

PHYTOSOCIOLOGICAL ANALYSIS OF MANGROVE FOREST AT KADALUNDI- VALLIKUNNU COMMUNITY RESERVE, KERALA

Rahees N, Kiran M and Vishal V*

Department Of Forest Management and Utilization, College of Forestry, Kerala Agricultural
University, Vellanikkara– 680656, Kerala, India
E-mail: vishal00v@gmail.com (*Corresponding Author)

Abstract: Kadalundi-Vallikkunnu Community Reserve spread across the 1.5km², endowed with good patches of Mangrove forest. Phytosociology is a scientific discipline which encompasses the study of plant community, composition, diversity and relationships among the component species. The present study aims on floristic diversity and structural dynamics of Mangroves in Kadalundi-Vallikkunnu Community Reserve situated in Calicut-Malappuram districts of Kerala. A total of 7 species belonging to 5 families were enumerated. The study area showed a dominance of *Avicennia officinalis* followed by *Rhizophora mucronata*, *Excoecaria agallocha* whereas *Sonneratia alba* recorded lowest density. Maximum Relative Basal area was represented by *Avicennia officinalis* followed by *Rhizophora mucronata*, therefore these species registered the highest Important Value Index (IVI) and Relative IVI among the 7 mangrove species. Diversity indices was found out for entire study area with Shannon Weiner index (H') of 2.117, Equitability (e) of 0.745 and Simpson's diversity index (D) of 0.713 respectively. Since many of the anthropogenic activities going on this community reserve, unique composition of this mangrove forest has to be protected in its natural condition.

Keywords: Kadalundi-Vallikkunnu, Community Reserve, Mangroves, Phytosociology, Diversity indices.

INTRODUCTION

Mangroves are the trees and shrubs that colonize shorelines and islands in saline regions usually found in tropics and subtropics. The mangrove is one of the most productive ecosystems and a natural renewable resource [1]. The coastal habitat of mangrove includes the inter-tidal seaboards, backwater, river mouths and shelter bays of the west coast of the world [2]. Mangrove habitat acts as a shield for marine ecosystem and is a repository of biological diversity as the tropical rain forest. In India mangrove ecosystems cover a total area of 4639 km², occupying 0.14% of the land area which represent 8% of Asian mangroves and 3% of the global mangroves [3, 4].The distribution of mangrove habitats is scattered in Indian sub-continent, about 60% on the east coast along Bay of Bengal, 27% on the west

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coast of Arabian Sea, and 13% on Andaman & Nicobar Islands. Various studies in the mangrove coasts of Kerala showed the coverage of 1,095 ha [4] and however declined to 17 km² [5]. Mangrove vegetation in Malappuram is mainly concentrated along the Tirur-Kadalundi river basin. Kadalundi-Vallikkunnu Community Reserve, India's first community reserve is endowed with relatively good patches of mangroves. The estuary have undergone extensive clearing, vast degradation, heavy sand mining, land filling, waste dumping, coir retting, defoliation, extensive collection of oyster and mussels, as well as infrastructure development which pose problems for mangrove biodiversity and its natural regeneration [7,8]. Hence an attempt is made here to study the floristic composition, structural dynamics and diversity of mangroves of Kadalundi-Vallikkunnu Community Reserve of North West coast of Kerala.

MATERIALS AND METHODS

Study Area

Kadalundi-Vallikkunnu Community Reserve is located in Kozhikode (Calicut) and Malappuram districts of Kerala state is the first Community Reserve of India, declared in 2007 which spread across 1.5km². This Community Reserve is situated at the estuary of Kadalundi river at a height of above 200 m above sea level.

