Floristic Composition and Community Study of Ratan Nagar beed area, Churu District, Rajasthan, India

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Abstract

This study presents a comprehensive analysis of the floristic composition and community structure in the Ratan Nagar beed area of the Churu District, Rajasthan, India. Using the quadrat method, this research meticulously investigates the diversity and ecological parameters of plant species across different seasons—rainy, winter, and summer. The study reveals significant seasonal variations in species dominance, density, frequency, and importance values, illustrating the dynamic and resilient nature of the plant communities in this semi-arid region. During the rainy season, species such as Dactylocteniumaegyptium and Panicum turgidum dominate the herbaceous layer, while Aerva persica and Acacia senegal are prominent in the shrub and tree layers, respectively. In winter, key species include Chenopodium album and Tephrosia purpurea in the herbaceous community, Clerodendrumphlomidis and Crotalaria burhia in the shrub community, and Acacia senegal and Prosopis cineraria in the tree community. The summer season sees shifts with Tephrosia purpurea, Calotropis procera, and Prosopis juliflora becoming significant in the herbaceous, shrub, and tree communities, respectively. The study provides valuable insights into the ecological importance and distribution patterns of various species, emphasizing their roles in maintaining the ecological balance and diversity in this semi-arid landscape.

Keywords: Floristic Composition, Community Structure, Seasonal Variation, Semi-Arid Region, Ecological Parameters

Introduction:

Despite the historical existence of the concept of "diversity," the term "biological diversity" emerged in scientific literature during the 1980s. Lovejoy was among the first to utilize this phrase, although his initial usage didn't assign it a specific definition; instead, he regarded it simply as a count of species (Lovejoy, 1997). The term "biodiversity" was coined by Rosen during the inaugural planning session of the "National Forum on Biodiversity" held in Washington, D.C., in September 1986. This term, introduced in 1985, gained traction largely through 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 flowering plants, known as angiosperms, represent the largest and most diverse group within the plant kingdom. Records indicate the existence of approximately 350,000 species of flowering plants, categorized into 416 families and 14,559 genera. These flowering plants collectively constitute nearly 90% of all identified land plant species (Prance et al., 2014). Notably, angiosperms are the most recent major lineage among green plants, emerging and diversifying considerably later than other plant groups following the colonization of terrestrial habitats approximately 500–470 million years ago during the Ordovician period (Sanderson et al., 2004).

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).

The diversity of flora significantly contributes to soil quality by supplying nutrients, aiding in nitrogen fixation and facilitating biogeochemical and hydrological cycles. This rich plant diversity is instrumental in preventing and mitigating erosion while ensuring the supply of oxygen and absorbing carbon dioxide crucial for the environment. Furthermore, floral diversity yields various goods, serving as raw materials for manufacturing clothing, building materials, ornamental items and contributing to ecotourism, cosmetics, pharmaceuticals and personal-use goods. Additionally, the value of plant diversity extends to research, offering immense opportunities through botanical gardens, conservation areas and natural habitats for educational and research purposes (Jeph and Khan, 2019).

The present study endeavors to conduct a detailed investigation and analysis of the flora under consideration, while simultaneously evaluating diverse ecological parameters. Accurate identification of the plants with utmost attention placed on ensuring the authenticity and reliability of the informationobtained.

Materials and Methods:

The quadrat method, as detailed by Tripathi and Misra, (1971), will be utilized in this study to explore the ecological characteristics of the district. This research expands upon a prior extensive ecological investigation conducted within this specific district. Field trips were undertaken thrice annually for each study site within the district, ensuring thorough coverage of the entire Beed area encompassing both study area. Throughout these excursions, meticulous documentation was performed. Every collected plant specimen received a sequential numbering system for identification and reference purposes. Comprehensive field notes were recorded, encompassing details regarding the plant's behaviour, natural environment and the count of observed plants within each quadrat. For trees, quadrats measuring 10 x 10 meters will be utilized, while shrubs will be assessed within 5 x 5-meter quadrats. Herbaceous plants will be studied within 3 x 3-meter quadrats.

By implementing this methodology, the study aims to gather comprehensive data on the flora of the district. This includes information about the distribution, abundance and habitat preferences of various plant species, allowing for a thorough ecological analysis of the area.

(a) Species richness

Species richness refers to the total count of different species observed within a particular area or ecosystem. It serves as a statistical estimation of the overall diversity of species, encompassing those that have been directly identified as well as those that may exist but have not been observed in the available samples. This metric focuses solely on quantifying the number of unique species within a defined area, as outlined by Magurran, (1988), without considering factors like abundance or distribution patterns.

Evaluating species richness provides valuable insights into the diversity and variety of species coexisting within the designated study area.

$$R = \quad S$$

Where S is the number of species

(b) Species density:

Species density refers to the quantity of individual species observed within a designated unit area, offering details about the concentration or abundance of organisms in that specific space. This concept further allows insight into the potential competition among species coexisting within the area. As described by Oosting and Billings, (1942), density serves as a crucial measure aiding in the comprehension of interspecies competition. Analyzing the density of organisms within a defined unit area enables an understanding of their proximity or dispersion, thereby shedding light on the potential competition for resources among them.

$$Density = \frac{Total\ number\ of\ individual\ of\ the\ species}{Total\ Number\ of\ quadrat}$$

(c) Relative density (RD):

$$RD = \frac{Density\ of\ a\ species}{Total\ density\ of\ all\ the\ species} \times 100$$

(d) Frequency:

Frequency is the number of sampling units (like quadrat) in which a particular species occurs (Raunkiær and Stowe, 1936):

$$Frequency = \frac{Total\ number\ of\ quadrat\ with\ individual\ \ species}{Total\ Number\ of\ quadrat\ studied} \times 100$$

(e) Relative frequency (RF):

$$RF = \frac{Frequency\ of\ a\ species}{Total\ frequency\ of\ all\ the\ species}$$

(f) Frequency class:

According to Raunkiaer (1934), the species were categorized into five frequency classes, namely A, B, C, D and E, based on their percentage frequencies.

