



## Assessment of Diversity of Tree species and their Attribution at Ghansaur Range Forest Division North Seoni district Madhya Pradesh, India

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### ABSTRACT

The present investigation has been carried out of assessment of diversity of tree species in Ghansaur range north forest division Seoni district, Madhya Pradesh. 23 tree species and 21 tree genera have been recorded, belonging to 16 families. Lamiaceae family shows dominant with density ( $332.1\text{ha}^{-1}$ ). The highest average tree density ( $167.86\text{ha}^{-1}$ ) has been assessed in *Tectona grandis*. *Tectona grandis* is also the most frequently occurring tree species in Ghansaur range with frequency of 92.86%, the highest basal area ( $12.23\text{m}^2\text{ha}^{-1}$ ) due to larger size and the highest IVI value (143.3); whereas, the least IVI value (1.4) in Ghansaur range. Higher richness or diversity of tree species has been indicated by Shannon diversity index (*H'*) with a value of 1.90, whereas Simpson index (*D*) value is 3.50; which shows higher diversity in the tree species. The higher evenness of tree species has been computed with value of 0.428. Value of standard deviation (*SD*) (48.39) clearly shows the higher dispersion of the tree species. Phyto-sociological parameters of tree species such as density represent positive correlation with frequency, basal area and IVI. A total 04 clusters have been classified in dendrogram. In group I, a total of 16 tree species possess more similarity from each other; in group II, possess 05 tree species. Whereas, group III and IV show only 01 tree species. There is statistically significant different ( $p < 0.05$ ) in all phyto-sociological parameters in various study sites.

Key word: Diversity, Density, Frequency, IVI, Correlation

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### INTRODUCTION

Vegetation is gift of nature and its structure and composition differs from place to place because of varying climatic condition and topography [16, 12]. The vegetation of large area of the Earth remains poorly under stood; more than 50% species of tropical rain forest have not been recorded [2]. Plants community was emphasized on study of composition, development, geographic distribution and environmental relationships of plant communities [4, 5]. The development and deterioration of plant species changes the pattern of the species distribution in plant community [17]. According to Oosting [9], phyto-sociological parameters are and importance for spatial problems in sociological behavior of plants community. Mishra *et al.*, [6] were suggest the plants growing together have mutual relationship among themselves and with the environment. Species richness is dependent on different types of biotic and a biotic factors [3, 11]. Lac host plant diversity was assessed in Balaghat and Seoni districts by Bhatnagar, *et al.* [1]. Sandy loam soil type is found in North part of Seoni district. Normal rainfall of Seoni district is 1323.7mm. The normal annual means maximum temperature is  $31.3^{\circ}\text{C}$  and minimum temperature is  $18.9^{\circ}\text{C}$  of Seoni district, although temperature is varying in season to season wise. Mostly loamy soil found in north Seoni district. Geographical area is mostly slope, hilly and sometime plan area of Ghansaur range north forest division Seoni district, Madhya Pradesh.

### MATEREAL AND MATHODS

#### Study sites

Ghansaur range is located in north forest division Seoni district. Beats like Pondi beat (compartment no. RF-523 (latitudes  $22^{\circ}44'38.4''\text{N}$  and Longitude  $080^{\circ}03'44.7''\text{E}$  elevation-464m, Slop, RF-520, Latitudes  $22^{\circ}44'00.7''\text{N}$  and Longitude  $080^{\circ}05'59.3''\text{E}$  elevation-518m, Slop), North Kedarpur beat (compartment RF-511, latitudes  $22^{\circ}44'34.4''\text{N}$  and Longitude  $080^{\circ}08'42.2''\text{E}$ , elevation-533m, RF-510, latitudes  $22^{\circ}44'35.1''\text{N}$  and Longitude  $080^{\circ}08'56.0''\text{E}$ , elevation-538m, Slop, RF-506, latitudes  $22^{\circ}43'45.5''\text{N}$  and Longitude  $080^{\circ}09'50.0''\text{E}$ , elevation 566m, Slop), Kindrai beat (Compartment PF-514, latitudes

