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## Ecological analysis of vegetation at Manda forest of Singrauli (M.P.) India

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### Abstract

Madhya Pradesh has rich traditional knowledge associated with biodiversity. The present paper deals with the nature of ecological vegetation in Manda forest. For the study of vegetation list quadrat method is applied. Repeated quadrat sampling leads to occurrence of 10 trees species with their frequency, abundance and density. The frequency to Raunkiers classification and IVI value were done.

**Keywords:** Biodiversity, ecological vegetation, quadrat sampling

### Introductions

With a wealth of biological diversity, India is the seventh-largest nation in the world. According to the World Conservation and Monitoring Center, India is one of the world's 17 mega diversity countries. A fundamental understanding of the climate, rainfall, temperature, and other factors is necessary in order to understand the biological vegetation of plants in a given location. The climate of Madhya Pradesh varies greatly. A diverse variety of climatic conditions promotes the occurrence of a multitude of plant species. Manda has a semi-arid climate with little rainfall and a high rate of evaporation. Because they must struggle to survive, plants produce less food that can be fed to animals. There could be an overgrazing issue that upsets the equilibrium of the soil and throws off the ecology of the plants.

In India only work carried out by Botanical survey of India; FRLHT and various reports and documents has been published on conservation, assessment and management of threatened species by Mueller-Domboic, & Ellenberg, D.H. (1974) <sup>[1]</sup>, Aim and Methods of Vegetation Ecology. Red Data book was bought out by Botanical survey of India, which is followed by second and third volume (Nayar and Shastry 1987-1990) <sup>[2]</sup>. Ordination method in Ecology (Anderson, 1971) <sup>[3]</sup>. Name changes in flowering plants of India and adjacent region (Bennett, 1986) <sup>[4]</sup>. Studies of Teak plantation and mixed natural forest in Madhya Pradesh (Chaubey, *et al.* 1988) <sup>[5]</sup>. Medicinal Plants (India) Karki (2002) <sup>[6]</sup>. Principal and practice of ayurvedic medicine. Biotech Book. Delhi (Khory, 2004) <sup>[7]</sup>. Ecological diversity and its Measurement. (Magurran, 1988) <sup>[8]</sup>. Flora of Madhya Pradesh (Mudgal *et al.* 1997) <sup>[9]</sup>. Phenology of some tree and shrub species of social forestry, Rewa (Mishra and Gupta, 2004)<sup>[10]</sup> and Floristic composition and vegetation types of Rewa district in Madhya Pradesh: An overview (Shukla *et al.* 2010) <sup>[11]</sup>.

The plants or plant life of a region or place is called as vegetation. Flora in Madhya Pradesh include wide variety of vegetation. Taxonomic study of the floras is very essential for the understanding of biological diversity. Assessment of plant diversity, conservation management and sustainable utilization has only understood by floristic study

### Materials and Methods

Phytosociological studies were conducted by using quadrat method. The density, frequency and abundance were estimated in the randomly placed quadrates. For vegetation sampling and analysis minimum 11 quadrates taken and each of size 100 mt. x 100 mt. for trees (Phillips, 1959) <sup>[12]</sup>. Each quadrat was subdivided in to 5 mt. x 5 mt. The quadrates were laid out randomly throughout the study area in each site. The size and the number of quadrates were determined by the species curve (Misra, 1968) <sup>[13]</sup>. All the species occurring in each quadrat was noted and their numerical count was carried out. Names of species and number of individual species in each unit are recorded and percentage frequency, density and

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abundance are calculated by the formula. The Importance value index (IVI) for each species was determined as sum of relative density, relative frequency and relative dominance (Phillips, 1959; and Curtis, 1959) [12, 14].

The frequency of individual species is the number of times. The species occur in the sampling unit. It is usually represented as a percentage calculated as follows.

$$\text{Frequency} = \frac{\text{Number of plots in which species occurs}}{\text{Total number of plots sampled}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of a particular species}}{\text{Total frequency of all species}} \times 100$$

Raunkiaer (1934) [15] made an elaborative study, divided species into 5 classes viz. A, B, C, D, E. Raunkiaer suggested law of frequency species poorly distributed in an area are to be presented more compared to those that have better dispersion in an area, like that  $A > B > C > D > E$ . Raunkiaer's normal frequency diagram was a histogram made on the bases of the average frequency data in which value shows by above chart. In disturbed ecosystems, the frequency distribution varies from that of normal as proposed by Raunkiaer (1934) [15].

