

FLORISTIC DIVERSITY AND STRUCTURAL ANALYSIS OF MANGROVE FORESTS AT AYIRAMTHENGU, KOLLAM DISTRICT, KERALA

Vishal Vijayan* Rahees, N. and Vidyasagaran, K.

Department Of Forest Management and Utilization, College of Forestry,
Kerala Agricultural University, Vellanikkara, Kerala – 680656, India
Email: vishal00v@gmail.com

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Abstract: Vegetation science is a scientific discipline devoted to study plant communities, their composition, evolution and the relationships among the component species. The present study focuses on floristic diversity and richness of the Mangroves in Ayiramthengu, Kollam district. A total of 9 species belonging to 6 families were enumerated. The forests showed a dominance of *Avicennia marina* followed by *Avicennia officinalis* belonging to *Avicenniaceae* family, whereas *Sonneratia caseolaris* recorded lowest density. Maximum relative basal area was represented by *Avicennia marina* followed by *Avicennia officinalis*, therefore these species registered the highest Importance value index (IVI) and relative IVI among the 9 mangroves species distributed. Diversity indices such as Shannon Weiner index H' (2.763), equitability (0.872) and Simpson's diversity index (0.825) was worked out for the entire Ayiramthengu island. The mangroves are closely related to the social and cultural life of people in Ayiramthengu and its unique composition has to be protected in its pristine condition.

Keywords: Mangrove forest, Floristic composition, Diversity indices, Important value index

INTRODUCTION

Mangrove wetlands along tropical estuaries are intended as intertidal and ecotones of marine to fresh water biological communities, which have major role in biochemical process, nutrient recycling and often nutrient limited, Alongi, (2009). They act as a shield for marine animals and among the coastal ecosystems, mangroves ecosystem is a repository of biological diversity as the tropical rain forest, Swaminathan, (1991). According to the latest estimate of Forest Survey of India, (2005), total area under mangrove cover in India is 4663 km². Kerala along the west coast of India has a coastline of 590 km and presently the mangrove area is estimated to be about 17 sq. km, Basha, (1991), of which 36 percent is either completely degraded or is degrading. Mangrove vegetation in Ayiramthengu, Kollam occurs adjacent to the back water channels and along the banks of estuarine water bodies, in the form of narrow patches or continuous belts. Total of 15 pure mangroves and 33 semi mangroves had been recorded from entire coastal area of Kerala, Vidyasagaran *et al.*, (2014). The objectives of the investigation was to study the diversity, distribution and structural attributes of Ayiramthengu mangrove vegetation and their ecological status based on density, frequency, important value index (IVI) and relative IVI.

MATERIAL AND METHOD

Study site

Kerala lies towards the South-West coast of India, Ayiramthengu is a coastal region located in Kollam district (90° 54' 41.96" N and 76° 18' 32.36" E) east of Kayamkulam estuary which opens to the Arabian

Sea. Mangrove area in Ayiramthengu share the boundaries of three panchayaths including Alappad panchayath in western area, Clappana panchayath which contributes 70 percent of mangrove area and Devikulangara panchayath in northern part with 30 percent mangrove patches.

Diversity and Structural analysis

The distribution patterns of mangroves in Ayiramthengu were studied using species area estimation and quadrat analysis, Michael, (1998). Fifteen quadrats each of 5×5m size were taken on the basis of data received. Locations of the different transect were resolute based on canopy cover, length of intertidal area and observed vegetation classes. Density, frequency, basal area and their relative values and importance value index (IVI) of mangrove species were intended using standard Phytosociological methods, Curtis and McIntosh, (1951). Girth of trees exceeding 10cm (1.37m above the ground) diameter at breast height was measured using tree calipers. Importance value index of each species was calculated as the sum of relative density, relative frequency and relative dominance, Ellison, (2001) so as to reveal relative contribution of each species to the overall stand composition. The vegetation data were analyzed to calculate the diversity indices and species richness, Shannon–Weiner diversity (H'), Simpson index and equitability were measured, Legendre and Legendre, (2012). Species richness were measured (total number of species present) by Margalef, (1958).

