

# Phytosociological Analysis of Mixed Deciduous Forests of Bundelkhand Region

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**Abstract**—A phytosociological study was conducted in the mixed deciduous forests of the Bundelkhand region to analyze the community structure, species composition, and diversity patterns. Bundelkhand's unique semi-arid climate and varied edaphic conditions support a distinct flora. This research aimed to understand the ecological dynamics of these vital forests, crucial for biodiversity conservation and ecosystem services. Quadrat sampling was employed to collect data on species presence, abundance, and frequency. Various ecological indices, including species richness, diversity indices (Shannon-Wiener, Simpson), and dominance patterns were calculated. The study revealed the dominant tree species and their associated communities. Analysis of the data provided insights into the forest's current ecological status and its response to environmental factors. The findings contribute to effective conservation strategies and sustainable management of these ecologically important forests in the Bundelkhand region.

**Index Terms**—Bundelkhand, mixed deciduous forests, phytosociology, species diversity, dominance, community structure, ecological dynamics, biodiversity conservation.

## I. INTRODUCTION

Phytosociological analysis of a plant community is an important aspect of ecological study of any piece of vegetation. It reveals the structural picture of the vegetation and helps in analysis the community dynamics. Among the various kinds of ecosystem encountered in the Mixed deciduous forest, due to their unique features have always attracted ecologists. These ecosystems have evolved their own ways of complex biological processes and deserve attention as special ecological entities (Vidyasagan et al. 2004). Vegetation analysis is important as the structure of the vegetation expresses most relevant results and is a flexible tool in the analysis of

complex system (Weed et al. 1977). Bundelkhand region is covered by the mixed deciduous forest. Jhansi is situated between latitude 24°11' - 26°27' and Longitude 78°17' - 81°34 E at 275mm above sea level. Temperature ranges from 20°C -45.7°C and minimum from 2.5°C-29°C. The climate of Jhansi is semi-arid with an average rainfall of 900mm mostly between last week of June to September (Pandey et al. 2002). A thorough knowledge of the community can be best acquired if ecology of individual plant species, forming a constituting part of the community is studied (Joshi and Gupta, 1982). To have complete idea of the structure and composition of a community, it is essential to understand it is various analytical characters. Analytical characters viz. Relative frequency, Relative density, Relative basal area and IVI are very useful in the composition of two different forest communities. From the above information it is evident that is a scope for studying the Phytosociological attributes of Bundelkhand region in view to understand their conservation status. Thus, A thorough knowledge of the community can be helpful in understanding the ecological implication of the forest. Phytosociological studies in forest have carried out by many workers viz. Das and Lahiri (1997), Jose et al. (1994) and Balaji and Nitant(2002). There is paucity of data on performance, adaptability association and growth architecture of individual species.

The present study envisages Phytosociological behavior of Mixed deciduous forest in relation to its other associates at different topographic region of Bangoun and Orchha forests.

## II. MATERIAL AND METHOD

Phytosociological studies were carried out through quadrat methods. The both Banguon and Orchha forest were divided in the equal compartments arbitrarily 40 of 10X10m size each placed at equal distance in parallel lines. The study was carried out in July 2023. Three analytical characters viz. Relative frequency, Relative density, Relative basal area were considered for the calculation of IVI of each species (Curtis and Cotton, 1962). The formulae for the determination of these parameters are given below.

Relative Frequency =  $\frac{\text{Frequency of species}}{\text{Sum of Frequency value of all species}} \times 100$

Relative density =  $\frac{\text{Density of species}}{\text{Sum of Density of all species}} \times 100$

Relative Basal area =  $\frac{\text{Basal area of a species}}{\text{Sum of Frequency value of all species}} \times 100$

$IVI = \text{Relative frequency} + \text{Relative density} + \text{Relative Basal area}$

The species distribution of species in different stands has been derived from Whitford index of A/F ratio (Whitford, 1949). The A/F ratio if below 0.025 indicates regular distribution, between 0.025-0.05 indicates random distribution and when above 0.05 indicates a contagious distribution (Curtis and Cottam, 1956). The similarity between the two-forest stand (Banguon and Orchha) was determined by using the community coefficient.

### III. RESULTS AND DISCUSSION

Botanical composition, Percentage frequency, density/m<sup>3</sup>, Abundance, frequency class and IVI of each species of Banguon and Orchha forest are given in the Table 1 and 2.

