INFLUENCE OF DEER ON THE ARTIFICIAL REGENERATION IN THE MANGROVE OF SUNDARBANS, BANGLADESH

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Introduction

The Sundarbans is the largest continuous mangrove forest of the world. The forest within Bangladesh territory, covering an area of about 6000 km² (remaining 4000 km² in India), lies between the latitudes 21°31' and 22° 30' N and between the longitudes 89° and 90° E. The merchantable growing stock of both the dominant species of the forest, *Heritiera fomes* and *Excoecaria agallocha* has been depleted by 40 and 45 per cent respectively over a period of about 25 years (Chaffey *et al.,* 1985). A number of steps including artificial regeneration would assist in improving the stocking. Seedling availability in the forest floor was sufficient (27,750 seedlings/ha/year), but failure of the seedlings to survive and establish themselves was a major problem for ensuring a rich stocking (Siddiqi, 1984).

Various factors, both abiotic and biotic, affect successful establishment of mangrove regeneration. Among the biotic factors, the Spotted Deer *(Axis axis)* plays an important role in the regeneration of Sundarbans (Champion *et al.,* 1965; Blasco, 1977; Anon., 1982; Salter, 1984; Siddiqi and Husain, 1984). In raising trial plantations, the deer was found to be a problem (Siddiqi, 1986). So, the need to study the impact of Deer on artificial regeneration was felt.
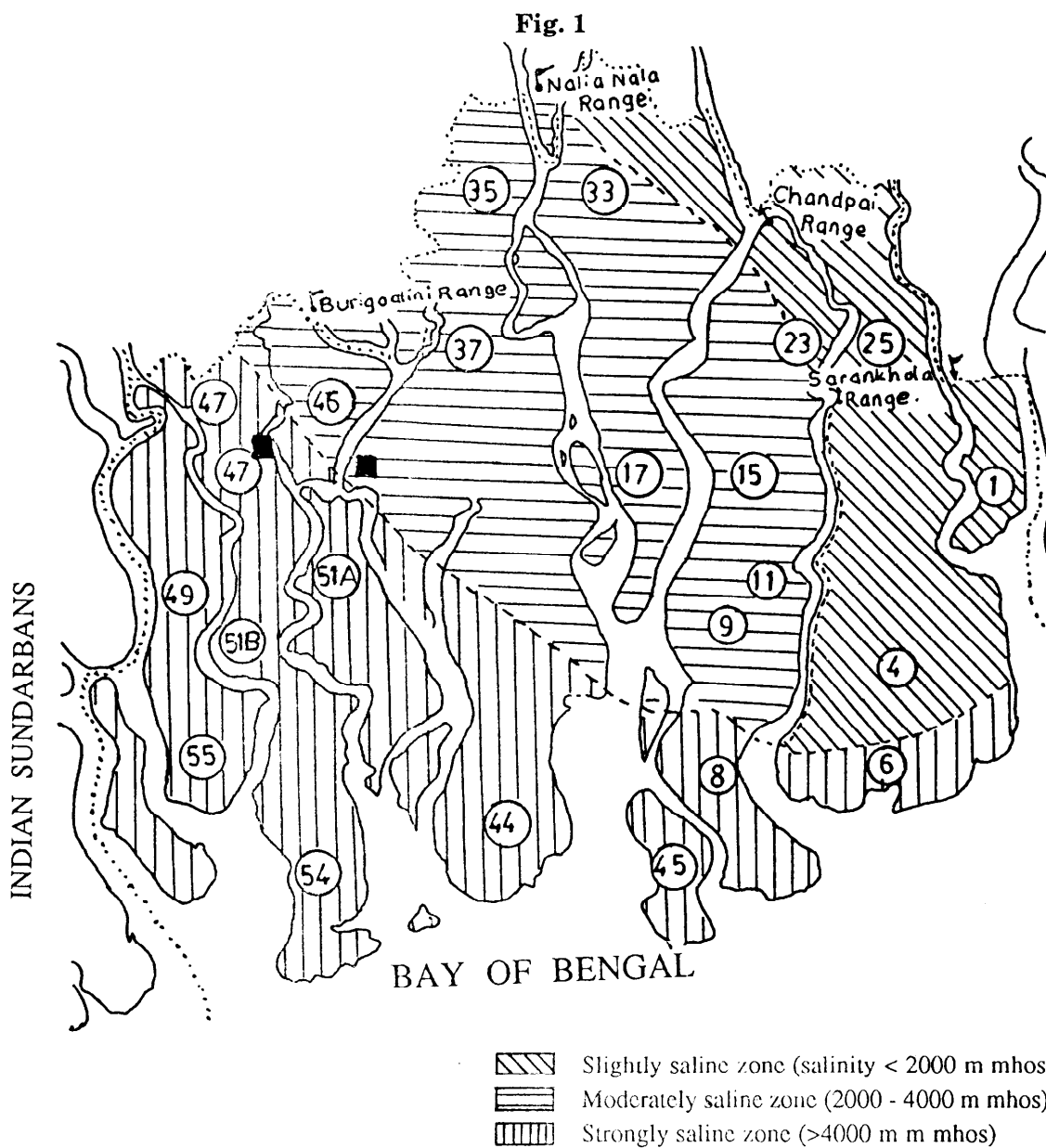
Materials and Methods

