Phytosociological Study of Tree Species of Dabla Beed Area, Churu District Rajasthan, India

Mukesh Kumar Meena[1], J.B. Khan[2]

[1,2]Department of Botany, Government Lohia P.G. College, Churu (Rajasthan), Maharaja Ganga Singh University, Bikaner

Abstract:
This study presents a comprehensive phytosociological analysis of tree species in the Dabla beed area of Churu District, Rajasthan, India, exploring seasonal variations in species composition, diversity, dominance, and evenness. The research was conducted across three seasons: rainy, winter, and summer, utilizing quadrat sampling methods to assess various ecological parameters. The findings reveal distinct seasonal shifts in the dominance and distribution of key species. During the rainy season, species such as *Acacia senegal* and *Acacia tortilis* exhibit high dominance and contribute to elevated species diversity and evenness. In winter, *Maytenus emarginata* and *Acacia senegal* emerge as prominent species, maintaining moderate diversity with increased dominance. The summer season sees a notable decline in diversity and evenness, accompanied by heightened dominance, with *Calotropis procera* and *Clerodendrum phlomidis* being particularly influential. These seasonal dynamics underscore the importance of adaptive management and conservation strategies to maintain the ecological integrity and biodiversity of the tree community in this arid region. The study highlights the critical need for targeted conservation efforts to ensure the sustainability of the diverse and dynamic tree populations in the Dabla beed area.

Keywords: Phytosociological analysis, tree species diversity, seasonal variation, ecological dominance, conservation strategies

Introduction:
Nature, with its bountiful offerings, inherently caters to the essential needs of all, steering clear of catering to anyone's insatiable greed. Over millennia, it has crafted a rich tapestry of life forms on Earth, meticulously meeting humanity's fundamental requirements. Safeguarding biodiversity becomes an imperative endeavour, ensuring a future devoid of regrettable losses. At the core of our planet's essence lies the coexistence and diversity of life, an intricate framework crucial for the sustenance and advancement of all living entities (Tilman, 2000). This rich variety of living organisms constitutes a foundation that facilitates growth and progression. However, this invaluable heritage faces severe jeopardy due to the swift expansion of human populations and the escalating environmental degradation.
Rajasthan stands as India's largest state, positioned in the north-western region of the country. Renowned for its diverse floral richness, the state boasts an impressive array of 911 wild species belonging to 780 genera and 154 families. Geographically, Rajasthan spans from 23°30' to 30°12' longitude and 69°30' to 78°17' latitude, encompassing a land area of 342,239 km^2, equivalent to 10.41% of India's total land area. The north-western region, known as the Thar Desert, stands as one of the most densely populated deserts globally.

The Churu district of Rajasthan, situated within the Thar Desert, stands out as a unique example of a thriving human habitat in the western desert region of India. The Churu District spanning between 27° 24' to 29° 00' North latitude and 73° 40' to 75° 41' East longitudes. It shares its boundaries with Hanumangarh district to the north, Sikar and Jhunjhunun districts of Rajasthan along with Hisar district of Haryana to the east, Nagaur district to the south and Bikaner district to the west. Spanning a vast area of 16,830 square kilometers, Churu is home to a population of 2,039,547 as per the 2011 census. The geographic condition of the region features an intense desert climate with an average precipitation of approximately 320 mm annually. Agriculture serves as the primary livelihood for the residents of Churu, engaging 76 percent of the working population in either farming or related agricultural activities.

Floral diversity pertains to the variety of plants present within a specific region during a particular period. It typically denotes the diversity of naturally occurring indigenous or native plants. The term "Flora" originates from the Latin word "Flora," representing the goddess of plants (where 'floris' signifies 'flower'). As of current records, approximately 215,644 plant species out of an estimated 298,000 have been documented on Earth. Additionally, data from the Environmental Information System (ENVIS) on Floral (Plant) Diversity indicates that around 8,600 flora species have been identified in oceanic regions out of an estimated 16,600 (Rathore and Patel 2020).

