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PLANT AND ANIMAL DYNAMICS IN SUNDARBAN MANGROVES —AN ECOLOGICAL STUDY

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ABSTRACT :

A Synthetic analysis of flora — fauna has been made for the mangroves of Sundarbans and other forest types of West Bengal. Mangrove Zone situated below the tide level was observed to be comparatively rich in generic and specific diversity than other zones which are either frequently inundated or situated above the tide level. Generic diversity of the flora of Sundarbans mangrove was observed to be lower than that of North and South Bengal. Molluscs were found to be more diverse that that of the Crustaceans, fish and other kinds of organisms. Generic diversities of trees, shrubs and herbs of South Bengal were observed to be higher than those of Sundarban mangrooves but lower than those of North Bengal.

Key-words : Flora and fauna, Mangroves, species diversity, Sunderbans.

Chakrabarti and Chaudhuri, (1976) dealt with the generic and specific diversity of the vegetation of North Bengal but no comprehensive study was made so far in respect of Sundarban mangroves and South Bengal forests. Therefore, there remains a gap in our knowledge in respect of ecological dynamics of the specific areas of West Bengal. Such an ecological exercise was long felt necessary to reconsider and re-orient the broad conservation strategies of the forests of West Bengal in general and Sundarban mangroves in particular. According to Williams, (1964) a low generic and specific diversity indicate high probability of extinction of the living organisms of the genera and species of the plant-animal complex. With the least generic diversity of the vegetation, Sundarbans is perhaps a unique example which enables the Wild denizens particularly the tiger to choose this habitat possibly for extraneous natural factors. The number of individuals within a species and the number of species within a genus remain in a state of natural balance in the midst of complexities of various interactions. The individual species have to struggle for survival for competion for food and against the danger of predation. The present study is intended to determine the generic and specific diversity of different types of West Bengal forests.

Linear transects in different parts of the mangrove forests and other forest areas of North Bengal in Darjeeling and Jalpaiguri district and South Bengal in laterite areas were laid out and data on floral and faunal genera & species were collected to classify the vegetation. Random plots were selected for the study

Sundarbans swamp forests were classified for the purpose of study into three zones viz. A-situated above tide level, B-frequently inundated due to tidal fluctuations and C-situated below tidal level (Table-I).

Table I: Distribution of genera, species and number of plant individuals per 0.4 hectare in laidout plots.

Zone	No. of genera (G)	No. of Species (S)	No. of individuals (N)
A. Above general tide level.	7	9	3000
B. Frequently inundated.	5	7	500
C. Below tide level.	10	13	2000

Laterite forests were categorised into natural and artificial forests. Each category of forest was subdivided into several plots of 0.4 hectares and 20 plots of each of the above categories were selected at random. The number of genera, species and individuals were then counted to find out the generic and specific diversities of vegetation — animal complex of each zone.

Williams' (1964) method was followed to calculate the generic and specific diversity using the formula given below :-

$$\text{Specific diversity} = \frac{N\,(1-X)}{X}$$

Where N - number of individuals in a species, S-number of species in a genus, X - a number less than unity determined from the formula given below

$$\frac{N}{S} = \frac{X}{(1-X)(-\log_e 1-X)}$$

where S is the number of species in a genus and N is the number of individuals in a species.

As N and S are determined from field observations, x can be found out. Similarly, generic diversity is calculated as per the following formula :

$$\text{Generic diversity} = \frac{S(1-X)}{X}$$

where x is determined from the formula :

$$\frac{S}{G} = \frac{X}{(1-X)(-\log_e 1-X)}$$

where G is the number of genera in a family.

As S and G are known from the field observations, x can be found out from the above formula.

Table II : Generic and specific diversity for the floral composition of Sundarbans, according to tidal fluctuations and salinity ranges.

Zone	No. of genera (G)	No. of Species (S)	No. of individuals (N)	S/G	N/S	X for S/G	X for N/S	Generic Diversity	Specific Diversity
A	7	9	3000	1.28	333.3	.42	.9996	12.4	1.2
B	5	7	500	1.4	71.43	.49	.9975	7.28	1.3
C	10	13	2000	1.3	153.8	.42	.0002	17.95	1.60

Table III : Distribution of generic diversity of fishes in Sundarbans and North Bengal.

