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Phytosociological study of tree species diversity of poshina forest range of Sabarkantha district, north Gujarat

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Abstract
Rapid extinction of species is one of the most serious environmental problems facing the humanity today. Assessment and documentation of present vegetation status becomes more essential for arriving at an appropriate conservation and sustainable management strategies. Phytosociological study is one of the best methods for the assessment and documentation of the present vegetation status. Present study describes the phytosociological analysis of tree species of dry deciduous Poshina forest range of sabarkantha district of north Gujarat. Poshina forest is rich in plant wealth, which includes variety of trees, shrubs, herbs and climbers. Phytosociological study of the present area is scanty. This study reveals the status of diversity of tree species. The result of the phytosociological study, indicate the need of adoption of strong ecosystem management strategies for the tree species of the area.

Keywords: rapid extinction, Poshina forest, management strategies

Introduction

The concept of biodiversity has been known to man ever since he began to observe the minute living beings around him. Biodiversity, the umbrella term for the degree of nature's variety, including both the number and frequency of ecosystem, species or genus in a given assemblage, encompasses all species of plants, animals and microbes and the ecological complexes in which they occur (McNeely *et al*, 1990) [1]. Phytosociology is the study of the characteristic, classification, relationship and distribution of plant communities. Phytosociological system is a system for classifying plant communities. The aim of Phytosociology is to achieve a sufficient empirical (based on observation, experience or experiment) model of vegetation using plant taxa combinations that characterize univocally vegetation units. Nowadays, Phytosociology tries to include higher level of complexity in the perception of vegetation, by describing whole successional units or, in general vegetation complexes. These lie in the scope of landscape phytosociology. Other development includes use of statistical methods in phytosociology to obtain exact status of particular plant community. Some authors consider that phytosociology is in the scope of contemporary vegetation science, as a successful approach because of its high descriptive and predictive power, and its use in Nature Management issues. Association is a fundamental and basic unit of phytosociology. It may be determined from the comparative study of relives, in which the floristic composition is annotated and quantified. The Indian subcontinent adobe a very rich and diverse flora and fauna with high percentage of endemism. India is placed on 10th position among the plant rich nation of the world and on 4th position among the Asian countries. Its rich biodiversity makes India one among the 12 mega diversity centers of the world. The Indian subcontinent has an estimated 48,736 species of plants, including 17,000 flowering plant species and 31,736 non-flowering plant species. This accounts 7% of the total world's flora, of which 33% flora is strictly endemic. Among monocotyledons, out of 588 genera occurring in the country, 22 are strictly endemic (Agrawal, 1999) [2]. Gujarat has territory of 1, 96, 024 sq.km. and is endowed with great diversity of natural ecosystem ranging from desert, semi-arid, mangroves, coral reef- rich coast and forests with dry deciduous, moist deciduous and evergreen trees. The angiosperm flora of Gujarat is mostly varied in extent and composition. There are 2198 species of higher plants belonging to 902 genera and 155 families which represent 12.91% of the total flora of the country.

Study Area

Poshina is situated in Khedbrahma taluka (Tehsil) of Sabarkantha district of North Gujarat. It is located 12 kms away from Ambaji-Khedbrama highway. It is divided in to two ranges i.e. 1) Poshina forest range 2).R.D.F. (Rehabilitation of Degraded Forests) Poshina range. The Poshina forest range measures an area of 12978 hectares. It's northern and eastern parts leads to Rajasthan state, western part joins with the border of Ambaji forest range of Banaskantha district and in southern part there is a R.D.F. Poshina range. The minimum & maximum temperatures recorded in the area are 10^{0}C in winter and 42^{0}C to 45^{0}C in 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 & Seth, 1968) [3].

