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Vegetation survey to assess the Important Value Index (IVI) of natural forest and plantations of Tropical Forest Research Institute, Jabalpur

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Important value index, Simpson's index, *Tectona grandis*, Vegetation survey

ABSTRACT

The study provides information about the vegetation survey conducted on the natural forest and plantations of Tropical Forest Research Institute, Jabalpur. The survey was conducted in the month of May 2016. On the basis of Important Value Index, it was observed that *Tectona grandis* is the most common tree species present in the campus followed by *Albizia procera, Eucalyptus hybrid* and *Dalbergia sissoo* in decreasing order. The Simpson's index of dominance is 0.8622, which indicates the dominance of one species in this forest. The calculated Pielou's index of eveness indicates an uneven distribution of tree species.

INTRODUCTION

The ranking of species in any forest in decreasing order of their importance can be used as a very useful device to elucidate its features and formulate ways for the improvement of the health of the forest. Simpson (1949), Margalef (1972), Shannon and Weiner (1963), Peilou (1975), Whittaker (1972) have given many qualitative and quantitative indices to understand the diversity and evenness in a forest.

STUDY AREA

During late '80s and early '90s a number of plantations of tropical forest tree species were raised in the institute campus and in the surrounding areas. After this period few plantations were also raised as part of research experiments. The main planted tree species are *viz. Albizia procera, Albizia lebbek, Tectona grandis, Dalbergia sissoo, Azadirachta indica, Eucalyptus* hybrid, *Gmelina arborea, Pongamia pinnata, Acacia nilotica, Santalum album* etc.

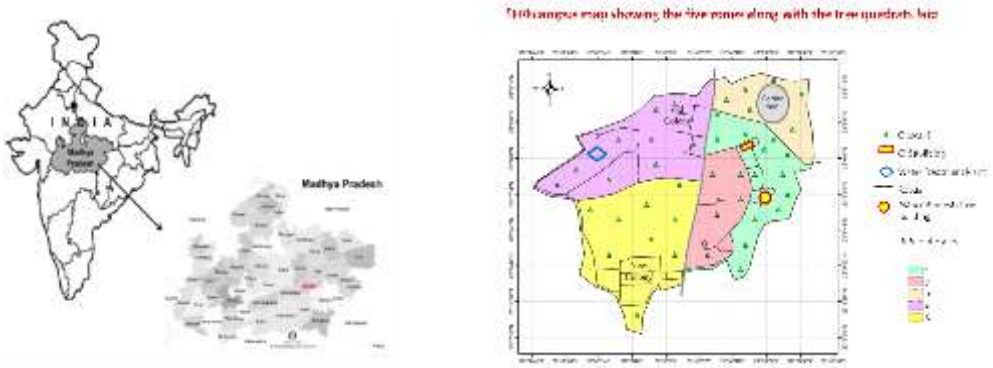

Fig 1: Map showing the study area within Jabalpur, MP

Tropical Forest Research institute (TFRI) is located in Jabalpur city of Madhya Pradesh at N 23°06´065´´ latitude and E 79°59´344´´ longitude. It is one of the eight regional institutes under the Indian Council of Forestry Research & Education, Dehradun. The Institute came into existence in April 1988, although its origin goes back to 1973 when a Regional Centre of Forest Research Institute, Dehradun was established at Jabalpur to provide research support to the problems of forest management in central India. The Institute is situated 10 km south east of Jabalpur on NH -12A. The campus is spread over an area of 109 ha amidst picturesque surroundings. (Fig. 1)

MATERIALS AND METHOD

The study area was divided into five zones depending on the type of manmade plantations or natural vegetations covering those zones. A total of 42 quadrates of 10 m X 10 m were laid out to study the vegetation and trees having DBH>10cm and falling within these quadrats were considered for the study. Vegetation survey was quantitatively analysed for frequency, density and abundance according to Curtis and McIntosh (1950)

Frequency (%) = Number of quadrats where species occurred/Total no. of quadrats laid

Density (plants m^{-2}) = Total number of individual species occurring in all the quadrats/Total no. of quadrats laid out

Abundance = Number of individuals of a species in all the quadrats/ No. of quadrats in which they occur

Importance Value Index (IVI) is a reasonable measure to assess the overall significance of a species since it takes into account several properties of the species in the vegetation. The IVI was calculated as per Curtis (1959). The parameters assessed for the purpose were density, frequency, and dominance, while importance value index (IVI) was calculated as:

IVI = Relative Frequency + Relative Density + Relative Dominance

Species diversity (H') was calculated by following Shannon and Wiener (1963) as:

IVI = Relative Frequency + Relative Density + Relative Dominance

Species diversity (H') was calculated by following Shannon and Wiener (1963) as:

$$H' = -\sum (Ni/N) \log_2 (Ni/N)$$

Where, Ni is the total number of species i and N is the number of individuals of all species in that site.