(g) Abundance:

This is the number of individuals of any species per sampling unit of occurrence Roberts and Oosting, (1958):

$$Abundance = \frac{Total\ number\ of\ individual\ \ of\ species}{Total\ Number\ of\ quadrat\ with\ individual\ species}$$

(h) Basal area:

Basal area is a term used in forestry and ecology to describe the cross-sectional area of a tree trunk or stem at breast height (usually 1.3 meters or 4.5 feet above ground). It is an important measure because it provides an estimate of the volume of wood or biomass in a forest or wooded area and helps in understanding the density and structure of the vegetation.

$$Basal\ area = \pi \times \left(\frac{DBH}{2}\right)^2$$

(i) Dominance:

$$Dominance = Basal\ area + Density$$

(j) Relative Dominance (RDm):

$$RDom = \frac{Dominance\ of\ a\ species}{Total\ dominance\ of\ the\ all\ species} \times 100$$

(k) Importance Value Index (IVI):

IVI orImportance Value Index, is a measure used in plant ecology to determine the ecological importance of a species within a given plant community. It provides a comprehensive assessment by combining three different parameters: relative density, relative frequency and relative dominance (or basal area).

$$IVI = RF + RD + RDom$$

Where,
RF- Relative Frequency
RD- Relative Density
RDom- Relative Dominance

(l) Shannon and Weaver index of species diversity (H'):

According to Shannon and Weave, (1949), species diversity refers to the quantification of the variety of species within a specific area, taking into account their abundance through measures such as the number of individuals or biomass.

$$H' = -\sum_{i=1}^{s} \frac{ni}{N} ln \frac{ni}{N}$$

"

Where,
H' = Diversity index of species
ni = Total number of individuals of a species in the quadrat
N = Total number of individuals of all species in the quadrat
S = Total number of species

(m) Simpson index of species dominance (D):

According to Simpson, (1949), species dominance is determined by calculating the dominance index. This index ranges from 0 to 1, with a maximum value of 1 indicating complete dominance by a single species. Near-zero values indicate the absence of dominance, typically observed when only a small fraction of the species is present.

$$D = \sum_{i=1}^{s} \left(\frac{ni}{N}\right)^2$$

Where,

D = Simpson index of dominance
ni = Total number of individuals of a species in the quadrat
N = Total number of individuals of all species in the quadrat
S = Total number of species

(n) Species index of evenness (e):

Pielou, (1966) introduced the concept of species evenness (e), which represents the relative distribution of individuals among different species within a community. A value of one indicates a similar proportion of individuals across all species, indicating high evenness. However, when the abundance of individuals is significantly varied, the evenness value decreases. Pielou developed a formula to quantify the index of evenness (e) in order to capture this concept.

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

Where,
e = Index of evenness
H'= Shannon Wiener index
S = Total number of species

Results and Discussions:

The floristic composition within the study areaRatan Nagar in the Churu District of Rajasthan, India, elucidates a comprehensive spectrum of plant biodiversity, embodying a remarkable array of families that are emblematic of the region's ecological and geographical habits. This synthesis of the plant diversity observed provides a critical foundation for understanding the intricate web of life sustained in these semi-arid landscapes, highlighting the resilience and adaptability of flora to the prevailing climatic conditions.

Herbaceous Community During Rainy Season

The herbaceous community at Ratan Nagar during site I the rainy season is characterized by significant species diversity and varying levels of abundance, dominance and importance. Among the species, *Dactylocteniumaegyptium* stands out with the highest dominance value of 18.470, indicating its substantial role in the community structure. This species, along with *Panicum turgidum*, which had a remarkably high dominance value of 30.359 and *Cyperus rotundus*, with a dominance value of 19.786, illustrates the variation in species impact within this ecosystem. *Cyperus arenarius* exhibited the highest density of 1.5 and a high frequency of 80%, suggesting its widespread distribution and significant presence.

The relative frequency and density values highlight the commonality and distribution of certain species. For instance, *Cenchrus biflorus* and *Cenchrus setigerus* both had a frequency of 50% and density values of 0.8, emphasizing their frequent occurrence and relative abundance across the study site. The importance value index (IVI) further accentuates the ecological roles of these species, with *Cenchrus*

biflorus attaining an IVI of 6.134 and *Cenchrus setigerus* an IVI of 5.940, indicating their combined influence on community structure through frequency, density and dominance metrics.

Shrub Community During Rainy Season

The shrub community at Ratan Nagar during the rainy season reveals distinct patterns of species distribution and ecological significance. *Aerva persica* emerged as the dominant species with a remarkably high dominance value of 31.840 and a frequency of 70%, underlining its critical role in the shrub layer. This species also showed a high relative density (15.789) and an IVI of 49.010, reflecting its overall ecological importance. *Crotalaria burhia* also demonstrated significant presence with a high density (1.2), frequency (80%) and an IVI of 31.932, highlighting its substantial contribution to the community dynamics.

Other notable species include *Calotropis procera* and *Clerodendrumphlomidis*, with dominance values of 6.801 and 7.164, respectively. These species had high frequencies and relative dominance values, indicating their strong presence and influence within the shrub community. *Ephedra foliata* and *Leptadeniapyrotechnica* also displayed notable IVI values of 14.539 and 17.446, respectively, further demonstrating the diverse and complex structure of the shrub community during the rainy season.

Tree Community During Rainy Season

The tree community at Ratan Nagar during the rainy season is dominated by a few key species that significantly shape the community structure. *Acacia senegal* emerged as the most dominant species with a high dominance value of 121.165 and a frequency of 80%. This species exhibited the highest relative density (12.500) and IVI of 40.984, emphasizing its critical role in the arboreal layer. *Balanites aegyptiaca* also showed significant presence with a dominance value of 207.456, frequency of 70% and an IVI of 44.448, reflecting its substantial ecological influence.

Other prominent species include *Azadirachta indica* and *Prosopis cineraria*, both displaying high dominance values and IVI scores of 213.365 and 97.023, respectively. These species contribute significantly to the overall tree community structure. *Acacia nilotica* also plays a vital role, with a dominance value of 64.698 and an IVI of 11.893, further highlighting the diverse and intricate nature of the tree community during the rainy season.

Herbaceous Community During Winter Season

During the winter season, the herbaceous community at Ratan Nagar shows distinct shifts in species composition and dominance. *Chenopodium album* stands out with a high density of 1.4, frequency of 70% and a dominance value of 11.254, indicating its significant role in the community structure. This species also had a high IVI of 39.168, reflecting its overall ecological importance. *Tephrosia purpurea* also demonstrated substantial presence with a high density (1.5), frequency (80%) and an IVI of 46.702, highlighting its crucial contribution to the community dynamics.

Other notable species include *Erianthusmunja* and *Datura innoxia*, with dominance values of 54.382 and 32.669, respectively. These species had high frequencies and relative dominance values, indicating their strong presence and influence within the herbaceous community. *Portulaca pilosa* and *Tribulus terrestris* also displayed notable IVI values of 8.322 and 8.501, respectively, further demonstrating the diverse and complex structure of the herbaceous community during the winter season.

