

Assessing Plant Species Diversity Indices in Arid Environment with Special Reference to Churu –Northeastern Part of The Thar Desert

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ABSTRACT

Quantitative data on patterns of distribution and diversity of community is necessary for conservation planning and sustainable utilization. This is the first study to document and analyse the phytosociological data of plants of northeastern Thar desert, with reference to Churu, Rajasthan state, India. The data was collected through stratified random sampling method by laying 515 sample plots. The study found 375 species belonging to 188 genera and 46 families. Species diversity (Shannon-Weiner diversity) in seven plant community types ranged between 2.59 and 3.18. The highest Shannon-Weiner diversity index ($H' = 3.18$) was found in *Aristida-Dichanthium* followed by *Sehima-Apluda* plants ($H' = 3.17$). The Simpson diversity index and Similarity index are quite different from each other reveals the uniqueness of these plant types. Based on our analysis we are concluding that, saline plants and swampy area plants are narrow-niched and ecologically unique. Analysis showed that plants of arid region of northeastern Thar desert with reference to Churu, Rajasthan have high species diverse communities and requires prioritization in the long term conservation planning.

Keywords: arid, zone, diversity indices, Churu, Thar desert, northeastern, plants



INTRODUCTION

Tropical plants are present nearer to the equator and characterized by the presence of hot weather throughout the year. Conservation of these arid zone plants is necessary to maintain biodiversity and to provide nutritious forages and to arrest desertification. The vegetation differs from forests in that the above ground vegetation is completely renewed each year. The length of growing season is determined by duration of rainy season. The increasing human and livestock populations have caused a serious stress on the plant resources. Investigation of species composition and sociological interaction of species in communities are integral part of vegetation ecology. It is necessary to conduct the phytosociological studies to understand the current status of vegetation, species richness, diversity, explain or predict its pattern, relationships, classification and distribution of plant communities for proper planning and conservation. Being located in arid zone, Churu, Rajasthan represents very high area (9,829 km²) under plants which occupies 2.9% of total geographical area of State of Rajasthan and somewhat lesser percentage in northeastern Thar desert area. So far, there is no comprehensive phytosociological study on plant ecosystems of arid zone of Churu district, Rajasthan have been undertaken.[1,2]

OBSERVATIONS

Phytosociological studies have been carried out to estimate species richness, species diversity and similarity among the plant types during post monsoon season. Stratified random samples were generated based on plant type map of Rajasthan. Accordingly sample plot data was collected from 515 square quadrats (each 1 × 1 m) and analysed in the study. The number of sample plots allocated in plant community types varies from 15 to 134 (*Lasiurus-Panicum* plants, *Cenchrus-Dactyloctenium* plants, *Aristida-Oropetium* plants, *Sehima-Apluda* plants, *Aristida-Dichanthium* plants, Saline and Swampy plants, Localities of sample plots were recorded using GPS. Voucher specimens were deposited at BSI, Jodhpur and ML Sukhadia University, Udaipur. Apart from field identification, the names of species were further confirmed with the Flora and Plantlist database.[3,4]



Aristida



Dichanthium

Importance Value Index (IVI) depicts the sociological structure of a species in its totality in the community. IVI as a function of relative density, relative frequency and relative abundance was calculated to know dominance and association of species. Based on the IVI values the predominant 2-5 species were considered as representatives of community communities. Shannon and Weiner index was calculated as per Shannon and Weiner (1963) and Simpson index was calculated as per Magurran (2004). Proportion of species of grasses, legumes and other herbs (forbs) were evaluated to find out the biological distinction. Similarity between the communities was determined using Sorenson's index of similarity based on incidence of occurrence (Sorenson, 1948).[5,6]



Cenchrus

DISCUSSION

Altogether 375 species belonging to 188 genera and 46 families were recorded. The predominant plants observed were *Aristida funiculata*, *Cenchrus biflorus*, *Dichanthium pertusum*, *Heteropogon contortus* and *Lasiurus scindicus*. Shannon-Weiner diversity in plant types ranged between 2.59 and 3.18. Analysis indicated high species diversity ($H' = 3.18$) in *Aristida-Dichanthium* plants represented by 188 species, 134 genera and 35 families followed by *Sehima-Apluda* plants (3.17) with 181 species 120 genera and by 33 families, then *Cenchrus-Dactyloctenium* plants (3.01) with 145 species by 82 genera and 30 families. The species with highest IVI in Churu were *Lasiurus-Panicum* and *Lasiurus scindicus* (63.6) nearly double that of the next higher, *Panicum turgidum* (32.9). Following these were *Ochthochloa compressa* (17.3), *Indigofera cordifolia* (12.6) and *Aerva persica* (6.9). [7,8]