22°45'22.0"N and Longitude 080°08'09.8"E elevation-458m, Slop), Jhurki beat (compartment RF-499 (latitude 22°47'21.5"N and Longitude 080°13'29.0"E, elevation-453m, slop), PF-493 (latitudes 22°48'18.5"N and Longitude 080°13'46.6"E elevation-444m, slop), PF-498 (latitudes 22°47'36.0"N and Longitude 080°13'03.8"E elevation-446m, slop). Budhera beat (compartment RF-491 (latitudes 22°45'45.1"N and Longitude 080°15'20.6"E, elevation-481m, plain), RF-492, (latitudes 22°46'08.4"N and Longitude 080°15'28.0"E, elevation-494m, slop), RF-490 (latitudes 22°45'19.5"N and Longitude 080°15'25.1"E, elevation-478m, slop), PF-484 (latitudes 22°44'48.5"N and Longitude 080°16'50.0"E, elevation-431m, slop), RP-482 (latitudes 22°44'36.0"N and Longitude 080°16'17.3"E, elevation-444m, slop). All forest compartments are adjoining from catchment area of Bargi Dam Narmada River Ghansaur range Forest Division North Seoni district Madhya Pradesh.

### Methodology

The project team conducted a reconnaissance survey of the whole study sites to identify the forest compartment; which near to catchment area of Bargidam Narmada River, to further detailed investigations for diversity assessment. After identification of the study sites, 14 quadrats of 31.62m X 31.62m for tree species have been laid out in the study sites for detailed observation on growth and phyto-sociological parameters. Coordinates of the quadrats were recorded with the help of G.P.S. soil types of the quadrats were also recorded. Plants species standing in the quadrats were identified in the field by the project team members.

The help of the Flora of Madhya Pradesh [13], Flora of Jabalpur [8] were also taken for identification. Plant specimens were also collected and their identification was verified with the standard specimens kept in the herbarium of State Forest Research Institute, Jabalpur. GBH of trees were measured with the help of measuring tape. The data collected was analyzed for various Phyto-sociological parameters, such as density, frequency, abundance, basal area and IVI (Importance Value Index), using standard methods as per Mishra [7]. The Shannon and Wiener diversity index ( $H'$ ) has been calculated using following formula [14].

$$H' = - \sum_{i=1}^s p_i \ln p_i$$

Where,  $p_i$  = proportion ( $n/N$ ) of individuals of one particular species found ( $n$ ),  $N$  = total number of individuals,  $\ln$  = natural log,  $\sum$  = sum of the calculations,  $S$  = number of species.

Concentration of dominance ( $D$ ) has been calculated by Simpson's index formula [15]

$$D = \frac{1}{\sum_{i=1}^s p_i^2}$$

Where,  $p_i$  = proportion ( $n/N$ ) of individuals of one particular species found ( $n$ ),  $N$  = total number of individuals,  $\sum$  = sum of the calculations,  $S$  = number of species.

Pilou evenness ( $J$ ) has been calculated by using formula [10]

$$J = \frac{H'}{H'_{max}}$$

$$= \frac{H'}{\ln S}$$

$H_{max} = \ln S$ , where  $S$  = total number of species,  $H'$  = Shannon-Wiener Index.

### RESULT AND DISCUSSION

From the primary data on plant species wise number of trees and GBH, secondary attributes, such as density, frequency, basal area, and abundance were worked out and these are shown in table 1. The abbreviations used in this table are given below. BA = Basal area, and IVI= Importance Value Index.

