International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 05-08-2025, Accepted: 04-09-2025, Published: 19-09-2025
Volume 10, Issue 9, 2025, Page No. 42-45

Phytodiversity assessment of jorbeer conservation reserve of Bikaner district, Rajasthan

Priyanka Devra, Smita Jain
Department of Botany, Govt. Dungar College, Bikaner, Rajasthan, India

Abstract
The present study investigates the phytodiversity and vegetation structure of the Jorbeer Conservation Reserve, located in Bikaner District of Rajasthan. Through systematic quadrat sampling and field surveys, the diversity, frequency, density, and dominance of plant species were calculated. In the study area, a total of 35 species belonging to 30 genera and 19 families were recorded. out of the 35 recorded species, 6 species were trees, 9 species were Shrubs, 20 species were herbaceous. In the study area invasive species Prosopis juliflora (Vilayati babool) were also observed. The Shannon-wiener diversity index and Simpson Dominance index indicated moderate diversity, with shrub and herbaceous species forming the major vegetative structure. The Shannon-wiener diversity index (H'), Simpson Dominance index (D) and Gini-Simpson Index of diversity (1-D) for different life forms lies between the range of 1.65 – 2.36, 0.120 – 0.216 and 0.754 – 0.880 respectively. The study provides essential baseline data for future conservation and habitat management strategies.

Keywords: Phytodiversity, jorbeer conservation reserve, vegetation structure, Bikaner Rajasthan

Introduction

A Conservation Reserve is a designated protected area focused on conserving biodiversity and natural resources. Unlike some other protected areas, it allows for the continuation of traditional rights and community-based practices, recognizing the importance of local communities in the stewardship of these lands. In India, the Conservation Reserve plays a crucial role as a protective zone, linking national parks, sanctuaries, and reserved forests. These reserves were established under the Wildlife (Protection) Amendment Act of 2002. There are currently 115 designated conservation reserves across India covering an area of approximately 5,548.75 square kilometers, which constitutes about 0.17% of the country's total geographical area, Wildlife Institute of India (WII). Rajasthan, with its varied topography and rich biodiversity, has designated 37 conservation reserves covering an area of 1782.81 square kilometers (Rajasthan Forest Department).

Phytodiversity plays a vital role in analyzing the structure and composition, and in thoroughly understanding the vegetation dynamics. Structure and diversity of vegetation both have significant functional roles in controlling ecosystem processes such as biomass production and cycling of water and nutrients (Gower *et al.* 1992) [2]. Understanding the floristic composition of a plant community is essential for grasping the overall structure and function of any ecosystem. Phytodiversity studies, especially in and around protected areas, provide baseline information. Pandey and Padhye (2007) [13] investigated the phytodiversity of Arid Machia Safari Park- Kailana in Jodhpur. Singh and Shrivastav (2007) [22] studied the biodiversity of the Ranthambhore tiger reserve in Rajasthan. Floristic studies of the Tal Chappar Wildlife Sanctuary of Rajasthan were documented by Bagoria *et al.* (2020). Phytodiversity of Seethal Bani Sacred groove in Jhunjhunu, Rajasthan, studied by Kumari and Gupta (2021) [10] and reported a total of 31 plant species belonging to 15 different families, with invasive species such as *Parthenium hysterophorus* and *Prosopis juliflora*. Malav *et al.* (2023) [11] described the comparative study of the phytosociological status of herbs and shrubs in the Nanta Forest Region, Rajasthan. Karel and Gena (2023) [9] gave a checklist of the angiosperm plants of Tal Chappar Wildlife Sanctuary. Analysing phytodiversity helps establish the community structure of an ecosystem. The Jorbeer Conservation Reserve, situated in the Bikaner district of Rajasthan, is part of the Thar Desert landscape and supports diverse flora and fauna. Despite its ecological significance, the plant diversity of this reserve remains underexplored. This study aims to evaluate the composition, diversity, and vegetation structure of the plant communities in Jorbeer Conservation Reserve to support biodiversity conservation and ecological restoration efforts.

