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RESEARCH ARTICLE

PHYTODIVERSITY ASSESSMENT IN NEYYAR WILDLIFE SANCTUARY WESTERNGHATS, INDIA

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ABSTRACT

Tropical forest ecosystems are one of the richest terrestrial ecosystems which support a variety of life forms and maintain huge global biodiversity. The phytosociology is one of the important aspects for analyzing the structure, composition and phytodiversity for thoroughly understanding the vegetation dynamics. Both structure and diversity of vegetation have strong functional role in controlling ecosystem processes like biomass production, cycling of water and nutrients. Phytosociological studies revealed that the southern hill top tropical evergreen forest has high species richness and diversity. The study of plant community implies knowledge of structure and composition of the component species. The combined influence of plant height, basal area, density and number of species on 'complexity index' is the evaluation of vegetation physiognomy. The present study analyses the compositional attributes of Neyyar wildlife sanctuary. The phytodiversity is one of the important aspects for analyzing the structure, composition and for thoroughly understanding the vegetation dynamics. Both structure and diversity of vegetation have strong functional role in controlling ecosystem processes like biomass production, cycling of water and nutrients.

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INTRODUCTION

The study of plant community structure is called plant sociology or phytosociology. "Phytosociology" the study of aspects of communal relations of plant was coined by Paczoski and this study is important for understanding the functioning of community. The study of plant community implies knowledge of structure and composition of the component species. The combined influence of plant height, basal area, density and number of species on 'complexity index' is the evaluation of vegetation physiognomy (Stone and Frayer 1935). The vegetation complex fluctuates from season to season and year to year. The fluctuation suggests a response by each species population to incoming heat, moisture and light as modified by the vegetation itself (Ghosh and Nagi, 2006). A number of qualitative and quantitative indices of species diversity have been proposed by several workers (Simpson, 1949; Shannon and Wiener, 1963; Whittaker, 1972) which provided information on compositional change at different analytical levels, includes species diversity in relation to size of area,

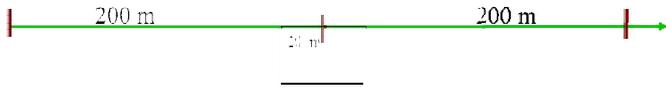
relationship between local and regional species diversity and diversity along gradients across space or environmental factors (Busing and White, 1997; Gaston, 2000). Information on floristic composition, diversity and phytomass are absolutely essential in understanding the forest ecosystem dynamics (Gentry, 1990).

A large number of indices are worked out to establish successional status of forest ecosystems. The structural aspects of vegetation especially the successional status of the vegetation can be measured by maturity index (Pitchi and Sermolli, 1948). To evaluate environmental influence over vegetation continuum index was developed. To assess the overall similarity or difference of different localities Similarity indices like Jaccard (1912) or modified Sorenson (1948) indices can be used (Muller- Dombios and Ellenberg, 1974). To compare and evaluate biodiversity Simpson's index based on proportion of individual can be used (Simpson, 1969). The most widely used index to measure species diversity is Shannon- Wiener index (1949) because it incorporates both species richness and abundance. Combined diversity indices to overcome the disparity that may occur while using these indices are also developed (Li and Krauchi, 2006).

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MATERIALS AND METHODS

A stratified transect survey was conducted in the Neyyar wildlife sanctuary during the period of 2007-2009. The strata were delineated by taking into consideration on the basis of different vegetation type and altitudinal variation of the study area.



The transect and quadrat size and location

The transect length was 2 km in most cases. Square plots of 20X20 m plot were laid on every 200 m interval along transects. For each vegetation type the size of quadrat was determined through species-area-curve. The size where the number of species became constant for at least 3 consecutive stage (e.g. 20 × 20 m tree, 5x5 for shrubs and 1x1 for herbs), in above example was considered as the size of quadrat. The number of quadrates was proportionately analyzed according to the area of the vegetation unit. In each plot, all woody plants with > 30 cm GBH (Girth at Breast Height I.e., 1.3 m from the ground) were identified at species level, counted individuals and measured GBH using a tape, A total of 14 transects (twelve 2 km transects + two 1 km transects) with 130 sampling plots were surveyed in Neyyar wildlife sanctuary.

The data were quantitatively analysed for density, frequency and abundance following Curtis and McIntosh (1950), the relative values of density, frequency and abundance were determined as per Philips (1959). These values were summed up to get Importance Value Index (IVI). For calculating diversity of the area, the indices were used in addition to simple species richness (number of species). The indexes that are calculated was Shannon-weiner diversity index and the second was Simpson dominance index.

