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Phytodiversity study in natural forest of Pavagadh, Gujarat

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Abstract

Phytodiversity study was carried out in the natural, dry decidous forest of Pavagadh, Panchmahal district, Gujarat, India. This study was carried out in various vegetational stratas *i.e.*, the woody and the herbaceous layer. The heterogeneity in selection of sampling sites was reflected from the similarity index. The various phytosociological parameters like species richness, dominance and evenness index exhibited variations in both the strata in almost all the sites.

Key words : Dry deciduous, Forest, Phytodiversity, Vegetational strata

Introduction

Forest diversity is becoming a significant component as it is used and exploited variously for food, fodder, timber, medicines, recreation *etc*. The sustainability of forest ecosystem can be assessed only on the plant species therein (Gentry, 1992). Thus along with the understanding of floral diversity characteristics, the studies in relation to the other components *i.e.,* in terms of their quantitative characters have become imperative for their proper management. The present research therefore has been attempted in Pavagadh Forest to understand the phytodiversity, which is an important aspect of forest biology entailing the status and contribution of various species in structure and function of ecosystem.

Materials and Methods

Site of study : The study site lies between 73° 27'E –73° 36'E, 22° 25'N—22° 32' N in Halol taluka of Panchmahal district (Figure 1). The climate is temperate and it falls under Middle Gujarat Agro-climatic Zone – III. The winters are cold having minimum temperature up to 6ºC; whereas summers are hot with maximum temperature up to 45ºC. The monsoon strikes from the middle of June to the middle of September. The average annual rainfall of the area is 800-1000 mm/yr. The soil type is deep black to loamy sand (goradu) soil. According to forest type classification given by Champion and Seth (1968), it comes under Type 5A, Tropical dry deciduous forest. The hill is about 11 km in length from north to south with a width of 6.4 km. The unworkable area as declared by the forest department is 2811 acres. It is one of the well-known pilgrimage sites of Gujarat state. Champaner- a World Heritage Site is situated at the foothills (Anonymous, 2004). It has number of tanks and many archeological spots, which add value to it and make it a complete, beautiful landscape. Thus, it has many tourists' attraction, which is at the peak especially during Festival and Vacation period.

The field study period extended over the months of July-October 2008. Four sites were selected for the present study. The size and number of quadrates were determined by species area curve (Ambasht and Ambasht, 1995). Total 12 quadrates of 10x10 m for trees and 12 quadrates of 1x1 m were randomly placed for the herbaceous layer. Frequency, diversity, dominance, IVI (Importance Value Index), basal area and GBH (Girth at breast height) for both the layers were determined. (Curtis 1959). General Diversity Index (H), Species Richness Index (d2), Evenness Index (e) and Similarity Index were calculated after Shannon-Wiener (1963), Menhinick (1964), Pileou (1975) and Simpson (1949) respectively.

Results and Discussion

Phytodiversity: Total 21 species belonging to 14 families were recorded. All these families showed very less variation in terms of number of species. Certain families as Caesalpiniaceae, Euphorbiaceae, Apocynaceae and Mimoseae were more dominant and the remaining were monospecific (Table 1).

Vegetational composition in different strata of various sites:

Tree layer : Diversity value and similarly index of windy species found the area are presented in tables 2 and 3.

Table 1 : Plant diversity of study area

No.	Species	Family
1.	*Pongamia glabra* Vert.	Caesalpiniaceae
2.	*Cassia fistula* L.	Caesalpiniaceae
3.	*Cassia tora* L.	Caesalpiniaceae
4.	*Wrightia tinctoria* R.Br.	Apocynaceae
5.	*Wrightia tomentosa* R.S	Apocynaceae
6.	*Phyllanthus niruri* L.	Euphorbiaceae
7.	*Acalypha indica* L.	Euphorbiaceae
8.	*Acacia nilotica sp. Indica (*Bth) Brenan	Mimosaceae
9.	*Acacia leucophloea* (Roxb.) Wild	Mimosaceae
10.	*Zizyphus mauritiana* Lam.	Rhamnaceae
11.	*Zizyphus xylopyra* (Retz.)	Rhamnaceae
12.	*Tectona grandis* L.f	Verbenaceae
13.	*Lannea coromandelica* (Houtt) Merrill	Anacardiaceae
14.	*Boswellia serrata* Roxb.	Burseraceae
15.	*Morinda tomentosa* Heyne ex Roth.	Rubiaceae
16.	*Terminalia bellerica* (geartn.) Roxb.	Combretaceae
17.	*Cynodon dactylon* Pers.	Cyperaceae
18.	*Abutilon indicum* Sweet.	Malvaceae
19.	*Aster amellus* L.	Compositae
20.	*Corchorus capsularis* Lam.	Tiliaceae
21.	*Commelina benghalensis* L.	Commelinaceae

Site I : In this site, only four species were recorded. Of which the highest density (13.75/100m²) was recorded for *Tectona grandis* followed by *Acacia nilotica* (1.75/100m²), *Pongamia glabra* (0.5/100m²) and *Wrightia tinctoria* (0.125/100m²) and IVI values for *Tectona grandis* (250.68) was maximum followed by *Wrightia tinctoria* (16.23), *Pongamia glabra* (6.93) *and Acacia nilotica.* (6.08).

