ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 8.4
IJAR 2022; 8(8): 75-79
www.allresearchjournal.com
Received: 05-05-2022
Accepted: 09-06-2022

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Plant biodiversity and phytosociological studies on tree species diversity of Ambikapur district, Chhattisgarh, India

Deep Shree Baraik and Kumud Sandya

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 Ambikapur district, Chhattisgarh state was studied. A total of 110 species belongs to 82 genera and 40 families were recorded. Among these only one family belongs to monocots (Arecaceae). Highest important index value was reported for the species *Anogeissus latifolia* (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* (4.33) and *Terminalia chebula* (4.23).

Keywords: Plant biodiversity, phytosociological studies, ambikapur

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 (Jha and Khanna, 2005) [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 (Khanna *et al.*, 2005) [2] and defined with the help of vegetation maps (Kotia *et al.* 2010) [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 Ambikapur 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
Ambikapur is located at 23°12′N 83°2′E. It has an average elevation of 623 metres (2078 feet). The district is spread over a forest-rich area of 22,237 km². Most of the district's terrain is forested and hilly. Natural resources include bauxite, forest products and paddy crops. The land is classified into six categories. About 41.67% is under agriculture, while about 5.70% remains fallow. A further 11.44% of the land could be brought under cultivation by improvements in farming techniques and reclamation of marginal areas. A further 1.27% is barren and uncultivated while 33.09% is forest cover and 6.83% is covered by buildings, roads and other infrastructure.

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. 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 Chhattisgarh (Jadhav, 2018 and Tiwari, 2015) [6, 7] and Forest flora of Chhattisgarh (Naik, 2016) [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 and McIntosh, 1950) [9] and (Muller-Dombois and Ellenberg, 1974) [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.

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

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

$$\text{Basal area} = Cbh^2/4\pi$$

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

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

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

Results and discussion

During the present study a total of 110 species belongs to 82 genera and 40 families are recorded. Out of 40 families 1 family belongs to monocot i.e Arecaceae and 39 families are dicots. Fabaceae is the most dominant family with 9 species, Euphorbiaceae Mimosaceae and Rubiaceae is the second largest families with 8 species followed by Anacardiaceae, Combretaceae, Verbenaceae, Ebenaceae and Moraceae, no Endemic species has been found from the study area (Fig-2). In The Present Study area the highest important value index is observed for *Anogeissus latifolia* (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* (4.33) and *Terminalia chebula* (4.23) in (Fig-1). According to (Raunkiaer, 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 floristic diversity of Gani Reserved forest of Kurnool district of Andhra Pradesh (Khaleel Bhasha and Niaj Parveen, 2013)[12] and vegetation composition, tree species diversity from tropical forests of eastern ghats of Vizianagarm (Srinivasa Rao *et al.* 2014) [13]. Tree species richness varied according to the disturbance gradients in the different strands (Srinivasa Rao *et al.* 2014) [14]. The Tree species diversity observed in tropical forest areas of Srikakulam district (Srinivasa Rao *et al.* 2013) [15]. In tropical rain forest, the range of tree species count per hectare was varied form 20-223 (Parthasarathy and Sethi, 1997) [16]. 42-47 species per hectare (Kadavul and Parthasarathy, 1998) [17].