RESULTS AND DISCUSSION

In Neyyar wildlife sanctuary about 176 tree species were found in the sampling. The distribution of sample points with other compositional attributes in different vegetation types is given in Table. Southern hill top tropical evergreen forest showed maximum number of species and followed by west coast evergreen forest. The stand density was higher at Southern hill top tropical evergreen forest and the stand density was low in Southern moist mixed deciduous forest. Shanon diversity index is higher at Southern hill top tropical evergreen forest. Average basal area is higher at west coast semi evergreen forest. Simpson Index of Dominance is higher in southern dry mixed deciduous forest. The average basal area is high in West coast semi evergreen forest. In Neyyar wildlife sanctuary the different compositional attributes such as Shanon diversity index, Simpson index of dominance, stand density/ha, average basal area are shown in the table.

Population density of tree species across girth class interval in Neyyar wildlife sanctuary showed that around 31.20% of individuals belonged to 30-60 cm GBH and least in 240-270

GBH class .The highest number of species was also observed in the 30-60 cm GBH category, the study area represents typical mature stands with good regeneration. The table represents the Neyyar wildlife sanctuary population structure of tree species along girth class frequencies.

Table 1. Neyyar wildlife sanctuary compositional attributes

Parameter	Vegetation type				
	Southern hill top tropical evergreen forest	West coast evergreen	West coast semi evergreen	Southern moist mixed deciduous forest	Southern dry mixed deciduous forest
No. Of plot	10	12	21	49	38
No. Of tree species	53	51	32	24	16
Shanon diversity index	4.12	4.09	3.41	3.1	2.8
Simpson index of dominance	0.021	0.023	0.052	0.069	0.091
Stand density/ha	388	379	348	249	253
Average basal area	37.1	38.5	60.7	28	24

Table 2. Neyyar wildlife sanctuary population structure of tree species along girth class frequencies

Neyyar wildlife sanctuary population structure of tree species along girth class frequencies					
S. No.	GBH class (cm)	No. of species	No. of individuals	% individuals	
1	30-60	130	488	31.20	
2	60-90	112	407	26.02	
3	90-120	84	264	16.87	
4	120-150	71	197	12.59	
5	150-180	55	91	5.82	
6	180-210	31	47	3.00	
7	210-240	21	25	1.6	
8	240-270	8	15	0.96	
9	>270	19	30	1.98	

Shannon-weiner and Simpson diversity indices indicated high diversity in the area in similar to many other places (Ayyappan and Parthasarathy, 1999, Srinivas and Parthasarathy, 2000). Tree density (stand density) in West coast tropical evergreen forest was 384 trees/ha which was slightly lower than the mean tree density (419 trees/ha) observed for Western Ghats closed canopy West coast tropical evergreen forest (Ghate *et al.*, 1998). The lowest basal area observed for southern dry mixed deciduous forest was in correspondence with the similar trend in Mudumalai wildlife sanctuary (Joseph *et al.*, 2008). The size class distributions of the stems were found to exhibit negative exponential or inverse 'J' curve, indicating a good regenerating population (Richards, 1996), a case commonly reported from Western Ghats biodiversity hotspot. For example, Ganesh *et al.* (1996) in Kakachi, Parthasarathy (2001) in Sengaltheri, and Pascal and Pelissier (1996) in Uppangala noted similar trends in their respective study areas. In the present study, the number of tree species, density and basal area values are in a range when compared with other tropical forest ecosystems (Verghese and Menon, 1998; Sunderpandian and Swamy, 2000). Singh and Singh (1991). Verghese and Menon (1998) also reported a stand density of 340 trees/ha, and basal area of 26.57 m²/ha in southern moist mixed deciduous forests of Agasthyamalai region of Kerala, India. The Shannon

index values of the present study area were comparatively same those values reported by Singh *et al.* (1984) and Swamy (1998) for other tropical forests of India. According to Pant and Samant (2007), the diverse habitat and suitable climatic factors can support the growth and survival of the species in the present study. The lower diversity of southern dry mixed deciduous forest ecosystem in this study is attributed to sharing of large proportion of resources by only a few species, while in tropical evergreen forests more number of species efficiently shared the resources. Therefore the higher diversity was found in those forests (Pascal, 1992; Swamy, 1998).

The estimation of compositional attributes of the forest ecosystem reveals the strength of the forest ecosystem and its regeneration capacity. Characterization of compositional attributes such as species richness, stand density, species diversity, dominance and basal area yielded valuable information about the organisation of this tropical forest. The phytodiversity assessment helps to know the species distribution in different types of forest ecosystems this will be helpful for the biodiversity conservation. Knowledge of forest characteristics is an important factor for the formulation of conservation practices.

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