Shrub Community During Winter Season

The shrub community during the winter season at Ratan Nagar reveals significant variations in species dominance and distribution. *Clerodendrumphlomidis* emerged as the most dominant species with a

dominance value of 17.910, frequency of 70% and an IVI of 58.344, indicating its critical role in the community structure. This species, along with *Crotalaria burhia*, which had a high dominance value of 15.260, frequency of 90% and an IVI of 58.954, highlights the significant impact of certain species within the shrub layer.

Other notable species include *Leptadeniapyrotechnica* and *Ephedra foliata*, with dominance values of 11.254 and 3.215, respectively. These species exhibited high frequencies and relative dominance values, indicating their strong presence and influence within the shrub community. *Zizyphusnummularia* and *Mimosa hamata* also displayed notable IVI values of 21.080 and 20.801, respectively, further demonstrating the diverse and complex structure of the shrub community during the winter season.

Tree Community During Winter Season

The tree community at Ratan Nagar during the winter season is dominated by a few key species that significantly shape the community structure. *Acacia senegal* and *Prosopis cineraria* emerged as the dominant species with high dominance values of 86.546 and 105.843, respectively. These species exhibited high frequencies (70% and 80%) and IVI values of 31.592 and 37.506, respectively, emphasizing their critical role in the arboreal layer.

Other prominent species include *Balanites aegyptiaca* and *Acacia tortilis*, both displaying high dominance values and IVI scores of 94.298 and 174.145, respectively. These species contribute significantly to the overall tree community structure. *Azadirachta indica* and *Maytenusemarginata* also play vital roles, with high dominance values and IVI scores of 142.244 and 36.483, respectively, further highlighting the diverse and intricate nature of the tree community during the winter season.

Herbaceous Community During Summer Season

During the summer season, the herbaceous community at Ratan Nagar shows distinct shifts in species composition and dominance. *Tephrosia purpurea* stands out with a high density of 1.4, frequency of 80% and a dominance value of 16.716, indicating its significant role in the community structure. This species also had a high IVI of 111.856, reflecting its overall ecological importance. *Erianthusmunja* also demonstrated substantial presence with a high density (0.3), frequency (30%) and an IVI of 41.846, highlighting its crucial contribution to the community dynamics.

Other notable species include *Datura innoxia* and *Verbesinaencelioides*, with dominance values of 32.669 and 2.769, respectively. These species had high frequencies and relative dominance values, indicating their strong presence and influence within the herbaceous community. *Xanthium strumarium* and *Aloe vera* also displayed notable IVI values of 10.281 and 11.356, respectively, further demonstrating the diverse and complex structure of the herbaceous community during the summer season.

Shrub Community During Summer Season

The shrub community during the summer season at Ratan Nagar reveals significant variations in species dominance and distribution. *Calotropis procera* emerged as the most dominant species with a dominance value of 18.137, frequency of 50% and an IVI of 58.828, indicating its critical role in the community structure. This species, along with *Clerodendrumphlomidis*, which had a high dominance value of 13.134, frequency of 70% and an IVI of 49.260, highlights the significant impact of certain species within the shrub layer.

Other notable species include *Leptadeniapyrotechnica* and *Zizyphusnummularia*, with dominance values of 10.258 and 7.385, respectively. These species exhibited high frequencies and relative dominance values, indicating their strong presence and influence within the shrub community. *Mimosa hamata* and

Lyciumbarbarum also displayed notable IVI values of 20.801 and 17.562, respectively, further demonstrating the diverse and complex structure of the shrub community during the summer season.

Tree Community During Summer Season

The tree community at Ratan Nagar during the summer season is dominated by a few key species that significantly shape the community structure. *Acacia senegal* and *Prosopis juliflora* emerged as the dominant species with high dominance values of 95.201 and 56.972, respectively. These species exhibited high frequencies (70% and 80%) and IVI values of 39.492 and 40.452, respectively, emphasizing their critical role in the arboreal layer.

Other prominent species include *Balanites aegyptiaca* and *Prosopis cineraria*, both displaying high dominance values and IVI scores of 188.596 and 97.023, respectively. These species contribute significantly to the overall tree community structure. *Azadirachta indica* and *Moringa oleifera* also play vital roles, with high dominance values and IVI scores of 71.122 and 71.595, respectively, further highlighting the diverse and intricate nature of the tree community during the summer season.

At Ratan Nagar Site I, the ecological diversity indices for plant species reveal distinct seasonal and habit-based variations in species diversity (H'), dominance (D) and evenness (e). During the rainy season, herbs exhibit the highest species diversity (H' = 4.3054), the lowest dominance (D = 0.0172) and high evenness (e = 0.9568). Shrubs show moderate diversity (H' = 2.9750), higher dominance (D = 0.0688) and high evenness (e = 0.9027). Trees have the lowest diversity among the habits in the rainy season (H' = 2.5377), with higher dominance (D = 0.1056) and moderate evenness (e = 0.8210).

In winter, herbs maintain moderate diversity (H' = 2.6538), with increased dominance (D = 0.1150) and moderate evenness (e = 0.8052). Shrubs display lower diversity (H' = 2.2198), higher dominance (D = 0.1478) and moderate evenness (e = 0.8006). Trees show moderate diversity (H' = 2.6152), moderate dominance (D = 0.0930) and moderate evenness (e = 0.8461).During summer, herb diversity significantly decreases (H' = 1.7540), with the highest dominance (D = 0.2977) and the lowest evenness (e = 0.7315) among all seasons. Shrubs maintain moderate diversity (H' = 2.0959), high dominance (D = 0.1506) and moderate evenness (e = 0.8435). Trees exhibit stable diversity (H' = 2.5408), moderate dominance (D = 0.1090) and moderate evenness (e = 0.8220).

These indices suggest that herbs generally maintain higher diversity and evenness, particularly during the rainy season, while shrubs and trees show greater dominance and lower diversity. This reflects the complex and dynamic nature of plant community structure at Ratan Nagar Site I, with significant seasonal shifts in species composition and distribution. Overall, the phytosociological studies at Ratan Nagar site I during different seasons reveal complex and dynamic community structures across herbaceous, shrub and tree layers. Key species such as *Dactylocteniumaegyptium*, *Aerva persica*, *Acacia senegal*, *Chenopodium album*, *Clerodendrumphlomidis* and *Tephrosia purpurea* play crucial roles in shaping these communities. The relative dominance, frequency, density and IVI values provide insights into the ecological importance and distribution patterns of these species, highlighting the intricate balance and diversity within this ecosystem.