**Table 1: Phyto-sociological parameters of trees species in Ghansaur range north forest division Seoni district (MP).**

Sl. No.	Botanical name of plant species	Common name of plant species	Av. Density (No. of trees ha <sup>-1</sup> )	Frequency (%)	BA (m <sup>2</sup> ha <sup>-1</sup> )	IVI
1	<i>Aegle marmelos</i>	Bel	0.71	7.14	0.00	1.36
2	<i>Annona squamosa</i>	Sitaphal	1.43	7.14	0.00	1.58
3	<i>Anogeissus latifolia</i>	Dhawara	20.00	50.00	0.76	18.74
4	<i>Azadirachta indica</i>	Neem	0.71	7.14	0.03	1.53
5	<i>Buchanania lanzan</i>	Achar	30.00	21.43	0.02	12.55
6	<i>Butea monosperma</i>	Palas	20.71	64.29	0.10	17.00
7	<i>Casearia elliptica</i>	Bhedi	2.14	21.43	0.01	4.08
8	<i>Casearia tomentosa</i>	Kari	13.57	42.86	0.13	11.65
9	<i>Cassia fistula</i>	Amaltas	2.14	14.29	0.01	2.94
10	<i>Dalbergia paniculata</i>	Dhoban	0.71	7.14	0.15	2.28
11	<i>Diospyros melanoxylon</i>	Tendu	20.00	57.14	0.11	15.71
12	<i>Diospyros montana</i>	Patwan	1.43	14.29	0.04	2.91
13	<i>Elaeodendron glaucum</i>	Jamrasi	1.43	14.29	0.01	2.74
14	<i>Haldina cordifolia</i>	Haldu	1.43	7.14	0.03	1.73
15	<i>Lagerstroemia parviflora</i>	Lendia	15.71	64.29	0.13	15.66
16	<i>Lannea coromandelica</i>	Moyan	3.57	28.57	0.18	6.74
17	<i>Madhuca longifolia</i>	Mahua	7.14	28.57	0.48	9.71
18	<i>Phyllanthus emblica</i>	Aonla	0.71	7.14	0.00	1.36
19	<i>Schleichera oleosa</i>	Kusum	0.71	7.14	0.11	2.02
20	<i>Semecarpus anacardium</i>	Bhilwa	3.57	14.29	0.27	5.03
21	<i>Tectona grandis</i>	Teak	167.86	92.86	12.23	143.33
22	<i>Terminalia tomentosa</i>	Saja	15.71	50.00	0.84	17.99
23	<i>Wrightia tinctoria</i>	Dudhi	0.71	7.14	0.00	1.36
	<b>Total</b>		<b>332.14</b>	<b>635.71</b>	<b>15.64</b>	<b>300</b>

Perusal of table 1 reveals the highest average tree density (167.86ha<sup>-1</sup>) has been assessed in Teak (*Tectona grandis*), followed by Achar (*Buchanania lanzan*) (30.00ha<sup>-1</sup>), Palas (*Butea monosperma*) (20.71ha<sup>-1</sup>), Dhawara (*Anogeissus latifolia*) and Tendu (*Diospyros melanoxylon*) (each 20.00 ha<sup>-1</sup>), Saja (*Terminalia tomentosa*) and Lendia (*Lagerstroemia parviflora*) (each 15.71ha<sup>-1</sup>) and Kari (*Casearia tomentosa*) (13.57ha<sup>-1</sup>). The lowest density was recorded for Bel (*Aegle marmelos*), Neem (*Azadirachta indica*), Dhoban (*Dalbergia paniculata*), Aonla (*Phyllanthus emblica*), Kusum (*Schleichera oleosa*) and Dudhi (*Wrightia tinctoria*) (each 0.71ha<sup>-1</sup>). Teak (*Tectona grandis*) is also the most frequently occurring tree species in Ghansaur range with frequency of 92.86%, followed by Palas (*Butea monosperma*) and Landia (*Lagerstroemia parviflora*) (each 64.29%), Tendu (*Diospyros melanoxylon*) (57.14%), and Dhawara (*Anogeissus latifolia*) and Saja (*Terminalia tomentosa*) (each 50.00%). Bel (*Aegle marmelos*), Sitaphal (*Annona squamosa*), Neem (*Azadirachta indica*), Dhoban (*Dalbergia paniculata*), Haldu (*Haldina cordifolia*), Aonla (*Phyllanthus emblica*), Kusum (*Schleichera oleosa*) and Dudhi (*Wrightia tinctoria*) have been the least frequently occurring species of frequency with each 7.14%. Teak (*Tectona grandis*) trees due to larger size have the highest basal area with 12.23m<sup>2</sup>ha<sup>-1</sup>. Teak (*Tectona grandis*) has the highest IVI value with 143.3, followed by Dhawara (*Anogeissus latifolia*) (18.7), Saja (*Terminalia tomentosa*) (18), Palas (*Butea monosperma*) (17.0). Bel (*Aegle marmelos*), Aonla (*Phyllanthus emblica*) and Dudhi (*Wrightia tinctoria*) have the least IVI value with 1.4 (fig.1).

