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Floristic and Structural Analysis of Mangrove Species in Kadalundi-Vallikkunnu Community Reserve in Southern India

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Abstract: ***The study focuses on assessing the floristic and structural analysis ofthe mangrove species of Kadalundi-Vallikunnu Community Reserve, Kerala, India. Phytosociological analysis was conducted in 25 sites using quadrate method (species area curve method). To determine the floristic and structural composition, standard formulas of density, abundance, % frequency, basal area, important value index (IVI), and their relative values was used. Community structure was interpreted using the diversity indices viz. Shannon Weiner index, equitability, and Simpson's Index functions. A total of seven species of mangrove which belonged to 6 genera and 5 families were recorded from the study area. Avicennia officinalis was the dominant one in terms of number followed by Acanthus ilicifolius and R. mucronata. Shannon index value (H') of 5.27 and Species richness (d) of 0.778 were also recorded. The Shannon index values of the sites indicated a highest Shannon index and Equitability of (H'5.27, 2.05). The present study indicates that anthropogenic activities like heavy sand mining, land filling for constructional purposes, waste dumping pose problems for mangrove biodiversity and its natural regeneration which may affect the biodiversity of the area***

Keywords: Kadalundi Vallikunnu Community Reserve, Mangroves, Phytosociological parameters, Importance value index, Shannon Weiner index

1. Introduction

Mangrove habitats are unique coastal wetland ecosystems, globally distributed along the tropical and subtropical tidal zones, around 30°N and 30°S latitude. Mangrove habitats are of high ecological and economic significance (Lee S. Y. et al., 2014). Globally they occupy an area nearing 15, 000, 000 ha (Giri C. et al., 2011) with high economic and biomass values (Alongi, 2015). At the land-sea interface, these forests serve as food sources, breeding grounds, and nascent habitats for numerous terrestrial and marine species, including many commercial fish species (Igulu M. M. et al., 2014; FAO, 2007). The primary production rates of mangrove forests are on par with those of tropical humid ever-green forests, making them highly productive ecosystems (Alongi, 2014). Mangrove forests are among the highest carbon (C) sinks in the tropics and subtropics worldwide, and are hence considered blue carbon ecosystems (Howard *et al.*, 2014). Mangroves play also an essential role in human sustainability and livelihoods, as they serve in providing food, timber, fuel and medicine (Saenger, P, 2003). They reduce shoreline erosion and provide protection from severe natural disasters including tsunamis, tropical storms, and tidal bores. (Alongi, *2014).* Despite its significance, globally mangroves are disappearing at a rate of 1% to 2% annually, and the loss rate reached 35% over the past 20 years (Spalding M, 2011, FAO 2007). Major threats to the mangrove habitat include anthropogenic activities such as urban growth, aquaculture, mining, and overexploitation of fish, crustaceans, and shellfish as well as natural climate changes including sea level rise and changed rainfall patterns. (McLeod, E. & Salm R. V, 2006; Ellison J. C. & Zouh I, 2012).

As per FSI (2013) records, India has only 4, 628 km^2 (0.14% of the country's land area), total mangrove cover that is only 3% of the world's mangrove area, and 8% of Asia's mangrove cover.60% is found along the coasts of the Bay of Bengal ineast, 27% are found along the coastsof the Arabian Sea in the west, and the remaining 13% are in the Andaman and Nicobar Islands (FSI, 2013). Kerala with 560 km of coastline has roughly 25 square kilometres mangrove region along its coast (Sreelakshmi *et al*., 2018).

The species distribution of mangroves and their zonation across the globe has been a matter of scientific interest since long time. Understanding the species' composition and community structure of different region are the basic information required for scientific management and conservation of species in the ecosystem (Hai et al., 2020). Phytosociology aims to empirically represent a particular area's structure, the composition of vegetation stands and the interrelationship among the plants' constituent community (Thomas et al., 2017).

Vinod *et al.* (2021) documented the composition of mangroves along with other flora and fauna of the Kadalundi community reserve. Rahees *et al.* (2014) conducted phytosociological investigations on the mangroves of Kadalundi.

An effort is taken to analyse floristic composition and community structure of the mangrove species in the Kadalundi Community Reserve, taking into account extensive degradation and other anthropogenic and natural disturbances in the reserve.

2. Materials and Methods

Study Area

Kadalundi – Vallikkunnu Community Reserve (11°7'28"-11°8'1" N and 75°49'36"-75°50'20" E), located in Kozhikode (Calicut) and Malappuram districts of Kerala state, is the first Community Reserve of India, The reserve spread across 1.5km^2, is surrounded by patches of mangroves serves as wintering ground for migratory birds visiting the bird sanctuary associated with the community reserve. This Community Reserve is situated at the estuary of Kadalundi river at a height of above 200 m above sea level. The Kadalundi estuary is located at the mouth of the Kadalundi river that drains into the Arabian Sea on the western coast of India.