RESULT AND DISCUSSION

Floristic composition

In the present study, the mangrove flora of Ayiramthengu comprise of totally 9 mangrove species

*Corresponding Author

belonging to 6 families (Myrsinaceae, Avicenniaceae, Rhizophoraceae, Euphorbiaceae, Combretaceae and Sonneratiaceae). Present study on species dominance and species composition revealed that the family Avicenniaceae is the largest family in Ayiramthengu region followed by Rhizophoraceae, which is dominated by a higher density of smaller trees. Diversity of *Avicennia marina* and *Avicennia officinalis* were prioritized among every mangrove in Ayiramthengu, 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, Tomlinson, (1986), and this can contribute much to the marine to fresh water biological ecosystem. Jose, (2003) recorded that *Avicennia officinalis* as the dominant species in Kunhimangalam, Valapatnam and Dharmadam areas of Kannur. Least diverse species in Ayiramthengu are *Sonneratia caseolaris* as well as *Lumnitzera racemosa* in which, *Lumnitzera racemosa* confined to landward margin and also inner fringes of the estuarine areas, found only in Kollam district in the southern Kerala. *L. racemosa* and *Ceriops tagal* are the most threatened species in the west coast, Vidyasagar *et al.*, (2014).

Structural analysis

Structural analysis revealed that *Avicennia marina* constituted highest density (5361 ha^{-1}) and frequency (100%) which manifested an erratic distribution, abided by *Avicennia officinalis* (3067 ha^{-1})

(Table.1). The relative density for *Avicennia marina* was maximum (30.83) and the lowest relative density was recorded by *Sonneratia caseolaris* (0.46). The highest basal area was recorded for *Avicennia marina* (32.05), *Lumnitzera racemosa* (1.59) and *Sonneratia caseolaris* (0.45) registered lowest basal area among all. The highest IVI value was 82.84 and 49.18 for *Avicennia marina* and *Avicennia officinalis* respectively followed by *Rhizophora apiculata* (40.38) and *Rhizophora mucronata* (36.28), *Excoecaria agallocha* (29.82) and *Aegiceras corniculatum* (25.73). *A. marina* revealed maximum RIVI (27.61), the lowest IVI and RIVI were recorded for *Sonneratia caseolaris* (2.17 & 0.72 respectively) revealing rarity and sporadic distribution of species. The sightings of *Sonneratia caseolaris* and *Lumnitzera racemosa* were the first record of this species from Ayiramthengu region. Plant diversity indices indicated that Shannon Weiner index (2.763) and equitability (0.872), Simpson's diversity index (0.825) (Figure.1) were almost similar to the studies conducted earlier in several parts of Kerala, Vidyasagar *et al.*, (2011). Analysis of data on different indices, unveiled that there was high diversity (more heterogeneous) of species along the different mangrove patches in Ayiramthengu. An ecosystem with H' value greater than 2 has been considered as medium to high diverse in terms of species, Cottom & Curtis, (1956) and thus, Ayiramthengu can be treated as high species diversity zone.

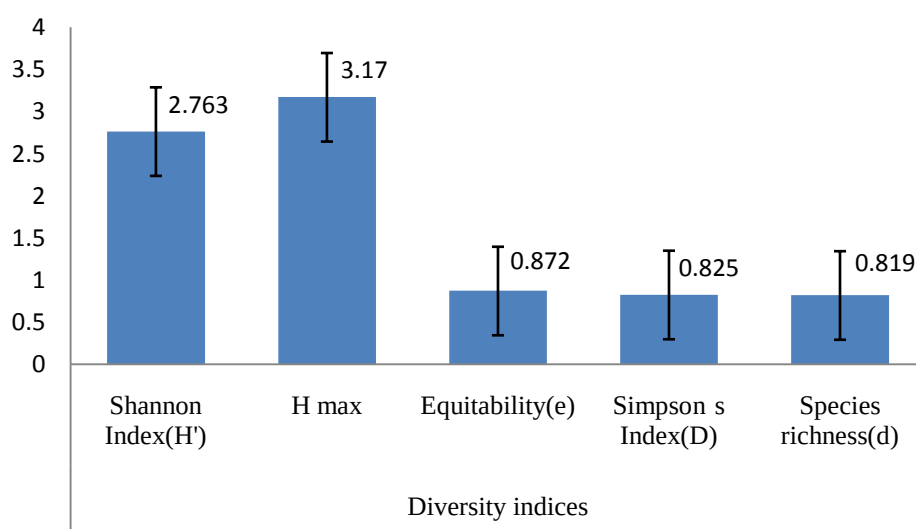


Figure 1. Diversity indices of Mangroves at Ayiramthengu, Kollam district of Kerala.