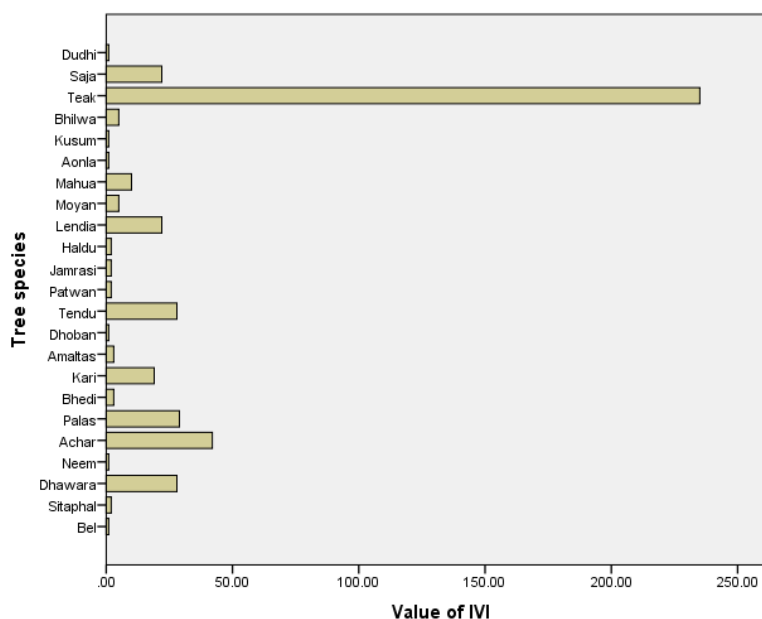


Fig.1: Graphical representation of IVI value of tree species.

Table no-2 Tree Family, Genus, Species and their Average density family wise.

S.No.	Family name	Genus	Species	Av. Density ha <sup>-1</sup>
1	Anacardiaceae	3	3	37.14
2	Annonaceae	1	1	1.43
3	Apocynaceae	1	1	0.71
4	Celastraceae	1	1	1.43
5	Combretaceae	2	2	35.71
6	Ebenaceae	1	2	21.43
7	Fabaceae	3	3	23.57
8	Lamiaceae	1	1	167.86
9	Lythraceae	1	1	15.71
10	Meliaceae	1	1	0.71
11	Phyllanthaceae	1	1	0.71
12	Rubiaceae	1	1	1.43
13	Rutaceae	1	1	0.71
14	Salicaceae	1	2	15.71
15	Sapindaceae	1	1	0.71
16	Sapotaceae	1	1	7.14
<b>Total</b>		<b>21</b>	<b>23</b>	<b>332.14</b>

It can be seen table 2 that a total 16 families have been recorded of tree species. 23 species have been recorded; belonging to 21 genera. Of which, 03 species have been noted from Anacardiaceae and Fabaceae families. Lamiaceae family is dominant family with density (332.14ha<sup>-1</sup>). In other hand, numbers of individual trees of Lamiaceae family are more than other number of individuals of tree species of families.

#### STATISTICAL ANALYSIS

##### *Diversity index of Tree species:*

Higher richness or diversity of tree species has been indicated by Shannon diversity index (H') with a value of 1.90, whereas Simpson index (D) value is 3.50; which shows higher the diversity of the samples. The higher evenness of tree species has been computed a value of 0.428 which indicates high variation in abundances between different taxa within the community. Value of standard deviation (SD) (48.39) clearly shows the high dispersion of the tree species (see table 3).