Table 1 Phytosociological study of herbaceous Community at Ratan Nagar during rainy season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Achyranthes aspera*	0.2	20	A	1.00	1.815	0.257	0.885	0.660	1.802
2	*Aloe vera*	0.2	10	A	2.00	4.410	0.623	0.442	0.660	1.726
3	*Alysicarpusmonilifer*	0.2	20	A	1.00	2.035	0.288	0.885	0.660	1.833
4	*Amaranthus hybridis*	0.4	30	B	1.33	3.215	0.454	1.327	1.320	3.102
5	*Amaranthus viridis*	0.3	20	A	1.50	2.412	0.341	0.885	0.990	2.216
6	*Argemone mexicana*	0.4	40	B	1.00	2.123	0.300	1.770	1.320	3.390
7	*Aristida funiculata*	0.2	20	A	1.00	0.692	0.098	0.885	0.660	1.643
8	*Blepharissindica*	0.1	10	A	1.00	0.415	0.059	0.442	0.330	0.831
9	*Boerhaviadiffusa*	0.3	20	A	1.50	3.401	0.481	0.885	0.990	2.356
10	*Borreria articularis*	0.2	20	A	1.00	2.388	0.338	0.885	0.660	1.883
11	*Brachiariaramosa*	0.3	20	A	1.50	2.885	0.408	0.885	0.990	2.283
12	*Brachiariareptans*	0.2	20	A	1.00	1.608	0.227	0.885	0.660	1.772
13	*Celosia argentia*	0.2	20	A	1.00	2.035	0.288	0.885	0.660	1.833
14	*Cenchrus biflorus*	0.8	50	C	1.60	9.068	1.282	2.212	2.640	6.134
15	*Cenchrus ciliaris*	0.4	30	B	1.33	4.299	0.608	1.327	1.320	3.255
16	*Cenchrus setigerus*	0.8	50	C	1.60	7.693	1.087	2.212	2.640	5.940
17	*Citrullus colocynthis*	0.3	20	A	1.50	2.412	0.341	0.885	0.990	2.216
18	*Citrullus fistulosus*	0.2	20	A	1.00	2.639	0.373	0.885	0.660	1.918
19	*Citrullus lanatus*	0.2	20	A	1.00	1.710	0.242	0.885	0.660	1.787
20	*Cleome gynandra*	0.3	20	A	1.50	3.224	0.456	0.885	0.990	2.331
21	*Cleome viscosa*	0.3	20	A	1.50	2.722	0.38	0.88	0.99	2.26

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
							5	5	0	0
22	*Commelianabenghalensis*	0.2	20	A	1.00	1.608	0.227	0.885	0.660	1.772
23	*Corchorus depressus*	0.4	40	B	1.00	3.419	0.483	1.770	1.320	3.573
24	*Corchorus tridens*	0.3	20	A	1.50	1.717	0.243	0.885	0.990	2.118
25	*Croton sparsiflorus*	0.4	40	B	1.00	5.539	0.783	1.770	1.320	3.873
26	*Cynodondactylon*	0.4	20	A	2.00	8.167	1.154	0.885	1.320	3.359
27	*Cyperus arenarius*	1.5	80	D	1.88	8.584	1.213	3.540	4.950	9.704
28	*Cyperus bulbosus*	0.4	20	A	2.00	2.462	0.348	0.885	1.320	2.553
29	*Cyperus compressus*	0.3	20	A	1.50	1.472	0.208	0.885	0.990	2.083
30	*Cyperus iria*	0.3	20	A	1.50	1.140	0.161	0.885	0.990	2.036
31	*Cyperus rotundus*	0.5	30	B	1.67	19.786	2.797	1.327	1.650	5.774
32	*Dactyloctenіumaegyptium*	0.4	30	B	1.33	130.674	18.470	1.327	1.320	21.118
33	*Dactyloctenіumsindicum*	0.6	30	B	2.00	19.900	2.813	1.327	1.980	6.120
34	*Datura innoxia*	0.2	20	A	1.00	8.367	1.183	0.885	0.660	2.728
35	*Datura stramonium*	0.2	20	A	1.00	0.904	0.128	0.885	0.660	1.673
36	*Dichanthiumannulatum*	0.2	20	A	1.00	0.904	0.128	0.885	0.660	1.673
37	*Digera alternifolia*	0.3	30	B	1.00	2.263	0.320	1.327	0.990	2.637
38	*Digitariabiformis*	0.2	20	A	1.00	0.831	0.117	0.885	0.660	1.662
39	*Digitariaciliaris*	0.3	20	A	1.50	2.412	0.341	0.885	0.990	2.216
40	*Digitariasanguinalis*	0.3	20	A	1.50	2.722	0.385	0.885	0.990	2.260
41	*Echinopsechinatus*	0.3	30	B	1.00	1.981	0.280	1.327	0.990	2.597
42	*Eragrostisciliaris*	1.1	60	C	1.83	11.821	1.671	2.655	3.630	7.956

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
43	*Eragrostispilosa*	0.4	30	B	1.33	5.539	0.783	1.327	1.320	3.430
44	*Erianthusmunja*	0.3	30	B	1.00	3.052	0.431	1.327	0.990	2.749
45	*Euphorbia granulata*	0.4	20	A	2.00	1.963	0.277	0.885	1.320	2.482
46	*Euphorbia hirta*	1.3	70	D	1.86	5.878	0.831	3.097	4.290	8.219
47	*Euphorbia prostrata*	0.2	20	A	1.00	1.061	0.150	0.885	0.660	1.695
48	*Euphorbia thymifolia*	0.3	20	A	1.50	2.263	0.320	0.885	0.990	2.195
49	*Farsetiahamiltonii*	0.3	20	A	1.50	2.565	0.362	0.885	0.990	2.238
50	*Fumaria indica*	0.3	20	A	1.50	2.885	0.408	0.885	0.990	2.283
51	*Gisekiapharnaceoides*	0.3	20	A	1.50	1.846	0.261	0.885	0.990	2.136
52	*Heliotropiummarifolium*	0.2	20	A	1.00	1.815	0.257	0.885	0.660	1.802
53	*Heliotropiumovalifolium*	0.3	20	A	1.50	1.717	0.243	0.885	0.990	2.118
54	*Heliotropiumsubulatum*	0.3	30	B	1.00	6.125	0.866	1.327	0.990	3.183
55	*Indigofera cordifolia*	0.2	20	A	1.00	1.923	0.272	0.885	0.660	1.817
56	*Indigofera hochstetteri*	0.3	20	A	1.50	3.224	0.456	0.885	0.990	2.331
57	*Indigofera linifolia*	0.2	20	A	1.00	1.061	0.150	0.885	0.660	1.695
58	*Launaea procumbens*	0.2	20	A	1.00	2.267	0.320	0.885	0.660	1.865
59	*Mililotus indica*	0.2	20	A	1.00	1.815	0.257	0.885	0.660	1.802
60	*Mollugocerviana*	0.4	20	A	2.00	8.491	1.200	0.885	1.320	3.405
61	*Mollugo nudicaulis*	0.2	10	A	2.00	2.267	0.320	0.442	0.660	1.423
62	*Oligochaeta ramosa*	0.2	20	A	1.00	1.710	0.242	0.885	0.660	1.787
63	*Panicum antidotale*	0.2	10	A	2.00	17.641	2.493	0.442	0.660	3.596
64	*Panicum turgidum*	0.3	20	A	1.50	214.785	30.3	0.88	0.99	32.2

