur)
4. *Sonneratia apetala* (Keora)
5. *Carapa obovata* (Dhundal)
6. *Avicennia Officinalis* (Baen)
7. *Amoora cuculata* (Amoor)

B. **Mangroves (Rhizophoraceae) :**

8. *Bruguiera gymnorhiza* (Kankra)
9. *Ceriops roxburghiana* (Goran)
10. *Rhizophora conjugata* (Garjan)
11. *Rhizophora mucronata* (Garjan)

Amongst these species sundri represents 73% and gewa 16% of the total wood production in the Sundarbans.

3. SILVICULTURAL CHARACTERISTICS OF THE PRINCIPAL SPECIES

3.1 Light Requirements

Amoora cuculata (amoor), *Carapa obovata* (dhundal) *Carapa molluccensis* (Passur) and *Heritiera* (sundri) are moderately shade tolerant species and can grow in varied intensities of available light.

Ceriops roxburghiana (goran) is shade tolerant and forms the lower storey especially in the saline zones of the Sundarbans.

Excoecaria agallocha (gewa) is a strong light demander. It is stunted when it grows under the overhead canopy of sundri and kankra. It regenerates profusely under direct sunlight.

Heritiera minor (sundri) grows well under direct sunlight and in a well-drained soil inundated by tidal water of a low degree of salinity especially during the monsoon season. It can not stand stagnant water and prelonged flooding but at an early age it can withstand shade.

3.2 Root system

(i) Tap root system : Almost all species in the Sundarbans have a superficial root system which has led most of the species to develop buttresses for additional anchorage. A mature sundri develops a tap root to a depth of 4-5 feet only, and the horizontal spreading of roots is confined to a redius of about 8-10 feet. Gewa has less horizontal root spreading and vertical penetration than sundri.

Baen, keora, kankra and other species have a greater horizontal spreading of roots than sundri and gewa.

(ii) Stilt roots : Most of the members of mangrove family have stilt roots which act as supporting as well as absorbing organs.

(iii) Knee roots : Gewa produces a special type of breathing root unlike pneumatophores. These roots are exposed on the soil surface and look like knees which have numerous air pores for gas exchange.

(iv) Pheumatophores : Sundri, keora, baen and amoor have upward inverted peglike projecting bodies, pneumatophores. These are branches of true roots and are used for exchanging gases required in the respiratory metabolism of these species. It has been found that sundri and amoor start producing pneumatophores at the age of 3-4 years. Keora and baen have thin pheumatophores at an early age and these grow thicker and stronger with the passage of time.

3.3 Coppicing ability

Sundri and gewa are good coppicers. Ten to twenty year old sundris coppice quite well and the resulting coppice stock, if properly thinned, may represent as good a stock as that originating from seed. Normally 20-30 shoots develop from one sundri stool.

Gewa, when cut between the ages of 10-15 years, produces excellent coppice shoots which are healthy, vigorous and fast growing. It has been found that coppice gewa produces about one cft of wood per year at the age of ten years, and the growth rate accelerates with age, it is faster than that of gewa grown from seed, at the same age (Khan, Banik and Ahmed 1971). Baen, amoor, goran and keora also are good coppicers. Kankra is a poor coppicer.

3.4 Reproductive Capacity

Reproduction by self-sown seeds is quite satisfactory for almost all the species of the Sundarbans. It is fortunate that the viability of seeds of most of the species is adequate for good stocking provided the ground is receptive enough for germination. Coppice reproduction may also be possible in the case of some species as indicated above.

3.5 Damaging Agencies

3.5.1 Biotic

(i) Insect Pests : Some members of the following families of wood borers cause considerable damage : *Bostrychidae, Bruchidae, Cerambycidae* and *Platypodidae.* Weak and diseased trees are susceptible to the attacks of wood and bark borers. Felled trees and logs are attacked by the powder post beetle and pinhole borers. Marine borers like *Teredo navalis* and *Laminaria* spp. are found to damage trees and logs in water.

(ii) Phytopathogens : Healthy plants are rarely attacked by fungal pathogens. However, members of the following genii are found to damage weak and dying trees and felled logs : *Polyporus, Polystr ffictus* and *Ganoderma.*

(iii) Plant Parasites : The parasites are represented by *Gassytha, Cuscuta, Loranthus* and *Viscum.* The typical woody climbers like *Derris sinuata, Derris uliginosa, Mucuna gigantea, Sarcolobus globusus, Finlaysonia abovata, Dalbergia torta* and *Dalbergia Spinosa* do considerable damage to the crop. There are about 8 genera and 13 species of epiphytic orchids growing in the Sundarbans. These opiphytes do not cause direct damage to the trees but are responsible for impairing the shape of the host.