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	2.05
2	*Acacia chundra*	38024.25	65	90	65	0.9	1.04	0.83	0.39	2.27
3	*Acacia leucophloea*	53108.25	65	110	65	1.1	1.04	1.02	0.55	2.61
4	*Acacia nilotica*	15398.25	45	82	45	0.82	0.72	0.76	0.16	1.64
5	*Aegle marmelos*	70706.25	52	110	52	1.1	0.83	1.02	0.73	2.59
6	*Ailanthus excelsa*	90818.25	42	60	42	0.6	0.67	0.55	0.94	2.18
7	*Alangium salvifolium*	53108.25	75	120	75	1.2	1.20	1.11	0.55	2.87
8	*Albizia amara*	113444.25	35	52	35	0.52	0.56	0.48	1.18	2.23
9	*Albizia lebbeck*	70706.25	42	95	42	0.95	0.67	0.88	0.73	2.29
10	*Albizia odoratissima*	152097	72	130	72	1.3	1.15	1.20	1.58	3.95
11	*Anacardium occidentale*	70706.25	35	65	35	0.65	0.56	0.60	0.73	1.90
12	*Annona squamosa*	25454.25	45	82	45	0.82	0.72	0.76	0.26	1.74
13	*Anogeissus acuminata*	53108.25	76	145	76	1.45	1.22	1.34	0.55	3.121
14	*Anogeissus latifolia*	608388	57	110	57	1.1	0.91	1.02	6.35	8.28
15	*Atalantia monophylla*	15398.25	43	60	43	0.6	0.69	0.55	0.16	1.40
16	*Azadirachta indica*	53108.25	61	85	61	0.85	0.97	0.78	0.55	2.32
17	*Bambusa arundinacea*	15398.25	35	75	35	0.75	0.56	0.69	0.16	1.41
18	*Barringatonia acutangula*	152097	32	56	32	0.56	0.51	0.51	1.58	2.62
19	*Bauhinia racemosa*	70706.25	45	85	45	0.85	0.72	0.78	0.73	2.25
20	*Bombax ceiba*	90818.25	47	85	47	0.85	0.75	0.78	0.94	2.49
21	*Borasassus flabellifer*	70706.25	45	95	45	0.95	0.72	0.88	0.73	2.34
22	*Bridelia monoica*	38024.25	42	85	42	0.85	0.67	0.78	0.39	1.86
23	*Bridelia montana*	25454.25	57	110	57	1.1	0.91	1.02	0.26	2.20
24	*Bridelia retusa*	90818.25	65	120	65	1.2	1.04	1.11	0.94	3.10
25	*Buchanania axillaris*	70706.25	57	90	57	0.9	0.91	0.83	0.73	2.48
26	*Buchanania lanzan*	90818.25	75	140	75	1.4	1.20	1.29	0.94	3.45
27	*Butea monosperma*	70706.25	57	110	57	1.1	0.91	1.02	0.73	2.67
28	*Callicarpa arborea*	152097	45	85	45	0.85	0.72	0.78	1.58	3.10
29	*Canthium parviflorum*	31425	54	95	54	0.95	0.86	0.88	0.32	2.07