Six major species namely, *Heritiera fomes, Excoecaria agallocha, Avicennia officinalis, Bruguiera sexangula, Ceriops decandra* and *Xylocarpus mekongensis* were included in the trial initiated in 1990. Ten-months old seedlings of these species, raised in polybags, were planted in fenced (protected from Deer) and unfenced areas (accessible to Deer) side by side in vacant places of the forests at Compartment Nos. 37 and 46 (Fig. 1).

The experiment was laid out in Randomised Complete Block Design (RCBD) with there replications in fenced and unfenced areas in both places. Each plot was planted with 135 seedlings at 0.6 x 0.6m spacing. Thus a total of 9,720 seedlings were planted. Data on the survival, height growth and Deer browsing of the planted seedlings were collected at quarterly intervals. Data recorded one year after planting out were analysed to ascertain the magnitude of damage to the plantations.

Results

A considerable proportion of seedlings was damaged by Deer in the unfenced plots.

Fig. 1

Slightly saline zone (salinity < 2000 m mhos)
Moderately saline zone (2000 - 4000 m mhos)
Strongly saline zone (>4000 m m mhos)

Map of the Sundarbans showing the locations (■) of the experimental plantations

In both the places (Compt. Nos. 37 and 46). all the planted seedlings of *X. mekongensis*, *B. sexangula* and *A. officinalis* died in the unfenced plots (Table 1, Fig. 2). The intensity of browsing was so severe that virtually all the seedlings died within only two months after out-planting. The difference in seedlings survival between fenced and

Fig. 2
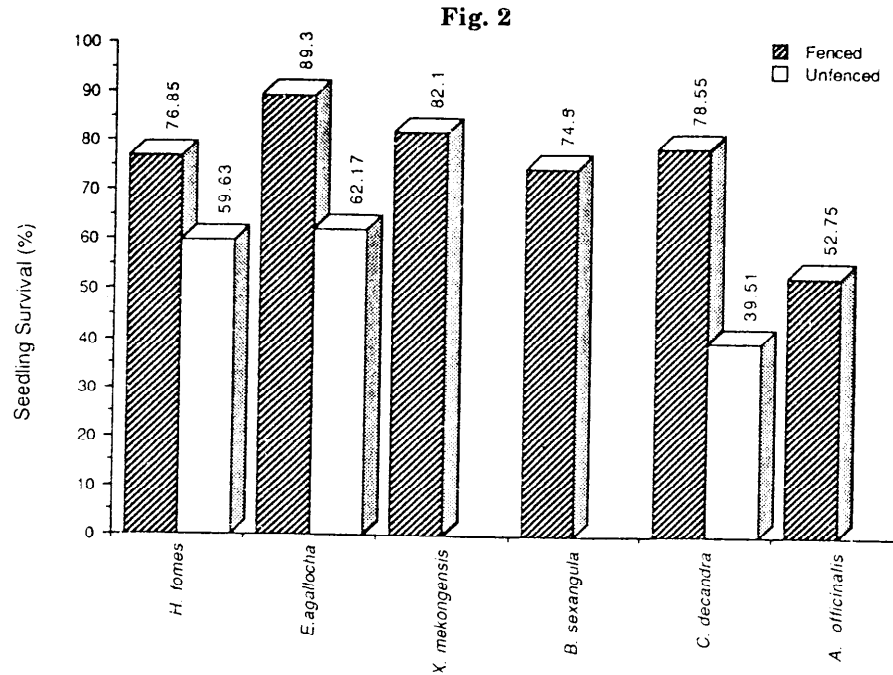
Average survivals of six species planted in fenced and unfenced plots