(iv) Wildlife : Deer, porcupines, squirrels and wild boars do considerable damage to seeds, seedlings, saplings and pole stands all over the Sundarbans. It has been estimated that due to deer browsing, a clear-felled site which normally gets fully covered with trees in 3-4 years, is only 40% covered in 6 years after clearcutting (Khan Banik and Ahmed 1971). However, deer damage is mostly confined to the forest fringes and river banks.

3.5.2 Abiotic

Storms, cyclones and tidal bores do considerable damage to trees. The damage is directly proportional to the intensity of such natural causes. It is estimated that, on an average, we lose about one 20 cft tree on each 20 acres every year on account of cyclones, storms, tidal bores and the erosion of river banks. This means that we lose some 9,00,000 cft wood a year due to these natural phenomena.

4. MANAGEMENT TECHNIQUES IN THE SUNDARBANS

4.1 Present System of Management

At the present the forests of the Sundarbans are managed under a selection system. The prescription is to remove all trees of and above the exploitable diameter annually from each annual coupe. The coupes are divided according to felling series and cutting sections. According to the current working plan prescriptions, yield regulation is to be done by area, and yield control by volume. The selection system applied today in the Sundarbans is a century-old system. Hunger for food, clothing and shelter has put great pressure on the limited forest land.

The yield of wood from forests must be high and the forest industries adequate to meet these numerous and growing needs of the country. The forest resource of the country must also be brought to a satisfactory level of production efficiency as compared with agriculture, to justify its existence, as most of the forest lands in the plains and on undulating lands are more or less suitable for agriculture.

Unfortunately, today's forests in the Sundarbans produce only 16 cft of timber per acre per annum. This poor yield casts a shadow on our management efficiency and obviously the existing system of management.

4.2 Future Management Policy

The future management policy may be oriented keeping in view the following basic objectives :

1. To ensure maximum protection to the watersheds and coastal areas ;
2. Increase production up to the level of the maximum sustainable yield ;
3. Lead the forests towards normality under proper and efficient management systems ;
4. Manage the forests keeping in view the concept of multiple use, and
5. Appraise occasionally forest management from the economic point of view, comparing it with the management of similar resources of the country to maintain a satisfactory level of yield from forest resources.

It is obviously the Government policy which will decide about the maintenance and improvement of forests in particular regions. The policy will have to decide how to get enough forest produce to feed the wood-based industries and how to protect the country from devastation due to unforeseen natural phenomena. When there is definite policy of the Government to maintain and improve forests in certain parts of the country to fulfil the main objectives, such as production and protection, it is the duty of the technical personnel in the profession to manage the forests so that the interest of the owner Government is achieved to the latter's fullest contentment.

The present forests of the Sundarbans can provide for meeting all the basic objectives listed above to the highest extent.

The silvical characteristics such as light requirement, development of the root system, coppicing power, reproductive capacity and the immunity to insect pests, phyto-pathogens and parasites reveal that the two main species, sundari and gewa. can be managed under a clear felling system followed by aided natural regeneration. A survey conducted in the Sundarbans by a team of 8 members associated with forest research, clearly shows that after clear-felling the site does not deteriorate. It even improves due to enhanced biological activities and the rapid decomposition of litter and slash on the soil surface. Profuse natural regeneration of mainly gewa and sundri covers the cleared site within 2-3 years of such felling (Khan, Banik & Ahmed 1971). Also

the existance of quite large and uniform patches of gewa and sundri all over the Sundarbans may be taken as evidence that these two principal species are adapted to clear felling or to a uniform system of management.

Therefore, the system of management proposed for the main species of the littoral Sundarbans forests is a clear felling system followed by natural regeneration aided by keeping some mother trees in the areas to be regenerated.

The next two important questions affecting the adoption of the proposed system of management are :

1. the anticipated yield of the principal species under the proposed system of management, and
2. the financial implications of implementing the proposed system.

The yields of sundri and gewa in pure and uniform patches with an adequate density of 5000 cft per acre, are expected to be 80 and 100 cft to the ages of 60 and 50 years respectively, per acre per annum. At this increment rate, we find that gewa alone, grown in 1/3 of the area of the Sundarbans in pure and even-aged stands and managed under a clear felling system, can feed at least five paper mills like one established at Khulna. The financial benefits and other economic advantages of the clear felling system are so well recognised that they do not have to be emphasized here.