Plieou's Index of Evenness value represent the distribution of individuals among the species and is calculated as:

P = H'/Total number of species present

Where H' is Shannon Weiner Index.

RESULTS

Table 1 shows the different characteristics of the selected five zones of the study area. The tree quadrats were laid proportionately to the area of the respective zones. Analysis of the vegetation along with the Important Value Index (IVI) is depicted in the table 2. The total number of tree quadrats of dimension 10m X 10m is 42 and the total number of trees present in the selected quadrats is 436 comprising of 28 species. The IVI decreases from 64.80 for *Tectona grandis* to 34.52 for *Albizia procera* followed by Eucalyptus (21.51) then *Dalbergia sissoo* (21.37). The decreasing order for relative density is also the same as IVI whereas that for relative frequency is *Tectona grandis* > *Albizia procera*=*Dalbergia sissoo* > *Eucalyptus hybrid*=*Phyllanthus emblica*. The forest biodiversity is predominantly made of *Tectona grandis-Albizia procera-Eucalyptus hybrid*.

Table 3 shows the tree biodiversity in Zone 1 of the study area which contains 13 tree quadrats and they contain 142 individuals comprising of 12 species. The decreasing order for the IVI is *Tectona grandis* > *Albizia procera* > *Phyllanthus emblica* > *Dalbergia sissoo* in contrast to the relative abundance which is maximum for *Phyllanthus emblica*. Table 4 shows the findings

of the vegetation survey conducted on zone 2 of the study area. It consists of 5 tree quadrats of 10m X 10m dimension each. The quadrats contain 70 individuals of 12 different species. Here the IVI is maximum for *Tectona grandis* followed by *Albizia procera* and then *Azadiracta indica*. Table 5 shows the vegetation survey conducted on zone 3 of the study area. It contains 6 tree quadrats containing 49 individuals of 7 different species. The IVI is maximum for *Dalbergia sissoo* followed by *Tectona grandis* then *Tamarindus indica*. The relative abundance is maximum for *Tectona grandis* in this zone. Table 6 shows the tree biodiversity of zone 4 of the study area which contains 98 individuals of 11 different species. The decreasing order of the IVI is *Tectona grandis* > *Terminalia arjuna* > *Dalbergia latifolia*. Table 7 shows the vegetation survey conducted on zone 5 of the study area which contains 9 tree quadrats with 77 individuals of 16 different species. The decreasing order of IVI is *Eucalyptus* > *Tectona grandis* > *Butea monosperma*.

A majority portion of the study area comprises of plantations of Teak plantations which explains its predominance in the study area. The main aim of this study was to generate database regarding the vegetation type and tree biodiversity of the study area. Such studies coupled with study of carbon sequestration potential of these species can help manage the forests sustainably and increase the carbon stock with the aim of obtaining optimum yield without disturbing the equilibrium of the forest thereby increasing the carbon sink.

Table 1. Different parameters of the 5 zones of the study area

Zone	Area (approx in ha)	No. of Tree Quadrats	No. of individuals found	No. of species found	Shannon Weiner Diversity Index	Pielou's Index of Evenness
1	22.68	13	142	13	1.652	0.127
2	14.58	5	70	12	1.866	0.156
3	12.96	6	49	7	1.670	0.239
4	24.3	9	98	11	1.792	0.163
5	32.38	9	77	16	2.090	0.131