Material and Methods

Study Area: The Jorbeer Conservation Reserve of Bikaner District (Rajasthan) is situated in the western part of the Thar Desert. Jorbeer is situated southeast of Bikaner at a distance of 10 km, which is both the district and sub-district headquarters of Jorbeer village. As per the 2009 status, Gadhwala is a gram panchayat of Jorbeer village. The geographical location of the area is 27º96' north latitude and 73º35' east longitude at a height of 234.84 MSL. The total geographical area of Jorbeer is 7583 hectares. Jorbeer Conservation Reserve experiences an arid climate characterized by intense heat and minimal precipitation. The climate of Jorbeer is dry with an average rainfall of 100 mm and temperature ranges from a minimum of -1 to -2 degrees in winter to a maximum of 49.5 degrees in summer. The winter month from November to February provides the most favorable climate for visiting Jorbeer Conservation Reserve with mild temperatures and optimal conditions for wildlife sighting and exploration.

Methodology: An extensive field survey was conducted over different seasons (winter, summer, monsoon and post-monsoon) from 2021-2022 in the Jorbeer Conservation Reserve. All the plant specimens were identified with the help of floras such as Flora of British India (Hooker, J. D., 1872-1997), Flora of Northeast Rajasthan (Sharma and

Tyagi, 1979) [16, 17], Flora of the Indian desert (M. M. Bhandari 1978 revised 1990) [3], The Flora of Rajasthan (Shetty and Singh, 1987-1993) [18, 19, 20], The Flora of Rajasthan (South and South east Rajasthan, Tiagi and Aery 2007) [24]. The families are organised according to Bentham & Hooker's classification system (1862-1883) with some modifications based on changes suggested by Hutchinson (1959) [8]. The information for each species, such as vernacular name, habitat, occurrence and life form, is collected. The species area curve methods (Misra, 1968) were used to calculate the Quadrat numbers and size, respectively. A total of 10 quadrats with quadrat size of 5m × 5m for trees, 20 quadrats of 3m × 3m for shrubs and 20 quadrates of 1m × 1m for herbaceous vegetation were randomly placed at study area. For trees, the diameter at breast height was measured at 1.37 m above ground level, while for shrubs and herbs, the collar diameter was recorded 2.5 cm above ground level. Total basal area is the sum of basal area of all species present in study area. Basal area was used to determine the relative dominance of a species**.** In accordance with Misra (1968), a quantitative analysis of vegetation for frequency, density, and dominance was done. The density, frequency, and basal area of a species are converted into relative density, relative frequency, and relative dominance. The Important Value Index (IVI) was obtained by sum the value of relative frequency, relative density, and relative dominance. Species diversity and dominance were evaluated by Shannon-wiener index (Shannon-Weaver, 1963) [15] and Simpson's index. The value of Shannon-wiener index and Simpson's index was calculated using Important Value Index (IVI) of species.

Important Value Index (IVI): IVI is a statistical measure that provides a comprehensive overview of a species' significance within a plant community. To express the dominance and ecological success of any species with a single value, the concept of the important value index has been developed. Philips (1959) [14] defined it as the total of relative density, relative dominance and relative frequency (Philips, 1959) [14]. All these parameters are calculated from the collected field data.
Important Value Index (IVI) = Relative Dominance + Relative Density + Relative Frequency.

Species Diversity and Dominance Indices
Species diversity refers to the number of species (species richness) and abundance of each species (species evenness) in a given area. Species diversity is measured through a combination of species richness and species evenness. The Shannon-Weiner index (H') is a popular ecological metric that combines species richness and evenness.

1. **Shannon-Weiner index of diversity (H'):** The Shannon-Weiner index (Shannon & Weaver, 1963) [15] is a diversity index that can have a value greater than one. Species diversity is higher when there are a large number of species with evenly distributed abundance, indicating low dominance. Shannon-Weiner diversity index (H') was calculated basis on the important value index. To calculate the Shannon-Weiner index (H) for a quadrat, use the formula:

$$H' = -\sum P_i \log P_i$$

Where, H' = Shannon index of diversity

$$P_i = \frac{n_i}{N} = \frac{\text{The important value index of i}^{th}\text{ species}}{\text{important value index of all species}}$$

2. **Simpson index of dominance (D):** The Simpson Dominance index (D) is also largely used, but it is inversely proportional to diversity. To address this limitation, the Gini-Simpson index of (1-D) is used. Simpson's index of Dominance was calculated using the important value of plant species. To calculate the Simpson Dominance index (D) for a quadrate, use the formula:

$$D = \sum (P_i)^2$$

Where D = Simpson index of dominance

$$P_i = \frac{n_i}{N} = \frac{\text{The important value index of i}^{th}\text{ species}}{\text{important value index of all species}}$$

