

Vegetation in the Sacred Groves Across India: A Review

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Abstract

Ethno-botany is a scientific study related to traditional knowledge, local culture and customs of a people and plants specifically with regard to practical uses. Sacred groves are located in different parts of India have diverse culture, religion, rituals, festivals, traditions associated with the people living in these area. These groves are treasure house of flora and fauna. This study aims to prepare a qualitative review including the details of vegetation composition of sacred grove in five different zones of India. The vegetation data was analysed by Shannon index (Shannon and Weaver 1949) and Evenness, Simpson's index (Simpson 1949) and Sorenson's Coefficient (CC). This study will help in planning as a protocol for the conservation of the plant species.

Keywords: Sacred Groves, Vegetation, Statistical tools, Threats, Conservation

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INTRODUCTION

The term "Ethno-botany" was coined by J. W. Harshberger in 1895 to indicate plants used by the indigenous population. "Ethno" refers to a study of people and "botany" to the study of the plants. It represents relationship between plant and human in all phases, the effect of plant on environment and in turn on human society [13]. From the time immemorial plants have been playing a major role in the development of human civilisation and culture [37]. Sacred groves are ancient landscape that occur in many parts of India, particularly where the indigenous communities live viz.

Western Ghats, Central India, Eastern India, Northeast India, etc. It is also found not only in India but also reported from many countries extending from Asia, Africa, Europe and America. It has been reported that the present occurrence of sacred groves is mostly limited in Africa and Asia [80]. The groves provide climax vegetation and demonstrate diversity in species of trees and other various life forms. Sacred groves also provide environmental and socio-economic benefits to the local communities [54]. Sacred sites and sacred forests all across the globe have been conserved for spiritual, cultural, economic and aesthetic

purposes [35]. Human involvement in natural systems have resulted in huge changes in vegetation composition and distribution patterns [9]. The necessity of natural resources sustainability for human survival has given way to traditional laws and practices.

This system obviously would help in conserving the surrounding natural resources [4]. All efforts have been made towards the sustainable development by implementing conservation of species and nations which aims a appeal for moral concern and with the conformity of aspects including pattern, structure of resource management [31].

In India, a good number of studies have been conducted on sacred groves in regards to ethno-botanical plants. Based on published literatures, effort has been made to maintain & manage the collected records and information in consolidated form towards reviewing the vegetation details of sacred groves. The main idea of this article is (a) to analyse the bio-diversity aspects as well as the vegetation details in five zones of India and to be (2) to find out the different aspects of threats which will help for planning a protocol for the conservation of the plants.

STUDY AREA

The country was divided into six broad geographical regions i.e. North-East India, Northern India, Eastern India, Western India, Central India and South India. The regions considered are:

North-East India – Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya.

Eastern India – West Bengal, Bihar, Jharkhand, Orissa.

Northern India – Uttar Pradesh, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Jammu & Kashmir.

Western India – Rajasthan, Gujarat;

Central India – Madhya Pradesh, Chhattisgarh (Figure A1)

The Study Area of Five Zones

There are 346 sacred groves all over five zones of different parts of India, which are marked on Google Earth as shown in Figure A2.

METHODOLOGY

Secondary data was collected from various sources, published literatures and websites to make further analysis. The following method has been adopted.

Data Collection

The data available from published papers in regards to ethno-botanical plants of sacred groves has been compiled. Information collected includes plants, family, plant forms, and their distribution, number of sacred groves, tribes and threats.

Data Analysis

Proportions like plant families, habit and frequency were computed.

Statistical analysis

Dominant families and their corresponding species were considered the analysing the following biodiversity factors:

Species richness -The number of species considered on the basis of area is a measure of richness. The more species present in a area, the 'richer' the area. Evenness is a measure of the relative abundance of the different species making up the richness of an area.

A diversity index is a mathematical measure of species diversity in a given community. Based on the species richness (the number of species present) and species abundance (the number of individuals per species).