Table 2. Vegetation survey of the entire study area

Species	No. of individuals in all the quadrats	No. of Quadrats in which they occur	Density	Frequency	Abundance	Relative density	Relative frequency	Relative dominance	IVI
T grandis	159	15	3.79	35.71	10.6	36.47	15.957	12.37	64.80
A lebbek	6	3	0.14	7.14	2.0	1.38	3.191	2.33	6.90
S album	10	3	0.24	7.14	3.3	2.29	3.191	3.89	9.37
A procera	69	10	1.64	23.81	6.9	15.83	10.638	8.05	34.52
D sissoo	31	10	0.74	23.81	3.1	7.11	10.638	3.62	21.37
B purporea	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
B retusa	4	2	0.10	4.76	2.0	0.92	2.128	2.33	5.38
B ceiba	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
L leucocephala	6	4	0.14	9.52	1.5	1.38	4.255	1.75	7.38
P pinnata	4	3	0.10	7.14	1.3	0.92	3.191	1.56	5.66
A indica	18	4	0.43	9.52	4.5	4.13	4.255	5.25	13.63
D latifolia	15	3	0.36	7.14	5.0	3.44	3.191	5.83	12.47
B monosperma	15	7	0.36	16.67	2.1	3.44	7.447	2.50	13.39
M azederach	3	1	0.07	2.38	3.0	0.69	1.064	3.50	5.25
G arborea	4	2	0.10	4.76	2.0	0.92	2.128	2.33	5.38
N arbor	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
P emblica	19	5	0.45	11.90	3.8	4.36	5.319	4.43	14.11
T indica	8	1	0.19	2.38	8.0	1.84	1.064	9.33	12.23
A latifolia	3	2	0.07	4.76	1.5	0.69	2.128	1.75	4.57
M indica	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
T arjuna	13	2	0.31	4.76	6.5	2.98	2.128	7.58	12.69
Eucalyptus	35	5	0.83	11.90	7.0	8.03	5.319	8.17	21.51
Z jujuba	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
Jatropa	2	2	0.05	4.76	1.0	0.46	2.128	1.17	3.75
A pendula	2	1	0.05	2.38	2.0	0.46	1.064	2.33	3.86
H integifolia	3	2	0.07	4.76	1.5	0.69	2.128	1.75	4.57
Gulmohar	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
B serrata	1	1	0.02	2.38	1.0	0.23	1.064	1.17	2.46
Total	436		10.38	223.81	85.71	**100.01**	**100.000**	**100.00**	**300.01**

Table 3. Vegetation survey of Zone 1 of the study area

Species	No. of Individuals in all Quadrats (13)	No. of Quadrats in which they occur	ZONE 1 Density	ZONE-1 Frequency	Abundance	Relative Density	Relative frequency	Relative abundance	IVI
T grandis	59	7	4.538	0.538	8.429	41.550	24.998	18.418	84.966
B monosperma	3	2	0.231	0.154	1.500	2.113	7.142	3.278	12.533
A procera	44	6	3.385	0.462	7.333	30.986	21.427	16.025	68.438
B retusa	1	1	0.077	0.077	1.000	0.704	3.571	2.185	6.461
L leucocephala	1	1	0.077	0.077	1.000	0.704	3.571	2.185	6.461
M azederach	3	1	0.231	0.077	3.000	2.113	3.571	6.556	12.240
D sissoo	10	4	0.769	0.308	2.500	7.042	14.285	5.463	26.790
A lebbek	3	1	0.231	0.077	3.000	2.113	3.571	6.556	12.240
S album	3	1	0.231	0.077	3.000	2.113	3.571	6.556	12.240
G arborea	2	1	0.154	0.077	2.000	1.408	3.571	4.370	9.350
N arbor	1	1	0.077	0.077	1.000	0.704	3.571	2.185	6.461
P emblica	10	1	0.769	0.077	10.000	7.042	3.571	21.852	32.466
A indica	2	1	0.154	0.077	2.000	1.408	3.571	4.370	9.350
	142		**10.923**	**2.154**	**45.762**	**100.001**	**99.993**	**100.000**	**299.993**

Table 4. Vegetation survey of Zone 2 of the study area

Species	No. of Individuals in all Quadrats	No. Of Quadrats in which they occur	Density	ZONE-2 Frequency	Abundance	Relative Density	Relative frequency	Relative abundance	IVI
T grandis	26	2	5.2	0.400	13	37.143	13.333	26.804	77.280
A lebbek	1	1	0.2	0.200	1	1.429	6.667	2.062	10.157
S album	6	1	1.2	0.200	6	8.571	6.667	12.371	27.609
A procera	14	2	2.8	0.400	7	20.000	13.333	14.433	47.766
D sissoo	3	2	0.6	0.400	1.5	4.286	13.333	3.093	20.712
B purporea	1	1	0.2	0.200	1	1.429	6.667	2.062	10.157
B retusa	3	1	0.6	0.200	3	4.286	6.667	6.186	17.138
B ceiba	1	1	0.2	0.200	1	1.429	6.667	2.062	10.157
L leucocephala	1	1	0.2	0.200	1	1.429	6.667	2.062	10.157
P pinnata	1	1	0.2	0.200	1	1.429	6.667	2.062	10.157
A indica	11	1	2.2	0.200	11	15.714	6.667	22.680	45.061
D latifolia	2	1	0.4	0.200	2	2.857	6.667	4.124	13.648
	70		**14**	**3.000**	**48.5**	**100.000**	**100.000**	**100.000**	**300.000**