Table 1. Phytosociological parameters of mangroves in Ayiramthengu, Kollam district.

SI No.	Name of the Species	F	RF	D	RD	BA	RBA	IVI	RIVI
1	<i>Aegiceras corniculatum</i>	53.33	9.88	1520	8.74	6.8	7.11	25.73	8.58

2	<i>Avicennia marina</i>	100	18.52	5361	30.83	32.05	33.49	82.84	27.61
3	<i>Avicennia officinalis</i>	80.00	14.81	3067	17.64	16.01	16.73	49.18	16.39
4	<i>Bruguiera cylindrica</i>	60.00	11.11	1067	6.14	3.89	4.07	21.32	7.11
5	<i>Excoecaria agallocha</i>	60.00	11.11	1894	10.87	7.5	7.84	29.82	9.94
6	<i>Lumnitzera racemosa</i>	40.00	7.41	560	3.22	1.59	1.66	12.29	4.10
7	<i>Rhizophora apiculata</i>	73.33	13.58	2134	12.27	13.9	14.53	40.38	13.46
8	<i>Rhizophora mucronata</i>	66.67	12.35	1707	9.82	13.5	14.11	36.28	12.09
9	<i>Sonneratia caseolaris</i>	6.67	1.24	80	0.46	0.45	0.47	2.17	0.72

* 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



Plate.1 Land filling at mangroves of Ayiramthengu area.

Threats

In 1991, the mangrove territory in Kerala is estimated to be about 17km^2 , in which 36% of these are degraded or still in degrading condition, Basha, (1991). Mangroves are one of the foremost vulnerable ecosystems of the world. Over the past few years mangroves are disappearing at disturbing rate. Coastal urbanization, conversion to Aquaculture, changes in the local hydrology is the biggest threats to mangroves. This unique biological system is in imminent danger of extinction as a result of indiscriminate and unplanned advancement and needs quick protection and conservation, Subramanian, (2002). Apart from the sites with high diversity, Ayiramthengu has many other small patches of mangroves which are under threats of degradation. Most people does not have legitimate

knowledge about mangroves, they consider mangroves spots as places appropriate for dumping trash and other unwanted material. Increasing fish and prawn culture in mangroves of Ayiramthengu ought to be considered seriously, as several studies from different parts of the world pointed out increased aquaculture practices as one of the real dangers to these fragile environments. The species composition and the agents causing maximum destruction, depends upon the localities, Rao, (1986). The present study observed couple of threats to mangroves of Ayiramthengu including land filling, human development, housing, clear cutting, several industrial developments etc.

Land filling is one of the major threats in this region (Plate.1) which leads to limiting climate regulation and storm prevention. In order to protect and

conserve the mangrove patches in Ayiramthengu which facing acute threat from development activities and extension of human inhabitation, government should take quick necessary actions to conserve this unique ecosystem

CONCLUSION

Phytosociological studies are important to ascertain the distribution of sustenance plants for wildlife and mandatory for the basic research in tropical ecosystems, Dudley, (2005) and Jain S.K, (1976). Ayiramthengu mangrove's areas are large and diverse in species, and are inevitable ecosystem in marine fresh water interface. Floristic diversity indicated that the study area constituted 9 species of true mangroves under 5 genera belonging to 6 families. The pattern of distribution of mangrove species in all the locations were discontinuous and in patches of varying extent. *Avicennia marina* was the most dominant species followed by *A. officinalis*. *Lumnitzera racemosa* and *Sonneratia caseolaris* are least diverse species in Ayiramthengu. Where, *Lumnitzera racemosa* confined only in Kollam district in the southern Kerala. Structural analysis of mangroves of Ayiramthengu unveiled the domination of *Avicennia marina* having highest IVI and RIVI values owing to high values of relative density and relative frequency. Diversity indices indicated that Shannon-Weiner index of diversity (2.763) considered as medium to high diverse in terms of species. Urbanization, industrialization and chemical discharge are some of the major common threats that dwindle mangrove ecosystems.

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