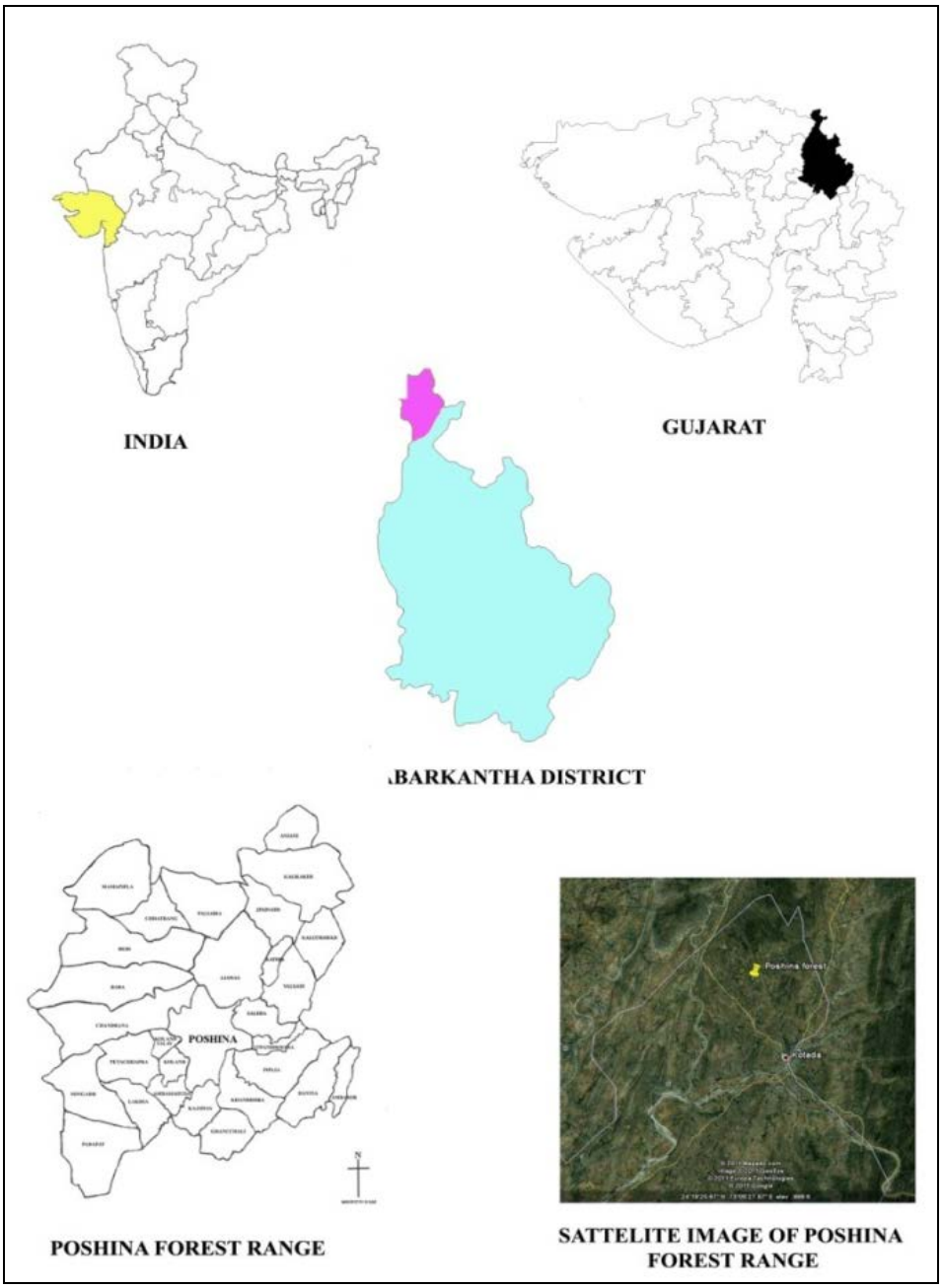

Fig 1

Methodology

Sample Design

215 sample plots, each of 50 x 50 mt.sq. size were laid down for enumeration of tree species. Different Phytosociological parameters of trees were also counted. Phytosociological data were collected in 215 sample plots of 50 x 50 mt.sq size. The vegetation data were quantitatively analysed for following parameters.