**Density**

Density is the number of counting units per unit area and is measured in quadrates of varying sizes. Density can be calculated by species or for all species combined. The formula for calculation of species density is as follows. Total number of individuals of the species in all the sampling units

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

$$\text{Relative density} = \frac{\text{Density for a species}}{\text{Total density for all species}} \times 100$$

**Abundance**

Abundance is also calculated like density but in this case, only those quadrates are considered for calculation where a species actually occurs. The formula for calculation of species abundance is as follows.

$$\text{Abundance} = \frac{\text{Total number of individuals of the species in all the sampling units}}{\text{Number of sampling units in which the species occurred}}$$

$$\text{Relative Abundance} = \frac{\text{Abundance of a species}}{\text{Total Abundance of all species}} \times 100$$

**Important Value Index**

The sum of three relative values is considered an Important value Index:

$$\text{IVI} = \text{Relative frequency} + \text{Relative Abundance} + \text{Relative density}$$

**Results and Discussion**

Present study field covers approximately an area of 3250 m<sup>2</sup>. In this area ecological study was made, table: 1 which shows *Acacia nilotica* has maximum 81.82, 2.27 frequency and density respectively, whereas, *Ficus benghalensis* has minimum 27.27, 0.36 frequency and density respectively.

**Table 1:** Result of frequency, density and abundance analysis

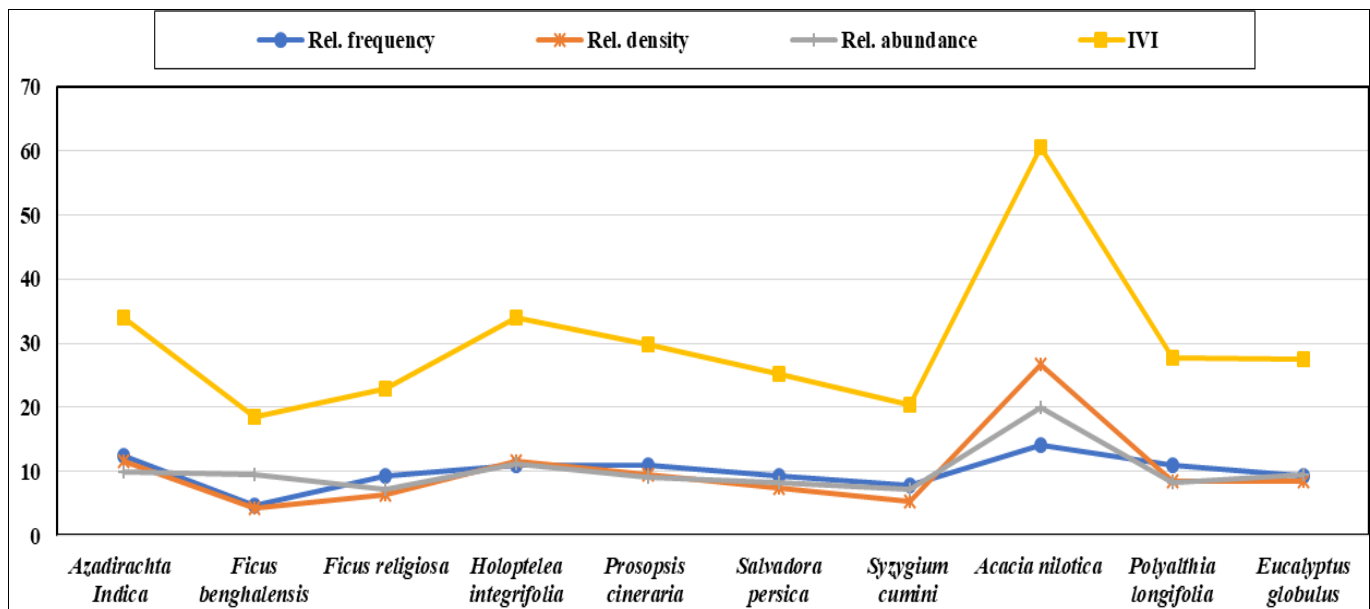
S. No.	Name of the Species	Quadrat										Total No. of individual species	Total No. of Quadrat of occurrence	Total No. of Quadrat studied	Frequency (%)	Frequency class	Density	Abundance	
		1	2	3	4	5	6	7	8	9	10								11
1.	<i>Azadirachta Indica</i> A. Juss	2	1	-	1	-	2	1	-	2	1	1	11	8	11	72.73	D	1.00	1.38
2.	<i>Ficus benghalensis</i> L.	1	1	-	-	2	-	-	-	-	-	-	4	3	11	27.27	B	0.36	1.33
3.	<i>Ficus religiosa</i> L.	1	-	1	1	-	-	1	1	-	-	1	6	6	11	54.55	C	0.55	1.00
4.	<i>Holoptelea integrifolia</i> (Roxb) P.	2	-	1	-	1	1	2	-	1	2	1	11	7	11	63.64	D	1.00	1.57
5.	<i>Prosopis cineraria</i> (L.) Druce	-	1	2	1	-	2	1	-	1	1	-	9	7	11	63.64	D	0.82	1.29
6.	<i>Salvadora persica</i> L.	-	-	1	1	-	2	1	-	1	-	1	7	6	11	54.55	C	0.64	1.17
7.	<i>Syzygium cumini</i> (L.) Skeels	1	-	1	-	1	-	1	-	-	1	-	5	5	11	45.45	C	0.45	1.00
8.	<i>Acacia nilotica</i> L.	2	2	3	1	3	-	3	4	-	4	3	25	9	11	81.82	E	2.27	2.78
9.	<i>Polyalthia longifolia</i> Sonn.	1	2	-	1	1	-	-	-	1	1	1	8	7	11	63.64	D	0.73	1.14
10.	<i>Eucalyptus globulus</i> Labill.	-	1	1	-	-	2	-	1	1	-	2	8	6	11	54.55	C	0.73	1.33