3. **Gini-Simpson index of Diversity (1-D):** The Gini-Simpson index is directly proportional to diversity. The Gini-Simpson index of diversity is calculated by subtracting the Simpson Index (D) from 1. So, this value is directly proportional to diversity**.**

Result and Discussion
The present study provides a comprehensive analysis of the floristic diversity in the Jorbeer Conservation Reserve. In the study area, a total of 35 species belonging to 30 genera and 19 families were recorded. Among these, dicotyledons were represented by 29 species belonging to 25 genera and 17 families and monocotyledons by 6 species, 5 genera and 2 families. The proportional ratio of monocotyledons to dicotyledons is 1:8.5 of families, 1:5 of genera and 1:4.8 of species. In the present study, Fabaceae emerged as the dominant family, represented by 6 species from 3 genera followed by Poaceae with 5 species from 4 genera, and Asteraceae with 3 species from 3 genera. A similar investigation has been reported by Charan and Sharma (2016) and Sultana *et al* (2014) [23], which also reported Fabaceae and Poaceae as the most abundant families in Rajasthan. an analysis of plant habits revealed that out of the 35 recorded species, 6 were trees, 8 were Shrubs, 13 were herbs, 6 were grasses, and 2 were climbers. The vegetation structure of the Jorbeer Conservation Reserve was predominantly composed of herbaceous species, with a relatively smaller proportion of tree species. out of the total recorded plant species, herbaceous species accounted for 60 %, shrubs for 22.85 %, and tree only for 17.14%.
The ecological success of every species can be observed by the highest Importance Value Index (IVI). A species with higher value of IVI indicates its dominance, ecological success, effective regeneration potential, and its broad ecological amplitude. In the study area, trees constitute 17.14 % of the total specie. The higher values of relative density (31.25), relative frequency (26.47), and relative dominance (37.92) are recorded for *Prosopis juliflora* (Swartz.) DC. Prod. Among, the tree vegetation, the dominant tree species *Prosopis juliflora* (Swartz.) DC. Prod. occurred with the higher value of IVI (95.64) followed by *Acacia senegal* (Linn.) Willd. (72.26). The lower value of IVI recorded *Acacia tortilis* (Forssk.) Hayne. (20.04). Shrub species constitutes 22.85% of the total species. Among 8

species, 6 species of shrubs were recorded in the quadrat sample. In the shrub species, higher value of relative density (25.78), relative frequency (25.75) and relative dominance (71.42) was recorded in *Calotropis procera. Calotropis procera* found as the dominant shrub species, having the highest IVI (82.95) followed by *Ziziphus nummularia* (Burm. f.) Wt. & Arn. (53.34). *Cassia angustifolia* M. Vahl. showed lower value of IVI (20.21). A total of 21 herb, grass and climber species are recorded within the study area, which constitute 60% of all species. Among them, 14 species were observed in the quadrat sample. In the herbaceous vegetation, *Cleome viscosa* L. showed a higher value of relative density (25.22), and relative frequency (10.52), and relative dominance (51.38). The herbaceous layer was dominated by *Cleome viscosa* L. with the highest IVI value (87.60) followed by *Dactyloctenium aegyptium* (L.) P. Beauv (34.12). The species with high IVI value is always ecologically best-adapted species and those with low IVI value, are poorly adapted species.

The most commonly used diversity indices, such as Shannon-Weiner diversity index (H), Simpson index of dominance and Gini-Simpson index, were used to analyses phytodiversity in the study area for different growth forms. Shannon-Weiner diversity index (H') is the most widely used diversity index. H' is directly proportional to diversity. A higher value of Shannon-Weiner diversity index (H') reveals the variability in species types increased community heterogeneity, while a lower value indicates homogeneity in the community. Shannon-Weiner diversity index (H') was calculated based on the important value index. The value of the Shannon-Weiner diversity index (H') was calculated for tree vegetation as 1.65, for shrub vegetation as 1.68, and herbaceous vegetation as 2.364. The value of the Shannon-Weiner diversity index (H) for trees, shrubs and herbs lies between the range of 1.65 – 2.36. This diversity index of tree, shrub and herbaceous vegetation is comparable to that found in the Seethal Bani sacred grove in Jhunjhunu, Rajasthan, ranging between 0.868 – 2.539 (Kumari and Gupta, 2021) [10].