Analysis of Phytosociological Data

Relative Dominance, Relative Density, Relative Frequency and IVI

In order to express the dominance and ecological success of any species, with single value, the concept of IVI (important value index) has been developed. The important value index was calculated for tree species by using the formula given by Phillips (1959).

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

$$\text{Relative density} = \frac{\text{Number of individuals of the species}}{\text{Number of individuals of all species}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Number of occurrence of the species}}{\text{Number of occurrence of all species}} \times 100$$

IVI = Relative dominance + Relative density + Relative frequency

Relative IVI= IVI/3

Result and Discussion

Poshina forest range is rich in tree diversity. Total 89 tree species are recorded in forest. Out of which, 55 tree species recorded inside sample plots while 34 tree species recorded

outside the sample plots. 55 tree species are enumerated in the 215 sample plots. Among all 55 tree species *Butea monosperma* occurred with highest percentage (21.97%) followed by *Lannea coromandelica* (11.56%), *Diospyros melanoxylon* (8.86%), *Boswellia serrata* (6.26%), *Wrightia tinctoria* (5.79%) and *Holoptelea integrifolia* (5.70%). All these six species constitute 60.15% of total tree population while remaining tree species constitute 39.85% tree population.

A list of 55 tree species along with their total number of individuals and percentage in 215 sample plots is given in following table:

Table 1: Total number of individuals and percentage of tree species in the forest:

Sr. No.	Name of Plant species	Total No. of Plants in 215 Sample plots	% of Plant species
1	*Butea monosperma*	3694	21.97
2	*Lannea coromandelica*	1943	11.56
3	*Diospyros melanoxylon*	1489	8.86
4	*Boswellia serrata*	1053	6.26
5	*Wrightia tinctoria*	974	5.79
6	*Holoptelea integrifolia*	959	5.70
7	*Alangium salvifolium*	852	5.07
8	*Anogeissus latifolia*	605	3.60
9	*Holarhhena antidysenterica*	507	3.02
10	*Wrightia tomentosa*	484	2.88
11	*Mitragyna parvifolia*	444	2.64
12	*Phoenix sylvestris*	326	1.94
13	*Terminalia bellirica*	280	1.67
14	*Pongamia pinnata*	276	1.64
15	*Milliusa tomentosa*	276	1.64
16	*Acacia tortilis*	257	1.53
17	*Aegle marmelous*	239	1.42
18	*Cassia fistula*	221	1.31
19	*Acacia leucophloea*	207	1.23
20	*Dendrocalamus strictus*	199	1.18
21	*Albizia lebbeck*	172	1.02
22	*Eucalyptus globules*	149	0.89
23	*Acacia senegale*	141	0.84
24	*Dalbergia latifolia*	124	0.74
25	*Azadirachta indica*	118	0.70
26	*Acacia nilotica*	110	0.65
27	*Madhuca indica*	61	0.36
51	*Zizyphus mauritiana*	54	0.32
28	*Terminalia arjuna*	47	0.28
29	*Syzygium cumini*	47	0.28
30	*Emblica officinalis*	43	0.26
31	*Sapindus Laurifolius*	41	0.24
32	*Ailanthus excels*	36	0.21
33	*Soymida febrifuga*	36	0.21
34	*Ficus benghalensis*	34	0.20
35	*Tamarindus indica*	33	0.20
36	*Bombax ceiba*	27	0.16
37	*Sterculia urens*	26	0.15
38	*Limonia acidissima*	25	0.15
39	*Ficus religiosa*	24	0.14
40	*Tecomella undulate*	23	0.14
41	*Helicteres isora*	22	0.13
42	*Adina cordifolia*	20	0.12
43	*Acacia chundra*	20	0.12
44	*Crateva nurvala*	16	0.10
45	*Dalbergia paniculuta*	15	0.09
46	*Ficus racemosa*	15	0.09
47	*Bauhinia racemosa*	10	0.06
48	*Albizia odoratissima*	9	0.05
49	*Terminalia crenulata*	8	0.05
50	*Syzygium heyneanum*	6	0.04
52	*Cordia rothii*	5	0.03
53	*Moringa oleifera*	4	0.02
54	*Pithecellobium dulce*	3	0.02
55	*Manilkara hexandra*	2	0.01
	Total	16811	100