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
							59	5	0	34
65	*Parthenium hysterophorus*	0.2	20	A	1.00	1.923	0.272	0.885	0.660	1.817
66	*Pedalium murex*	0.2	20	A	1.00	2.639	0.373	0.885	0.660	1.918
67	*Peristrophebicalyculata*	0.3	20	A	1.50	6.867	0.971	0.885	0.990	2.846
68	*Perotis indica*	0.2	20	A	1.00	4.245	0.600	0.885	0.660	2.145
69	*Phyllanthus fraternus*	0.4	20	A	2.00	3.419	0.483	0.885	1.320	2.688
70	*Phyllanthus niruri*	0.2	20	A	1.00	8.139	1.150	0.885	0.660	2.695
71	*Physalis minima*	0.2	20	A	1.00	2.639	0.373	0.885	0.660	1.918
72	*Polycarpaeacorymbosa*	0.2	20	A	1.00	2.903	0.410	0.885	0.660	1.955
73	*Polygala erioptera*	0.2	20	A	1.00	3.322	0.470	0.885	0.660	2.015
74	*Portulaca oleracea*	0.3	20	A	1.50	3.959	0.560	0.885	0.990	2.435
75	*Portulaca pilosa*	1.3	70	D	1.86	12.501	1.767	3.097	4.290	9.155
76	*Portulaca quadrifida*	0.1	10	A	1.00	1.385	0.196	0.442	0.330	0.968
77	*Pulicariacrispa*	0.2	20	A	1.00	1.710	0.242	0.885	0.660	1.787
78	*Sesamum indicum*	0.1	10	A	1.00	1.590	0.225	0.442	0.330	0.997
79	*Solanum nigrum*	0.2	20	A	1.00	3.468	0.490	0.885	0.660	2.035
80	*Solanum surattense*	0.4	40	B	1.00	7.235	1.023	1.770	1.320	4.113
81	*Sonchus asper*	0.2	20	A	1.00	4.245	0.600	0.885	0.660	2.145
82	*Sorghum halepense*	0.2	20	A	1.00	2.388	0.338	0.885	0.660	1.883
83	*Spermacocearticularis*	0.2	20	A	1.00	3.179	0.449	0.885	0.660	1.994
84	*Tephrosia purpurea*	0.8	60	C	1.33	13.288	1.878	2.655	2.640	7.173
85	*Trianthemaportulacastrum*	0.2	20	A	1.00	2.149	0.304	0.885	0.660	1.849

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
86	*Trianthema triquetra*	0.4	20	A	2.00	4.534	0.641	0.885	1.320	2.846
87	*Tribulus terrestris*	0.6	50	C	1.20	7.536	1.065	2.212	1.980	5.258
88	*Verbesinaencelioides*	0.2	20	A	1.00	2.769	0.391	0.885	0.660	1.936
89	*Vernonia cinerea*	0.4	40	B	1.00	6.359	0.899	1.770	1.320	3.989
90	*Xanthium strumarium*	0.1	10	A	1.00	1.320	0.187	0.442	0.330	0.959

Table 2 Phytosociological study of shrub Community at Ratan Nagarduringrainy season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Abutilon indicum*	0.3	30	B	1.00	2.722	2.102	3.704	3.158	8.963
2	*Aerva persica*	1.5	70	D	2.14	31.840	24.579	8.642	15.789	49.010
3	*Artemisia scoparia*	0.1	10	A	1.00	1.017	0.785	1.235	1.053	3.073
4	*Calligonumpolygonoides*	0.1	10	A	1.00	1.075	0.830	1.235	1.053	3.117
5	*Calotropis procera*	0.6	50	C	1.20	6.801	5.250	6.173	6.316	17.739
6	*Clerodendrumphlomidis*	0.6	60	C	1.00	7.164	5.530	7.407	6.316	19.253
7	*Cocculus pendulus*	0.2	20	A	1.00	1.923	1.485	2.469	2.105	6.059
8	*Crotalaria burhia*	1.2	80	D	1.50	12.208	9.424	9.877	12.632	31.932
9	*Cryptostegia grandiflora*	0.2	20	A	1.00	2.267	1.750	2.469	2.105	6.324
10	*Cucumis callosus*	0.2	20	A	1.00	2.149	1.659	2.469	2.105	6.234
11	*Cucumis melo*	0.2	20	A	1.00	1.923	1.485	2.469	2.105	6.059
12	*Ephedra foliata*	0.5	50	C	1.00	4.019	3.103	6.173	5.263	14.539
13	*Fagonia indica*	0.1	10	A	1.00	1.320	1.019	1.235	1.053	3.306
14	*Ipomoea cairica*	0.2	20	A	1.00	1.710	1.320	2.469	2.105	5.894

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
15	*Ipomoea pestigridis*	0.2	20	A	1.00	2.149	1.659	2.469	2.105	6.234
16	*Ipomoea sindica*	0.2	20	A	1.00	1.815	1.401	2.469	2.105	5.975
17	*Leptadeniapyrotechnica*	0.6	60	C	1.00	4.823	3.723	7.407	6.316	17.446
18	*Lyciumbarbarum*	0.3	30	B	1.00	12.550	9.688	3.704	3.158	16.550
19	*Merremiaaegyptia*	0.2	20	A	1.00	2.769	2.138	2.469	2.105	6.712
20	*Merremiadissecta*	0.1	10	A	1.00	2.042	1.576	1.235	1.053	3.863
21	*Mimosa hamata*	0.4	40	B	1.00	2.289	1.767	4.938	4.211	10.916
22	*Momordica balsamina*	0.3	30	B	1.00	1.846	1.425	3.704	3.158	8.287
23	*Mukiamadraspatana*	0.2	20	A	1.00	0.981	0.757	2.469	2.105	5.332
24	*Opuntia elatior*	0.1	10	A	1.00	0.380	0.293	1.235	1.053	2.580
25	*Pergulariadaemia*	0.3	20	A	1.50	11.872	9.164	2.469	3.158	14.791
26	*Withaniasomnifera*	0.1	10	A	1.00	0.962	0.742	1.235	1.053	3.030
27	*Zizyphusnummularia*	0.5	50	C	1.00	6.924	5.345	6.173	5.263	16.781