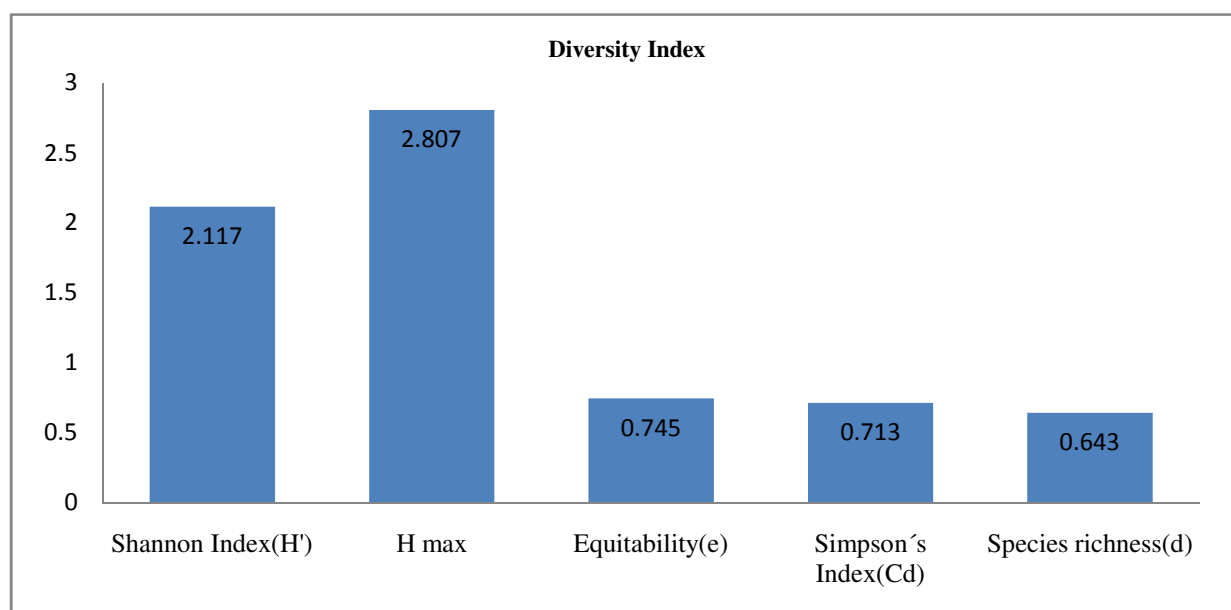
Diversity and Structural analysis

The distribution patterns of mangroves in Kadalundi-Vallikkunnu Community Reserve were studied using species area estimation and quadrat analysis [9]. The study area was divided into fifteen quadrates of each 5×5m size and analysis was carried out using quadrat method. Density, Frequency, Basal area and their relative values and Importance Value Index (IVI) of mangrove species were calculated using standard Phytosociological methods [10]. Girth of trees exceeding 10cm (1.37m above the ground) diameter at breast height was measured using tree calipers. The plant diversity analysis is been done to assess and compare the range and distribution of mangrove species and were calculated by using different diversity indices such as Shannon–Weiner diversity (H'), Simpson index (D) and Equitability (e) [11]. Species richness (total number of species present) was also measured [12].

Table 1. Phytosociological parameters of mangroves in Kadalundi-Vallikkunnu, Kerala

Name of the Species	F	RF	D	RD	BA	RBA	IVI	RIVI
<i>Aegiceras corniculatum</i>	13.33	5.26	347	3.08	1.50	1.81	10.15	3.38
<i>Avicennia marina</i>	13.33	5.26	240	2.13	1.15	1.38	8.77	2.92
<i>Avicennia officinalis</i>	100.00	39.47	5014	44.55	46.69	56.19	140.21	46.74
<i>Bruguiera cylindrica</i>	40.00	15.79	1600	14.21	5.89	7.09	37.09	12.36
<i>Excoecaria agallocha</i>	33.33	13.16	1414	12.56	6.38	7.68	33.40	11.13
<i>Rhizophora mucronata</i>	46.67	18.42	2534	22.51	21.18	25.49	66.42	22.14
<i>Sonneratia alba</i>	6.67	2.63	107	0.95	0.30	0.36	3.94	1.31

* F= Frequency (%), D = Density (ha^{-1}), BA = Basal Area ($\text{m}^2 \text{ha}^{-1}$), RF = Relative Frequency, RD= Relative Density, RBA= Relative Basal Area, IVI= Importance Value Index, RIVI= Relative Importance Value Index

