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Tree species distribution and composition of dense forest in different ranges of Chitrakoot forest division Uttar Pradesh

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Abstract

Assessments of vegetation cover of any areas provide guidance for forest planners to maintain the adequate amount of greenery for human wellbeing as well as to maintain the biodiversity. The floristic diversity study was made by adopting random sampling approach, under which, 50 quadrates of 10 m x 10 m were laid down in Chitrakoot Forest Division. The density, frequency, abundance, IVI, species-richness, and other useful parameters for comparison of different range were recorded and analyzed for all five ranges. Present study show that Manikpur range has maximum no. of tree species (21) and families (14). The Shannon index maximum in Manikpur forest range (4.49335) followed by Markundi forest range (3.232), Karvi forest range (3.1031) and Bargarh forest range (1.14713) while minimum was recorded in Raipura forest range (0.62767). Considering the importance of rich biodiversity study area needs special attention for conservation and management.

Keywords: Species distribution, composition, dense forest, Chitrakoot, tree diversity

Introduction

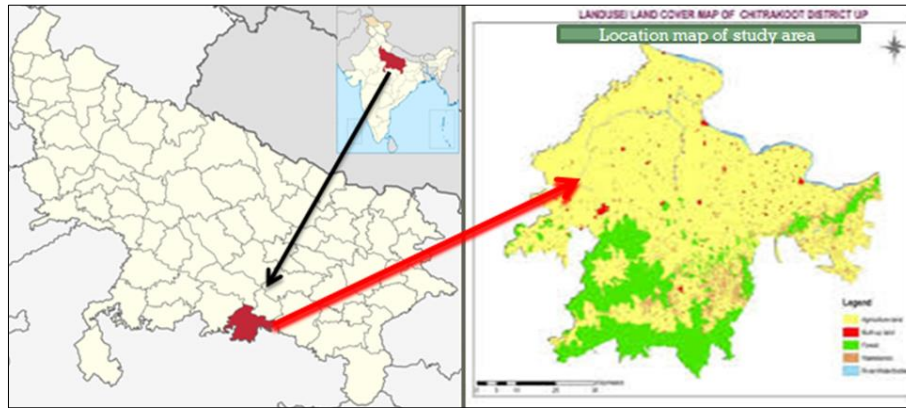
Chitrakoot is one of the famous places of pilgrimage of Hindus in India and surrounded by lush green hills of legendary Vindhyan hill series. Chitrakoot is also well known for its beautiful hill ranges, historical caves, perennial streams and varied flora and fauna. Therefore, the Chitrakoot has been sacred place of worship for sages and hermits since antiquity. The relative importance of the families in a biodiversity study is usually expressed by tabulating 10 dominant families in the order of their number of species. In Chitrakoot, the Poaceae is the largest family, followed by Fabaceae, Asteraceae, Cyperaceae etc. Forestry is the science, art and practice of understanding, managing and using wisely the natural resources associated with, and derived from forest lands. These resources include timber, water, fish, wildlife, soil, plants, and recreation. Forestry is the science and craft of creating, managing, using, conserving, and repairing forests and associated resources to meet desired goals, needs, and values for human and environment benefits. Forestry is practiced in plantations and natural stands. The science of forestry has elements that belong to the biological, physical, social, political and managerial sciences. Modern forestry generally embraces a broad range of concerns, in what is known as multiple use management, including the provision of timber, fuel wood, wildlife habitat, natural water quality management, recreation, landscape and community protection, employment, aesthetically appealing landscapes, biodiversity management, watershed management, erosion control, and preserving forests as 'sinks' for atmospheric carbon dioxide.

Materials and Methods

Study area and sites

The experiment was conducted in five forest ranges Markundi, Karvi, Raipura, Manikpur and Bargarh of District Chitrakoot. District lies between Lat. 24°48' to 25°12' N and Long. 80°58' to 81°34' E. Distance covered by district from east to west is 62 Km and North to South is 57.5Km. It is bounded in the north by Kaushambi, in the south by Satna (MP) & Rewa (MP), in the east by Allahabad and in west by Banda. The district is linked with Roadways to all adjoining district of Banda, Prayagraj, Satna, Rewa and Kaushambi. Total geographical area of District is about 3452.91 Sq.Km. The Normal annual rainfall in the district is 876.4 mm for the period 2011 to 2020.