30	*Careya arborea*	53108.25	65	110	65	1.1	1.04	1.02	0.55	2.61
31	*Caryota urens*	70706.25	54	85	54	0.85	0.86	0.78	0.73	2.39
32	*Cassia fistula*	38024.25	75	145	75	1.45	1.20	1.34	0.39	2.94
33	*Ceiba pentandra*	90818.25	49	85	49	0.85	0.78	0.78	0.94	2.52
34	*Chloroxylon swietenia*	38024.25	85	135	85	1.35	1.36	1.25	0.39	3.01
35	*Cleistanthus collinus*	25454.25	81	145	81	1.45	1.30	1.34	0.26	2.91
36	*Cochlospermum religiosum*	90818.25	45	85	45	0.85	0.72	0.78	0.94	2.46
37	*Dalbergia latifolia*	70706.25	75	145	75	1.45	1.20	1.34	0.73	3.28
38	*Dalbergia paniculata*	70706.25	70	142	70	1.42	1.12	1.31	0.73	3.18
39	*Dalbergia sissoo*	53108.25	65	110	65	1.1	1.04	1.02	0.55	2.61
40	*Dendrocalamus stricta*	25454.25	32	54	32	0.54	0.51	0.50	0.26	1.28
41	*Dichrostachys cinerea*	15398.25	35	75	35	0.75	0.56	0.69	0.16	1.41
42	*Dillenia pentagyna*	70706.25	51	95	51	0.95	0.81	0.88	0.73	2.43
43	*Diospyros chloroxylon*	38024.25	45	95	45	0.95	0.72	0.88	0.39	2.00
44	*Diospyros melanoxylon*	53108.25	35	85	35	0.85	0.56	0.788	0.55	1.90
45	*Diospyros montana*	70706.25	32	85	32	0.85	0.51	0.788	0.73	2.04
46	*Diospyros peregrina*	38024.25	12	24	12	0.24	0.19	0.22	0.39	0.81
47	*Diospyros sylvatica*	53108.25	60	95	60	0.95	0.96	0.88	0.55	2.39
48	*Drypetes roxburghii*	38024.25	20	35	20	0.35	0.32	0.32	0.39	1.04
49	*Erythrina suberosa*	113444.25	45	75	45	0.75	0.72	0.69	1.18	2.60
50	*Ficus benghalensis*	181008	75	135	75	1.35	1.20	1.25	1.89	4.34
51	*Ficus hispida*	229088.25	58	110	58	1.1	0.93	1.02	2.39	4.34
52	*Ficus religiosa*	264284.25	79	130	79	1.3	1.26	1.20	2.76	5.22
53	*Ficus semicordata*	152097	25	55	25	0.55	0.40	0.51	1.58	2.50
54	*Gardenia gummifera*	70706.25	40	75	40	0.75	0.64	0.69	0.73	2.07
55	*Gardenia latifolia*	113444.25	51	94	51	0.94	0.81	0.87	1.18	2.87
56	*Garuga pinnata*	70706.25	65	110	65	1.1	1.04	1.02	0.73	2.80
57	*Gmelina arborea*	152097	35	65	35	0.65	0.56	0.60	1.58	2.75
58	*Grewia tiliaefolia*	70706.25	67	95	67	0.95	1.07	0.88	0.73	2.69
59	*Haldinia cordifolia*	152097	80	120	80	1.2	1.28	1.11	1.58	3.98
60	*Holarrhena pubescens*	25454.25	52	85	52	0.85	0.83	0.78	0.26	1.88
61	*Holoptelea integrifolia*	181008	67	110	67	1.1	1.07	1.02	1.89	3.98
62	*Hymenodictyon orixense*	90818.25	35	75	35	0.75	0.56	0.69	0.94	2.20
63	*Ixora arborea*	25454.25	45	65	45	0.65	0.72	0.60	0.26	1.59
64	*Kydia calycina*	53108.25	35	85	35	0.85	0.56	0.78	0.55	1.90
65	*Lagerstroemia parviflora*	61593	85	150	85	1.5	1.36	1.39	0.64	3.40
