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Plant biodiversity and phytosociological studies on tree species diversity of Ratanpur forest Bilaspur district (C.G.) India

Annu Soni and Dr. KP Namdeo

Abstract
Loss of biodiversity is a threat to the natural ecosystem in any particular area locally and leads to ecological imbalance as a whole globally. So study of the plant biodiversity is an important parameter to understand and assess the population structure. The present paper deals with the population structure and tree species diversity of Ratanpur forest, Bilaspur district, Chhattisgarh state was studied. A total of 94 species belongs to 78 genera and 36 families were recorded. Among these only one family belongs to monocots (Arecaceae). Highest important index value was reported for the species *Mangifera indica* (8.28) followed by *Tamarindus indica* (6.65), *Ficus religiosa* (5.22) *Xylia xylocarpa* (4.51), *Madhuca longifolia* (4.47), *Terminalia bellerica* (4.42) *Ficus benghalensis* (4.34), *Ficus hispida* (4.34) *Semecarpus anacardium* (4.34) and *Terminalia chebula* (4.22).

Keywords: Plant Biodiversity, Phytosociological studies, Ratanpur forest, Bilaspur, Chhattisgar.

Introduction
The Current construction of biodiversity is causes for alarm while disappearance is most series Biodiversity is continuously declining due to the activities of human kind (Krishnamurthy, *et al.* 2010) [1] Phytosociology is the study of the characterstics, classification, relationship and distribution of plant communities and it is useful to collect such as data to describe the population dynamics of each species studied and how they relate to the other species in the same community. Phytosociological studies are essential for protecting the natural plant communities and biodiversity as well as understanding the changes experienced in the past and continuing on in to the future. Most of the developed countries have these basic studies (Hamzaoglu, 2005) [2] and Working plan for Koria forest division (Tiwari, 1992) [3]. However, most of these forests are under immense anthropogenic disturbances and require careful management intervention to maintain overall biodiversity and sustainability (Kumar *et al.* 2006) [4]. In The Present investigation studies were carried out on Phytosociological and species diversity in the Ratanpur forest, Bilaspur district of Chhattisgarh State. The Main Purpose of the phytosociological analysis is to understand floristic vegetation characteristics, to estimate the species richness and diversity which is existing in the study area.

Study area
Bilaspur is located at 22.09°N 82.15°E. It has an average elevation of 264 metres (866 ft). Bilaspur is situated on the banks of the rain-fed Arpa River, which originates from the Maikal Range of Central India. It's a dolomite rich region surrounded by dense forests in the north and the coal mines of the Hasdeo Valley in the east. Bilaspur District is surrounded by Koria District in the north, Anuppur District of Madhya Pradesh, Mungeli and, Baloda Bazar-Bhata Para District in the south and Korba and Janjgir-Champa District in the east.
Around 38.78% of the total area is covered by forest. The southern part of the district is a plain land with gentle slopes covering an area of 48% of the total geographical area in the district. It is also called the Chhattisgarh plains. The land is very fertile and is mostly used for the agriculture purposes with few surface irrigation facilities. The northern part of the district is mostly hilly with highly undulating topography where the agriculture is restricted to few patches only. The net area sown during the year 2011 is around 360195 ha. Paddy is the main crop (88%) followed by pulses. There are three medium and 125 no of small irrigation projects exist in the district.

Material and Methods

Phytosociological studies were carried out during 2020 June to cover all spectrum of vegetation. The entire stretches of the study are divided in to 6.25x6.25 km, The objective of the present study is to stratify the forest vegetation into different forest type and to analyze the community structure for species richness, stand population structure, density, frequency, abundance and species girth class relationship. The total study area was nearly 100km in and around study sites. Observation from each line transect were recorded for various quantitative characteristics relative frequency, relative density and relative dominance were determined by following methods of (Philips, 1959) [5]. The species richness were identified with the help of Flora of Madhya Pradesh **(**Mudgal, V., Khanna, K.K. and Hajra, 1997) [6], Diversity of Ethnomedicinal Plants in Boridand Forest of District Korea, Chhattisgarh (Ahirwar, 2015) [7] and Forest flora of Bilaspur district (Panigarhi and Murti, 1989) [8]. The main purpose of the phytosociological analysis is to understand floristic vegetation characteristics, to estimate the species richness and diversity which is existing in the study area, the standard protocols of (Curtis J.T, and McIntosh, 1950) [9] and (Muller-Dombois and Ellenberg) [10] have been adapted to analyze the density, frequency and abundance. for calculation of frequency, density and abundance the following formulas have to be used.