Table 4.24 Phytosociological study of tree Community at Ratan Nagar site I during rainy season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Acacia jacqemontii*	0.1	10	A	1.00	3.957	0.392	1.563	1.176	3.131
2	*Acacia nilotica*	0.2	20	A	1.00	64.698	6.415	3.125	2.353	11.893
3	*Acacia senegal*	1.4	80	D	1.75	121.165	12.014	12.500	16.471	40.984
4	*Acacia tortilis*	0.1	10	A	1.00	19.349	1.919	1.563	1.176	4.658
5	*Ailanthus excelsa*	0.1	10	A	1.00	52.253	5.181	1.563	1.176	7.920
6	*Albizia lebbeck*	0.1	10	A	1.00	5.150	0.511	1.563	1.176	3.250

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
7	*Azardirachta indica*	0.3	30	B	1.00	213.365	21.156	4.688	3.529	29.373
8	*Balanites aegyptiaca*	1.1	70	D	1.57	207.456	20.570	10.938	12.941	44.448
9	*Capparis decidua*	0.1	10	A	1.00	8.328	0.826	1.563	1.176	3.565
10	*Cordia dichotoma*	0.1	10	A	1.00	4.183	0.415	1.563	1.176	3.154
11	*Dalbergia sissoo*	0.1	10	A	1.00	32.669	3.239	1.563	1.176	5.978
12	*Maytenusemarginata*	1.2	80	D	1.50	39.800	3.946	12.500	14.118	30.564
13	*Melia azedarach*	0.1	10	A	1.00	1.194	0.118	1.563	1.176	2.857
14	*Moringa oleifera*	0.1	10	A	1.00	71.595	7.099	1.563	1.176	9.838
15	*Parkinsonia aculeata*	0.1	10	A	1.00	2.289	0.227	1.563	1.176	2.966
16	*Prosopis cineraria*	1.1	80	D	1.38	97.023	9.620	12.500	12.941	35.061
17	*Prosopis juliflora*	1.1	70	D	1.57	44.764	4.438	10.938	12.941	28.317
18	*Ricinus communis*	0.1	10	A	1.00	1.385	0.137	1.563	1.176	2.876
19	*Salvadoraoleoides*	0.1	10	A	1.00	2.042	0.202	1.563	1.176	2.941
20	*Salvadora persica*	0.5	50	C	1.00	7.948	0.788	7.813	5.882	14.483
21	*Tamarixaphylla*	0.1	10	A	1.00	1.320	0.131	1.563	1.176	2.870
22	*Tecomellaundulata*	0.3	30	B	1.00	6.615	0.656	4.688	3.529	8.873

Table 3 Phytosociological study of herbaceous Community at Ratan Nagar during winter season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Aloe vera*	0.1	10	A	1.00	2.205	1.429	1.887	1.333	4.649
2	*Argemone mexicana*	0.1	10	A	1.00	0.531	0.344	1.887	1.333	3.564
3	*Asphodelus tenuifolius*	0.2	20	A	1.00	1.145	0.742	3.774	2.667	7.182

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
4	*Blepharissindica*	0.1	10	A	1.00	0.415	0.269	1.887	1.333	3.489
5	*Cenchrus setigerus*	0.1	10	A	1.00	0.962	0.623	1.887	1.333	3.843
6	*Chenopodium album*	1.4	70	D	2.00	11.254	7.294	13.208	18.667	39.168
7	*Chenopodium murale*	0.4	30	B	1.33	3.419	2.216	5.660	5.333	13.210
8	*Croton sparsiflorus*	0.1	10	A	1.00	1.385	0.897	1.887	1.333	4.118
9	*Cynodondactylon*	0.1	10	A	1.00	2.042	1.323	1.887	1.333	4.543
10	*Cyperus rotundus*	0.1	10	A	1.00	0.380	0.246	1.887	1.333	3.466
11	*Datura innoxia*	0.1	10	A	1.00	32.669	21.173	1.887	1.333	24.393
12	*Echinopsechinatus*	0.1	10	A	1.00	3.317	2.150	1.887	1.333	5.370
13	*Erianthusmunja*	1.3	60	C	2.17	54.382	35.247	11.321	17.333	63.901
14	*Heliotropiummarifolium*	0.1	10	A	1.00	0.754	0.489	1.887	1.333	3.709
15	*Heliotropiumovalifolium*	0.1	10	A	1.00	0.855	0.554	1.887	1.333	3.774
16	*Launaea procumbens*	0.2	20	A	1.00	1.815	1.176	3.774	2.667	7.617
17	*Parthenium hysterophorus*	0.1	10	A	1.00	1.075	0.697	1.887	1.333	3.917
18	*Pedalium murex*	0.1	10	A	1.00	1.385	0.897	1.887	1.333	4.118
19	*Portulaca pilosa*	0.2	20	A	1.00	2.903	1.881	3.774	2.667	8.322
20	*Pulicariacrispa*	0.1	10	A	1.00	1.134	0.735	1.887	1.333	3.955
21	*Solanum nigrum*	0.1	10	A	1.00	1.320	0.855	1.887	1.333	4.075
22	*Solanum surattense*	0.1	10	A	1.00	1.194	0.774	1.887	1.333	3.994
23	*Sorghum halepense*	0.2	20	A	1.00	2.639	1.711	3.774	2.667	8.151
24	*Tephrosia purpurea*	1.5	80	D	1.88	17.910	11.608	15.094	20.000	46.702
25	*Tribulus terrestris*	0.2	20	A	1.00	3.179	2.06	3.77	2.66	8.50

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
							1	4	7	1
26	*Verbesinaencelioides*	0.1	10	A	1.00	1.256	0.814	1.887	1.333	4.034
27	*Xanthium strumarium*	0.2	20	A	1.00	2.769	1.795	3.774	2.667	8.235

