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QUANTITATIVE VEGETATION ANALYSIS OF BARAYTHA FOREST IN CENTRAL INDIA

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ABSTRACT

Various parameters of quantitative vegetation analysis of tree species were studied. On the basis of IVI four forest communities were identified. Population density and basal area of tree species were 218 ha^{-1} and 6.83m^2 ha^{-1} respectively. The distribution pattern for most of the tree species was contagious. The Shannon-Weiner index and beta diversity for site were 3.66 and 1.65 respectively. The value of concentration of dominance was observed as 0.068 indicating that the dominance was shared by more than one and/or many species. Tree species showed log–normal dominance diversity curve indicative of shared resources pattern by a number of species.

Key Words: Quantitative vegetation analysis, forest communities, Central India.

INTRODUCTION

Quantitative inventories of forest ecosystems provide necessary context for understanding, planning and interpreting long-term ecological research (Baithalu *et al*., 2013). The information resulting from forest inventories serves as an invaluable research base for diverse aspects of tropical ecology while providing information crucial for their conservation and management (Ayyappan and Parthasarthy, 1999). Tropical dry forests form a major biome in India by covering 46% of the total forest cover of India. Most of these forests are under great anthoropogenic pressure and require management intervention to maintain the overall biodiversity, productivity and sustainability. Among different types of forest in India, tropical dry deciduous forests occupy largest area in Central India. The forests of Sagar district can be classified under the tropical dry deciduous type after Champion and Seth (1968). Deciduous forests are not considered species rich, but have a diversity of life forms. Still these forests assume unusual significance for conservation since they are the most used and threatened ecosystem, especially in India.

STUDY AREA

The present study was conducted in Baraytha located 62 KM in north of Sagar (M.P.). It lies at 24°17'N latitude and 78°56' E longitude. Altitude ranges from 400 to 425 meter and highest peak is 455 meters. On the basis of rock formations and their characteristics, the site subdivided into four sub sites. i. Sandstone quartzite ii.

Bijawar sedimentary iii. Bundelkhand granite and iv. Banded iron formation. The area enjoys a topical monsoonic climate with three well recognized seasons viz.-rainy, winter and summer. Average annual rainfall is about 1200 mm, chiefly received during the rainy season from the month of late June to early September. Winter rains are of common occurrence. Summer season is from March to mid June and very hot with maximum temperature of 45°C. Winter season is pleasant and dry with mean minimum temperature of 12.5°C.

MATERIALS AND METHODS

Phytosociological studies of woody species on sub sites and entire site of Baraytha forest were carried out by five (for sub site) and ten (for entire site) randomly placed quadrats of 10X10m. The data were quantitatively analysed for frequency, density and basal area (Curtis and McIntosh, 1950). Reletative values of frequency, density and dominance were determined following Misra (1968).The sum of all above relative values represented as Importance Value Index (IVI). On the basis of IVI, dominant, co-dominant and main associate species were recognized (Mullar Dombois and Ellenberg, 1974). The ratio of abundance to frequency (A/F) was used to determining distribution pattern of species Whitford (1949). It is <0.025, random if between 0.025-0.050 and contagious if >0.050.

Shannon and Wiener diversity index (H) was calculated after (Shannon and Wiener, 1963). Concentration of dominance (Cd) was determined following Simpson's index (Simpson, 1949). Beta diversity (BD) was calculated following Whittaker (1975). Dominance-diversity curve was prepared taking the IVI of species determination in relation to species number for resource partitioning among different species following Whittaker (1965) and Ralhan *et al*., (1982). Similarity index (community co-efficient) among different sub sites was calculated following Sorenson (1948).

RESULTS AND DISCUSSION

On the basis of highest values of IVI of tree species following four forest communities, one for each sub site, have been recognized Table 1-

I. *Aegle marmelos – Tectona grandis* type

II. *Tectona grandis – Lagerstroemia parviflora* type

III. *Tectona grandis – Diospyros melanoxylon* type

IV. *Diospyros melanoxylon –Lagerstroemia parviflora* type

The study site was subdivided into four sub sites on the basis of underlying rock formations. Subsite I to IV characterised by sandstone quartzite, ferruginous quartzite, Bundelkhand granite and banded iron quartzite respectively.