The current flora of India is a remnant of the dominant vegetation that existed prior to the rise of civilizations in India, as noted by Mani in 1974. Warner's prediction in 1982 suggested that about 80% of India's geographical area was covered by forests around 3000 BC. However, this forest cover has significantly dwindled and currently stands at only 19.1% of the total land area. Notably, India hosts two of the 34 Biodiversity Hotspots recognized globally, as outlined by Myers et al., (2000).

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The objective of this study is to comprehensively assess the tree diversity in Dabla beed region of Churu District, Rajasthan.

Materials and Methods:

The methodology employed for the study of floral biodiversity in the Dabla beed area Churu District involves comprehensive techniques aimed at collecting, documenting and analyzing plant samples within the study area. The collection process will occur at regular intervals, covering different stages of plant growth, including flowering, fruiting and vegetative phases. Upon collection, meticulous preservation of the plants on herbarium sheets in polythene bags will be carried out for future reference. Simultaneously, detailed notes will be recorded concerning the social, economic, medicinal and cultural significance of the plants to provide a comprehensive understanding of their importance.

The phytosociological analysis of tree species in the Dabla Beed area of Churu District, Rajasthan, India, was conducted using randomly positioned quadrats. This study encompassed various aspects, including species richness (the number of different species present), species density (the number of individuals of each species per unit area), frequency (the occurrence of a particular species within the quadrats), frequency class (categorizing species based on their frequency of occurrence, such as common, frequent, or rare), abundance (the total number of individuals of each species), species diversity index (a measure that combines species richness and evenness of species abundance to assess overall diversity), index of species dominance (an indicator of the extent to which certain species dominate the plant community in terms of abundance or cover), index of species evenness (a measure of how evenly distributed individuals are among different species), and the Importance Value Index (IVI). The IVI integrates relative density, relative frequency, and relative dominance to provide a comprehensive measure of a species' ecological role and influence within the community. These parameters were analyzed to gain insights into the composition, structure, diversity, and dominance patterns of the plant community within the studied quadrats, aiding in understanding community structure and making conservation and management decisions (Oosting & Billings, 1942; Pielou, 1966; Raunkiaer, 1934; Raunkiær & Stowe, 1936; Shannon & Weave, 1949; Simpson, 1949).

Results and Discussion:

The tree community at Dabla site I during the rainy season displayed distinct patterns in species distribution and dominance. *Acacia senegal* and *Acacia tortilis* emerged as the dominant species with density values of 0.8 and 0.6, respectively. These species also demonstrated high frequency, with *Acacia senegal* reaching 60 and *Acacia tortilis* 80 (Table 1). The dominance of *Acacia tortilis* was particularly pronounced, with a dominance value of 116.097, underscoring its significant impact on the tree community's structure. The IVI further confirmed the dominance of these species, with *Acacia tortilis* recording an IVI of 33.929 and *Acacia senegal* 28.224. These results highlight the critical roles of *Acacia senegal* and *Acacia tortilis* in maintaining the ecological integrity of the tree community during the rainy season.

The tree community during the winter season at Dabla site I was characterized by the dominance of *Acacia senegal* and *Maytenus emarginata*. These species exhibited the highest density values, with *Acacia senegal* at 0.9 and *Maytenus emarginata* at 1.0 (Table 2). The frequency of *Acacia senegal* was 70 and *Maytenus emarginata* had a frequency of 50, indicating their significant presence in the community. Dominance values were notably high for *Maytenus emarginata* and *Acacia senegal*, with values of 715.951 and 77.892, respectively. The IVI confirmed the importance of these species, with *Maytenus emarginata* achieving an IVI of 84.165 and *Acacia senegal* 36.602, identifying them as the key species in the tree community during winter.