Table 5. Vegetation survey of Zone 3 of the study area

Species	No. of Individuals in all Quadrats	No. of Quadrats in which they occur	ZONE 3 Density	Frequency	Abundance	Relative Density	Relative frequency	Relative abundance	IVI
D sissoo	17	3	2.833	0.500	5.667	34.692	33.333	15.044	83.070
A procera	6	1	1.000	0.167	6.000	12.244	11.111	15.929	39.285
T indica	8	1	1.333	0.167	8.000	16.326	11.111	21.239	48.676
A latifolia	2	1	0.333	0.167	2.000	4.081	11.111	5.310	20.502
A indica	4	1	0.667	0.167	4.000	8.163	11.111	10.619	29.893
M indica	1	1	0.167	0.167	1.000	2.041	11.111	2.655	15.807
T grandis	11	1	1.833	0.167	11.000	22.448	11.111	29.203	62.762
	49		**8.167**	**1.500**	**37.667**	**99.996**	**100.000**	**99.999**	**299.995**

Table 6. Vegetation survey of Zone 4 of the study area

Species	No. of Individuals in all Quadrats	No. of Quadrats in which they occur	ZONE 4 Density	Frequency	Abundance	Relative Density	Relative frequency	Relative abundance	IVI
T grandis	44	3	4.889	0.333	14.667	44.898	17.646	25.882	88.426
D latifolia	11	1	1.222	0.111	11.000	11.224	5.882	19.412	36.518
T arjuna	12	1	1.333	0.111	12.000	12.245	5.882	21.176	39.303
Eucalyptus	10	2	1.111	0.222	5.000	10.204	11.764	8.823	30.791
P pinnata	3	2	0.333	0.222	1.500	3.061	11.764	2.647	17.472
B monosperma	4	2	0.444	0.222	2.000	4.082	11.764	3.529	19.375
A procera	7	2	0.778	0.222	3.500	7.143	11.764	6.176	25.083
Z jujuba	1	1	0.111	0.111	1.000	1.020	5.882	1.765	8.667
Jatropa	1	1	0.111	0.111	1.000	1.020	5.882	1.765	8.667
E officinalis	4	1	0.444	0.111	4.000	4.082	5.882	7.059	17.022
A indica	1	1	0.111	0.111	1.000	1.020	5.882	1.765	8.667
	98		**10.889**	**1.889**	**56.667**	**99.999**	**99.994**	**99.999**	**299.993**

Table 7. Vegetation survey of Zone 5 of study area

	ZONE 5								
Species	**No. of Individuals in all Quadrats**	**No. of Quadrats in which they occur**	**Density**	**Frequency**	**Abundance**	**Relative Density**	**Relative frequency**	**Relative abundance**	**IVI**
A pendula	2	1	0.222	0.111	2.000	2.597	4.166	4.979	11.743
Eucalyptus	25	3	2.778	0.333	8.333	32.466	12.498	20.747	65.711
T grandis	19	2	2.111	0.222	9.500	24.674	8.332	23.651	56.658
A latifolia	1	1	0.111	0.111	1.000	1.299	4.166	2.490	7.954
L leucocephala	4	2	0.444	0.222	2.000	5.195	8.332	4.979	18.506
P emblica	5	3	0.556	0.333	1.667	6.493	12.498	4.149	23.141
B monosperma	8	3	0.889	0.333	2.667	10.389	12.498	6.639	29.526
H integrefolia	2	1	0.222	0.111	2.000	2.597	4.166	4.979	11.743
G arborea	2	1	0.222	0.111	2.000	2.597	4.166	4.979	11.743
D latifolia	2	1	0.222	0.111	2.000	2.597	4.166	4.979	11.743
S album	1	1	0.111	0.111	1.000	1.299	4.166	2.490	7.954
Gulmohar	1	1	0.111	0.111	1.000	1.299	4.166	2.490	7.954
D sissoo	1	1	0.111	0.111	1.000	1.299	4.166	2.490	7.954
Jatropa	1	1	0.111	0.111	1.000	1.299	4.166	2.490	7.954
A lebbek	2	1	0.222	0.111	2.000	2.597	4.166	4.979	11.743
B serrata	1	1	0.111	0.111	1.000	1.299	4.166	2.490	7.954
	77		**8.556**	**2.667**	**40.167**	**99.995**	**99.988**	**99.999**	**299.981**

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