

## SITE SUITABILITY FOR RAISING *NYPA FRUTICANS* PLANTATIONS IN THE SUNDARBANS MANGROVES

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**SIDDIQI, N.A. 1995. Site suitability for raising *Nypa fruticans* plantations in the Sundarbans mangroves.** A study was conducted to ascertain the site suitability in relation to inundation for raising plantation with *Nypa fruticans* in the Bangladesh Sundarbans mangroves. Apparently stable site having lower level of tidal inundation appeared most suitable for this species.

Key words: *Nypa fruticans* - Bangladesh Sundarbans - site suitability

**SIDDIQI, N.A. 1995. Kesesuaian tapak untuk menubuhkan ladang *Nypa fruticans* di bakau Sundarbans.** Satu kajian dijalankan untuk memastikan kesesuaian tapak berhubung dengan banjir untuk menubuhkan ladang *Nypa fruticans* di bakau Sundarbans di negara Bangladesh. Kajian ini jelas menunjukkan bahawa tapak stabil yang mempunyai paras pasang surut banjir yang rendah adalah paling sesuai untuk spesies ini.

### Introduction

Site selection for raising successful plantations with *Nypa fruticans* is an important task in Bangladesh. Little information is available on this topic except for some aspects of the nursery technique (Siddiqi *et al.* 1991, Siddiqi *et al.* 1993). The Mangrove Silviculture Division of Bangladesh Forest Research Institute conducted trials for developing nursery and planting techniques of nipa in the Sundarbans during the period from 1987 to 1992. Data collected from such trials on survival and growth of seedlings planted in different site conditions and observations made form the basis of this report.

In the past, *N. fruticans* was planted on a small scale in different areas of the Sundarbans. Some data on the growth were reported. Nothing has so far been documented on the site suitability and plantation success. Growth was reportedly stunted in the saline zone of the forests (Habib 1982). Similarly, little is known on the nipa plantations raised on new accretions along the coastal belt of Bangladesh (Siddiqi & Khan 1990). Salinity and tidal inundation have been considered as important requirements for the occurrence of *N. fruticans* (Watson 1928, De Haan 1931 in Chapman 1975, Aksornkoe 1987, Untawale 1987). Naturally, in the Sundarbans, nipa grows well in relatively less saline areas and on the river banks (Choudhury 1968, Das & Siddiqi 1985).

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### Materials and methods

#### Study area

The study was conducted in the Sundarbans mangrove forest. The Sundarbans is the largest single continuous mangrove in the world (Chaudhuri & Naithani 1985) covering an area of 10 000 km<sup>2</sup> of which 62% falls within the territory of Bangladesh (Hendrichs 1975). The Bangladesh Sundarbans lies between the latitudes 21° 31' N and 22° 30' N and between the longitudes 89° E and 90° E. The forest has been divided into three salinity zones (Hassan *et al.* 1990) on the basis of the soil salinity, viz. less saline (< 2 m mhos cm<sup>-1</sup>), moderately saline (2-4 m mhos cm<sup>-1</sup>) and strongly saline (> 4 m mhos cm<sup>-1</sup>). The trial was established in the less saline zone located in the northeastern part of the forest (Figure 1).