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

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

$$Basal\ area = \frac{Gbh^4}{4\pi}$$

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

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

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

Results and discussion

The Predominant forest types in study area of Eastern Ghats are Dry deciduous, Moist Deciduous and Thorny scrub forest. During the present study a total of 94 species belongs to 78 genera and 36 families are recorded. In The Present Study area the highest important value index is observed for *Mangifera indica* (8.28) followed by *Tamarindus indica* (6.65), *Ficus religiosa* (5.22) *Xylia xylocarpa* (4.51) *Madhuca longifolia* (4.47), *Terminalia bellerica* (4.42) *Ficus benghalensis* (4.34), *Ficus hispida* (4.34) *Semecarpus anacardium* (4.34) and *Terminalia chebula* (4.22) in (Fig-1). According to (Raunkiaer C. 1934) [11] classify to 5 frequency classes based on percentage of frequency, the species frequency ranging from (1-20) i.e. class A,21-40 class B, 41-60 Class C, 61-80 Class D and 81-100 Class E. In this results A Class belongs to (2), B Class (18), C Class (42) D Class (39) and E Class belongs to 9 species respectively. The species richness diversity were low when comparing with earlier studies such as floral diversity in Dhamtari district of Chhattisgarh (Raj, Abhishek and Toppo, Pratap, 2014) [12] and vegetation composition, tree species diversity from tropical forests of eastern ghats of Vizianagarm (Srinivasa *et al.* 2014) [13]. Tree species richness varied according to the disturbance gradients in the different strands (Srinivasa *et al.* 2014) [14]. Biodiversity of ethno medicinal plants used by traditional healers in selected remote villages of Seoni district (Madhya Pradesh), India (Meshram and Singh, 2022) [15]. Tree diversity and population structure in a low land tropical rain forest in Eastern Himalayas (Panna, *et al.* 2009) [16].

Table 1: Phytosociological attributes of Study Area

S. No	Name of the Species	Basal area	TOI	TNI	Frequency	Density	Relative Frequency	Relative Density	Relative Dominance	IVI
1	*Acacia auriculiformis*	53108.25	52	72	52	0.72	0.83	0.66	0.55	2.04
2	*Acacia leucophloea*	53108.25	65	110	65	1.1	1.04	1.02	0.55	2.61
3	*Acacia nilotica*	15398.25	45	82	45	0.82	0.72	0.76	0.16	1.64
4	*Aegle marmelos*	70706.25	52	110	52	1.1	0.83	1.02	0.73	2.58
5	*Ailanthus excelsa*	90818.25	42	60	42	0.6	0.67	0.55	0.94	2.16
6	*Alangium salvifolium*	53108.25	75	120	75	1.2	1.20	1.11	0.55	2.86
8	*Albizia lebbeck*	70706.25	42	95	42	0.95	0.67	0.88	0.73	2.28
7	*Albizia procera*	1134.25	35	52	35	0.52	0.56	0.48	1.18	2.22
9	*Anacardium occidentale*	70706.25	35	65	35	0.65	0.56	0.60	0.73	1.89
10	*Annona squamosa*	25454.25	45	82	45	0.82	0.72	0.76	0.26	1.74
11	*Anogeissus acuminata*	53108.25	76	145	76	1.45	1.22	1.34	0.55	3.11
12	*Anogeissus latifolia*	70706.25	85	152	85	1.52	1.36	1.40	0.73	3.49
13	*Atalantia monophylla*	15398.25	43	60	43	0.6	0.69	0.55	0.16	1.40
14	*Azadirachta indica*	53108.25	61	85	61	0.85	0.97	0.78	0.55	2.30
15	*Bambusa arundinacea*	15398.25	35	75	35	0.75	0.56	0.69	0.16	1.41
16	*Barringatonia acutangula*	152097	32	56	32	0.56	0.51	0.51	1.58	2.62
17	*Bauhinia racemosa*	70706.25	45	85	45	0.85	0.72	0.78	0.73	2.25
18	*Bombax ceiba*	90818.25	47	85	47	0.85	0.75	0.78	0.94	2.49
19	*Bridelia retusa*	90818.25	65	120	65	1.2	1.04	1.11	0.94	3.10
20	*Buchanania lanzan*	90818.25	75	140	75	1.4	1.20	1.29	0.94	3.45
21	*Butea monosperma*	70706.25	57	110	57	1.1	0.91	1.02	0.73	2.67
22	*Callicarpa arborea*	152097	45	85	45	0.85	0.72	0.78	1.58	3.10
23	*Careya arborea*	53108.25	65	110	65	1.1	1.04	1.02	0.55	2.61
24	*Caryota urens*	70706.25	54	85	54	0.85	0.86	0.78	0.73	2.39
25	*Cassia fistula*	38024.25	75	145	75	1.45	1.20	1.34	0.39	2.94

