Phytosociological Analysis and Tree Species Diversity of Tropical Dry Deciduous Forest of Laling, Dhule District, Maharashtra

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Abstract: ***The investigation was carried out in order to explore the existing vegetation structure in Laling forest, Dhule (Maharashtra). The forest is tropical dry deciduous, thorny scrub type. A total of 20 quadrats of 31.6 m× 31.6 m were established to understand the vegetation structure. A total of 18 species belonging to 15 genera under 12 families with 474 individuals were documented. The Importance value index was highest for Dolichandrone falcata (79.643) in Laling forest. IVI values ranged from 1.255 to 79.643. Species diversity index (H′=1.975) and Simpson dominance index (D=0.20) were recorded in Laling forest. Dolichandrone falcata was the dominant species followed by Acacia catechu.***

***Index Terms*—IVI, Laling Forest, Phytosociology, Quadrat, Tropical Dry Deciduous, Vegetation analysis.**

I. INTRODUCTION

Approximately two-thirds of the world's biodiversity is supported by tropical forests, which are among the most diverse global ecosystems [1], [2]. Forests provide varieties of products like foods, timber, energy, and medicinal resources [3], [4]. Plant communities are essential to sustainable management because they conserve biodiversity and the environment [5]. In plant ecology and forestry, forest tree diversity is a helpful tool for comparing the compositions [6], [7].

The tree species diversity depends on the distribution and abundance of species [8] while species richness is determined by biotic and abiotic factors [9]. For instance, species diversity in forest ecosystems varies with topography, climate, soil, and geographic location [10]. The species diversity is a key component of every forest ecosystem [11] and its indices indicate the sustainability and stability of the forest communities [12].

The Shannon-Wiener Diversity Index (H') and Importance Value Index (IVI) quantify the distribution, dominance, and species richness within a community [13]. According to [14], phytosociological analysis is important for examining the composition, distribution, and structure of plant communities. Deciduous forest types have been identified in Dhule district and belong to Type Group 5: Tropical Dry deciduous forest [15].This study was carried out in the Laling forest with the objective to assess the importance value index and diversity index of species in Laling forest of Dhule district.

II. STUDY AREA AND METHODOLOGY

A. Study Area:

The area under investigation lies in Dhule forest division in Dhule district between 20.812°N latitude to 74.739°E longitude, covers an area of 4698.328 Ha. The climate of the study area can be divided into three seasons, viz. summer, rainy and winter. The total annual rainfall in this area is 555.10 mm.

B. Methodology:

The data was collected by sampling using quadrats of 31.6 m × 31.6 m size. 20 quadrats were randomly laid down at study area. All the trees >10 cm Diameter at breast height (DBH;1.37 m above ground) were counted. Tree population structure was analysed using DBH. The Importance Value Index (IVI) for each species was calculated and indicated as the sum of relative density, relative dominance and relative frequency of each species [16].

The formula used for calculating Shannon-wiener diversity index (H') [17] was as follows:

$H' = -\sum_{i=1}^{s}(p_i * \ln(p_i)),$ (1)

Where $p_i = n_i/N$; and ln= Natural logarithm

The Simpson's Index of Dominance (D) [18] was calculated by using following formula:

$D = \frac{\sum n_i(n_i-1)}{N(N-1)}$ (2)

Where n_i: Total number of individuals of i^{th} species; and N: Total number of individuals of all species.

III. RESULT AND DISCUSSION

A total of 18 species belonging to 12 families were recorded from the study area. Fabaceae was the dominant family having 5 species followed by Caesalpiniaceae and Mimosaceae with 2 species each. Families like Anacardiaceae, Apocynaceae, Bignoniaceae, Celastraceae, Meliaceae, Moringaceae, Rhamnaeae, Salicaceae and Tiliaceae were represented by 1 species each.

The distribution analysis of the species in the study area showed that *Dolichandrone falcata* had the highest IVI (79.643), *Acacia catechu* followed by (60.008) and *Azadirachta indica* (35.076). The lowest IVI (1.255) was recorded for *Flacourtia indica* (Table I).

The findings further indicated that *Dolichandrone falcata* had the maximum RD of 34.177% while least recorded RD were *Wrightia tinctoria, Grewia tiliifolia, Dalbergia latifolia, Acacia leucophloea, Dalbergia sissoo, Flacourtia indica* (0.211%) each as presented in Table I.

Table I: Different phytosociological values of tree vegetation of Laling Forest.