Total 16 species were present in Banguon forest and 19 species in Orchha forest. The 8 species were found common in both forests viz. *Butea monosperma*, *Cassia fistula*, *Tectona grandis*, *Flacourtia indica*, *Holoptelia intrigrifolia*, *Acacia leucophloea*, *Carissa carandas* and *Capparis aphylla*. The *Alangium lamarkii* was most frequent in Banguon forest whereas in Orchha forest it was lacking. This might have due to microclimate and edaphically variation at these two sites. *Tectona grandis* appeared to be both the forests. *Capparis aphylla*, *Butea frondosa* and *Holoptelia intrigrifolia*

were noted more frequent in Banguon forest as compared to Orchha forest. *Cassia fistula* which is a miscellaneous tree occur in the both forests. *Wrightia tinctoria*, *Anogeissus pendula*, *Lantana camara* and *Azadiacta indica* were totally absent in Orchha forest. In Banguon forest *Zizyphus xylopyrus*, *Terminalia belerica*, *Albizia lebbek*, *Mitragyana parvifolia*, *Diospyrus melonoxydon*, *Aegle marmelos*, *Eugenia jambolana*, *Melia azedarach*, *Terminalia arjuna* and *Cordia myxa* completely absent. In view of the above the Orchha forest appear rich as regard to species diversity than Banguon forest most provably this variability should associate with the reserve nature of Orchha forest. *Butea monosperma* which is the common species in both the forest has higher average height (8.670m) in Banguon forest. The average height of *Butea monosperma* in the Orchha forest is 9.5m.

Density gives the numerical strength of a species in a community. In Banguon forest *Lantana camara* had the highest density (8.615 individual/m<sup>2</sup>). Followed by *Alangium lamarkii* ((7.6 individual/m<sup>2</sup>), *Butea monosperma* (4.75 individual/m<sup>2</sup>) and *Tectona grandis* (3.45 individual/m<sup>2</sup>). At Orchha forest *Tectona grandis* had the highest density (18.05 individual/m<sup>2</sup>). *Butea monosperma* had 1.2 individual/m<sup>2</sup> density other species of Orchha forest have density less than 1.

The Abundance gives the number of individuals of a habitat. On Banguon forest *Lantana camara* has highest Abundance value (10.147). Other highest Abundance species are *Alangium lamarkii* (7.6) and *Wrightia tinctoria* (5.842). On orchha forest *Tectona grandis* has highest Abundance value (18.05). Other higher Abundance species are *Eugenia jambolana* (6.5) and *Terminalia arjuna* (6). Other species of Orchha forest have Abundance between the range of 1 to 2. The higher Dbh value in Banguon forest is reported in *Butea monosperma* (56.78cm.). Other higher Dbh value in Banguon is *Alangium lamarkii* (27.95cm) and *Cassia fistula* (33.28cm.). in Orchha forest the higher Dbh value is reported in *Butea monosperma* (56.78cm.) and *Cassia fistula* (35.37cm.).

Importance value index (IVI) represents the extent of dominance of a species in the community. In Banguon forest *Lantana camara* represent highest IVI value (57.263) followed by *Alangium lamarkii* (46.113) and *Butea monosperma* (33.459)

respectively. At Orchha forest *Tectona grandis* represent highest IVI value (138.135).

The analysis of distribution pattern of individual species on Banguon and Orchha forest indicates that among the three-distribution pattern viz. regular, random and contagious, the contagious distribution was found most common in the study area. The Table-1 Vegetation Characteristics of Banguon forest

dominance of contagious distribution may be due to the fact that a majority of trees species reproduce vegetatively in addition to sexually and most of the species occur low frequency and high Abundance.

The value of community coefficient of the two forests was reported to be 53.537 which indicate marked dissimilarities of the species composition.

Name of the species	Frequency %	Density	Abundance	Frequency class	A/F ratio	Relative frequency	Relative Density	Relative dominance	IVI
Alangium lamarkii	100%	7.6	7.6	E	0.076	12.853	20.416	12.844	46.113
Wrightia tinctoria (R.Br.)	47%	2.775	5.842	C	0.124	6.041	7.454	9.87	23.365
Butea monosperma (Roxb.)	97%	4.75	4.871	E	0.502	12.467	12.760	8.232	33.459
Cassia fistula (Linn.)	15%	0.15	1	A	0.067	1.928	0.4029	1.690	2.733
Tectona grandis (Linn.)	77%	3.45	4.451	D	0.057	9.897	9.267	7.522	26.686
Anogeissus pendula (Edgew.)	45%	1.75	3.889	C	0.086	5.784	4.701	6.572	17.057
Flacourtia indica (Burm.f.) Merr.	60%	1.425	2.375	C	0.039	7.712	3.828	4.013	15.553
Laucaena leucocephala (Benth.)	30%	0.75	2.5	B	0.083	3.856	2.014	4.225	10.095
Lantana camara (Linn.)	85%	8.625	10.147	E	0.119	10.925	23.169	17.149	57.263
Azadirachta indica (Adr. juss)	7%	0.075	1	A	0.142	0.899	0.2014	1.690	2.7904