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Map of the study areas

Land use

The block wise land utilization data for the district indicate that out of the total area of the district of 338897 ha, forest occupies an area over 59767 hectares which is roughly 18 percent of the total geographical area of the district. There are vast stretches of tendu, bamboo, babul jungles. Maximum forest area of 35188 ha is seen in southern parts of Manikpur block followed by Karvi block where forest area is 15975 ha. The district is mainly agriculture dominated with about 47% of the total area, i.e. 158161 ha falling under net sown area. Multiple cropping is uncommon due to water scarcity in the district. Only 28401 ha area falls under area cropped more than once.

Sample plot establishment

The sample areas from each forest range were selected on the basis of their reaches. From each forest range ten different quadrants were analyzed, totally 50 quadrants were analyzed. Data of different forest range were collected using random plot design technique with main quadrant size 10m x 10m (for trees with DBH > 5 cm).

Study of floristic diversity:

The floristic diversity study will be carried out adopting random sampling approach, under which ten quadrates was laid down with size of 10x10m in each forest range for the observation and data of trees. Then density and basal area of each plot were calculated. Diversity index was calculated following Shannon and Wiener (1963) formula. The Phytosociological parameters analysis will be carried out after collecting the data of various species which include the value of Frequency, Density, abundance A/F (Abundance/Frequency), Relative Frequency, Relative Density, Relative Dominance and Importance Value index (IVI) determined for each species of the community according to the formula given by Raunkiaer, 1934 [16], Hason and Churchill, (1961) [14]

Frequency percent

This term refers to the degree of dispersion of individual species in an area and usually expressed in terms of percentage occurrence. (Raunkiaer, 1934) [16]

$$\text{Frequency \%} = \frac{\text{No. of sampling units in which the species occurred}}{\text{Total number of units studied}} \times 100$$

Density

It is an expression of the numerical strength of a species where the total no. of individual of each species in the quadrates is divided by the no. of the quadrates studies.

(Hanson and Churchill, 1961) [14]

$$\text{Density} = \frac{\text{Total number of individual}}{\text{Total Number of quadrates studies}}$$

Abundance

Abundance is the relative representation of a species in a particular ecosystem. It is usually measured as the number of individuals found per sample. How species abundances are distributed within an ecosystem is referred to as relative species abundances. Both indicators are relevant for computing biodiversity

$$\text{Abundance} = \frac{\text{Total No. of individual of the species}}{\text{Total No. of quadrates in which the species has occurred}}$$

Distribution Pattern

The distribution pattern of each tree species of selected urban area was analyzed by using the ratio of abundance to frequency. (Whitford, 1949) [15]

$$\text{Distribution Pattern} = \text{Abundance/Frequency}$$

Dominance

It refers to the relative importance of the constituent unit in a community.

$$\text{Dominance} = \text{Density for a species X average basal area for species}$$

Relative dominance

Dominance of a species is determined by the value of the basal cover, whereas the relative dominance is the coverage value of a species with respect to the sum of the coverage of all species in the area.

$$\text{RelativeDominance (RDO)} = \frac{\text{Dominance}}{\text{Total Dominance of all species}} \times 100$$

Relative Density

Relative density is the study of numerical strength of a species in relation to the total no. of individual of all the species & can be calculating as.

$$\text{RelativeDensity (RD)} = \frac{\text{No. of individuals of the species}}{\text{No. of individual of all species}} \times 100$$

Relative Frequency

The degree of dispersion of individual species in an area in relation to the no. of all the species occurred.

$$\text{Relative Frequency (RF)} = \frac{\text{No. of occurrence of the specie}}{\text{No. of Occurrence of all species}} \times 100$$

Importance value Index

This index is used to determine the overall importance of each species in the common structure. In calculating this index, the percentage value of the relative, frequency, relative density & this value is designated as an or IVI of the species. (Curtis 1959, Phillips, 1959) [17-18]

Importance value Index (IVI) = Relative Dominance + Relative density + Relative frequency
Studies on Floristic diversity

Diversity is the totality of life form from where we directly draw ecological economic and aesthetic benefits. The flora and fauna of the area is the back bone of biodiversity studies. The plants species composition and diversity were studied by random sampling method. Shannon Weiner diversity index was implied to examine the biodiversity among the groves. The methods for various studies are as follows.

i) Shannon’s Index

For studying the species richness and diversity Simpson's (1949) and Shannon-Wiener's (1963) indices were used. Shannon’s Index for diversity was calculated based on the abundance value of plant species.

