Environment and Ecology 41 (3B): 1773—1777, July—September 2023
Article DOI: https://doi.org/10.60151/envec/IHJM7356
ISSN 0970-0420

Phytosociological Studies of Tree Species Biodiversity in Sabarkantha District, Gujarat

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Received 6 March 2023, Accepted 17 June 2023, Published on 21 August 2023

ABSTRACT

The present work aimed to study the "Phytosociological Studies of Tree Species in Sabarkantha District, Gujarat" was conducted in the rural area 14 sites under Sabarkantha district village during the period of January to May 2022 have been presented and discussed in this chapter. Several field trips of duration 2 to 3 days were made at regular intervals to various part of Sabarkantha district, Gujarat. The study was done to assess the tree diversity ad species richness of the rural areas. A grand total 2085 tree presenting 55 species and 27 families were identified from the total area. Fabaceae was the dominant family. Each sampled trees was evaluated in the field in terms of species, species identification was done by on the basis of local and regional flora. All tree > 10 cm girth at breast height (dbh, 1.37m from the ground) were measured. The Shannon-Wiener index value increases with biodiversity. The higher the value of H, the higher the diversity of species in a particular community. The lower the value of H, the lower the diversity. The overall values for Shannon-Weiner index ranged between 0.99 and 1.16. Sites Chitariya and Kanadar have higher Shannon-Weiner index values whereas lower values have been recorded for sites Balisana and Chotasan. The values recorded in this index characterize the relative distribution of species in different sites. The value of Margalef index of species richness for the sites 1 to 14 varied between 5.78 and 8.61. Sites Nadri and Mahor had higher values, 8.61 and 8.32 respectively, while sites Balisana and Sitvada recorded relatively lower values, 5.78 and 6.39. The greater Margalef index of species richness values were proportional to the number of species found at each site.

Keywords Species diversity, Species richness, Shannon diversity index, Tree composition, Important index value.

INTRODUCTION

India has ancient history of use of plants in the indigenous system of medicine via; Ayurveda. There are estimated to be around 15,000 species of medicinal plants in India that are used in different system of Indian medicine. There are estimated to be around 2000 effective plant based formulations used in folk medicines and known to rural communities all over India. Around 10,000 designed formulations are available in the indigenous remedial texts. There are estimated to be over 7,843 herbs products manufacturing units in India. The growing demand for herbal products has led to a quantum jump in volumes of plant material traded within a across countries. Out of 13,720 sacred groves 29 sacred groves have been

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Fig. 1. Map of Sabarkantha district.

reported from Banaskantha district of Gujarat state by Yadav *et al.* (2010) and Mehta (2011).

The Gujarat state of India has the most large geographical zones of any Indian state, which is a clear indication of the state's high biodiversity. Biodiversity provides significant direct economic benefits to people. It comes in the form of raw materials for food, fuel, gum, fiber, resin, dye and insecticides. Regulation of the nutrient cycle is an important aspect of biodiversity as well. Phytosociology the branch of ecology concerned with the identification, analysis and classification of plants communities or plant association a mixture of species which lives in a habitat and is held to gather by common ecological tolerances farm a community. The study of plant community structure is called plant sociology or Phytosociology. Phytosociology is the study of the characteristics, classification, relationships and distribution of plant communities (The American Heritage Dictionary, 3rd Ed). It is useful to collect such data to describe the population dynamics of each species studied and how they relate to the other species in the same community. Subtle differences in species composition and structure may point to differing abiotic conditions such as soil moisture, light availability, temperature, exposure to prevailing wind. When tracked over time, species and individual dynamics can reveal patterns of response to disturbance and how the community changes over time. Gujarat state is endowed with a great diversity of natural ecosystem. The Gujarat state has largest number of big geographically zones amongst the state of India.

Study area

Poshina is situated in Khedbrahma taluka (Tehsil) of Sabarkantha district of North Gujarat which is depicted in Fig. 1. It is located 12 kms away from Ambaji-Khedbrama highway. It is separated into two ranges: 1) Poshina woodland range and 2) Other ranges. Poshina range of RDF, (Rehabilitation of Degraded Forests) 12978 hectares are covered by the Poshina forest range. Its northern and eastern portions connect to the state of Rajasthan, its western portion forms the western border of the Ambaji forest range in the Banaskantha district and its southern portion is home to the RDF Poshina range. The area's minimum and highest recorded temperatures are 100 C in the winter and 42^0C to 45^0C in the summer, 15th June to 15th August is a monsoon period. Biogeographically the area belongs to hilly tract of Aravalli Mountain

range. According to Gujarat State Forest Department (GSFD), it is an unclassified forest area (under section-4) and ecologically it comes under semiarid zone, Tropical dry deciduous forest-5A type (Champion and Seth 1968).