Phytosociological Study

Relative density, relative frequency and relative dominance

Butea monosperma occurs with the higher value (21.97) of relative density, followed by *Lannea coromandelica* (11.56), *Diospyrus melanoxylon* (8.80), *Boswellia serrata* (6.26) and *Wrighitia tinctoria* (5.79), while higher value of relative frequency is also reported in *Butea monosperma* (9.14), followed by *Lannea coromandelica* (7.14), *Diospyrus melanoxylon* (5.82), *Alangium salvifolium* (4.80), *Wrighitia tomentosa* (4.46) and *Holoptelea integrifolia* (4.21). Relative dominance is calculated on the basis of basal area and GBH (girth at breast height) of tree species. As *Ficus benghalensis* occurs with higher value of basal area and shows maximum plants in higher girth class, it reveals higher value of relative dominance i.e. 24.06. It is followed by *Soymida febrifuga* (6.41), *Ficus racemosa* (5.50), *Emblica officinalis* (3.91), *Sapindus laurifolius* (3.80), and *Terminalia bellerica* (3.78). Tree species like *Acacia chundra*, *Albizia odoratissima*, *Bauhinia racemosa*, *Cordia rothii*, *Crateva naruvala*, *Manilkara hexandra*, *Moringa sativa*, *Pithecolobium dulci*, *Syzigium heyneanum*, *Terminalia crenulata* reveals lower values of relative density, relative frequency and relative dominance. (Table-2)

(Important value index)

The important value index (IVI) is a statistical representation which gives an overall picture of the importance of the species in the given plant community. It considers the relative values of density, frequency and dominance of every species in the given area. It thus, in corporate three important parameters which are measures of diversity and productivity of every species. As in any plant community, the quantitative value of each of frequency, density and dominance has its own importance but the total picture of ecological importance cannot be obtained through them. The important value index as, such, gives the total picture of sociological structure of species in a plant community. *Butea monosperma* is represented by higher value of IVI i.e. 33.80, which indicates that this plant species spreaded out everywhere in the forest area, followed by *Ficus benghalensis* (25.49), *Lannea coromandelica* (19.92), *Diospyros melanoxylon* (15.42), *Boswelia serrata* (11.83) and *Holoptelea integrifolia* (11.02). Tree species like *Manilkara hexandra*, *Pithecellobium dulci*, *Moringa sativa*, *Cordia rothii*, *Syzygium heyneanum*, *Bauhinia racemosa*, *Crateva nurvala*, *Acacia chundra* and *Terminalia crenulata* reveals lower values of IVI i.e. less than 1.0.

Based on recorded higher value of IVI, *Butea monosperma* is considered as the most important and ecologically successful species in this forest.

Table 2: Relative Density (RD), Relative Frequency (RF), Relative Dominance, IVI & Relative IVI of Tree species recorded in the 215 Sample plots:

Sr.No.	Name of Plant species	1	2	3	4	5
		Relative Frequency	Relative Density	Relative Dominance	IVI	Relative IVI
1	*Butea monosperma*	9.14	21.97	2.69	33.80	11.27
2	*Lannea coromandelica*	7.14	11.56	1.22	19.92	6.64
3	*Diospyros melanoxylon*	5.82	8.86	0.88	15.56	5.19
4	*Boswelia serrata*	3.83	6.26	1.74	11.83	3.94
5	*Wrightia tinctoria*	3.44	5.79	1.32	10.55	3.52
6	*Holoptelea integrifolia*	4.21	5.70	1.11	11.02	3.67
7	*Alangium salvifolium*	4.80	5.07	0.74	10.61	3.54
8	*Anogeissus latifolia*	3.74	3.60	0.68	8.02	2.67
9	*Holarrhena antidysenterica*	3.70	3.02	0.09	6.81	2.27
10	*Wrightia tomentosa*	4.46	2.88	0.68	8.02	2.67
11	*Mitragyna parvifolia*	3.87	2.64	1.36	7.87	2.62
12	*Pheonix sylvestris*	3.44	1.94	0.40	5.78	1.93
13	*Terminalia bellirica*	3.53	1.67	3.78	8.98	2.99
14	*Pongamia pinnata*	1.91	1.64	1.83	5.39	1.80
15	*Milliusa tomentosa*	2.38	1.64	2.53	6.55	2.18
16	*Acacia tortilis*	1.79	1.53	0.11	3.42	1.14
17	*Aegle marmelous*	1.87	1.42	0.74	4.03	1.34
18	*Cassia fistula*	2.51	1.31	1.61	5.44	1.81
19	*Acacia leucophloea*	0.89	1.23	0.01	2.13	0.71
20	*Dendrocalamus strictus*	2.08	1.18	0.02	3.29	1.10
21	*Albizia lebbeck*	1.74	1.02	1.59	4.36	1.45
22	*Eucalyptus globulus*	1.74	0.89	0.76	3.39	1.13
23	*Acacia senegale*	1.70	0.84	0.33	2.87	0.96
24	*Dalbergia latifolia*	1.15	0.74	1.49	3.38	1.13
25	*Azadirachta indica*	2.04	0.70	0.58	3.32	1.11
26	*Acacia nilotica*	1.23	0.65	0.06	1.95	0.65
27	*Madhuca indica*	1.28	0.36	3.09	4.72	1.57
51	*Zizyphus mauritiana*	0.89	0.32	0.01	1.23	0.41
28	*Terminalia arjuna*	0.51	0.28	1.70	2.49	0.83
29	*Syzygium cumini*	0.98	0.28	1.57	2.82	0.94
30	*Emblica officinalis*	1.28	0.26	3.91	5.44	1.81
31	*Sapindus Laurifolius*	1.53	0.24	3.80	5.57	1.86
32	*Ailanthus excels*	0.60	0.21	0.25	1.06	0.35
33	*Soymida febrifuga*	0.68	0.21	6.41	7.31	2.44
34	*Ficus benghalensis*	1.23	0.20	24.06	25.49	8.50
35	*Tamarindus indicus*	0.89	0.20	3.44	4.53	1.51

36	*Bombax ceiba*	0.81	0.16	2.58	3.55	1.18
37	*Steculia urens*	1.02	0.15	1.84	3.02	1.01
38	*Limonia accidissima*	0.43	0.15	0.46	1.04	0.35
39	*Ficus religiosa*	0.68	0.14	3.48	4.30	1.43
40	*Tecomela undulata*	0.26	0.14	0.08	0.48	0.16
41	*Helicteris isora*	0.26	0.13	1.29	1.68	0.56
42	*Adina cordifolia*	0.47	0.12	1.48	2.07	0.69
43	*Acacia chundra*	0.21	0.12	0.07	0.40	0.13
44	*Crateva nurvala*	0.13	0.10	0.16	0.38	0.13
45	*Dalbergia paniculuta*	0.34	0.09	2.93	3.36	1.12
46	*Ficus racemosa*	0.34	0.09	5.50	5.93	1.98
47	*Bauhinia racemosa*	0.13	0.06	0.13	0.32	0.11
48	*Albizia odorrittisima*	0.21	0.05	1.07	1.33	0.44
49	*Terminalia crenulata*	0.21	0.05	0.75	1.01	0.34
50	*Syzygium heyneanum*	0.13	0.04	0.77	0.93	0.31
52	*Cordia rothii*	0.13	0.03	0.24	0.39	0.13
53	*Moringa sativa*	0.09	0.02	0.32	0.43	0.14
54	*Pithecellobium dulce*	0.09	0.02	0.14	0.24	0.08
55	*Manilkara hexandra*	0.04	0.01	0.12	0.18	0.06

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