Table 2 : Plant diversity of the woody species

Details of Sites	General Diversity Index (H)	Species Richness Index (d2)	Index of Dominance	Evenness Index (e)
Site 1	0.303	0.48	0.003	0.51
Site II	0.736	0.73	0.003	0.77
Site III	0.592	0.68	0.013	0.98
Site IV	0.575	0.88	0.011	0.68

Table 3 : Similarity index of the woody species

	Site II	Site III	Site IV
Site I	0.46	0.54	0.75
Site II		0.50	0.30
Site III			0.36

Site II: This forest site had nine species. *Zizyphus mauritiana* exhibited maximum density (26.5/100m²) followed by *Tectona grandis* (18.00/100m²) *Wrightia tinctoria* (13.5/100m²), *Morinda tinctoria* (5/100 m²), *Zizyphus xylophyrus* (5/100m²), *Acacia nilotica* (4/100m²), *Lannea coromandelica* (2/100m²), *Boswellia serrata* and *Cassia fistula* (1.5/100m²). IVI values reflected that *Tectona grandis* (97.92) occupied first position followed by *Zizyphus mauritiana* (80.65), *Wrightia tinctoria* (46.99), *Zizyphus xylophyrus* (14.7), *Morinda tomentosa* (13.528), *Acacia nilotica* (13.208), *Boswellia serrata* (12.39), *Cassia fistula* (11.43) and *Lannea coromandelica* (8.94).

Site III: On this site, only four species were recorded. The highest density (3.3/100m²) was exhibited by *Wrightia tomentosa* followed by *Acacia nilotica* (3/100m²), *Pongamia glabra* (2.6/100m²) and Tectona *grandis* (2.3/100m²). The trend of IVI was *Acacia nilotica* (129.44), *Wrightia tomentosa* (62.22), *Tectona grandis* (55.71) and *Pongamia glabra* (52.67).

Site IV: This site had six species. The highest density was 19/100m² for *Tectona* grandis followed by *Acacia nilotica* (3.5/100m²), *Wrightia tinctoria* (3/100m²), *Morinda tomentosa* (1.5/100m²), *Terminallia bellerica* and *Acacia leucophloea* (1/100m²). The IVI values was highest for *Tectona grandis* (172.24), followed by *Acacia nilotica* (29.541), *Wrightia tinctoria* (26.558), *Terminallia bellerica* (20.590), *Morinda tomentosa* (20.533) and *Acacia leucophloea* (10.03).

Hebaceous layer : Diversity value and similarly index of herbaceous species are presented in tables 4 and 5.

Table 4 : Plant diversity of the herbaceous layer

Details of Sites	General Diversity Index (H)	Species Richness Index (d2)	Index of Dominance	Evenness Index (e)
Site 1	0.403	0.34	0.0015	0.84
Site II	0.494	0.48	0.0021	0.71
Site III	0.612	0.36	0.0007	0.87
Site IV	0.501	0.35	0.00104	0.83

Table 5 : Similarity index of the herbaceous layer

	Site II	Site III	Site IV
Site I	0.50	0.57	0.50
Site II		0.66	0.80
Site III			0.22

Site I: Herbaceous layer of this site had a very poor diversity. Only three species were recorded. The density of these species ranged from 3.5–18.5/m². Highest IVI was recorded for *Cassia tora* (156.25) followed by *Cynodon dactylon* (104.30) and *Acalypha indica* (39.41).

Site II: Poor variation was observed at this site also. Only four species were recorded and their density ranged from 0.5-31.5/m². The highest IVI was recorded for *Cynodon dactylon* (157.59) followed by *Cassia tora* (43.3), *Abutilon indicum* (35.86), *Aster amellus* (2.09).