66	*Lannea coromandelica*	90818.25	65	110	65	1.1	1.04	1.02	0.94	3.01
67	*Luecaena leucocephala*	25454.25	30	65	30	0.65	0.48	0.60	0.26	1.35
68	*Macaranga peltata*	152097	59	110	59	1.1	0.94	1.02	1.58	3.55
69	*Madhuca longifolia*	152097	85	165	85	1.65	1.36	1.53	1.58	4.47
70	*Mallotus philippensis*	53108.25	64	120	64	1.2	1.02	1.11	0.55	2.69
71	*Mangifera indica*	70706.25	85	152	85	1.52	1.36	1.40	0.73	3.51
72	*Manilkara hexandra*	90818.25	65	85	65	0.85	1.04	0.78	0.94	2.78
73	*Maytenus emarginata*	25454.25	54	75	54	0.75	0.86	0.69	0.26	1.82
74	*Mitragyna parvifolia*	113444.25	75	130	75	1.3	1.20	1.20	1.18	3.59
75	*Morinda tinctoria*	53108.25	50	65	50	0.65	0.80	0.60	0.55	1.96
76	*Naringi crenulata*	38024.25	45	60	45	0.6	0.72	0.55	0.39	1.67
77	*Nyctanthes arbortristis*	25454.25	35	56	35	0.56	0.56	0.51	0.26	1.34
78	*Oroxylum indicum*	53108.25	57	75	57	0.75	0.91	0.69	0.55	2.16
79	*Phoenix sylvestris*	15398.25	45	65	45	0.65	0.72	0.60	0.16	1.48
80	*Phyllanthus emblica*	152097	75	145	75	1.45	1.20	1.34	1.58	4.13
81	*Polyalthia subarosa*	11313	43	65	43	0.65	0.69	0.60	0.11	1.41
82	*Pongamia pinnata*	90818.25	65	110	65	1.1	1.04	1.02	0.94	3.01
83	*Premna latifolia*	53108.25	75	110	75	1.1	1.20	1.02	0.55	2.77
84	*Premna tomentosa*	80448	54	95	54	0.95	0.86	0.88	0.84	2.58
85	*Protium serratum*	70706.25	65	99	65	0.99	1.04	0.91	0.73	2.70
86	*Pterocarpus marsupium*	152097	45	85	45	0.85	0.72	0.78	1.58	3.10
87	*Pterospermum xylocarpum*	113444.25	65	97	65	0.97	1.04	0.89	1.18	3.12
88	*Sapindus emarginatus*	152097	75	105	75	1.05	1.20	0.97	1.58	3.76
89	*Schleichera oleosa*	113444.25	65	95	65	0.95	1.04	0.88	1.18	3.11
90	*Semecarpus anacardium*	152097	85	150	85	1.5	1.36	1.39	1.58	4.33
91	*Soymida febrifuga*	80448	75	130	75	1.3	1.20	1.20	0.84	3.25
92	*Sterculia foetida*	90818.25	65	95	65	0.95	1.04	0.88	0.94	2.87
93	*Sterculia urens*	70706.25	75	110	75	1.1	1.20	1.02	0.73	2.96
94	*Streblus asper*	31425	62	82	62	0.82	0.99	0.76	0.321	2.08
95	*Strychnos nuxvomica*	90818.25	85	140	85	1.4	1.36	1.29	0.94	3.61
96	*Strychnos potatorum*	53108.25	54	95	54	0.95	0.86	0.88	0.55	2.30
97	*Syzygium cumini*	70706.25	57	72	57	0.72	0.91	0.66	0.73	2.32
98	*Tamarindus indica*	407268	75	130	75	1.3	1.20	1.20	4.25	6.65
99	*Terminalia alata*	90818.25	75	145	75	1.45	1.20	1.34	0.94	3.49
100	*Terminalia arjuna*	113444.25	55	105	55	1.05	0.88	0.97	1.18	3.04
101	*Terminalia bellerica*	152097	85	160	85	1.6	1.36	1.48	1.58	4.42