**Figure 1.** Diversity indices of mangroves at Kadalundi-Vallikkunnu Community Reserve, Kerala

RESULTS AND DISCUSSION

Floristic composition

In the present study, the mangrove flora of Kadalundi-Vallikunnu Community Reserve comprises about 7 true mangrove species belonging to 5 families (Myrsinaceae, Avicenniaceae, Rhizophoraceae, Euphorbiaceae and Sonneratiaceae). Present study on species dominance and species composition revealed that the family Avicenniaceae is the largest family in Kadalundi-Vallikunnu Community Reserve with two species *Avicennia marina* and *Avicennia officinalis* followed by the family Rhizophoraceae having species of *Bruguiera cylindrica* and *Rhizophora mucronata*. Diversity of *Rhizophora mucronata* and *Avicennia officinalis* were prioritized among every mangrove in Kadalundi-Vallikunnu Community Reserve, as these species are regarded as salt tolerant pioneers and light demanders and they possess certain adaptive characters for reproduction and survival with efficient mechanism of persistence by producing widely dispersed propagules [13]. Least diverse species in study area were *Sonneratia alba* and *Aegiceras corniculatum* with scarce distribution.

Structural Analysis

Structural analysis includes the study of vegetation and its internal social relationship as well as structure, composition and successional relations among the plant communities. The structural analysis of Kadalundi-Vallikunnu Community Reserve revealed that the highest density and frequency (100%) was for *Avicennia officinalis* (5014 stems/ha) followed by *Rhizophora mucronata* (2534 stems/ha) and least was observed for *Sonneratia alba* (107 stems/ha) (Table.1). The relative density for *Avicennia officinalis* was maximum (44.55) and the lowest relative density was recorded by *Sonneratia alba* (0.95). Relative frequency was highest for *Avicennia officinalis* (39.47) where as *Avicennia marina* and *Aegiceras corniculatum* have same relative frequency of 5.26. The highest basal area was recorded for *Avicennia officinalis* (46.69) whereas *Avicennia marina* (1.15) and *Sonneratia alba* (0.30) registered lowest basal area among all. The IVI and RIVI value was recorded for *Avicennia officinalis* (140.21 and 46.74) was found to be the dominant species owing to high values of Relative density and Relative frequency, followed by *Rhizophora mucronata* (66.42 and 22.14) and lowest value was found in *Sonneratia alba* (3.94 and 1.31) revealing rarity and sporadic distribution of species. The structural analysis of the mangrove communities at different estuarine formations revealed that there is site specific domination of species which in turn supported by the adaptability of the species to specific site conditions [14]. Plant diversity indices can be used to characterize the species abundance across a community.

Shannon's diversity index is used to describe species diversity and Simpson's index represent the probability of occurring two randomly chosen individuals belonging to same species. The present study indicates that Kadalundi-Vallikunnu Community Reserve have Shannon index value (H') of 2.117 and Species richness (d) of 0.643. The value of Shannon index greater than 2 in an ecosystem has been considered as medium to high diverse in terms of species [15] and thus, Kadalundi-Vallikkunnu Community Reserve can be treated as high species diversity zone.

CONCLUSION

Phytosociological studies are important to analyze the distribution of biodiversity and are mandatory for the basic research in tropical ecosystems. Floristic diversity indicated that the study area constituted 7 true mangrove species under 6 genera belonging to 5 families. The pattern of distribution of mangrove species in all the locations were discontinuous and in patches of varying extent. *Avicennia officinalis* was the dominant species followed by *Rhizophora mucronata* and *Sonneratia alba* as well as *Avicennia marina* was the least diverse species in Kadalundi-Vallikkunnu Community Reserve. Highest value of IVI and RIVI (140.21 and 46.74) was for *Avicennia officinalis* and least value was found in *Sonneratia alba* showing the discontinuous distribution of mangrove species in study area. Diversity indices indicated that Shannon-Weiner index of diversity (2.117) considered as medium to high diverse in terms of species. Anthropogenic activities like heavy sand mining, land filling for constructional purposes, waste dumping pose problems for the mangrove biodiversity and its natural regeneration.

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