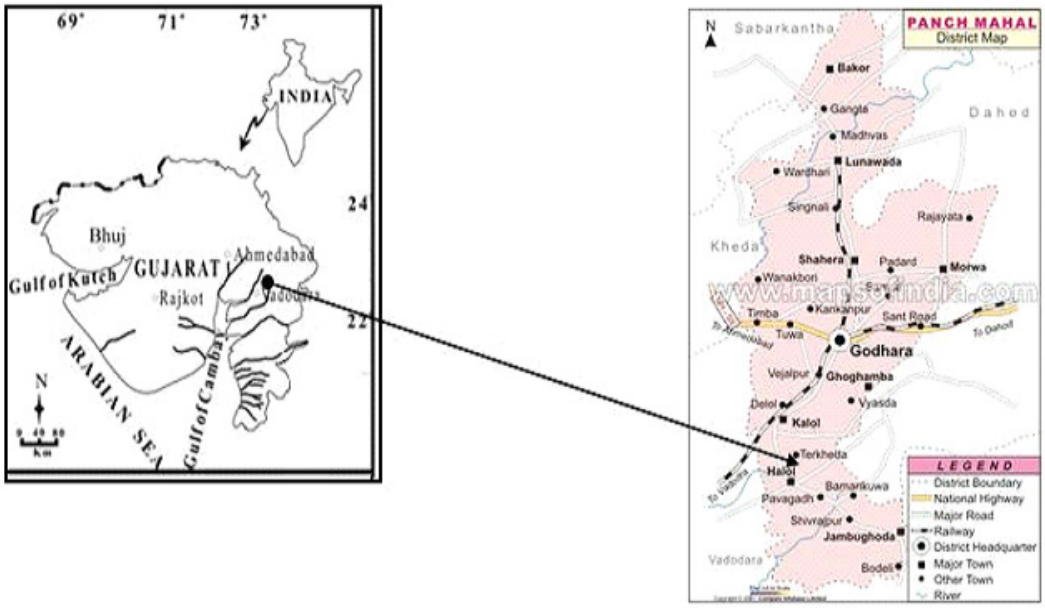

Figure 1 : Location Map of Pavagadh

Site III: Similar to the site II, this site also showed the presence of only five species. The highest density was found for *Cassia tora* (20/m²) followed by *Phyllanthus niruri* (16.60/m²), *Acalypha indica* (13.33/m²), *Corchorus capsularis* (8.66/m²) and *Commelina benghalensis* (3.0/m²). *Acalypha indica* (101.25) had highest IVI, followed by *Cassia tora* (75.47), *Phyllanthus niruri* (56.86), *Corchorus capsularis* (46.43) and lowest was for *Commelina benghalensis* (19.94).

Site IV: Poor diversity with the presence of only three species was seen at this site and their density ranged from 2.5 -16.5/m². The grass *Cynodon dactylon* was dominant with 114 IVI, followed by *Abutilon indicum* and *Cassia tora* with 73.26 and 20.65 respectively.

Considering IVI as an indicator of dominance, *Tectona grandis* and *Cassia tora* dominated the woody species and herbaceous layer respectively, in all the studied sites except for two sites in herbaceous layer where the *Cynodon* and *Acalypha* exhibited a higher value.

Generally, the diversity index is higher in tropical forests *i.e.,* 5.06 and 5.40 for young and old stand respectively and for Indian forests it ranged between 0.83 to 4.1 (Parthasarathy *et al.*1992;Visalakshi, 1995). In this area the species diversity values for the woody layer ranged between 0.303 - 0.736 (Table 2) which are very low when compared to the Indian standard. (Yadava and Devi, 2006).

This brings out the fact that this area is proving to be an example of accelerating species extinction with reducing diversity affecting the forest ecosystem. The reason behind this decreased diversity may be human dominance as it has been proved by earlier workers that a high rate of anthropogenic activities result into reduction in diversity. (Lindenmayer *et al.,* 2008; Goparaju *et al.,* 2005)

Though many a times there occurs an increase in undergrowth species diversity due to such activities (Ram *et al*., 2004) but man made disturbances usually leads to the forest degradation due to insufficient recovery time and also contribute to the disappearance of economically, ecologically or medicinally important plant species.

As this forest is situated in the hilly terrain and being a hot spot area with respect to biodiversity, it requires specific protective and conservational measures to create a more favorable environment for the establishment of native forest flora and facilitate to attract fauna. If conserved properly this forest area will definitely act as a catalyst for successful natural forest succession. Conservation of such biodiversity rich natural heritage will also help in providing the basic needs and demands of locals, visitors and tribal of the forest area. (Al-Amin *et al*., 2007).

The present study eventually concludes that specific ameliorative steps in terms of a proper protection from human interferences and scientific management of this forest area are imperative for making this a biodiversity rich site in the state.

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