102	*Terminalia chebula*	212433	62	110	62	1.1	0.99	1.02	2.22	4.23
103	*Trema orientalis*	53108.25	57	85	57	0.85	0.91	0.78	0.55	2.25
104	*Vitex negunda*	25454.25	55	85	55	0.85	0.88	0.78	0.26	1.93
105	*Vitex pinnata*	90818.25	32	65	32	0.65	0.51	0.60	0.94	2.06
106	*Wrightia arborea*	53108.25	71	110	71	1.1	1.14	1.02	0.55	2.71
107	*Wrightia tinctoria*	70706.25	75	150	75	1.5	1.20	1.39	0.73	3.33
108	*Xylia xylocarpa*	152097	85	170	85	1.7	1.36	1.57	1.58	4.51
109	*Ziziphus mauritiana*	25454.26	35	55	35	0.55	0.56	0.51	0.26	1.33
110	*Ziziphus xylopyrus*	15398.26	22	35	22	0.35	0.35	0.32	0.15	0.83
		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

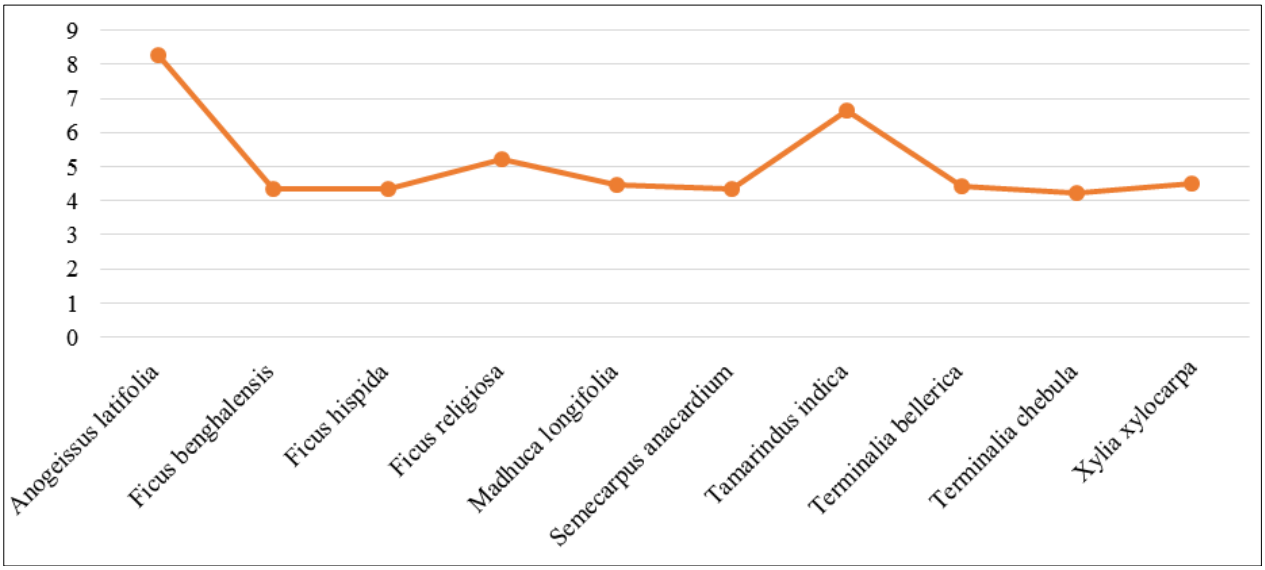

Fig 1: Top ten Important Value Index species in study area.

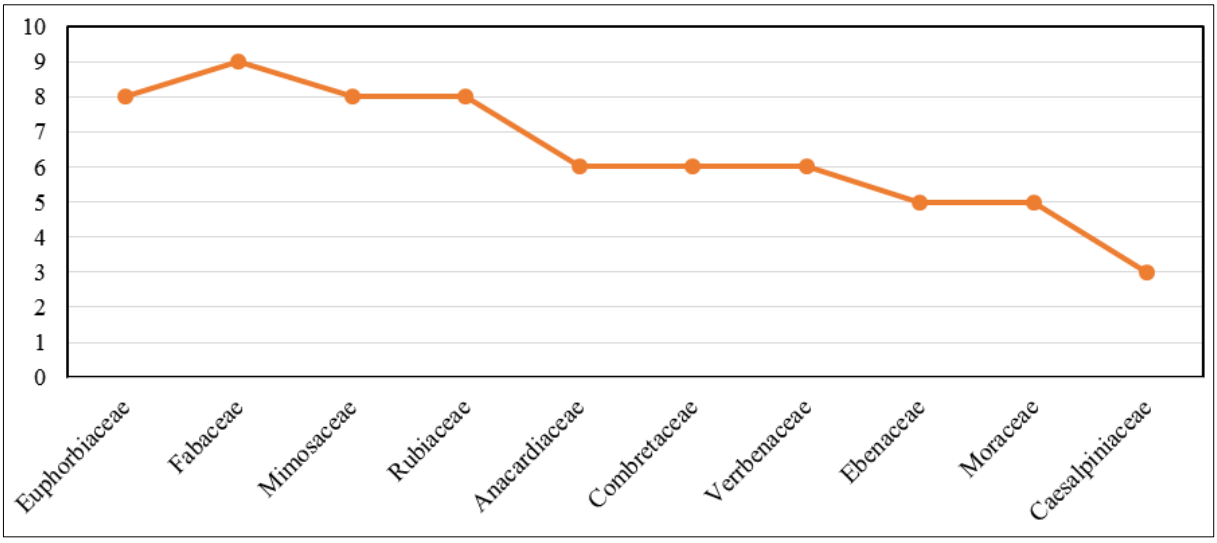

Fig 2: Top ten families based on species number in study area.

Conclusion

The quantitative characters with references to density, frequency, dominance and their relative values distribution could well act as indicators of anthropogenic disturbances that are affecting the various forests types and such studies would help in understanding the threats that are being faced by the tropical forests and would help in deriving conservation policies. There is an urgent need for recognizing these traditionally valued natural systems at various levels and planning for their better management, ultimately aiming to conserve biodiversity.

Acknowledgement

The authors are grateful to the Forest Deportment of Ambikapur District for providing their help during my field survey, and also to the authority of Govt. Girls P.G. College, Rewa (M.P.) for providing necessary facilities during the work.

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