Phytosociogycal and Structural Analysis

The study was done following quadrate method (species area curve method).25 sampling plots were chosen for the study. Each sample plot was divided into smaller quadrates of 10m x 10m size. With the data obtained from field observations, the structural parameters, density, relative density, abundance, % frequency, relative frequency, basal area, relative basal area, importance value index (IVI) were calculated by the standard formulas. Community structure of the ecosystem was assessed using the functions of Simpson's index, equitability, and Shannonwiener's index (Shannon and Wiener, 1963).

3. Results and Discussions

A number of seven species of mangroves which belonged to 6 genera and 5 families were recorded from the Kadalundi mangrove wetland. Among these seven species, Avicennia officinalisis the dominant one in terms of number and *Avicennia marina* is found the least (Table 1).

A total of ten species of mangrove associate flora which belonged to seven orders, eight families and nine genera were also documented

Table 1: Different Mangrove Species, Family snd Predominance In The Community Reserve

Species	Family	Dominance
Avicennia officinalis	Acanthaceae	********
Acanthus ilicifolius	Acanthaceae	*****
Bruguiera cylindrica	Rhizophoraceae	***
Sonneratia alba	Lythraceae	***
Excoecaria agallocha	Euphorbiaceae	***
Rhizophora mucronate	Rhizophoraceae	***
Avicennia marina	Acanthaceae	*

Phytosociology Analysis

The most densely populated mangrove species in the Kadalundi vallikunnu community reserve are Avicennia officinalis with 1568 numbers / ha (Table 2) followed by *Acanthus ilicifolius*, and *R. mucronata*. In this area, Sonneratia alba species were found to be less common than any other mangrove species. The distribution of GBH frequency classes of the mangrove species in the reserve showed the forest's maturity. *Excoecaria agallocha* has the smallest average basal area (2.55 m^2 ha^{-1}). Mangrove tree basal areas ranged from 2.55 to 28.26 m^2 ha^{-1}. It was clear that *R. mucronata* and *Avicennia officinalis* were the dominating species in the area, with IVI values of 240 and 106, respectively, and higher values in the structural parameters. Despite of a smaller number of *R. mucronata*, it had higher relative frequency and highrelative basal area.

Table 2: Structural analysis of mangroves of Kadalundi community reserve

Species	Density (ha^{-1})	RD	Frequency (%)	Relative Frequency	B A (m^2 ha^{-1})	RBA	IVI
Avicennia officinalis	1568	41.72	100	35.71471	22.01886	29.91056	106.2369
Avicennia marina	310	2.75	13.33	53.32	3.07039	4.170838	60.24688
Rhizophora mucronata	375	16.67	46.67	186.68	28.26	36.84485	240.1945
Bruguiera cylindrica	250	16.00	40	160	8.170135	10.65207	186.6549
Sonneratia alba	198	1.76	6.67	26.68	5.146624	6.710071	35.15038
Excoecaria agallocha	110	10.93	33.33	133.32	2.550605	3.32543	147.5807
Acanthus ilicifolius	947	8.42	26.66667	106.6667	3.47867	4.535424	119.6214

According to the current study, the Shannon index value (H') and species richness (d) for the Kadalundi-Vallikunnu Community Reserve are 5.87 and 0.778, respectively. The area is thought to be a zone of high species variety based on the area's higher Shannon index value (Fig 1)

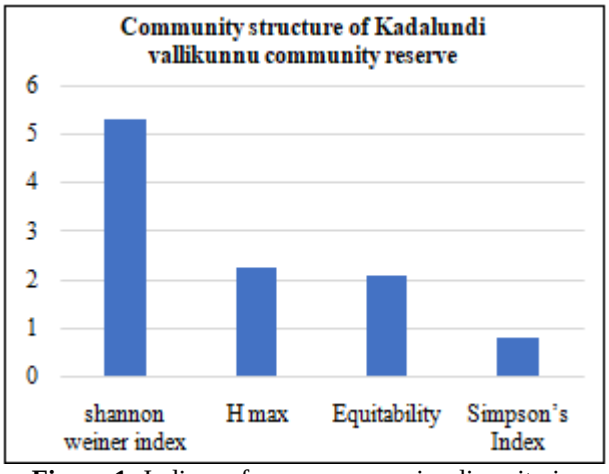

Figure 1: Indices of mangrove species diversity in Kadalundi Community Reserve, Kerala

4. Conclusion

The study region had 7 species under 6 genera and 5 families, according to floral diversity. *Acanthaceae* is identified as the dominant family in the study area which comprised of 3 species of *Avicenna*. The dominance of *Avicennia officinalis* among the seven species of mangroves distributed throughout the Kadalundi Community Reserve was revealed by structural analysis of the mangroves. *Rhizophora Mucronata* registered the highest Importance value index (IVI) and relative importance value index (RIVI). The sites' diversity index showed the greatest Shannon Weiner index and equitiness (H' 5.27, 2.05). The biodiversity of mangroves and their natural regeneration are affected by anthropogenic activities including extensive sand mining, land fill for development, and garbage disposal.

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