Shannon’s Index, $H' = -\sum P_i \log P_i$

P_i = the proportion of the important value of the i^{th} species $P_i = n_i/N$

N_i = importance value of i^{th} species.

N = importance value of all the species.

The maximum diversity which could possibly occur would be found in a situation where all species were equally abundant. Shannon -Wiener's index (H') depends on tree abundance and their distribution among the species. The index is maximum when the species have same number of individuals and

minimum when the individuals are maximally concentrated in one species.

Result and Discussion

The study was undertaken in five different forest ranges of Chitrakoot forest division to access the Phyto-sociological parameters. Data on species composition and diversity of dense forest of the study areas presented in table 1 and figure 1 shows that Total 42 species belongs to 14 families were recorded.

Table 1: Species richness and diversity indices of dense forest in Chitrakoot forest Division of U.P

S. No.	Forest Range	Total no. of species	Total no. of family	Shannon Index(H)
1	Markundi	17	12	3.232
2	Karvi	14	11	3.103
3	Raipura	5	3	0.627
4	Manikpur	21	14	4.493
5	Bargarh	9	7	1.147

Total no. of species recorded in all forest ranges of dense part Chitrakoot Forest Division in Manikpur forest range (21) followed by Markundi forest range (17), Karvi forest range (14) and Bargarh forest range (9) while minimum no. of species was recorded in Raipura forest range (5). Maximum no. of family in dense forest was recorded in Manikpur forest range (14) followed by Markundi forest range (12), Karvi forest range (11) and Bargarh forest range (7) while minimum no. of family recorded in Raipura forest range (3).The Shannon index maximum in Manikpur forest range (4.49335) followed by Markundi forest range (3.232), Karvi forest range (3.1031) and Bargarh forest range (1.14713) while minimum was recorded in Raipura forest range (0.62767).Diagram showing the tree species dominance and diversity in different forest range of Chitrakoot Forest Division Uttar Pradesh

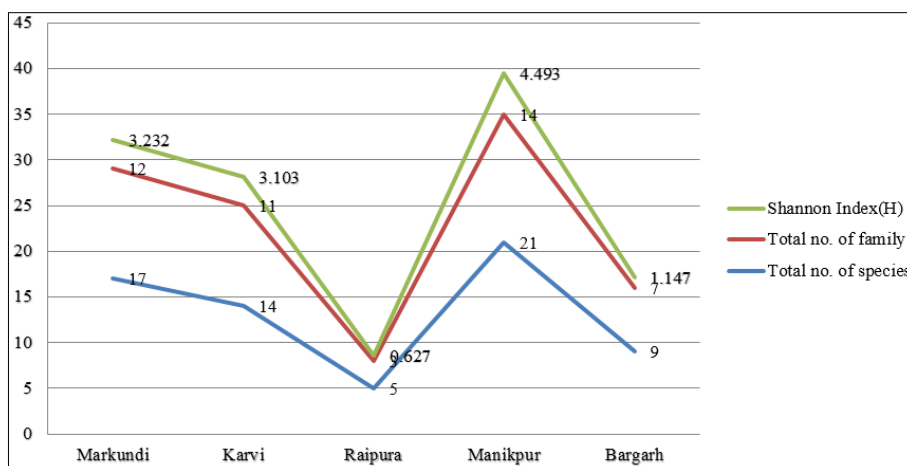


Fig 1: Species richness and diversity indices of dense forest in Chitrakut forest Division of U.P

Conclusion

Present study show that Manikpur range has maximum no. of tree species (21) and families (14) and is most diverse among all range. The Shannon index maximum in Manikpur forest range (4.49335) followed by Markundi forest range (3.232), Karvi forest range (3.1031) and Bargarh forest range (1.14713) while minimum was recorded in Raipura forest range (0.62767). Considering the importance of rich

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