Sr. No.	Species Name	D (ind/ha)	A (ind/plot)	F (%)	RD (%)	RF (%)	RDo (%)	IVI
1	*Acacia leucophloea* (Roxb.) Willd.	0.5	1	5	0.211	0.971	0.175	1.356
2	*Acacia nilotica* (L.) Willd. Ex Delile	6	3	20	2.532	3.883	1.836	8.251
3	*Acacia catechu* (L. f.) Willd.	60	7.5	80	25.316	15.534	19.158	60.008
4	*Albizia lebbeck* (L.) Willd.	4.5	4.5	10	1.899	1.942	4.303	8.144
5	*Azadirachta indica* A. Juss.	17.5	2.692	65	7.384	12.621	15.071	35.076
6	*Bauhinia racemosa* Lamk.	14.5	2.9	50	6.118	9.709	4.931	20.758
7	*Dalbergia latifolia* Roxb.	0.5	1	5	0.211	0.971	0.543	1.724
8	*Dalbergia sissoo* Roxb. ex DC.	0.5	1	5	0.211	0.971	0.128	1.310
9	*Dolichandrone falcata* (Wall. ex DC.) Sem.	81	9	90	34.177	17.476	27.990	79.643
10	*Flacourtia indica* (Burm. f.) Merr.	0.5	1	5	0.211	0.971	0.073	1.255
11	*Grewia tiliifolia* Vahl.	0.5	1	5	0.211	0.971	1.266	2.448
12	*Hardwickia binata* Roxb.	8.5	3.4	25	3.586	4.854	4.193	12.634
13	*Lannea coromandelica* (Houtt.) Merr.	13.5	3.375	40	5.696	7.767	10.208	23.672
14	*Leucaena leucocephala* (Lamk.) de Wit.	10	2.857	35	4.219	6.796	4.899	15.914
15	*Maytenus emarginata* (willd.) Ding Hou	1	2	5	0.422	0.971	0.095	1.488
16	*Wrightia tinctoria* R. Br.	0.5	0.5	10	0.211	1.942	0.653	2.806
17	*Ziziphus mauritiana* (Burm.f.) Wight & Arn.	16.5	33	5	6.962	0.971	0.169	8.102
18	*Moringa concanensis* Nimmo ex Dalzell & A Gibson	1	0.182	55	0.422	10.680	4.308	15.409

A= Abundance, D=Density, F= Frequency, RD= Relative Density, RF= Relative Frequency, IVI= Importance Value Index, ind/ha = individuals per hectare, ind/plot = individuals per plot