Table 3: Diversity index of Tree species in the Shikara range Seoni district, MP

S. No.	Indices	Value
1	Shannon Index (H')	1.90
2	Simpson index (D)	3.50
3	Pilou Evenness (J)	0.31
4	Standard Deviation (SD)	48.39

### Correlation

Pearson's correlation analysis has been performed in order to analyze correlations between various phyto-sociological parameters were analyzed in the study sites. Phyto-sociological parameters of tree species such as density represent positive correlation with frequency, basal area and IVI. It can be perused table 4 that density with basal area ( $r=0.972331^{**}$ ), density with IVI ( $r=0.993756^{**}$ ) and basal area with IVI ( $r=0.985047^{**}$ ) show a highly significant positive correlation. Density with frequency ( $r=0.720987$ ), frequency with IVI ( $r=0.732726$ ) and frequency with basal area ( $r=0.614037$ ) indicate a moderate positive association.

Table 4: Pearson's correlation matrix among the phyto-sociological parameters

	Density	Frequency	Basal Area	IVI
Density	1			
Frequency	0.720987	1		
Basal Area	0.972331**	0.614037	1	
IVI	0.993756**	0.731726	0.985047**	1

### Ward Linkage Agglomeration Coefficients

It can see table 5 and fig. 2 that stage 18 and 19 are combined at the first stage because Euclidean distance has the smallest out of all stages. Hence, agglomeration coefficients value has very small (approximately 0.000) for the first several stages and slowly increases as the agglomeration schedule progresses. Stages 20, 21 and 22 show more dissimilarity.

Table 5: Agglomeration Coefficients

Agglomeration Schedule						
Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	1	23	.000	0	0	6
2	10	18	.000	0	0	4
3	7	12	.500	0	0	8
4	10	14	1.167	2	0	8
5	4	19	2.167	0	0	9
6	1	9	3.500	1	0	9
7	13	16	5.000	0	0	11
8	7	10	6.633	3	4	12
9	1	4	9.500	6	5	10
10	1	2	13.467	9	0	11
11	1	13	19.300	10	7	12
12	1	7	26.154	11	8	13
13	1	20	42.286	12	0	16
14	11	22	61.286	0	0	18
15	8	15	82.786	0	0	17
16	1	17	114.367	13	0	19
17	3	8	154.867	0	15	18
18	3	11	255.867	17	14	20
19	1	6	373.563	16	0	20
20	1	3	610.286	19	18	21
21	1	5	2059.364	20	0	22
22	1	21	7130.522	21	0	0

(Where 18= *Phyllanthus emblica*, 19= *Schleichera oleosa*, 20= *Semecarpus anacardium*, 21= *Tectona grandis*, 22= *Terminalia tomentosa*)

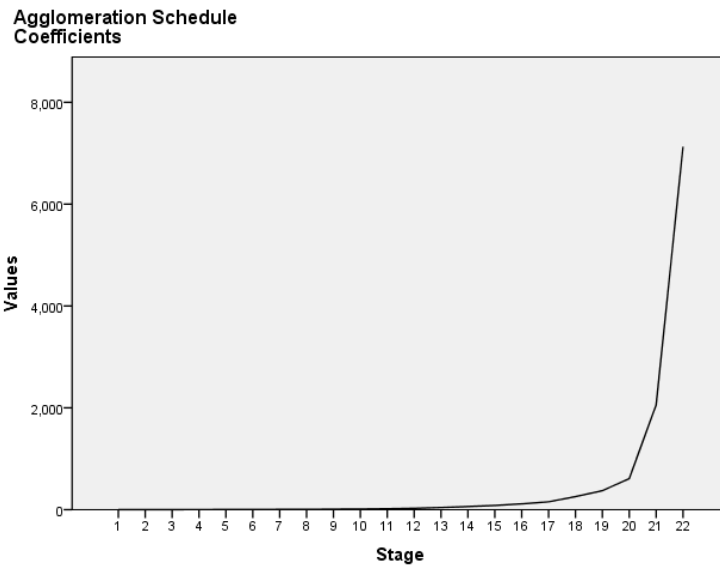


Fig. No.2 Graphical representation of agglomeration schedule Coefficients

**Agglomerative Hierarchical Cluster**

The clusters have been classified by hierarchical clustering to base on their similarity of variables. A total 04 clusters have been classified in dendrogram. In group I, a total of 16 tree species possess more similarity from each other; in group II, possess 05 tree species. Whereas, group III and IV show only 01 tree species (see table 6 and fig. 3).