26	*Ceiba pentandra*	90818.25	49	85	49	0.85	0.78	0.78	0.94	2.52
27	*Chloroxylon swietenia*	38024.25	85	135	85	1.35	1.36	1.25	0.39	3.01
28	*Cleistanthus collinus*	25454.25	81	145	81	1.45	1.30	1.34	0.26	2.91
29	*Cochlospermum religiosum*	90818.25	45	85	45	0.85	0.72	0.78	0.94	2.46
30	*Dalbergia latifolia*	70706.25	75	145	75	1.45	1.20	1.34	0.73	3.28
31	*Dalbergia paniculata*	70706.25	70	142	70	1.42	1.12	1.31	0.73	3.18
32	*Dalbergia sissoo*	53108.25	65	110	65	1.1	1.04	1.02	0.55	2.61
33	*Dendrocalamus stricta*	25454.25	32	54	32	0.54	0.51	0.50	0.26	1.28
34	*Dichrostachys cinerea*	15398.25	35	75	35	0.75	0.56	0.69	0.16	1.41
35	*Dillenia pentagyna*	70706.25	51	95	51	0.95	0.81	0.88	0.73	2.43
36	*Diospyros chloroxylon*	38024.25	45	95	45	0.95	0.72	0.88	0.39	2.00
37	*Diospyros melanoxylon*	53108.25	35	85	35	0.85	0.56	0.788	0.55	1.90
38	*Diospyros montana*	70706.25	32	85	32	0.85	0.51	0.788	0.73	2.04
39	*Diospyros sylvatica*	53108.25	60	95	60	0.95	0.96	0.88	0.55	2.39
40	*Drypetes roxburghii*	38024.25	20	35	20	0.35	0.32	0.32	0.39	1.04
41	*Erythrina suberosa*	113444.25	45	75	45	0.75	0.72	0.69	1.18	2.60
42	*Ficus benghalensis*	181008	75	135	75	1.35	1.20	1.25	1.89	4.34
43	*Ficus hispida*	229088.25	58	110	58	1.1	0.93	1.02	2.39	4.34
44	*Ficus religiosa*	264284.25	79	130	79	1.3	1.26	1.20	2.76	5.22
45	*Ficus semicordata*	152097	25	55	25	0.55	0.40	0.51	1.58	2.50
46	*Gardenia gummifera*	70706.25	40	75	40	0.75	0.64	0.69	0.73	2.07
47	*Gardenia latifolia*	113444.25	51	94	51	0.94	0.81	0.87	1.18	2.87
48	*Garuga pinnata*	70706.25	65	110	65	1.1	1.04	1.02	0.73	2.80
49	*Gmelina arborea*	152097	35	65	35	0.65	0.56	0.60	1.58	2.75
50	*Grewia tiliaefolia*	70706.25	67	95	67	0.95	1.07	0.88	0.73	2.69
51	*Haldinia cordifolia*	152097	80	120	80	1.2	1.28	1.11	1.58	3.98
52	*Holarrhena pubescens*	25454.25	52	85	52	0.85	0.83	0.78	0.26	1.88
53	*Holoptelea integrifolia*	181008	67	110	67	1.1	1.07	1.02	1.89	3.98
54	*Hymenodictyon orixense*	90818.25	35	75	35	0.75	0.56	0.69	0.94	2.20
55	*Ixora arborea*	25454.25	45	65	45	0.65	0.72	0.60	0.26	1.59
56	*Kydia calycina*	53108.25	35	85	35	0.85	0.56	0.78	0.55	1.90
57	*Lagerstroemia parviflora*	61593	85	150	85	1.5	1.36	1.39	0.64	3.40
58	*Lannea coromandelica*	90818.25	65	110	65	1.1	1.04	1.02	0.94	3.01
59	*Luecaena leucocephala*	25454.25	30	65	30	0.65	0.48	0.60	0.26	1.35
60	*Madhuca longifolia*	152097	85	165	85	1.65	1.36	1.53	1.58	4.47
61	*Mallotus philippensis*	53108.25	64	120	64	1.2	1.02	1.11	0.55	2.69
62	*Mangifera indica*	608388	57	110	57	1.1	0.91	1.02	6.35	8.28
63	*Manilkara hexandra*	90818.25	65	85	65	0.85	1.04	0.78	0.94	2.78
64	*Maytenus emarginata*	25454.25	54	75	54	0.75	0.86	0.69	0.26	1.82
65	*Mitragyna parvifolia*	113444.25	75	130	75	1.3	1.20	1.20	1.18	3.59
66	*Nyctanthes arbortristis*	25454.25	35	56	35	0.56	0.56	0.51	0.26	1.34
67	*Oroxylum indicum*	53108.25	57	75	57	0.75	0.91	0.69	0.55	2.16
68	*Phoenix sylvestris*	15398.25	45	65	45	0.65	0.72	0.60	0.16	1.48
69	*Phyllanthus emblica*	152097	75	145	75	1.45	1.20	1.34	1.58	4.13
70	*Polyalthia subarosa*	11313	43	65	43	0.65	0.69	0.60	0.11	1.41
71	*Pongamia pinnata*	90818.25	65	110	65	1.1	1.04	1.02	0.94	3.01
72	*Premna tomentosa*	80448	54	95	54	0.95	0.86	0.88	0.84	2.58
73	*Pterocarpus marsupium*	152097	45	85	45	0.85	0.72	0.78	1.58	3.10
74	*Pterospermum xylocarpum*	113444.25	65	97	65	0.97	1.04	0.89	1.18	3.12
75	*Sapindus emarginatus*	152097	75	105	75	1.05	1.20	0.97	1.58	3.76
76	*Schleichera oleosa*	113444.25	65	95	65	0.95	1.04	0.88	1.18	3.11
77	*Semecarpus anacardium*	152097	85	150	85	1.5	1.36	1.39	1.58	4.34
78	*Soymida febrifuga*	80448	75	130	75	1.3	1.20	1.20	0.84	3.25
79	*Sterculia urens*	70706.25	75	110	75	1.1	1.20	1.02	0.73	2.96
80	*Streblus asper*	31425	62	82	62	0.82	0.99	0.76	0.321	2.08
81	*Strychnos nuxvomica*	90818.25	85	140	85	1.4	1.36	1.29	0.94	3.61
82	*Strychnos potatorum*	53108.25	54	95	54	0.95	0.86	0.88	0.55	2.30
83	*Syzygium cumini*	70706.25	57	72	57	0.72	0.91	0.66	0.73	2.32
84	*Tamarindus indica*	407268	75	130	75	1.3	1.20	1.20	4.25	6.65
85	*Terminalia alata*	90818.25	75	145	75	1.45	1.20	1.34	0.94	3.49
86	*Terminalia arjuna*	113444.25	55	105	55	1.05	0.88	0.97	1.18	3.04
87	*Terminalia bellerica*	152097	85	160	85	1.6	1.36	1.48	1.58	4.42
88	*Terminalia chebula*	212433	62	110	62	1.1	0.99	1.02	2.22	4.22
89	*Vitex negunda*	25454.25	55	85	55	0.85	0.88	0.78	0.26	1.93
90	*Wrightia arborea*	53108.25	71	110	71	1.1	1.14	1.02	0.55	2.71