Holoptelia intrifolia (Planch.)	45%	1.125	2.5	C	0.055	5.784	3.022	4.225	13.031
Acacia leucophloea (Willd.)	47%	0.85	1.789	C	0.038	6.041	2.283	3.023	11.347
Albizia odoratissima (Benth.)	7%	0.075	1	A	0.142	0.899	0.2014	1.690	2.790
Zizyphus oenoplia (mill.)	27%	0.5	1.818	B	0.067	3.470	1.343	3.072	7.885
Carissa carandas (Linn.)	5%	0.05	1	A	0.2	0.642	0.134	1.690	2.466
Capparis aphylla (Roth.)	67%	2.725	4.037	D	0.060	8.611	7.320	6.822	22.753

Table-2 Vegetation Characteristics of Orchha forest

Name of the species	Frequency %	Density	Abundance	Frequency class	A/F ratio	Relative frequency	Relative Density	Relative dominance	IVI
Butea monosperma (Roxb.)	65%	12	1.846	D	0.0284	15.987	5.189	3.630	24.806
Acacia leucophloea (willd.)	57%	0.95	1.652	C	0.0289	14.004	4.108	3.249	21.361
Tectona gaudis (Linn.)	100%	18.05	18.05	E	0.1805	24.579	78.054	35.502	138.135
Cassia fistula (Linn.)	27%	0.3	1.090	B	0.403	6.633	1.297	2.143	10.073
Zizyphus oenoplia (mill.)	25%	0.4	1.6	B	0.064	6.142	1.729	3.147	11.018
Zizyphus xylopyrus (Willd.)	10%	0.125	1.25	A	0.125	2.457	0.540	2.4562	5.453
Terminalia belerica (Roxb.)	27%	0.325	1.181	B	0.0437	6.633	1.405	2.322	10.36
Carissa	10%	0.15	1.5	A	0.15	2.457	0.648	2.950	6.055

carandas (Linn.)									
Flacourtia indica (Burm.f.) Merr.	32%	0.625	1.923	B	0.060 0	7.862	2.702	3.782	14.34 6
Capparis aphylla (Roth.)	7%	0.075	1	A	0.142 8	1.719	0.324	1.966	4.009
Albizia lebbak (Benth.)	2%	0.025	1	A	0.5	0.491	0.108	1.966	2.565
Mitragyna parvifolia (Roxb.) Korth	7%	0.1	1.333	A	0.190 4	1.719	0.432	2.556	4.707
Holoptelia intrifolia (Planch)	7%	0.05	0.666	A	0.095 1	1.719	0.216	1.309	3.244
Diospyros melanoxyl on (Roxb.)	7%	0.075	1	A	0.142 8	1.719	0.324	1.966	4.009
Aegle marmelos (Correa.)	10%	0.125	1.25	A	0.125	2.457	0.540	2.456	5.453
Eugenia jambolana (Lom.)	5%	0.325	6.5	A	1.3	1.228	1.405	12.784	15.41 7
Melia azedarach (Linn.)	5%	0.05	1	A	0.2	1.228	0.216	1.966	3.41
Terminalia arjuna (Bedd.)	2%	0.15	6	A	3	0.491	0.648	11.801	12.94
Cordia myxa (Linn.)	2%	0.025	1	A	0.5	0.491	0.108	1.966	2.565

#### IV. SUMMARY

Forest is a grandest biological association of the nature predominated by the trees and other plant species. The present study deal with investigation and characterize the floristic composition and vegetation diversity of the two Mixed deciduous forests (Banguon and Orchha) of Bundelkhand region. The climate of the two forests almost similar and can be said as semi-arid with undulating topography. The 19

trees species were found in Orchha forest while 16 trees species occur in Banguon forest. *Alangium lamarkii* was most frequent in Banguon forest whereas in Orchha forest *Tectona grandis* appeared to most frequent. Only 8 species were common in both forests. *Lantana camara* had the highest density (8.625 individual/m<sup>2</sup>) on Banguon Forest while highest density (18.05 individual/m<sup>2</sup>) tree of Orchha forest was *Tectona grandis*. The community

coefficient value of these forests was 59.537% which indicates less similarity.

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