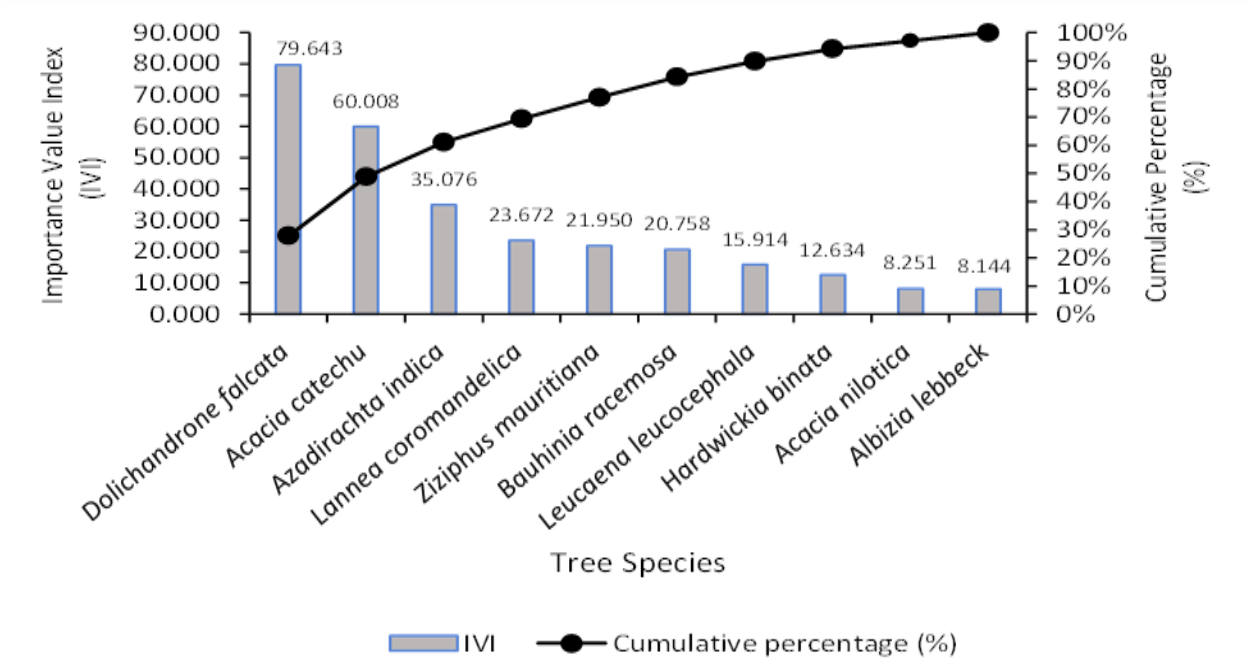

Fig. 1. IVI of top 10 tree species in Laling Forest.

Table II: Shannon Index (H') value of observed species of Laling Forest, Dhule District.

Sr. No.	Species Name	Family	Shannon index
1	*Acacia leucophloea* (Roxb.) Willd.	Mimosaceae	0.013
2	*Acacia nilotica* (L.) Willd. Ex Delile	Mimosaceae	0.093
3	*Acacia catechu* (L. f.) Willd.	Fabaceae	0.348
4	*Albizia lebbeck* (L.) Willd.	Fabaceae	0.075
5	*Azadirachta indica* A. Juss.	Meliaceae	0.192
6	*Bauhinia racemosa* Lamk.	Caesalpiniaceae	0.171
7	*Dalbergia latifolia* Roxb.	Fabaceae	0.013
8	*Dalbergia sissoo* Roxb. ex DC.	Fabaceae	0.013
9	*Dolichandrone falcata* (Wall. ex DC.) Sem.	Bignoniaceae	0.367
10	*Flacourtia indica* (Burm. f.) Merr.	Salicaceae	0.013
11	*Grewia tiliifolia* Vahl.	Tiliaceae	0.013
12	*Hardwickia binata* Roxb.	Caesalpiniaceae	0.119
13	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	0.163
14	*Leucaena leucocephala* (Lamk.) de Wit.	Fabaceae	0.134
15	*Maytenus emarginata* (willd.) Ding Hou	Celastraceae	0.023
16	*Wrightia tinctoria* R. Br.	Apocynaceae	0.013
17	*Ziziphus mauritiana* (Burm.f.) Wight & Arn.	Rhamnaeae	0.186
18	*Moringa concanensis* Nimmo ex Dalzell & A Gibson	Moringaceae	0.023

The species diversity index is a crucial factor for characterizing the community structure. Tree species diversity indices (H') varied from 0.013 to 0.367 (Table II), with a total H' was 1.972. The result showed that the positive relation between IVI and Diversity indices. The Shannon-Wiener index and Simpson's index of diversity (1-D) were calculated as 1.972 and 0.80, respectively. *Dolichandrone falcata* is the dominant species followed by *Acacia catechu.* The recorded Shannon-Wiener index (1.972) in the present study lies within the tropical forest range. The Shannon index value in this current study falls within the range of previous studies [19], [20]. In our findings, the Shannon-Wiener index was (1.972), which is lower than 3.14 recorded in the dry tropical forest of Gudwa, Sakti District, Chhattisgarh, Central India [21].

The important value index (IVI) is used in forest ecological studies to show a species ecological significance in a community and to illustrate an overall idea of species social structure [12]. According to [22], [23], species with low IVI index values are prioritized for conservation more than those with high values because of their rarity.

In the present work, species like *Dalbergia latifolia*, *Maytenus emarginata, Acacia leucophloea, Dalbergia sissoo, Flacourtia indica* exhibited lower IVI values. The low IVI value resulted from the species were sporadic and low abundance in the forest, conservation was necessary to prevent their extinction. In contrast to other species, *D. falcata* showed high IVI value was mainly due to a combination of high relative density, relative dominance, and frequency in the forest (Table I). The High frequency of *D. falcata* indicates that it has a broader range of ecological adaptations than other species.

IV. CONCLUSION

Results showed that the IVI values ranged from 1.255 to 79.643. The present study provides a significant findings about the species composition and abundance of the study area. Our findings provide baseline data to conservation managers, policymakers, researchers and scientists for management plans.

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ABBREVIATIONS:

DBH	Diameter at breast height
D	Simpson's Index of Dominance
H'	Shannon-Wiener Diversity Index
IVI	Importance Value Index
RD	Relative Density

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