Table 4Phytosociological study of shrub Community at Ratan Nagar siteduring winter season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Aerva persica*	0.1	10	A	1.00	2.123	2.716	2.000	1.429	6.144
2	*Calligonumpolygonoides*	0.1	10	A	1.00	1.075	1.375	2.000	1.429	4.804
3	*Calotropis procera*	0.3	30	B	1.00	3.401	4.351	6.000	4.286	14.637
4	*Clerodendrumphlomidis*	1.5	70	D	2.14	17.910	22.915	14.000	21.429	58.344
5	*Cocculus pendulus*	0.1	10	A	1.00	0.962	1.230	2.000	1.429	4.659
6	*Crotalaria burhia*	1.5	90	E	1.67	15.260	19.526	18.000	21.429	58.954
7	*Cryptostegia grandiflora*	0.1	10	A	1.00	1.134	1.450	2.000	1.429	4.879
8	*Ephedra foliata*	0.4	40	B	1.00	3.215	4.114	8.000	5.714	17.828
9	*Ipomoea pestigridis*	0.1	10	A	1.00	1.320	1.688	2.000	1.429	5.117
10	*Ipomoea sindica*	0.1	10	A	1.00	0.907	1.161	2.000	1.429	4.590
11	*Leptadeniapyrotechnica*	1.4	80	D	1.75	11.254	14.399	16.000	20.000	50.399
12	*Lyciumbarbarum*	0.2	20	A	1.00	8.367	10.705	4.000	2.857	17.562
13	*Mimosa hamata*	0.4	40	B	1.00	5.539	7.087	8.000	5.714	20.801
14	*Opuntia elatior*	0.1	10	A	1.00	2.042	2.612	2.000	1.429	6.041
15	*Withaniasomnifera*	0.1	10	A	1.00	0.572	0.732	2.000	1.429	4.161
16	*Zizyphusnummularia*	0.5	50	C	1.00	3.077	3.937	10.000	7.143	21.080

Table 5 Phytosociological study of tree Community at Ratan Nagar site during winter season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Acacia jacqemontii*	1	60	C	1.67	39.572	4.204	9.231	11.628	25.063
2	*Acacia nilotica*	0.1	10	A	1.00	32.349	3.437	1.538	1.163	6.138
3	*Acacia senegal*	1	70	D	1.43	86.546	9.195	10.769	11.628	31.592
4	*Acacia tortilis*	0.9	60	C	1.50	174.145	18.501	9.231	10.465	38.197
5	*Ailanthus excelsa*	0.1	10	A	1.00	52.253	5.551	1.538	1.163	8.252
6	*Albizia lebbeck*	0.1	10	A	1.00	5.150	0.547	1.538	1.163	3.248
7	*Azardirachta indica*	0.2	20	A	1.00	142.244	15.112	3.077	2.326	20.514
8	*Balanites aegyptiaca*	0.5	50	C	1.00	94.298	10.018	7.692	5.814	23.524
9	*Capparis decidua*	0.1	10	A	1.00	8.328	0.885	1.538	1.163	3.586
10	*Cordia dichotoma*	0.1	10	A	1.00	4.183	0.444	1.538	1.163	3.146
11	*Dalbergia sissoo*	0.1	10	A	1.00	32.669	3.471	1.538	1.163	6.172
12	*Maytenusemarginata*	1.1	60	C	1.83	36.483	3.876	9.231	12.791	25.897
13	*Melia azedarach*	0.1	10	A	1.00	1.194	0.127	1.538	1.163	2.828
14	*Moringa oleifera*	0.1	10	A	1.00	71.595	7.606	1.538	1.163	10.307
15	*Parkinsonia aculeata*	0.1	10	A	1.00	2.289	0.243	1.538	1.163	2.944
16	*Prosopis cineraria*	1.2	80	D	1.50	105.843	11.245	12.308	13.953	37.506
17	*Prosopis juliflora*	0.9	70	D	1.29	36.625	3.891	10.769	10.465	25.125
18	*Ricinus communis*	0.1	10	A	1.00	1.385	0.147	1.538	1.163	2.848
19	*Salvadoraoleoides*	0.1	10	A	1.00	2.042	0.217	1.538	1.163	2.918
20	*Salvadora persica*	0.4	40	B	1.00	6.359	0.676	6.154	4.651	11.481
21	*Tamarixaphylla*	0.1	10	A	1.00	1.320	0.140	1.538	1.163	2.841

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
22	*Tecomellaundulata*	0.2	20	A	1.00	4.410	0.469	3.077	2.326	5.871

Table 6 Phytosociological study of herbaceous Community at Ratan Nagar siteduring summer season.

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Aloe vera*	0.1	10	A	1.00	2.205	2.890	4.762	3.704	11.356
2	*Croton sparsiflorus*	0.1	10	A	1.00	1.385	1.815	4.762	3.704	10.281
3	*Datura innoxia*	0.1	10	A	1.00	32.669	42.818	4.762	3.704	51.284
4	*Echinopsechinatus*	0.1	10	A	1.00	3.317	4.347	4.762	3.704	12.813
5	*Erianthusmunja*	0.3	30	B	1.00	12.550	16.449	14.286	11.111	41.846
6	*Launaea procumbens*	0.1	10	A	1.00	0.907	1.189	4.762	3.704	9.655
7	*Parthenium hysterophorus*	0.1	10	A	1.00	1.075	1.409	4.762	3.704	9.874
8	*Sorghum halepense*	0.1	10	A	1.00	1.320	1.730	4.762	3.704	10.195
9	*Tephrosia purpurea*	1.4	80	D	1.75	16.716	21.909	38.095	51.852	111.856
10	*Verbesinaencelioides*	0.2	20	A	1.00	2.769	3.630	9.524	7.407	20.561
11	*Xanthium strumarium*	0.1	10	A	1.00	1.385	1.815	4.762	3.704	10.281

Table 7 Phytosociological study of shrub Community at Ratan Nagar during summer season

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Calligonumpolygonoides*	0.1	10	A	1.00	1.075	1.453	2.222	1.449	5.125
2	*Calotropis procera*	1.6	50	C	3.20	18.137	24.528	11.111	23.188	58.828
3	*Clerodendrumphlomidis*	1.1	70	D	1.57	13.134	17.762	15.556	15.942	49.260
4	*Cocculus pendulus*	0.1	10	A	1.00	0.962	1.301	2.222	1.449	4.972
5	*Crotalaria burhia*	0.4	40	B	1.00	4.069	5.504	8.889	5.797	20.190

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
6	*Ephedra foliata*	0.4	40	B	1.00	3.215	4.348	8.889	5.797	19.034
7	*Leptadeniapyrotechnica*	1.2	70	D	1.71	10.258	13.873	15.556	17.391	46.820
8	*Lyciumbarbarum*	0.2	20	A	1.00	8.367	11.315	4.444	2.899	18.658
9	*Mimosa hamata*	0.3	30	B	1.00	4.154	5.618	6.667	4.348	16.633
10	*Opuntia elatior*	0.1	10	A	1.00	2.042	2.761	2.222	1.449	6.433
11	*Withaniasomnifera*	0.2	20	A	1.00	1.145	1.548	4.444	2.899	8.891
12	*Zizyphusnummularia*	1.2	80	D	1.50	7.385	9.988	17.778	17.391	45.157

Table 8 Phytosociological study of tree Community at Ratan Nagar during summer season