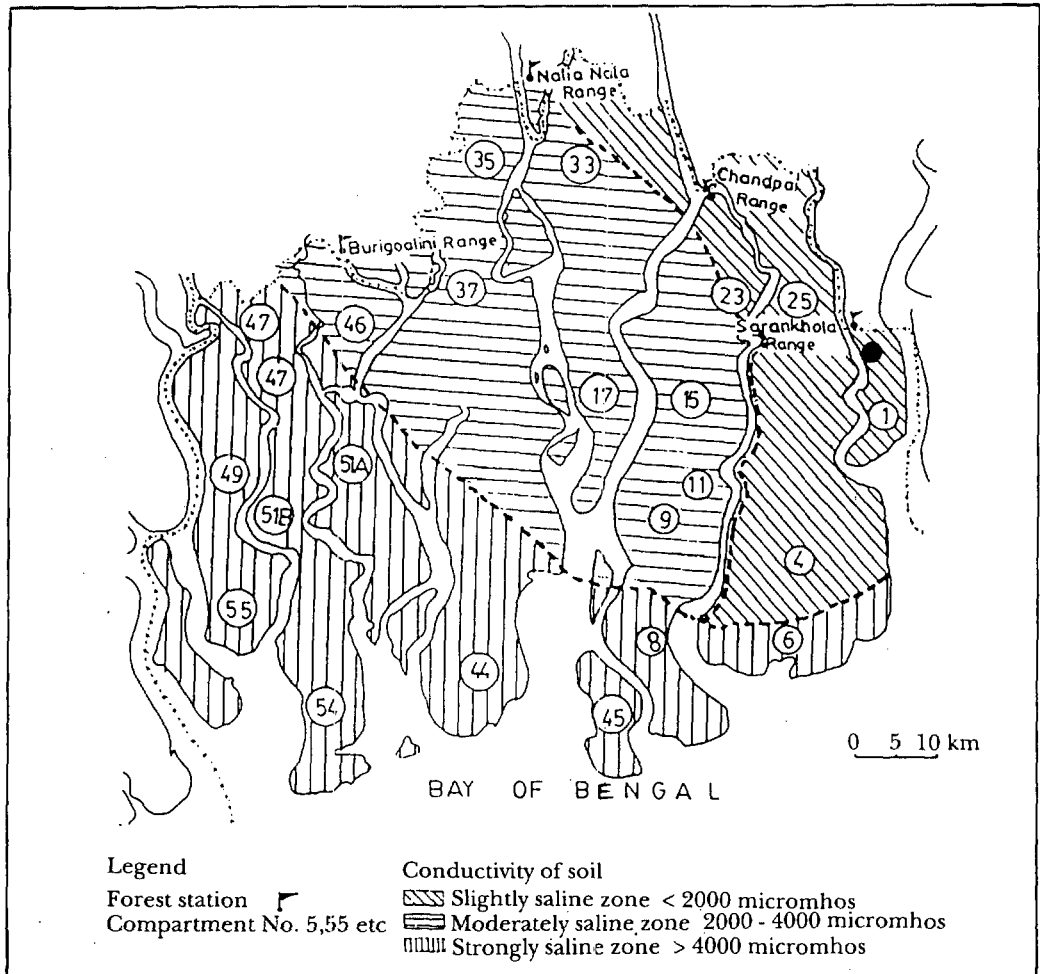


Figure 1. Map of the Sundarbans showing the location of the research plot (•)

### Methods

Initially, seeds and one-month and two-month-old seedlings were tried for raising nipa plantations (Siddiqi *et al.* 1991). Maximum survival was obtained from older seedlings. Subsequently, trials with only two-months-old seedlings were established on three types of sites as follows :

#### Site 1

Along the creeks on bare soils above the water level during low tide in monsoon. The site was unstable and under the influence of running water; erosion and accretion were common phenomena. Most of the time the site remained inundated (30 days a month for 14 to 16 h day<sup>-1</sup>). Rate of siltation during dry season was high.

#### Site 2

Along the creeks on bare soils below the water level during high tide, 1.5 - 2m above the previous position (18 to 20 days inundation per month in dry season for 6 to 8 h day<sup>-1</sup>). The site was relatively stable with sparse distribution of sedge (*Cyperus tegetum*), although it was under the influence of running water. Both accretion and erosion were low.

#### Site 3

Relatively matured and less inundated land on the river bank. Soil was covered with thick grasses (*Myriostacha wightiana*, *Phragmites karka* and *Typhale lephantia*). The site was only inundated in the monsoon during spring tides (10 to 12 days inundation per month for 4 to 6 h day<sup>-1</sup>).

The experiment was laid out in Randomized Complete Block Design (RCBD) in the less saline zone of the forests, at the Compartment No. 1 only. Soil was silty-clay-loam and the salinity varied between 0.2 and 1.2 m mhos cm<sup>-1</sup>. Maximum water salinity recorded during dry season was 6 ppt (parts per thousand). Each plot was planted with 1050 seedlings at 0.6 × 0.6 m spacing. Weeding and clearing of the sites were first undertaken. Seedlings with a height of 24 cm were planted in the beginning of the monsoon ( in June).