MATERIALS AND METHODS

Phytosociological studies of tree species for experimental sites the quadrat methods were used. The tree were measured and recorded by random sampling with 10 quadrats of 10 m×10 m in each study site. All plant species were recorded within each quadrat and these plants species were identified then counted and estimated their cover percentage.

The phytosociological parameters analysis was carried out after collecting the data of various species. Which include the value of Frequency, Density, Relative Frequency, Relative Density, Relative Dominance and Importance Value index (IVI) determined for each species of the community according to the formula given by Raunkiaer (1934). On the basis of Frequency, Density and Abundance, their values have been calculated with Relatives Frequency, Relative and Relative Dominance, which were added for the determination of Importance Value Index (IVI) of each species. The formula for the determination of relative frequency, relative density and relative dominance are given below.

The circumferences at breast height was taken for determination of tree basal area and calculated by πr^2 where r is the radius measured at 1.37 m height. The area of species was calculated by multiplying the mean tree basal area with density total basal area was used to determine the relative dominance of the species. For Total Basal Cover (TBC), the CBH of all individuals of all the species was measured and then the basal area (BA) of each species was calculated by using the formula :

$$\text{Density} = \frac{\text{Total number of individuals in all sampling units}}{\text{Total number of sampling units studied}}$$

(Rao *et al*. 2015)

$$\text{Frequency} = \frac{\text{Number of sampling units in which species occur}}{\text{Total number of sampling units}} \times 100$$

(Rao *et al*. 2015)

Dominance=Density for a species×Average basal area of the species

Basal area

It is the area occupied by the base of a tree, is considered as a good indicator of the size, volume or weight of a tree. It provides information on the proportion or dominance of the larger and smaller trees in an ecosystem and is one of the most important parameters in estimating the standing biomass in an area.

Basal area = $Cbh^2 / 4\pi$

(Rao *et al.* 2015)

Where Cbh = Circumference of the tree at breast height.

Usually after the quantitative estimation of relative values of density, frequency and dominance, the species are listed in order of decreasing importance.

Important value index (IVI)

IVI=Relative density+Relative frequency+Relative dominance

(Shahid and Joshi 2016)

$$\text{Relative density} = \frac{\text{Density value of species}}{\text{Sum of density value of all species}} \times 100$$

(Shahid and Joshi 2016)

$$\text{Relative frequency} = \frac{\text{Frequency value of species}}{\text{Sum frequency value of all species}} \times 100$$

(Shahid and Joshi 2016)

$$\text{Relative dominance} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all species}} \times 100$$

(Shahid and Joshi 2016)

Simpson's index (1949) : Species dominance is measured by using this index,

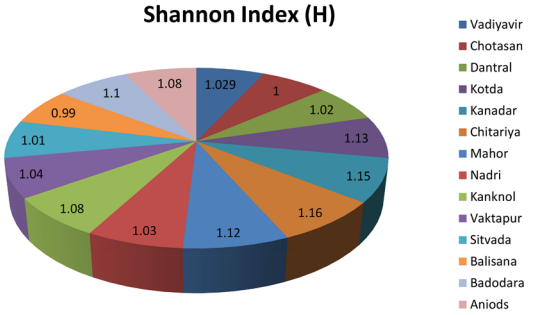

Fig. 2. Diagram showing shannon index of all experimental sites in the rural areas of Sabarkantha district, Gujarat.

$Cd = \Sigma (ni / N)^2$
ni = Importance value index of ith species
N = Sum of importance value index of all the species

Shannon wiener index (1963)

It is also called species diversity index. The natural logarithm of the total no. of species. This index is based on information theory and improves upon the Simpson's by giving more importance to the rare species. Therefore to get a clear picture of species dominance we use this method.

$H = \Sigma (ni / N) \log (ni / N)$

ni = Importance value index of i^{th} species

N = Sum of importance value index of all the species

Measurement of species richness

Margalef's index was used as a simple measure of

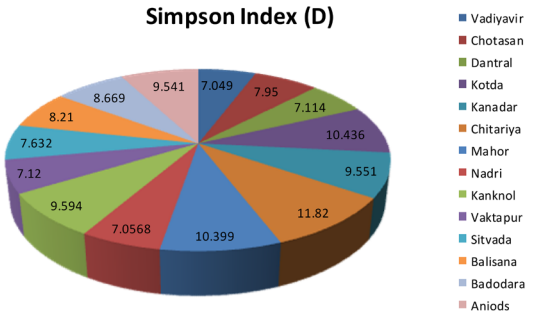

Fig. 3. Diagram showing simpson index values of all experimental sites under rural areas of Sabarkantha district, Gujarat.