Indigofera cordifolia

The top five species in seven plant communities were responsible for 55.6% to 133.3% of the total IVI obtained in the individual types. The top five species in *Cenchrus-Dactyloctenium* plant community contributes 218.4% of IVI followed by Saline plants (164.9), swampy community plants, *Aristida-Oropetium* community (138.9), *Lasiurus-Panicum* plant community (133.3), *Sehima-Apluda* plant community (88.5) and

Aristida-Dichanthium community (55.6) indicates high resource sharing and predominance of few species. [9,10]



Dactyloctenium

Species density is a quantitative indicator of the numerical strength of species growing in an area. The highest density was recorded in *Lasiurus-Panicum* (115 individuals/m²) followed by *Aristida-Dichanthium* (101), *Sehima-Apluda* (100), *Aristida-Oropetium* (85), *Cenchrus-Dactyloctenium* (60), Swampy community (41) and Saline community (34). All plant community types show high number of species of forbs, but their representation was found to be less than 50% of population density of various grass species. *Aristida-Oropetium* community has highest (86.7%) cumulative percentage of individuals of all species followed by Swampy community (85%) and *Lasiurus-Panicum* community (84.6%). Forbs represent 46.1% of total population in saline community. Legumes occupy 11% of population in *Cenchrus-Dactyloctenium* community. [11,12]



Aerva persica

Similarity index value shows that less than 30% of species are common. High similarity (29%) was found between *Aristida-Dichanthium* community and *Sehima-Apluda* community types. Saline community are unique ecosystems and do not share any species common with other community. In case of swampy community only *Cynodon*

dactylon (Indian doob grass) is the ubiquitous species and found scattered in *Aristida-Dichanthium* community and *Sehima-Apluda* community.[13,14]



Cynodon dactylon

Rarity of species -Singletons and doubletons were considered as rare and form about 11% (42 species) of the total sampled area of northeastern Thar , Churu district. Rarity of species varies between seven community. The highest rarity was recorded in Saline community (28%), Swampy community (24%), *Cenchrus-Dactyloctenium* community (21%), *Lasiurus Panicum* community (20%), *Aristida-Oropetium* community (18%), *Sehima-Apluda* community (17%) and *Aristida-Dichanthium* community (11%). The species rarity in Rajasthan was found to be low as compared to different areas of western region of Thar.[15,16]



Lasiurus Panicum

RESULTS

The plant community of Churu district, Rajasthan have been broadly categorized as dry community . The Shannon, Simpson diversity indices and Similarity index of community types are quite different from each other reveals the uniqueness of these vegetation systems. *Lasiurus scindicus* community are climax vegetation systems adapted to very low rainfall (annual < 300mm) areas of northeastern Thar desert. *Lasiurus scindicus* (king of desert plants) and *Panicum turgidum* are

predominant species in this system and found in loose sandy soils[17,18]



Tephrosia purpurea

Lasiurus scindicus represents very high importance value index (63.6) among *Lasiurus-Panicum* plant community . The study conducted in three sites of Churu district provides clear picture of grazing pressure . Site I with no grazing had 9200 tussocks/ha, Site II with controlled grazing had 8300 tussocks/ha and Site III with open (uncontrolled) grazing had only 5700 tussocks/ha. *Cenchrus-Dactyloctenium* community shows dominance of both grass (*Cenchrus biflorus*, *Dactyloctenium scindicum*, *Aristida adscensionis*) and non grass species (*Farsetia hamiltonii*, *Crotalaria burhia*, *Tribulus terrestris*, *Tephrosia purpurea*, *Aerva persica*, *Indigofera cordifolia*). It was distributed throughout central and eastern part of Rajasthan desert. This community receives annual rainfall of 300 mm to 550 mm.[18]



Tribulus terrestris



Farsetia hamiltonii

CONCLUSIONS

The present work is an attempt to provide information on phytosociological aspects to understand the species diversity patterns of northeastern arid zone plants of Thar with reference to Churu district. Some of the best plant systems observed in biological reserves. There is an urgent need to understand the affect of ongoing anthropogenic pressure on the species diversity of plants to prepare long term conservation plans.[19]

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