### Results

Data recorded during a period of two years following out-planting showed the best performance of the seedlings at Site 3 (Tables 1, 2). Seedling survival after two years was 0, 3.29 and 19.07 % at Sites 1, 2 and 3 respectively. On the other hand, seedlings at Site 1 died within a period of three months after planting, where rate of inundation was higher and the soil was unstable. An analysis of variance showed significant difference in survival among the three site types (F 2, 4 = 11.82;

$p < 0.05$ ). Survival at Site 3 was significantly higher (Table 1, Figure 2); however, the difference in survival between Sites 1 and 2 was insignificant.

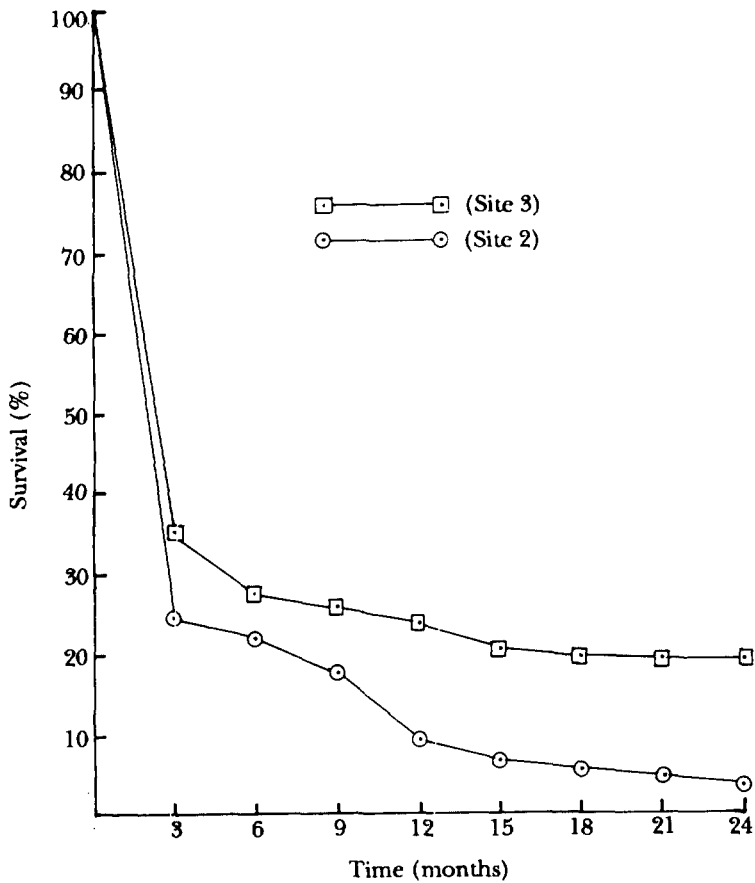
**Table 1.** Survival (%) of *Nypa fruticans* seedlings after two years in different site conditions

Site	Replications			Mean
	I	II	III	
Most inundated (Site 1)	0	0	0	0 b
Moderately inundated (Site 2)	5.18	2.51	2.17	3.29 b (0.95)
Less inundated (Site 3)	19.78	27.57	9.85	19.07 a (5.13)

LSD = 11.63 at  $t 0.05$ .

Means followed by different letters indicate significant difference.

Values within parentheses indicate standard error of mean.



**Figure 2.** Survivals of *Nypa fruticans* seedlings in moderately inundated (Site 2) and less inundated (Site 3) areas

For the seedling height, a significant difference was found ( $F_{2, 4} = 187.75; p < 0.01$ ) among the three sites. Mean height of nipa seedlings after two years was 119.28 and 108.93 cm at Sites 2 and 3 (Table 2) respectively. Consequently, the mean annual height increments of seedlings were 59.64 cm (Site 2) and 54.46 cm (Site 3). However, the mean height difference between Sites 2 and 3 was insignificant (Table 2, Figure 3).