Fig. 3
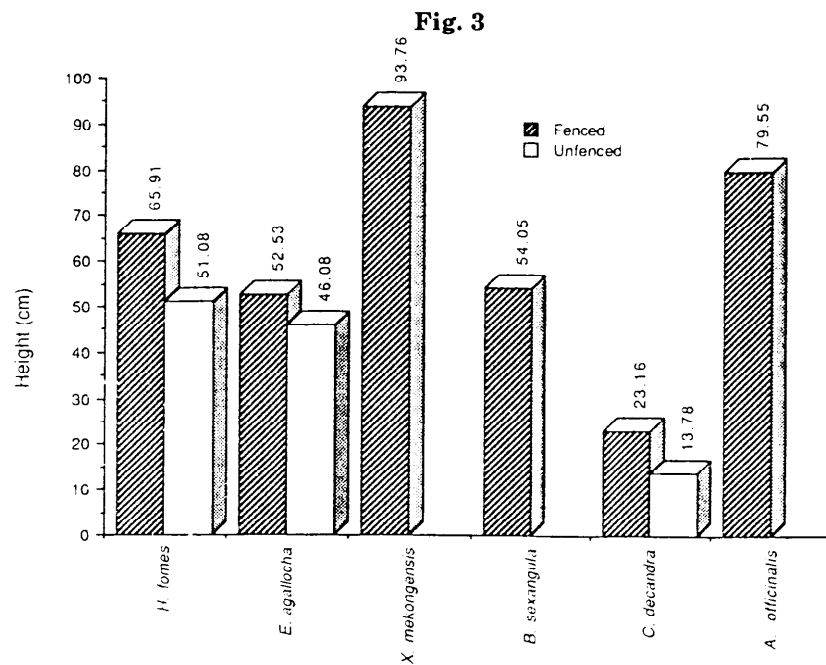
Averge heights of six species planted in fenced and unfenced plots

Table 1

Survival and growth of the seedlings one year after planting in the fenced (protected from Deer)
and unfenced (accessible to Deer) plots

Location	Species	Mean Survival (%)±S.E.		Mean Height (cm)±S.E.	
		Fenced	Unfenced	Fenced	Unfenced
Comptt. No. 37	H. fomes	73.5±3.51	55.3±8.53	70.2±1.30	50.6±3.47
	E. agallocha	85.4±1.35	48.9±8.63	50.5±1.91	40.6±3.13
	X. mekongensis	85.2±1.72	0.0	98.9±4.72	0.0
	B. sexangula	79.4±0.00	0.0	63.7±2.21	0.0
	C. decandra	86.5±2.40	51.4±23.73	23.3±1.36	13.3±1.26
	A. officinalis	74.1±5.59	0.0	95.1±8.82	0.0
Comptt. No. 46	H. fomes	80.2±4.38	64.0±7.18	61.6±2.54	51.5±1.78
	E. agallocha	93.2±2.17	75.5±9.86	54.6±2.46	51.5±1.53
	X. mekongensis	79.0±3.89	0.0	88.6±1.70	0.0
	B. sexangula	69.6±2.57	0.0	44.4±0.60	0.0
	C. decandra	70.6±4.48	27.6±3.71	23.0±1.10	14.3±0.96
	A. officinalis	31.4±4.74	0.0	64.0±2.87	0.0

unfenced plots was significant $(F_{1,60}=214.09 ; P<0.01)$. This difference for individual species namely, *H. fomes* $(t_5=2.83; P<0.05)$, *E. agallocha* $(t_5=3.14; P<0.05)$ and *C. decandra* $(t_5=2.88; P<0.05)$ was also significant.