**Table 2:** Raunkiaer's Frequency class distribution.

Raunkiaer's Frequency class	Class value	Raunkier's value	Frequency class of vegetation
A	0-20	53	10
B	21-40	14	10
C	41-60	9	40
D	61-80	8	30
E	81-100	16	10

**Table 3:** Result of phyto-sociological analysis.

S. No.	Name of the species	Rel. frequency	Rel. density	Rel. abundance	IVI
1.	<i>Azadirachta Indica</i> A. Juss	12.50	11.70	9.83	34.02
2.	<i>Ficus benghalensis</i> L.	4.69	4.25	9.53	18.47
3.	<i>Ficus religiosa</i> L.	9.37	6.38	7.15	22.90
4.	<i>Holoptelea integrifolia</i> (Roxb) P.	10.94	11.70	11.23	33.87
5.	<i>Prosopis cineraria</i> (L.) Druce	10.94	9.57	9.19	29.70
6.	<i>Salvadora persica</i> L.	9.37	7.44	8.34	25.16
7.	<i>Syzygium cumini</i> (L.) Skeels	7.81	5.32	7.15	20.28
8.	<i>Acacia nilotica</i> L.	14.06	26.58	19.86	60.50
9.	<i>Polyalthia longifolia</i> Sonn.	10.94	8.51	8.17	27.61
10.	<i>Eucalyptus globulus</i> Labill.	9.37	8.51	9.53	27.41



**Fig 1:** Graph analysis of phytosociological comparative species within study area

*Acacia nilotica* has maximum abundance 2.78 and *Ficus religiosa* L. and *Syzygium cumini* (L.) Skeels have minimum abundance 1.00. The distribution of species was calculated based on frequency class and vegetation. Present ecological study was made, table 2 which shows the frequency values refers to Raunkier’s formula  $A=BD>E$ . Present investigation in Table 3 study of IVI value *Ficus benghalensis* L. has minimum 18.47 IVI, and *Acacia nilotica* 60.50 has maximum IVI.

**Conclusion**

Present study provided information about of ecological study. 10 tree species were studied. The observation of the area are highly dependent on the natural plant resources surrounding their vicinity and these resources play an important role in their routine life. The prepared frequency diagram did not matched with the Raunkier’s normal frequency diagram. Hence, type of vegetation is heterogeneous. *Acacia nilotica* L. which was most abundant species in Manda forest.

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