As far as the dominance of tree species is concerned, every sub site showed dominance of more than one species, however as per values of IVI two sub sites were dominated by *Tectona grandis* (subsite II and III) while the other showed dominance of *Aegle marmelos* and *Tectona grandis* (subsite I) and *Diospyros melanoxylon* and *Lagerstromia parviflora* (subsite IV). Vegetation of entire site recognized as *Tectona grandis-Diospyros melanoxylon* type. Apart from above tree species, other associated species of entire site were *Anogeissus latifolia*, *Cassia fistula, Butea monosperma, Madhuca indica* and *Terminalia belerica* etc. Total numbers of 36 tree species were found at this site; however the sub sites consisted of 15 to 27 species. Highest IVI of teak indicates its dominance and ecological success on account of its good power of regeneration and greater ecological amplitude. Teak dominating vegetation has also been reported by Saxena *et al*., (1992) Dixit (1997) and Thakur and Khare (2006) in other parts of Central India. Depth and moisture in the soil, and anthropogenic pressure are supposed to be the main factors which

Table 1: Importance Value Indices (IVI) of tree species at different subsites and for total Baraytha forest.

S. No.	Name of the plant species	Subsite				Baraytha Forest
		I	II	III	IV	
1.	*Tectona grandis* Linn.	32.67	58.92	39.80	42.60	41.91
2.	*Diospyros melanoxylon* Roxb.	26.95	25.31	27.74	68.50	36.58
3.	*Lagerstroemia parviflora* Roxb.	29.59	38.95	25.11	52.43	35.97
4	*Aegle marmelos Correa*	33.75	18.50	26.86	7.15	22.40
5.	*Anogeissus latifolia* (Roxb. ex. DC) Wall	12.15	17.12	21.38		13.13
6.	*Cassia fistula Linn.*	12.64	12.74	13.88	11.19	12.57
7.	*Butea monosperma* (Lamk.) Taub.		38.70	7.04		11.88
8.	*Madhuca indica Gmel.*	7.40			43.35	10.77
9.	*Terminalia belerica* (Gaearth.) Roxb.	6.72	8.04	23.14		10.19
10.	*Anogeissus pendula Edgew*		18.65	15.48		8.3
11.	*Gardenia latifolia Aiton.*	2.50	5.39	15.79	9.03	7.71
12.	*Schleichera oleosa* (Lour) Oken.		7.26	3.88	24.33	7.62
13.	*Terminalia tomentosa* (DC.) W & A.	9.37		12.0	6.11	6.99
14.	*Flacourtia indica* (Burm f.) Merr.	5.19	15.19	4.14	4.27	6.90
15.	*Lannea coromandelica* (Houtt.) Merr.	2.65	10.26	10.45	4.28	6.68
16.	*Bucahnania lanzan Spreng.*	16.49			6.41	6.27
17.	*Miliusa tomentosa* (Roxb.) J. Sinclan	14.81			5.87	5.87
18.	*Mitragyna parvifolia* (Roxb.) Korth.	5.91	16.36			5.83
19.	*Bridelia retusa* (L.) Spreng.	13.13		4.50		5.05
20.	*Adina cordifolia* Hook. f.	4.79	4.49		9.34	4.48
21.	*Elaeodendron glaucum* Pers.	8.45	3.90	3.69		4.40
22.	*Terminalia arjuna* W.& A.		14.47			3.79
23.	*Boswellia serrata* Roxb. ex. Colebr.	12.63				3.48
24.	*Albizzia odoratissima* (L.f.) Benth.			13.37		3.22
25.	*Wendlandia puberula* D.C.	9.20				2.56
26.	*Albizzia lebbek Benth.*	7.52				2.13
27.	*Cordia vestita* Hook.f. & Thoms	7.07				2.04
28.	*Kydia calycina* Roxb.	5.29				1.75
29.	*Xylia xylocarpa* (Roxb.) Taub.		6.72			1.67
30.	*Acacia leucophloea* Willd.		5.77			1.30
31.	*Erythrinia variegate* L.	4.27				1.29
32.	*Acacia catechu* (L.f.) Willd.		4.53			1.07
33.	*Casearia graveolens* Dal.			4.92		0.94
34.	*Ehretia laevis Roxb.*	2.81				0.91
35.	*Ougeinia dalbergioides* (Roxb.) Hochr.	2.81				0.91
36.	*Zizyphus xylopyrus* Willd.	2.79				0.90

Table 2: Similarity matrix of tree species of Baraytha Similarity Index (%)

Sites → / ↓	Site I	Site II	Site III	Site IV	Baraytha
Site I	X				
Site II	60.45	X			
Site III	54.16	75.67	X		
Site IV	61.90	54.51	55.55	X	
Baraytha	85.71	61.53	73.68	58.82	X