Table 6: group and their tree species

Group	No. of tree species	Tree species
I	16	<i>Aegle marmelos, Wrightia tinctoria, Cassia fistula, Azadirachta indica, Schleicheria oleosa, Annona squamosa, Elaeodendron glaucum, Lannea coromandelica, Casearia elliptica, Diospyros Montana, Dalbergia paniculata, Phyllanthus emblica, Haldina cordifolia, Semecarpus anacardium, Madhuca longifolia, Butea monosperma</i>
II	5	<i>Diospyros melanoxylon, Terminalia tomentosa, Casearia tomentosa, Lagerstroemia parviflora, Anogeissus latifolia</i>
III	1	<i>Buchanania lanzan</i>
IV	1	<i>Tectona grandis</i>

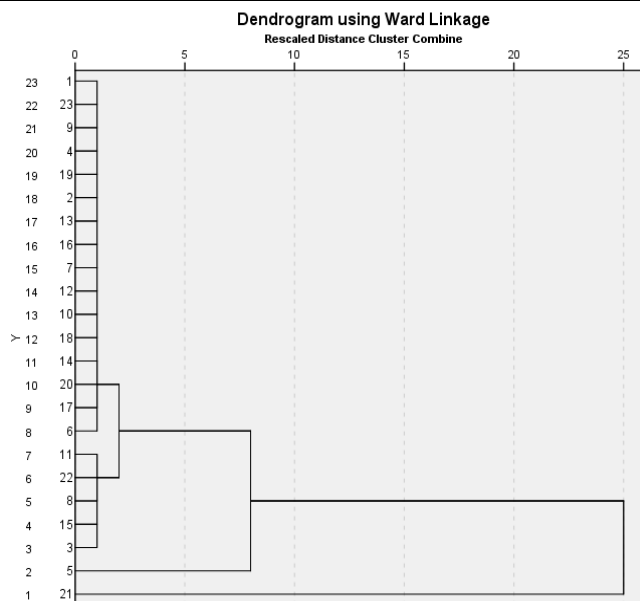


Fig. 3 Dendrogram of tree species

**ANOVA analysis**

One way Analysis of Variance (ANOVA) has been computed to analyze the association of phyto-sociological parameters in the various study sites of Ghansaur range north forest division, Seoni district. Significance level ( $\alpha$ ) is 0.05 in ANOVA. The ANOVA analysis perused table 7 that there is statistically significant different ( $p < 0.05$ ) in all phyto-sociological parameters in various study sites of the Ghansaur range north forest division, Seoni district. The null hypothesis ( $H_0$ ) is rejected and alternative hypothesis ( $H_1$ ) is statistically significant difference that is, all parameters have variation among them in Ghansaur range north forest division Seoni district (see table 7).

Table 7: One way analysis of Variance

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	8385.11066	3	2795.0369	4.223993	0.007716	2.708187
Within Groups	58230.0385	88	661.70498			
Total	66615.1492	91				

**CONCLUSION**

The study area comprising of Ghansaur range North Forest division Seoni district, Madhya Pradesh is quite rich in tree flora *Tectona grandis* is the dominant tree species among all the available tree species having the highest density, basal area, frequency and IVI. However, several other alternative tree species also occur in the area and there is potential to dense forest. A total 16 families have been recorded of tree species in study area. Lamiaceae family is dominant family with density ( $332.14\text{ha}^{-1}$ ), followed by Anacardiaceae family ( $37.14\text{ha}^{-1}$ ). Shamon diversity index (H) and Simpson index (D) indicate higher diversity of tree species in study sites. Phyto-sociological parameters of tree species such as density represent positive correlation with frequency, basal area and IVI. This study indicates health plant diversity and plant community in study sites. For health plant diversity, there should be protect to deforestation, fire, heavy grazing and soil erosion.

So, this study is recommended that forest department, forest research Institute and researcher to be monitoring of forest time to time for health environment and plant community so that; they are thriving and tried.

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