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
1	*Acacia jacqemontii*	0.5	40	B	1.25	19.786	2.514	7.273	6.667	16.454
2	*Acacia nilotica*	0.1	10	A	1.00	32.349	4.111	1.818	1.333	7.262
3	*Acacia senegal*	1.1	70	D	1.57	95.201	12.098	12.727	14.667	39.492
4	*Acacia tortilis*	0.1	10	A	1.00	19.349	2.459	1.818	1.333	5.610
5	*Ailanthus excelsa*	0.1	10	A	1.00	52.253	6.640	1.818	1.333	9.792
6	*Albizia lebbeck*	0.1	10	A	1.00	5.150	0.654	1.818	1.333	3.806
7	*Azardirachta indica*	0.1	10	A	1.00	71.122	9.038	1.818	1.333	12.189
8	*Balanites aegyptiaca*	1	70	D	1.43	188.596	23.966	12.727	13.333	50.027
9	*Capparis decidua*	0.1	10	A	1.00	8.328	1.058	1.818	1.333	4.210
10	*Cordia dichotoma*	0.1	10	A	1.00	4.183	0.532	1.818	1.333	3.683
11	*Dalbergia sissoo*	0.1	10	A	1.00	32.669	4.151	1.818	1.333	7.303
12	*Maytenusemarginata*	0.4	40	B	1.00	13.267	1.686	7.273	5.333	14.292

Sr. No.	Plant Species	Density	Frequency	Class	Abundance	Dominance	RDm	RF	RD	IVI
13	*Melia azedarach*	0.1	10	A	1.00	1.194	0.152	1.818	1.333	3.303
14	*Moringa oleifera*	0.1	10	A	1.00	71.595	9.098	1.818	1.333	12.250
15	*Parkinsonia aculeata*	0.2	20	A	1.00	4.578	0.582	3.636	2.667	6.885
16	*Prosopis cineraria*	1.1	50	C	2.20	97.023	12.329	9.091	14.667	36.087
17	*Prosopis juliflora*	1.4	80	D	1.75	56.972	7.240	14.545	18.667	40.452
18	*Ricinus communis*	0.1	10	A	1.00	1.385	0.176	1.818	1.333	3.327
19	*Salvadoraoleoides*	0.1	10	A	1.00	2.042	0.259	1.818	1.333	3.411
20	*Salvadora persica*	0.4	40	B	1.00	6.359	0.808	7.273	5.333	13.414
21	*Tamarixaphylla*	0.1	10	A	1.00	1.320	0.168	1.818	1.333	3.319
22	*Tecomellaundulata*	0.1	10	A	1.00	2.205	0.280	1.818	1.333	3.432

Table 9 Ecological Diversity Indices of plant species at Ratan Nagar

Sr. No.	Season	Habit	H'	D	e
1	Rainy	Herb	4.305443	0.01722053	0.9568056
2		Shrub	2.9750258	0.06880886	0.9026617
3		Tree	2.5376938	0.10560554	0.8209832
4	Winter	Herb	2.6538236	0.11502222	0.8052048
5		Shrub	2.2198098	0.1477551	0.8006271
6		Tree	2.6152493	0.09302326	0.8460736
7	Summer	Herb	1.7540245	0.29766804	0.731485
8		Shrub	2.0959209	0.15059861	0.8434606
9		Tree	2.5408189	0.10897778	0.8219942

Conclusion:

The comprehensive phytosociological study conducted in the Ratan Nagar beed area of the Churu District, Rajasthan, highlights significant seasonal variations in floristic composition and community structure. During the rainy season, the herbaceous community is prominently dominated by species such as

Dactylocteniumaegyptium and Panicum turgidum, which exhibit high dominance and importance values, indicating their substantial roles in the community structure.

In the shrub community, Aerva persica emerged as the most dominant species, reflecting its critical ecological significance. The tree community is chiefly influenced by Acacia senegal and Balanites aegyptiaca, both of which display high dominance and importance values, signifying their pivotal roles in shaping the community structure during the rainy season.

In the winter season, the herbaceous layer sees significant contributions from species like Chenopodium album and Tephrosia purpurea, while the shrub community is dominated by Clerodendrumphlomidis and Crotalaria burhia. The tree community during winter is prominently shaped by Acacia senegal and Prosopis cineraria. The summer season reveals distinct shifts, with Tephrosia purpurea becoming significant in the herbaceous community, Calotropis procera in the shrub community, and Prosopis juliflora in the tree community. These findings underscore the dynamic nature of plant communities in this semi-arid region, demonstrating the resilience and adaptability of key species to varying climatic conditions, thereby maintaining the ecological balance and diversity throughout different seasons.

References:

1. Jeph, A., & Khan, J. B. (2019). Study on Some Threatened, Rare and Endangered Plant's Speciesin Reserve Forest Area of Jhunjhunu District, Rajasthan. *Indian Journal of Ecology*, *46*(4), 755–759.
2. Lovejoy, T. E. (1997). Biodiversity: what is it. *Biodiversity II. Understanding and Protecting Our Biological Resources*, 7–14.
3. Magurran, A. E. (1988). *Ecological diversity and its measurement*. Princeton university press.
4. 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.
5. Oosting, H. J., & Billings, W. D. (1942). Factors effecting vegetational zonation on coastal dunes. *Ecology*, *23*(2), 131–142.
6. Pielou, E. C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, *13*, 131–144.
7. Prance, G. T., Dixon, G. R., & Aldous, D. E. (2014). Biodiversity and green open space. *Horticulture: Plants for People and Places, Volume 2: Environmental Horticulture*, 787–816.
8. 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.
9. 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*.
10. Raunkiær, C., & Stowe, E. (1936). *Recherchesstatistiques sur les formations végétales*. United States Forest Service, Division of Silvics.
11. Roberts, P. R., &Oosting, H. J. (1958). Responses of Venus fly trap (Dionaea muscipula) to factors involved in its endemism. *Ecological Monographs*, *28*(2), 193–218.
12. Sanderson, M. A., Skinner, R. H., Barker, D. J., Edwards, G. R., Tracy, B. F., &Wedin, D. A. (2004). Plant species diversity and management of temperate forage and grazing land ecosystems. *Crop Science*, *44*(4), 1132–1144.
13. Shannon, C. E., & Weave, W. (1949). The mathematical theory of communication. In *The University of Illinois. Urbana, Chicago, London* (pp. 3–24).
14. Simpson, E. H. (1949). Measurement of diversity. *Nature*, *163*(4148), 688.
15. Tripathi, R. S., &Misra, R. (1971). *Phytosociological studies of the crop-weed association at Varanasi*.