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NOTES

SOME OBSERVATIONS ON THE NATURAL REGENERATION OF MAJOR TREE SPECIES AT CHANDPAI RANGE OF THE SUNDARBANS, BANGLADESH

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The Sundarbans, the largest continuous mangrove forest of the world, is home to many species of plants and animals, some of which may be endangered. The plant composition of the forest is mainly of halophytic tree species. Maintaining regeneration of tree species is important for sustainable management and conservation. However, the regrowth characteristics of the species in the Sundarbans are little known, with some information available only for a few economic tree species. *Heritiera fomes* has been reported by workers such as Troup (1921), Curtis (1933), Khan *et al.* (1971) and ODA (1985) to represent nearly 75 % of the growing stock, *Excoecaria agallocha* 15%, followed by various proportions of mixtures represented by *Xylocarpus mekongensis, Sonneratia apetala, Avicennia officinalis. Bruguiera gymnorrhiza, Ceriops decandra, Nypa fruticans, Amoora cucullata* and *Cynometra ramiflora.*

It is evident that a greater share of stocking/regeneration is confined to only a few species of high occurrence. In this study, an effort was made to examine the natural regeneration of the major tree species at an area of the Sundarbans, representative of the entire forest.

The Sundarbans (21°38' - 22°30' N, 89°00' - 90°00' E) covers about 0.4 million ha in Bangladesh, constituting 24% of the total forest area of the country (Rashid 1977, Chaffey & Sandom 1985). The forest occupies a flat deltaic swamp, rarely exceeding 0.9 to 2.1 m above mean sea-level, and is mostly inundated by saline water during spring tides of the monsoon. The Chandpai range, which stretches over 100 012 ha and consists of 15 compartments, was selected as the study area. Almost all the major tree species of the Sundarbans are found in this area. Random samples were taken from 10 compartments.

The soil is silty clay loam and the subsoil consists of alternate layers of clay and sand; the soil is neutral to mildly alkaline, but some localities yielded subsoil samples with pH as low as 6.5 (Hassan & Razzaque 1981). The annual temperature ranges from 12 to 30 °C. The mean annual rainfall is 2000 mm, with most rain recorded in the monsoon (BBS 1994).

Stratified random sampling design was laid out for the regeneration study in the sample plots from each stratum, which was based on inundation at various distances from the water courses towards the interior, i.e. 0-50, 50-100, 100-150, 150-200, 200-250 and 250-300 m from the water courses towards the interior. Thus, the selected 46 random samples, each of 10 × 10 m size, were surveyed from 10 representative compartments. In each sample plot all trees, saplings and seedlings of *H. fomes, E. agallocha, X. mekongensis, A. officinalis, B. gymnorrhiza, S. apetala, C. ramiflora, A. cucullata* and *C. decandra* were recorded separately. Ocular estimation on the size was used to separate the seedlings, saplings and

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trees relative to individual species. Data were collected during September-November 1995 (the period representative of seedling production). Data obtained on the number of trees, saplings and seedlings of selected species were categorised specieswise to show their relative abundance (Figure 1). At all growth stages, *H. fomes* showed dominance over *E. agallocha* and all other species found in the sample plots. This dominance was also obvious among the seedlings.