Simpson's Dominance index is also largely used, but it is inversely proportional to diversity. To address this limitation, the Gini-Simpson index of (1-D) is often used. The Gini-Simpson index of diversity is calculated by subtracting the Simpson Index (D) from 1. So, this value is directly proportional to diversity. Simpson's index of Dominance was calculated using the important value of plant species. The value of the Simpson index of dominance (D) for tree vegetation is 0.216, for shrub vegetation is 0.246, and for herbaceous vegetation is 0.12. A higher value of Simpson dominance index signifies a more homogenous community while, a lower value of Simpson dominance index indicates that dominance is more evenly distributed among many species. The value of the Simpson index of dominance (D) for trees, shrubs and herbs lies between the range of 0.120 – 0.216. This diversity index of tree, shrub and herbaceous vegetation is comparable to that found in the Seethal Bani sacred grove in Jhunjhunu, Rajasthan, ranging between 0.110 – 0.472 (Kumari and Gupta, 2021) [10].

The value of the Gini-Simpson index of (1-D) diversity for tree vegetation is 0.784, for shrub vegetation is 0.754, and for herbaceous vegetation is 0.880. The value of the Simpson index of dominance (D) for trees, shrubs and herbs lies between the range of 0.754 – 0.880 (Table 5.13). This diversity index of tree, shrub and herbaceous vegetation is comparable to that found in the Seethal Bani sacred grove in Jhunjhunu, Rajasthan, ranging between 0.528 – 0.890 (Kumari and Gupta, 2021) [10]. The value of both the diversity index, Shannon-Weiner diversity index (H'), and the Gini-Simpson index of (1-D) diversity is highest for herbaceous vegetation.

Table 1: Important Value Index (IVI) of Tree vegetation in the study area

S. No.	Plant species	RD	RF	R Do	IVI
1	Acacia Senegal (Linn.) Willd.	25	20.58	26.68	72.26
2	Acacia tortilis (Forssk.) Hayne.	6.25	8.82	5.33	20.04
3	Capparis decidua (Forssk.) Edgew.	8.33	11.76	5.05	25.14
4	Prosopis cineraria (L.) Druce.	14.58	17.64	9.55	41.77
5	Prosopis juliflora (Swartz.) DC. Prod.	31.25	26.47	37.92	95.64
6	Salvadora oleoides Decne.	10.41	14.70	15.73	40.84

Table 2: Important Value Index (IVI) of shrub vegetation in the study area

S. No.	Plant species	RD	RF	R Do	IVI
1	Aerva persica (Burm. f.) Merril.	16.40	15.15	0.54	32.09
2	Calotropis procera (Ait.) R. Br.	25.78	25.75	31.42	82.95
3	Cassia angustifolia M. Vahl.	8.6	9.09	2.52	20.21
4	Fagonia indica Burm. f.	25	18.18	2.08	45.26
5	Leptadenia pyrotechnica (Forssk.) Decne.	6.25	10.60	9.78	26.63
6	Ziziphus nummularia (Burm. f.) Wt. & Arn.	17.96	21.21	14.17	53.34

Table 3: Important Value Index (IVI) of herbaceous vegetation in the study area

S. No.	Plant species	RD	RF	R Do	IVI
1	Cassia italica (Mill.) Spreng.	0.96	4.38	9.39	14.73
2	Cenchrus biflorus Roxb.	5.76	8.77	0.69	15.22
3	Cenchrus ciliaris L.	7.21	5.26	0.96	13.43
4	Citrullus colocynthis (Linn.) Schard.	2.40	7.01	1.51	10.92
5	Cleome viscosa L.	25.22	10.52	51.38	87.60
6	Cucumis callosus (Rottl.) Cong.	1.28	4.38	0.55	6.21
7	Cyperus rotundus Linn.	7.05	6.14	1.65	14.84
8	Dactyloctenium aegyptium (L.) P. Beauv	15.32	10.52	8.28	34.12
9	Eragrostis ciliaris (Linn.) R. Br.	15.22	9.64	0.41	25.27

10	Euphorbia serpens Kunth.	5.28	12.28	2.72	20.28
11	Heliotropium curassavicum L.	7.37	7.90	1.65	16.92
12	Pulicaria crispa (Cass.) Benth. & Hook. F.	0.80	3.50	0.69	4.99
13	Tribulus terrestris L.	3.52	5.26	1.51	10.29
14	Verbesina encelioides (Cav.) Benth. & Hook. f. A. Gray.	2.08	4.38	17.95	24.41