In the Shannon index, **p** is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), **ln** is the natural log, Σ is the sum of the calculations, and **s** is the number of species.

$$\text{Shannon Index (H)} = -\sum_{i=1}^s p_i \ln p_i$$

$$\text{Evenness} = E = H/H_{\max}$$

Where H_{\max} is Maximum Diversity possible. In the Simpson index, **p** is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), Σ is still the sum of the calculations, and **s** is the number of species.

$$\text{Simpson Index (D)} = \frac{1}{\sum_{i=1}^s p_i^2}$$

Community Similarity

Sorenson's coefficient gives a value between 0 and 1, the closer the value is to 1, the more the communities have in common. a. Complete community overlap is equal to 1; complete community dissimilarity is equal to 0.

The equation is:

$$\text{Sorenson's Coefficient (CC)} = 2C/(S1+S2)$$

Where C is the number of species the two communities have in common, S1 is the total number of species found in community 1, and S2 is the total number of species found in community 2 [82].

Determination on threat

International Union of Conservation of Nature and Natural Resources (IUCN) categories of threat status - rare, endangered plant species.

The objective of this endeavour is creating awareness about the importance of threatened species and conservation priorities at the local level.

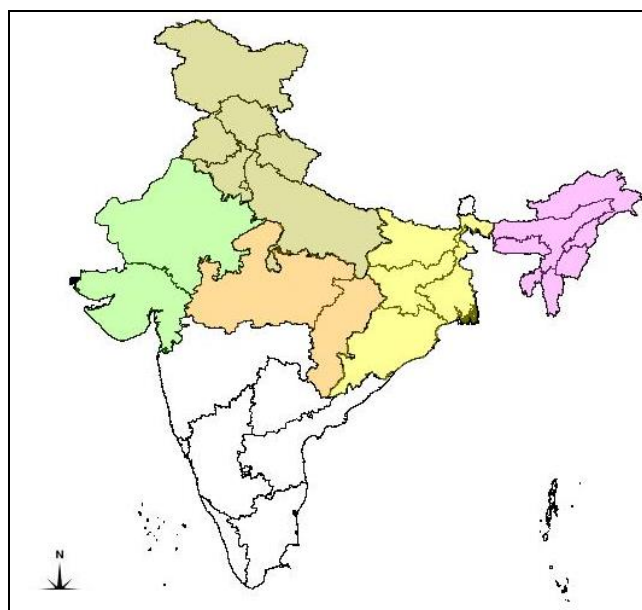


Fig. A1- Five Zones of Study Area.



Fig. A2: Spatial Distribution of Sacred Groves.

RESULTS AND DISCUSSION

Species Composition

From the review we have found 1740 number of plant species and out of that Angiosperms represents maximum 90.45% followed by lichen 4.11 %, pteridophyte 1.77%, gymnosperms with 1.2%, bryophyte with 0.4%, mosses 0.51% and algae 0.28%, the results is depicted in Figure 1. The analysis reveals that lichen have 12 families and 49

genera, pteridophyte represents 12 families and 15 genera, where gymnosperms with 6 families and 10 genera, bryophyte with 7 families and 7 genera, mosses 8 families and 8 genera and algae 3 families and 4 genera. Dominant family of each flowering and non flowering plants are represented in the Figure 2. The review highlight the angiosperm family than lower groups. The floristic study shows a total of 1582 angiosperm species (1373 dicots

and monocot 209) belonging to 837 genera and 178 families were recorded from the five zone. Out of 178 families dicots shares 87.64 % of families and monocot 12.35% of families, Figure3. The dominant plant forms are trees (35.33%) followed by herbs (34.88%), shrubs (19.55%),climbers(8.21%), orchids(1.01%) and epiphytes(0.63) including 4 aquatic plants which are herbaceous in character, Figure 4.Highlight Leguminosae is the most dominant families with 293 species then Laminaceae with 226 species and Asteraceae with 197 species in this study region, as shown in Figure 5. Here some plant species are common among all zones are *Aegle marmelos*, *Azadirachta indica*,*Neolamarckia cadamba* and many more species. Some species found from 4 zones are *Albizia lebbeck*, *Dalbergia sissoo* and *Ficus glomerata* etc and many more from 2 zones in Figure 6. The total numbers of species represented in each five zone are mentioned in the Table 1 and Figure 6.