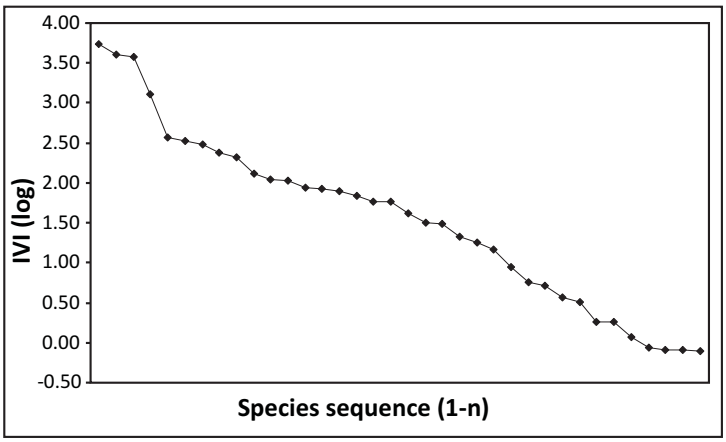

Fig. 1: Dominance-diversity curve of tree community at Baraytha forest

influence the composition of forests. The shallow and drier soils on higher elevations has supported miscellaneous forest in which the proportion of teak is less, while deep and moist soil in the valleys supported teak dominated forest Dixit (1997). Presence of *Diospiros melanoxylon* may be due to its rapid growth through the root suckers.

It is evident from ratio of abundance to frequency (A/F) that the distributions of tree species were characterized by a preponderance of contagious distribution (77.77%). However some species showed random distribution (19.44%) and rarity of regular distribution (2.77%). Fracker and Brischle (1944), Cole (1946) and Ashby (1948) stated that the contagious distribution of species depends upon local habitat differences, vegetative reproduction, local seed setting and daily and seasonal changes. In general preponderance of contagions distribution in natural vegetation has been reported by several workers (Singhal *et al*., 1986; Singhal and Sharma, 1989; Joshi and Tewari, 1990; Bhandari *et al*., 1995; Verma and Totey, 1996; Mishra *et al*., 1997 Kunhikanan *et al*., 1998; Khatri, 2000; Pandey, 2001; Thakur, 2003; Panchal and Pandey, 2004; Bhatt *et al*., 2004; Kumar *et al*., 2006 and Thakur and Khare , 2009).

In the present study population density of tree species was 218 ha^{-1} and basal area 6.83 m^2 ha^{-1} High value of basal area indicates the site have more mature forest whereas low values showed that site has younger forest in which number of mature trees were less probably due to greater biotic disturbances in the area Khatri (2000) reported total basal area at Satpura National Park, M. P. between 17.37 to 26.28 m^2 ha^{-1} Ilorkar and Khatri (2003) at Navegaon National Park observed total basal area in between 14.15 to 17.212 $m^2ha^{-1.}$ Jha and Singh (1990) observed 7.23 m^2ha^{-1} in Vindhyan region that represents tropical dry forest.

Similarity index among different studied sites are given in Table 2. The maximum similar sites were sub site I and entire Baraytha site (85.71%) while minimum similar sites were sub site I and sub site III.

Species diversity or Shannon-Wiener diversity index (H) of tree species was 3.66. Kushwaha and Kumar (2002) observed maximum diversity value

(2.505-2.511) in Madhav National Park followed by Satpura National Park (2.198-2.254) and minimum value (1.717 - 1.763) was found for Pachmarhi Wildlife Sanctuary in Central India. Pandey and Shukla (1999) and Panchal and Pandey (2004) observed lowest and highest value of H as 2.034 and 3.53 respectively in tropical forests in Gujrat and sal forest in North India. It is evident form the results that in general species diversity of tropical dry deciduous forest it much lower however, at place be higher due to more physical heterogeneity as in present study.

The value of concentration of dominance (Cd) was observed as 0.068 The low value of Cd indicating that dominance was shared by more than one or many species. Knight (1975) reported an average value of Cd as 0.06 for a tropical forest.

Beta diversity for the tree species was reported as 1.65 at this site. Several workers have assessed the beta diversity for the rate of species turnover along the different environmental gradient (Rikhari *et al*., 1999; Adhikari *et al.,* 1991; Bankoti *et al*., 1992; Pandey and Shukla, 1999 and Pandey, 2001).

Tree species showed log–normal dominance diversity curve (Fig. 1) indicative of shared resources pattern by a number of species. Similarly Pandey (2001) and Khurana and Saxena (2009) also observed log-normal dominance diversity curves for tree species.

CONCLUSION

Most of the species present in this forest show greater adaptability against anthropogenic factors and having good potential for natural regeneration. The vegetation can be easily conserved for its diversity and growth by adopting strategy of reduction of biotic pressure.

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