91	*Wrightia tinctoria*	70706.25	75	150	75	1.5	1.20	1.39	0.73	3.33
92	*Xylia xylocarpa*	152097	85	170	85	1.7	1.36	1.57	1.58	4.51
93	*Ziziphus mauritiana*	25454.25	35	55	35	0.55	0.56	0.51	0.26	1.33
94	*Ziziphus xylopyrus*	15398.25	22	35	22	0.35	0.35	0.32	0.16	0.83
		8390038	5374		5374	93.73	85.92	86.566	88.231	261.43
		9568598.25	6226		6226	107.81	100	100	100	300.000

TOI: Total occurrences of Individuals; TNI: Total No of Individuals; RF: Relative Frequency; RD: Relative Density; RDO: Relative dominance; IVI: Important Value Index

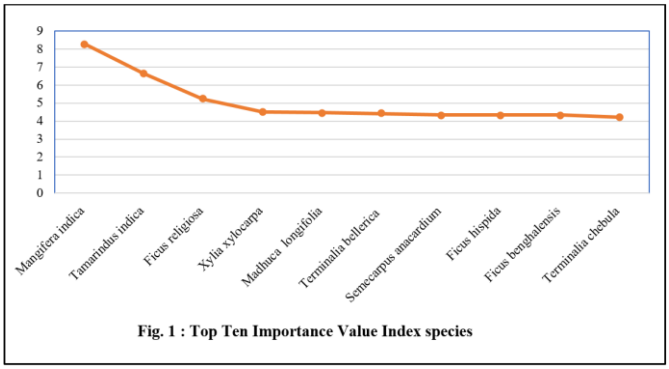

Fig. 1 : Top Ten Importance Value Index species

Conclusion

The quantitative characters with indicators of density, frequency, dominance and distribution of their relative values can serve as indicators of environmental degradation affecting a wide variety of forests and such studies can help to understand threats facing tropical forests and aid in achieving conservation goals. There is an urgent need to recognize these culturally sensitive systems at various levels and to plan for their better management, ultimately aimed at conserving biodiversity.

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