Some seedlings possible could recover partial browsing. But their height growth was affected (Table 1, Fig. 3). The seedling height was significantly higher in fenced plots for *H. fomes* $(t_5=5.12; P<0.01)$ and *C. decandra* $(t_5= 8.86; P<0.01)$. The difference between fenced and unfenced plots for *E. agallocha* was non-significant $(t_5=1.92)$ although average heights of seedlings in fenced and unfenced plots were 52.53 and 56.08 cm respectively. Browsing of leaves of this species was not noticed.

Discussion

The Spotted Deer (*Axis axis*) has roughly a population size of 80,000 individuals in the Bangladesh Sundarbans (Hendrichs, 1975). Density varied from North to South (10 km² in the North and increasing to 40 km² in the South). In natural state, the animals was not found to affect regeneration of *H. fomes*, *E. agallocha* and *C. decandra*. But browsing by the Deer was harmful for the regeneration of *A. officinalis*, *X. mekongensis* and *B. sexangula* (Siddiqi and Husain, 1984). In the trial plantations, the influence of Deer was greater. For raising plantations, the sites used to be cleared and Deer were noticed to have a special attraction for such site for grazing in herds. Trampling, together with browsing, were the cause for complete or partial disappearance of the planted seedlings.

The seedlings of *E. agallocha* were not found to be browsed in the experimental plots. Light browsing of young leaves of *H.*

fomes and *C. decandra* was noticed. Deer had a preferential browsing habit. It appears for the study that *E. agallocha* can be included as a suitable species for artificial regeneration when damage caused by Deer is taken into consideration. Further investigation on the inclusion of *H. fomes* and *C. decandra* for artificial regeneration is necessary. Species like *X. mekongensis*, *B. sexangula* and *A. officinalis* could only be raised in fenced areas protected from Deer. But fencing is not practically and economically feasible for large scale planting. Troup (1921) reported that in the mangrove of Myanmar, the Hog Deer (*Axis porcinus*). by eating off the main shoots, was the main cuase of the failure of experimental plantations of *Rhizophora mucronata*, *R. apiculata* and *Kandelia candel*. Chai and Lai (1984) suspected that many hypocotyls of newly planted seedlings in the mangrove of Sarawak (Malaysia) were broken off near the base by Deer. Siddiqi *et al.* (1984) reported that in a established mangrove plantation in Bhola District of Bangladesh, raising a second rotation crop with species like *X. mekongensis, B. sexangula, C. decandra* and *Aegiceras corniculatum* was difficult due to introduction of Deer.

Acknowledgements

SUMMARY

Studies made on the scope of artificial regeneration in the mangrove of Sundarbans, Bangladesh showed uncertain prospect due to browsing of the panted seedlings by the Spotted Deer (*Axis axis*). The Deer had a significant detrimental effect on the regeneration of *Heritiera fomes, Xylocarpus mekongensis, Bruguiera sexangula, Ceriops decandra* and *Avicennia officinalis*. Only *Excoecaria agallocha* was found to overcome the influence of Deer browsing to a large extent.

सुन्दरबन, बंगलादेश में वायुशिफों के कृत्रिम पुनर्जनन पर हिरणों का प्रभाव

एन०ए० सिद्दीकी

सारांश

सुन्दरबन, बंगलादेश में वायुशिफों के कृत्रिम पुनर्जनन क्षेत्र में किए गए अध्ययनों ने उनकी अनिश्चित संभावनाओं को दिखाया क्योंकि उनमें रोपे गए पौधों को चीतल (एक्सिस एक्सिस) चर जाते है । हिरणों का हेरिटियेरा फोमेस, जायलोकार्पस मेकोंगनेंसिस, ब्रुगुयेरा सेक्संगुला, सेरियोप्स डिकेण्ड्रा और एविसीनिया औफिसिनेलिस के पुनर्जनन पर बहुत हानिकारक प्रभाव पड़ता रहा है । केवल एक्सकीकेरिया अगालोचा ही काफी अधिक सीमा तक हिरणों द्वारा चरे जाने के प्रभाव से पार पाता पाया गया ।

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