Statistical Analysis

The statistical analysis shows in terms of species diversity in descending order of each five zones, which are Northern >Eastern>North eastern>Central>Western and are represented in Table 2. In respect to the Sorenson's coefficient, the results give a picture of common similarity in terms of species between two zone,the highest value of 1 represents the similarity of the two communities and 0 as dissimilarity. Under Eastern zone community similarity show more with Western, followed by Central and Northern compare with other zones. Also North-Eastern has similarity with Northern zone, Table 3.

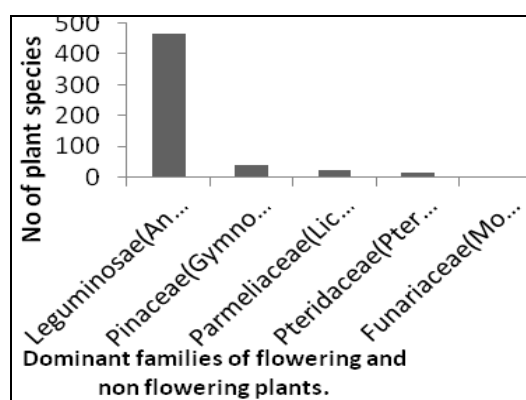


Fig. 1: Dominant Families of Each Flowering & non Flowering Plant.

Tribes and Taboos

From the review we have come across that the ethno-botanical plants have immense economical value that are used by tribal and local communities such as Kulta, Gonds, Santals, Koramudis, Meiti, Bodo, Kondhas, Bhatudi etc. These tribes follows some taboos such as cutting of trees, entry with shoes and leather accessories (made up of skin of animals) are strictly prohibited. Women are not allowed to enter in particular time, they offers different plant parts to the deities.

Threats

These patches have multiple disturbance factors like anthropogenic pressure, pollution, urbanization, soil erosion, logging, agriculture conversion of forest into land and road construction, fencing, silviculture invasion, over grazing, encroachment, developing industries, shifting social and cultural perspectives which put under threat category. The plant species herbs have 2 spp endangered, 1 spp critically endangered, 1 vulnerable, 33 spp under least concern, 1 data deficient, where tree species, have 4 spp endangered, 3 spp vulnerable, 18 spp least concern, 1 data deficient, shrub have 1spp near threatened, 7 spp least concern, climber have 5 spp least concern and even orchid also 1 spp endangered, 1 spp under least concern.

Table 1: Zone-wise Plant Species Density (Sacred Groves)

Zones	Plants Species
Western India	14.22%
North Eastern India	37.29%
Eastern India	16.18%
North India	35.52%
Central India	13.84%

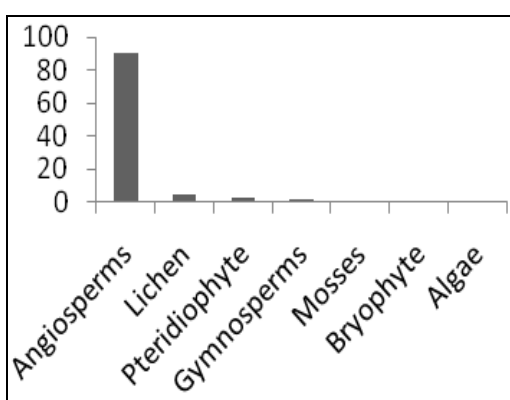


Fig. 1: Angiosperms Represent the Maximum Species.

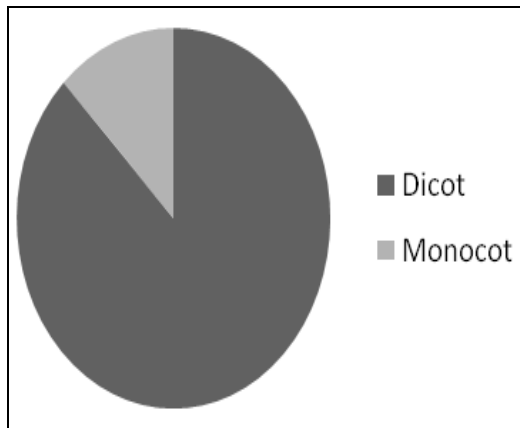


Fig. 3: Dicot have Highest Number of Families.