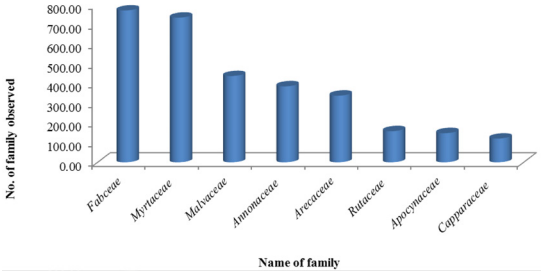

Fig. 4. The most prevalent families found in the research area.

species richness (Margalef 1958).

$$\text{Margalef' s index} = \frac{(S-1)}{\text{In } N}$$

S = Total number of species
N = Total number of individuals in the sample
In = Natural logarithm

RESULTS AND DISCUSSION

Tree species composition and distribution

The diversity and vegetation composition recorded in (10×10) m². Each quadrant with (10×10) m² was laid down randomly viz, North-West, North-East, and South-East and South-West direction from the center respectively. Several field trips of duration 2 to 3 days were made at regular intervals to various part of Sabarkantha district Gujarat. The study was done to assess the tree diversity ad species richness of the rural areas. A grand total 2085 tree presenting 55 species and 27 families were identified from the total area. Fabaceae was the dominant family. Each sampled trees was evaluated in the field in terms of species, species identification was done by on the basis of local and regional flora. All tree > 10 cm girth at breast height (dbh, 1.37m from the ground) were measured. All recorded with the aid of the local floras, trees in the field were recognized down to the species level (Gamble and Fisher 1915-1935; Mayuranathan 1929).

Comparison between species diversity and richness at rural and urban area

Richness and diversity of tree species were recorded

Table 1. Species diversity and richness of experimental sites in the rural areas of Sabarkantha district, Gujarat.

Sl. No.	Name of site	Total no. of species reported	Total no. of families	Shannon index (H)	Simpson index (D)	Species richness (SR)
1	Vadiyavir	19	11	1.029	7.049	8.21
2	Chotasan	15	12	1.00	7.950	6.80
3	Dantral	15	10	1.02	7.114	6.68
4	Kotda	18	12	1.13	10.436	7.63
5	Kanadar	20	15	1.15	9.551	7.86
6	Chitariya	17	12	1.16	11.820	7.29
7	Mahor	19	15	1.12	10.399	8.32
8	Nadri	21	16	1.03	7.0568	8.61
9	Kanknol	18	11	1.08	9.594	8.03
10	Vaktapur	17	13	1.04	7.120	7.157
11	Sitvada	14	10	1.01	7.632	6.39
12	Balisana	12	10	0.99	8.210	5.78
13	Badodara	18	12	1.10	8.669	8.29
14	Aniods	16	12	1.08	9.541	6.91

in each site by using Shannon diversity and Simpson's index. The Shannon diversity index is usually used to describe species diversity in a community. The extreme species diversity in a rural area was found at site- Chitariya, Kotda, Mahor, Kanknol, Kanadar, Aniods, Badodara, Balisana, Chotasan, Sitvada, Vaktapur, Dantral, Nadri and Vadiyavir. Species richness varied from 5.78 to 8.61 and Shannon index varied from 0.99 to 1.16. The findings have been included all experimental sites of the rural area of Sabarkantha district Gujarat presented in Table 1 and Figs. 2, 3–4.

CONCLUSION

According to the study areas have a high species richness and variety of trees. In terms of plant cover, the rural area Sabarkantha district of Gujarat has more green spaces and appropriate vegetation, which is one of the most significant assessments of the research to be taken into consideration for the preservation of environmental health. The study gives us the knowledge we need to investigate and define biodiversity through scientific analysis, as well as basic facts about the woody plant. The diversity of the woody species in the experimental region was counted using the Shannon diversity index as a measure of species abundance and richness. Rural areas have higher Shannon diversity indices than metropolitan areas. The research's findings and inquiry can be helpful to policy makers and the regions in delivering priceless ecosystem services like carbon sequestration and pollution abatement to the environment and managing habitat and cultural resource values in the studied area.

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