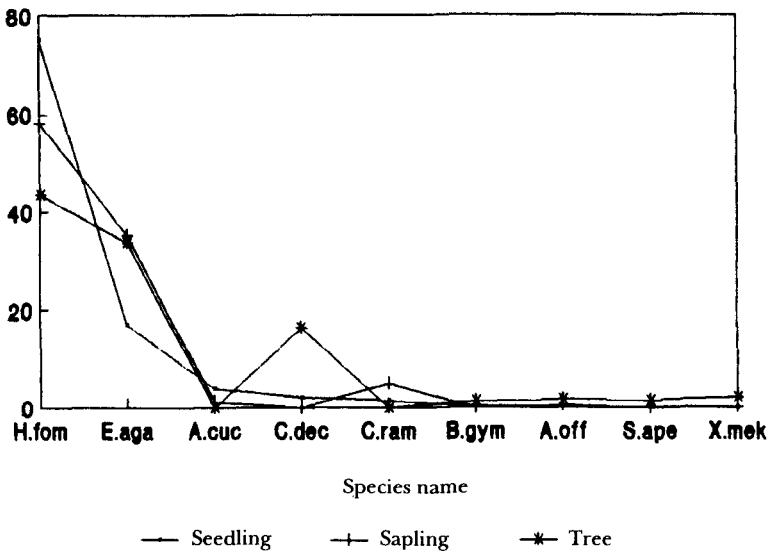

Figure 1. Relative occurrence of some major tree species of the Sundarbans at their different regeneration stages. (Analysis was done on the basis of average result of all the samples.)

There were more seedlings than trees of *H. fomes*, but it was the reverse in *E. agallocha*. *Amoora cucullata* and *C. ramiflora* produced some seedlings and saplings but no trees. On the other hand, some trees of *B. gymnorrhiza, A. officinalis, S. apetala* and *X. mekongensis* but no seedlings or saplings were found. Despite the higher occurrence of *C. decandra* trees, seedlings were almost absent.

The intensity of flooding and salinity are influenced by the distance from the canal bank which affects seedling establishment. Table 1 shows that in general *H. fomes* regeneration was the highest, followed by that of *E. agallocha*. But *H. fomes* regeneration showed an increasing trend with the increase of distance whereas *E. agallocha* showed a decreasing trend. With the exception of *C. decandra* trees and *A. cucullata* saplings, the other species were relatively of low occurrence, and almost all showed preference in regeneration within different distances from the bank. No generation was found in *X. mekongensis* and *S. apelata*.

Although *H. fomes* showed increasing regeneration of seedlings with distance from the bank, the trees showed the opposite trend. These trends were reverse in *E. agallocha*. To see whether such a behaviour influences the seedling establishment process of these two species, the distribution of their saplings among the distance classes was examined. A higher proportion of *H. fomes* saplings was accompanied by a lower proportion of *E. agallocha* saplings, and vice versa. The number of *E. agallocha* saplings decreased greatly with the increase in the number of trees; this trend was not clear in *H. fomes*. This shows that seedling

regeneration may be influenced not only by interspecific competition but also by intra-specific competition, especially for *E. agallocha*. Further research would be required to establish a scientific assertion.

Table 1. Regeneration status of some major tree species of the Sundarbans based on inundation at various distances from the water courses

Species name	Distance classes (in m)					
	0-50	50-100	100-150	150-200	200-250	250-300
Seedlings						
Heritiera fomes	61.11	56.28	49.85	56.80	96.15	96.15
Excoecaria agallocha	34.27	25.08	18.18	18.93	-	-
Avicennia officinalis	0.16	10.32	-	-	-	-
Bruguiera gymnorrhiza	0.18	-	7.62	19.38	-	-
Amoora cucullata	2.57	3.52	17.89	2.23	1.92	3.85
Cynometra ramiflora	0.52	3.40	6.45	2.67	1.92	-
Ceriops decandra	1.13	1.15	-	-	-	-
Trees						
Heritiera fomes	41.71	46.44	50	51.68	21.7	13.16
Excoecaria agallocha	37.07	34.03	45	39.73	78.2	86.84
Xylocarpus mekongensis	0.79	3.04	4	-	-	-
Avicennia officinalis	2.13	0.76	1	-	-	-
Sonneratia apetala	2.13	-	-	-	-	-
Bruguiera gymnorrhiza	0.37	-	-	8.59	-	-
Ceriops decandra	15.80	5.74	-	-	-	-
Saplings						
Heritiera fomes	36.72	70.90	62.57	83.17	58.14	67.13
Excoecaria agallocha	49.00	10.73	18.72	14.72	41. 6	23.08
Xylocarpus mekongensis	0.11	0.19	-	-	-	-
Avicennia officinalis	0.32	2.78	-	-	-	-
Sonneratia apetala	0.68	-	-	-	-	-
Amoora cucullata	10.82	5.35	14.44	2.11	-	-
Cynometra ramiflora	2.35	10.05	4.28	-	-	9.62

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