Generic Diversity	Sundarban Frequency	% Frequency	North Bengal Frequency	% Frequency
.5 to 1.0	0	0	0	0
1.0 to 1.5	1	2.4	1	3.1
1.5 to 2.0	3	7.1	0	0
2.0 to 2.5	3	7.1	2	6.2
2.5 to 3.0	0	0	0	0
3.0 to 3.5	6	14.2	5	15.6
> 3.5	29	69.2	24	75.1
	42		32	

The generic and specific diversity of floral composition in respect of Sundarbans mangroves were computed for different tidal levels and zonations and shown in Tables I and II.

Molluscs of families Ostreidae, Diotocardia and Nanariidae showed significant generic diversities but the crustaceans (about 50% of the genera) represented one species per genus and thus its generic diversity was 2.7 In molluscs 59 genera and 84 species and in crustaceans 24 genera and 48 species could be ascertained in Sundarbans.

It can be seen from Table II that at zone C (below tide level) both the generic and specific diversity was more than that at zone B while the reverse relationship was observed between the zones A and B so far as specific diversity is concerned. But as far as timber and fuel resources were concerned, zone A was richer than zone B and zone B richer than zone C. Therefore, the richness of resources was inversely related to the generic and specific diversity of the vegetation. Salinity was maximum in zone 'C' followed in zones 'B' and 'A'.

Sundarbans is perhaps a unique example which enables the wild denizens and particularly the tiger to choose the habitat having the least vegetational diversity

Table IV: Generic diversity of flora and fauna of North Bangal, South Bengal laterite forest and Sundarbans.

Source of variation	No. of Genera	No. of Species	Generic diversity
North Bengal			
(a) Monocotyledons	300	815	229.87
(b) Gymnosperms	9	11	15.83
(c) Pteridophytes	66	312	25.30
(d) Fish Fauna	32	45	46.8
South Bengal			
(a) Tree vegetation	51	63	98.5
(b) Shrubs, herbs and weeds	50	60	93.85
Sundarbans			
(a) Vegetation	22	29	40.04
(b) Molluscs	59	84	87.42
(c) Crustaceans	24	48	19.4
(d) Fish Fauna	42	69	46.0

possibly for other extraneous natural factors. Again this environment provides the unique example of a very dense but closed vegetational matrix as evidenced from the low figures of both generic and specific diversity. With such low diversity both generic and specific, Sundarbans inhabit perhaps one of the densest vegetation cover in the whole world. The other factors of biotic and abiotic interactions remaining constant, the low generic and specific diversities indicate the high probability of extinction of the vegetational complex of the region. (Williams, 1964, and Kendeigh, 1980) Therefore from ecological considerations, having low floral and faunal diversity the Sundarbans need special treatment of protection. Proper note of this warning signal need be taken to avoid furture ecological disasters.

Generic diversity was computed for fishes of North Bengal and Sundarban waters and shown in Table III. Similarly the generic diversity was also computed for the laterite tracts of South Bengal following the same method of systematic sampling, (20 plots each of size 0.4 hectare selected at random from the total number of plots) and the results are tabulated both for the tree vegetation and for shrubs and herbs. (Tables IV and V).

Table V Generic diversities for animals and plants of North Bengal, South Bengal and Sundarbans.

Type	Generic Diversity		
	North Bengal	South Bengal	Sundarbans
Tree vegetation	699.78	98.5	40.04
Shrubs, herbs, etc.	232.06	93.85	—
Monocotyledons	229.87	—	—
Gymnosperms	15.83	—	—
Molluscs	—	—	87.42
Crustaceans	—	—	19.4
Fish	46.8	—	46.0

The data shown in Table IV indicates that the distribution of generic diversity of fish fauna is more even for North Bengal in so far as the range of distribution of genus is limited upto 3 species at the most in case of North Bengal, while it is 7 in case of Sundarbans. 75.1 percent of fish fauna has the generic diversity greater than 3.5 in North Bengal, while 69.2 percent of fish fauna are having their generic diversity greater than 3.5 Sundarbans. Generic and Specific diversity of vegetation of North Bengal has been dealt by Chakrabarti, and Chaudhuri, (1976).

Sundarban mangroves show high caloric concentrations and significantly high bio-mass productivity (Kendeigh 1980) with low generic and specific diversity generally for both flora and fauna. Because of the locational advantages of the mangroves of Sundarbans, the biotic interference is least in Sundarbans in comparison to other forest types of West Bengal. The balance of poor floral and faunal diversity in Sundarbans mangroves is partially compensated by lesser biotic interference.

The quantitative ecological exercise is likely to open up new dimensions into unknown ecological properties of principal ecosystems of West Bengal. Further follow-up and detailed ecological exercises would be of considerable importance.

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