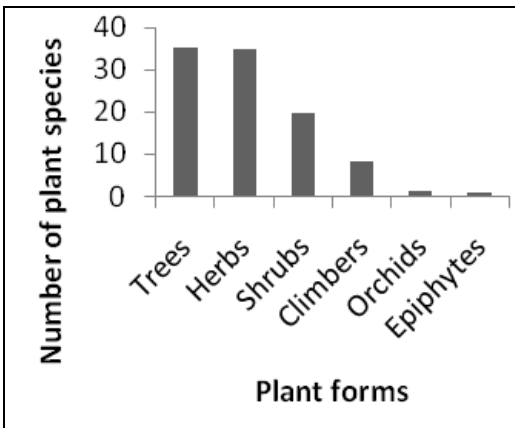


Fig. 4: Dominant Plant Forms Among 5 Zones

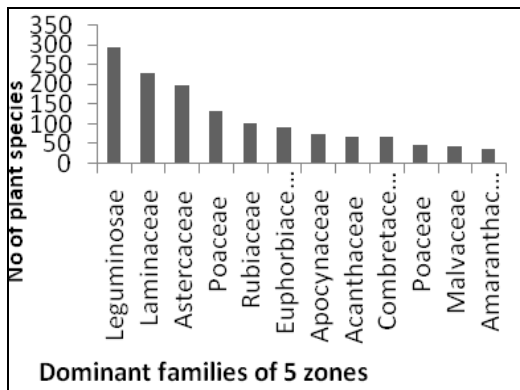


Fig. 5: Representing the most Dominant Families.

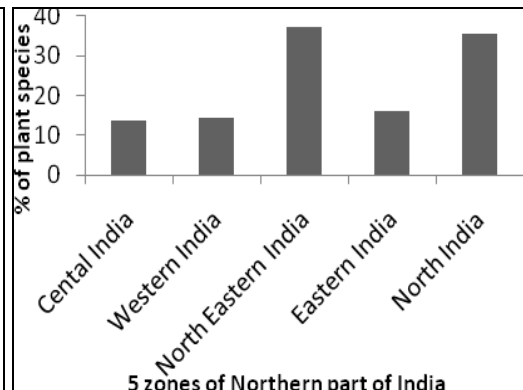


Fig. 6: Highest Number of Plant Species of Each 5 Zones.

Table 2: Plant Diversity (Sacred Groves) among the Five Broad Geographical Regions.

Zones	Species Richness	Shannon Index	Evenness	Simpson Index
North India	0.29	1.591	0.98	4.878
East India	0.34	1.566	0.97	4.629
North East India	0.27	1.554	0.96	4.484
Central India	0.43	1.527	0.95	4.219
West India	0.44	1.470	0.91	3.740

Table 3: Sorenson's Coefficient (Community Similarity) among the Five Broad Geographical Regions.

Zones & (No. Of Species)		East India (256)	North East India (870)	Central India (219)	North India (561)
East India (256)	C.C				
	C.S				
North East India (870)	C.C	44			
	C.S	0.08			
Central India (219)	C.C	70	44		
	C.S	0.08	0.08		
North India (561)	C.C	77	83	63	
	C.S	0.18	0.11	0.15	
West India (226)	C.C	62	34	57	60
	C.S	0.25	0.06	0.25	0.25

C.C.->Two Communities have Common species,
C.S.-> Community Similarity.

CONCLUSION

The study of plant species across regions of India shows its considerable importance and emphasise the need for development of strategies for the conservation of sacred groves through the involvement of local communities and the government. On the one hand, present study highlights the diversity of plant species in 5 zones by using diversity indices which helps to conserve towards regeneration of plant species. On the other hand, the community similarity signifies nearness or closeness of the two communities in terms of species composition useful in the ecological studies. The present information on threats requires urgent attention for conservation by creating local awareness and participatory management plans.

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Cite this Article

Sayantani Chanda, T.V.Ramachandra. Vegetation in the Sacred Groves across India: A Review. *Research & Reviews: Journal of Ecology*. 2019; 8(1): 29–38p.