The tree community during the summer season at Dabla site I was predominantly influenced by *Acacia tortilis* and *Azadirachta indica*, which exhibited the highest density values of 0.6 and 0.2, respectively (Table 3). The frequency analysis confirmed the significant presence of these species, with *Acacia tortilis* recording a frequency of 50 and *Azadirachta indica* a frequency of 20. *Acacia tortilis* had the highest dominance value of 116.097, indicating its substantial impact on the tree community structure. The IVI further highlighted the importance of *Acacia tortilis* and *Azadirachta indica*, with IVI scores of 33.929 and 32.323, respectively, identifying them as the key species in the tree community during summer.

The ecological diversity indices for tree species at the Dabla beed area highlight the seasonal variations in species diversity (H'), dominance (D), and evenness (e). During the rainy season, tree species exhibit a relatively high species diversity (H' = 2.5848), low dominance (D = 0.0880), and high evenness (e = 0.8943) (Table 4). In winter, tree species maintain moderate diversity (H' = 2.5041), with slightly increased dominance (D = 0.1031) and slightly lower evenness (e = 0.8664). During the summer, tree species show the lowest diversity (H' = 2.3291), highest dominance (D = 0.1267), and lowest evenness (e = 0.8221). These indices suggest that tree species in the Dabla beed area exhibit higher diversity and

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evenness during the rainy season, while winter and summer see a reduction in diversity and evenness with increased dominance. This pattern reflects the dynamic nature of the tree community structure and the impact of seasonal changes on species composition and distribution.

Table 1. Phytosociological study of Tree Community at Dabla site during rainy season.

S. No.	Name of Plants	Density	Frequency	Abundance	Dominance	IVI
1	*Acacia jacqemontii*	0.8	50	1.60	31.657	22.472
2	*Acacia nilotica*	0.1	10	1.00	32.349	6.531
3	*Acacia senegal*	0.8	60	1.33	69.237	28.224
4	*Acacia tortilis*	0.6	80	0.75	116.097	33.929
5	*Ailanthus excelsa*	0.1	10	1.00	52.253	8.709
6	*Azardirachta indica*	0.3	30	1.00	213.365	32.323
7	*Balanites aegyptiaca*	0.8	50	1.60	150.877	35.520
8	*Capparis decidua*	0.1	10	1.00	8.328	3.902
9	*Dalbergia sissoo*	0.2	20	1.00	7.914	6.848
10	*Maytenus emarginata*	0.9	60	1.50	10.202	23.115
11	*Melia azedarach*	0.1	10	1.00	0.855	3.084
12	*Moringa oleifera*	0.1	10	1.00	0.962	3.096
13	*Parkinsonia aculeata*	0.1	10	1.00	2.205	3.232
14	*Prosopis cineraria*	0.8	60	1.33	6.839	21.395
15	*Prosopis juliflora*	0.8	60	1.33	9.068	21.639
16	*Ricinus communis*	0.1	10	1.00	0.962	3.096
17	*Salvadora persica*	0.4	40	1.00	197.823	33.613
18	*Tecomella undulata*	0.3	30	1.00	2.722	9.270

Table 2 Phytosociological study of tree Community at Dabla site during winter season.

S. No.	Name of Plants	Density	Frequency	Abundance	Dominance	IVI
1	*Acacia jacqemontii*	0.6	40	1.50	23.743	20.734
2	*Acacia nilotica*	0.1	10	1.00	32.349	6.415
3	*Acacia senegal*	0.9	70	1.29	77.892	36.602
4	*Acacia tortilis*	0.6	50	1.20	116.097	30.176
5	*Ailanthus excelsa*	0.1	10	1.00	52.253	7.981
6	*Azardirachta indica*	0.2	20	1.00	142.244	18.932
7	*Balanites aegyptiaca*	0.2	20	1.00	37.719	10.706
8	*Capparis decidua*	0.2	20	1.00	16.656	9.049
9	*Dalbergia sissoo*	0.1	10	1.00	32.669	6.440
10	*Maytenus emarginata*	1	50	2.00	715.951	84.165
11	*Melia azedarach*	0.1	10	1.00	0.962	3.945
12	*Moringa oleifera*	0.1	10	1.00	2.123	4.036
13	*Parkinsonia aculeata*	0.1	10	1.00	1.320	3.973
14	*Prosopis cineraria*	0.7	50	1.40	9.237	23.461
15	*Prosopis juliflora*	0.6	50	1.20	5.770	21.493

S. No.	Name of Plants	Density	Frequency	Abundance	Dominance	IVI
16	*Ricinus communis*	0.1	10	1.00	0.855	3.936
17	*Salvadora persica*	0.1	10	1.00	1.590	3.994
18	*Tecomella undulata*	0.1	10	1.00	1.194	3.963

Table 3. Phytosociological study of tree Community at Dabla site during summer season.