R D- Relative Density, R F – Relative Frequency, R Do – Relative Dominance

Table 4: Phytodiversity indices of Tree, Shrub and Herbaceous vegetation

Habit	Shannon-Weiner diversity index (H')	Simpson dominance index (D)	Gini-Simpson diversity index (1-D)
Tree	1.65	0.216	0.784
Shrub	1.68	0.246	0.754
Herbs	2.36	0.12	0.88

Conclusion

This study provides the comprehensive account of floral diversity and vegetation structure in the Jorbeer Conservation Reserve. The vegetation structure observed in the study area reflects the region's arid climate characterized by low rainfall and ecological stress, where smaller, drought-resistant plant species outcompete taller woody vegetation. The dominance of herbaceous and shrub species contributes to ground cover, which plays a crucial role in preventing soil erosion, supporting wildlife, and maintaining ecological balance in arid landscape. The presence of diverse plant species, despite ecological constraints, highlights the adaptability and ecological value of desert flora. However, disturbance such as grazing, land degradation and invasive species threaten this fragile balance. Conservation planning, including vegetation monitoring and habitat restoration, is essential to sustain biodiversity in this arid system.

References

1. Bagoriya JK, Barupal G, Kapoor B. Floristic studies of Tal Chhapar Wildlife Sanctuary of Rajasthan, India. Journal of Phytological Research,2020:33(1):33–39.
2. Bhandari MM. Floral wealth and plant adaptation of the Indian desert. Desert Ecology Scientific Publishers, 1988, 89–109.
3. Bhandari MM. Flora of the Indian Desert. Scientific Publishers, 1978.
4. Bhandari MM. Flora of Indian Desert. MPS Repros, 1990.
5. Gena CB, Sharma KC. A note on vegetation of Rajasthan. Scientia,1988:31:19–26.
6. Gower ST, Vogt KA, Grier CC. Carbon dynamics of rockey mountain Douglas-fir. Influence of water and nutrient availability. Ecological Monographs,1992:62(1):43–65.
7. Hooker J.D. The Flora of British India. L. Reeve Co, 1–7, 1872–1897.
8. Hutchinson J. The families of flowering plants. 2nd ed. Clarendon Press, 1959, 1–2.
9. Karel A, Gena D. A checklist of the angiosperms of Tal Chhapar Wildlife Sanctuary, Rajasthan, India. Journal of Phytological Research, 2023, 36(1).
10. Kumari S, Gupta P. Studies on phytodiversity of Seethal Bani Sacred grove in Jhunjhunu, Rajasthan. Turkish Online Journal of Qualitative Inquiry, 2021, 12(9).
11. Malav A, Dadhich P, Jaiswal P. Comparative study of phytosociological status of herbs and shrubs in Nanta Forest Region, Rajasthan, India. Journal of Agriculture and Ecology Research International,2023:24(6):83–99.
12. Mishra R. Ecology Work Book. Oxford Publishing Company, 1968.
13. Pandey RP, Padhye PM. Studies on phytodiversity of Arid Machiya Safari Park Kailana in Jodhpur Rajasthan. Nelumbo, 2007, 15–78.
14. Philips E.A. Methods of vegetation study. Henry Holt Co. Inc, 1959.
15. Shannon CE, Weaver W. The Mathematical Theory of Communication. University of Illinois Press, 1963.
16. Sharma S, Tiagi B. Flora of North-East Rajasthan. Kalyani Publishers, 1979.
17. Shetty BV, Singh V. Flora of Rajasthan. Botanical Survey of India, 1987, 1.
18. Shetty BV, Singh V. Flora of Rajasthan. Botanical Survey of India, 1991, 2.
19. Shetty BV, Singh V. Flora of Rajasthan. Botanical Survey of India, 1993, 3.
20. Simpson E.H. Measurement of diversity. Nature,1949:163:188.
21. Singh V, Shrivastava AK. Biodiversity of Ranthambhore Tiger Reserve Rajasthan. Scientific Publishers, 2007.
22. Sultana A, Hussain MS, Rathore D.K. Diversity of tree vegetation of Rajasthan, India. International Society for Tropical Ecology,2014:55(3):403–410.
23. Tiagi B, Avery NC. Flora of Rajasthan South and South-east region. Himanshu Publication, 2007.