5. REGENERATION PROBLEMS

Under normal conditions there is no regeneration problem of any species ; keora is an exception in that it usually does not regenerate under shade or on old sites. Good regeneration of the other species does not however mean that natural regeneration has adequately stocked the selection forests of the Sundarbans. The present poor stocking is indicated by the low annual increment of 16 cft per acre of timber only under the existing management system. Profuse natural regeneration of the main species comes up when the ground is receptive enough and the seedlings get favourable conditions for establishment. In many parts of the forests, especially in the older forests, the conditions of regeneration for gewa and sundri are decidedly unfavourable, probably due to the following factores :

i. Prolonged flooding of the forest floor and the retention of stagnant water in saucer shaped depressions for three to four months of the year after the monsoon ;
ii. growth of noxious weeds like *Pandanus, Hibiscus, Cynometra* and the tiger fern ;
iii. excessive density of the tree canopy, and inadequate light reaching the forest floor ;
iv. deposition of a thick litter layer on the forest floor ; and
v. poor drainage facilities of the saucer-shapped depressions, and very little aeration of the humus and sub-soil layers.

In the older forests especially the fresh-water Heritiera forests, scanty regeneration is quite common, probably attributable to one or several of the adverse conditions listed above. Champion (1936) adds that "where the annual silting has raised the level too high for *Heritiera*, its regeneration fails, but the old trees persist for some time associated with pandanus & litsea, amoora and *Cynometra ramiflora*, forming a transition type. These high intermediate levels may be locally devoid of large trees. Perhaps in a temporary phase giving a pure scrub forest of *Cynometra ramiflora, Phoenix* or *Hibiscus, Heritiera* cannot survive long continued flooding during the monsoon.

From this observation it is clear that in due course, the lofty and luxuriant sundri forests will degenerate into a scrub forest if proper attention is not given to replenish the growing stock, by providing adequate conditions for the proper regeneration of these stands.

Profuse natural regeneration of gewa and sundri has been recorded in many clear felled areas of the Sundarbans (Khan *et al.* 1971). Areas along river banks and some elevated grounds in the marshes are colonised by thickets of sundri and gewa seedlings. This indicates that these two species produce viable seed ; inadequate regeneration in the older *Heritiera* forests may be due to adverse conditions such as a marshy and shady environment and poor drainage.

6. CONCLUSIONS

(i) The adopting of a clear felling system in the place of the selection system, with adequate provision for drainage, may ensure proper regeneration of the older sundri forests of the Sundarbans.

(ii) Gewa is mostly confined to new accretions and to river banks, especially in the saline and brackish zones. So, working circle should be constituted for islands (compartments) having a preponderance of gewa, exclusively managed for this species important for paper manufacture.

(iii) Goran is mostly confined to saline zones in the western and southern parts of the forests. Using the clear felling system, the constitution of a goran working circle may adequately ensure the increased and sustained production of firewood and other small wood for house-building purposes.

(iv) The management of keora forests poses a difficult problem. It has not yet been ascertained whether keora will regenerate under shade or in clear felled areas. In the absence of natural regeneration, the cleared areas can be re-stocked preferably with gewa, since the growing requirements for gewa are similar to those for keora.

(v) With quite reasonable assurance for higher yield, low cost and the proper protection of the site, there are good grounds to adopt the proposed new system in the place of the current century-old less productive system of management in the Sundarbans.

7. REFERENCES

Champion, H.G.1936. Indian Forest Records. Vol I(1) (Silviculture).

Forest Inventory Report of 1958-59 on the Sundarbans Forests by Forestal Forestry & Engineering International Limited, Canada.

Working plan of the Sundarbans Division for the period from 1960-61 to 1979-80, Vol I & II.

Mukharji, H. and Ganguly, A. K. 1957. General Botany. New Book-stall, 9 Ramanath Majumdar Street, Calcutta-9.

Zahiruddin, A. S. M. 1969. Inspection Report for the months of January-February 1969 on the Sundarbans Division. Forest. Deptt. East Pakistan.

Khan, Z. H. 1969. A suggestion for the improvement of the management system for the Sundarbans. Forest Research Institute, Chittagong.

Khan, Z.H., R. L. Banik and Asiruddin Ahmed. 1971. The clear felling system & its prospects for the forests of the Sundarbans. Forestdale News. 3(1&2);44-70p.