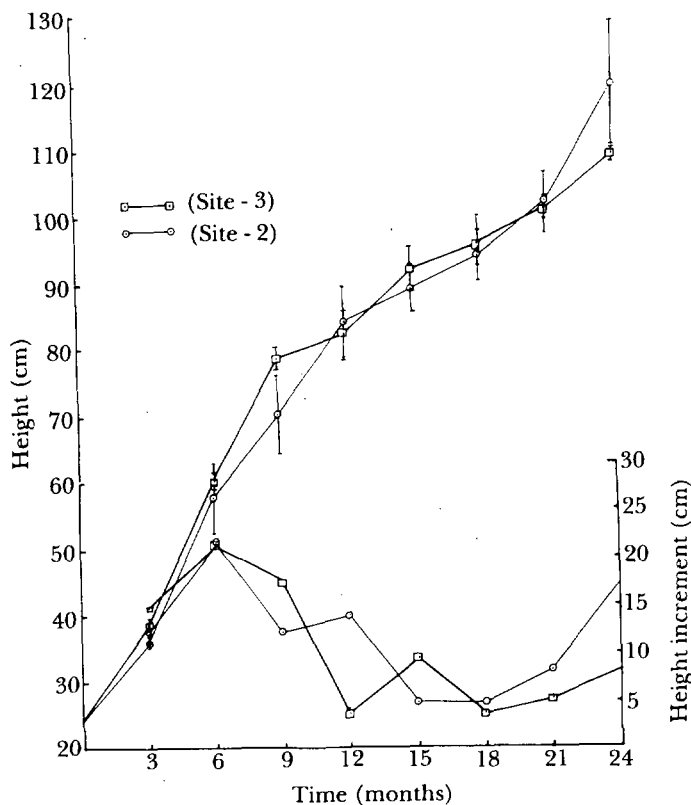
**Table 2.** Heights (cm) of *Nypa fruticans* seedlings after two years in different site conditions

Site	Replications			Mean
	I	II	III	
Most inundated (Site 1)	0	0	0	
Moderately inundated (Site 2)	113.84	135.71	108.28	119.28 a (8.37)
Less inundated (Site 3)	110.87	108.59	107.32	108.93 a (1.04)

LSD = 11.63 at  $t_{0.05}$ .

Means followed by different letters indicate significant difference.

Values within parentheses indicate standard error of mean.



**Figure 3.** Growth of *Nypa fruticans* seedlings in moderately inundated (Site 2) and less inundated (Site 3) areas

## Discussion

In the Sundarbans, nipa generally occurs on the banks of rivers or streams and needs regular inundation. It grows best in the less saline and moderately saline zones (Choudhury 1968, Das & Siddiqi 1985). In Papua New Guinea, nipa occupies an area where the water at low tide is practically fresh and thrives only with its base at least partially submerged in brackish water and flooded by the highest spring tides (Percival & Womersley 1975). This paper is intended only to project the site suitability of the species in relation to the levels of tidal inundation.

The good growth of nipa in low salinity areas of inundation in the Sundarbans suggests that large-scale plantation of this species in other coastal areas is feasible. However, this must be preceded by the development of plantation techniques (Saenger 1988). For this purpose adequate knowledge of the site suitability is a pre-requisite. Unfortunately, information based on trials is lacking in Bangladesh.

In Bangladesh, the best nipa germination and survival in the nursery have been obtained in locations that are submerged at least 230 min day<sup>-1</sup> (Hamilton & Snedaker 1984). Hasan and Howlader (1970) classified this species as medium to high submersion tolerant. Alim (1979) mentioned that nipa grows very luxuriantly in areas which get inundated during every high tide. A higher level of inundation inversely affected survival of nipa seedlings in the present trial. Plots at Site 3 were subjected to human interference during collection of non-timber forest products. The growth of weeds was also vigorous. These possibly affected the growth of seedlings. Three weedings were undertaken per year. A higher intensity of weeding was desirable which might improve the growth rate and also possibly the survival at the Site 3.

It appears that a stable site covered with grasses having lower level of tidal inundation is preferable for raising *N. fruticans*. No tidal inundation during dry season (October - May) is necessary, and 10 to 12 days inundation per month for a period of 4 to 6 h day<sup>-1</sup> in the wet season (June - September) seems to be preferred by the species. The site should be flat or with gentle slope and should only be inundated by the highest spring tides.

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