S. No.	Name of Plants	Density	Frequency	Abundance	Dominance	IVI
1	*Aloe vera*	0.2	20	1.00	4.410	9.360
2	*Calligonum polygonoides*	0.1	10	1.00	4.299	5.597
3	*Calotropis procera*	1.6	70	2.29	84.453	75.490
4	*Clerodendrum phlomidis*	1.3	60	2.17	52.903	55.179
5	*Cocculus pendulus*	0.1	10	1.00	2.289	4.717
6	*Crotalaria burhia*	0.5	50	1.00	20.916	27.733
7	*Ephedra foliata*	0.2	20	1.00	2.149	8.370
8	*Leptadenia pyrotechnica*	1.3	60	2.17	29.758	45.042
9	*Lycium barbarum*	0.1	10	1.00	0.962	4.136
10	*Mimosa hamata*	0.2	20	1.00	1.923	8.271
11	*Opuntia elatior*	0.1	10	1.00	4.069	5.497
12	*Pergularia daemia*	0.3	20	1.50	4.354	10.725
13	*Zizyphus nummularia*	1.2	70	1.71	15.835	39.881

Table 4. Ecological Diversity Indices of tree species at Dabla beed area

Sr. No.	Season	H'	D	e
1	Rainy	2.5847896	0.08802045	0.8942758
2	Winter	2.5041002	0.10313128	0.8663592
3	Summer	2.3291105	0.12665406	0.8220738

Conclusion:

The phytosociological study of tree species in the Dabla beed area of Churu District, Rajasthan, highlights the significant seasonal variations in the composition and structure of the tree community. During the rainy season, species such as *Acacia senegal* and *Acacia tortilis* dominate, contributing to higher species diversity and evenness. In the winter, *Maytenus emarginata* and *Acacia senegal* become more prominent, maintaining moderate diversity with slightly increased dominance. The summer season sees a further decrease in diversity and evenness, with increased dominance, with species like *Calotropis procera* and *Clerodendrum phlomidis* playing significant roles. These patterns reflect the dynamic nature of the tree community in response to seasonal changes, emphasizing the need for targeted conservation efforts to preserve the ecological balance and biodiversity of the region.

References:

1. Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, *403*(6772), 853–858.
2. Oosting, H. J., & Billings, W. D. (1942). Factors effecting vegetational zonation on coastal dunes.

Ecology, *23*(2), 131–142.
3. Pielou, E. C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, *13*, 131–144.
4. Rathoure, A. K., & Patel, U. R. (2020). Climate conditions and biodiversity decline: impact assessment. In *Current State and Future Impacts of Climate Change on Biodiversity* (pp. 79–94). IGI Global.
5. Raunkiaer, C. (1934). The life forms of plants and statistical plant geography; being the collected papers of C. Raunkiær. *The Life Forms of Plants and Statistical Plant Geography; Being the Collected Papers of C. Raunkiaer*.
6. Raunkiær, C., & Stowe, E. (1936). *Recherches statistiques sur les formations végétales*. United States Forest Service, Division of Silvics.
7. Shannon, C. E., & Weave, W. (1949). The mathematical theory of communication. In *The University of Illinois. Urbana, Chicago, London* (pp. 3–24).
8. Simpson, E. H. (1949). Measurement of diversity. *Nature*, *163*(4148), 688.
9. Tilman, D. (2000). Causes, consequences and ethics of biodiversity. *Nature*, *405*(6783), 208–211.