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STUDY ON PLANTS DIVERSITY IN CHHINDWARA DISTRICT OF MADHYA PRADESH

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ABSTRACT

Biodiversity is providing the basis for life on earth which includes the variability of animals, plants and microbes. India is home of rich plant diversity distributed across different habitats from sea level to world's highest mountains, the Himalaya. Forest of Chhindwara is regarded as one of the mega biodiversity centers of the India. Major plant species in three forests divisions of Chhindwara is *Tectona grandis*. Critical analysis of physiochemical properties of soil indicated that *Tectona grandis* trees favours well drain sandy loam soil with high amount of exchangeable calcium and magnesium and also cataion exchange capacity. Thus, teak prefers soil which is rich in calcium and magnesium and high in cataion exchange capacity. Teak soil is relatively fertile with high calcium (Ca), phosphorus (P), potassium (K), nitrogen (N) and organic matter (OM) contents (Bhatia, 1954; Seth and Yadav, 1958; Samapuddhi, 1963; Kiatpraneet, 1974; Sahunalu, 1970; Kaosa-ard, 1981; Bunyavejchewin, 1987; Srisuksai, 1991). Several studies indicate that teak requires relatively large amounts of calcium for its growth and development, and teak has been named as a calcareous species (Seth and Yadav, 1958; Kaosa-ard, 1981; Tewari, 1992). The amount of calcium content in the soil is also used as an indicator of teak site quality. That is, the greater the proportion of teak to other associate species, the higher the calcium content in the forest soil (Bunyavejchewin, 1983, 1987). Also *Buchnania lanzan*, *Butea monosperma*, *Diospyrous melanoxylon*, *Lagerstroemia parviflora* and *Madhuca indica* plant species seems to prefer physiochemical properties of soil like that of *Tectona grandis*. It is concluded that the Chhindwara district is harboring a variety of flora.

Introduction

India is known for its rich plant diversity distributed across different habitats from sea level to world's highest mountains, the Himalaya. It is regarded as one of the 20 mega biodiversity centers of the world (Paine, 1997). It is estimated that around 45,000 plants species are known to occur in India, of which 19,935 taxa (including infrasecific taxa) are angiospermic flora (Karthikeyan, 2000). Fabaceae (133 genera; 975 species) and Poaceae (263 genera;1,291 species) represent the families with largest number of species among dicots and monocots respectively. About 8000 flowering plant species have been recorded in different codified and non-codified system of medicine practiced by 4635 ethnic communities. These plants are distributed across different biogeographic zones, forest types, altitudinal gradations, soil types and rainfall regimes.

Biodiversity is providing the basis for life on earth which includes the variability of animals, plants and microbes. It includes inter alga, lower plants (including bacteria, viruses and

mycoplasma like organisms), higher plants (herbs, shrubs and trees), animal breeds including fishes, birds and invertebrates. Based on natural resource categories, it is further classified into Forests, Croplands, Rangelands and Aquatic environment. All these species are used directly or indirectly for food and agriculture; feed for domestic animals and also for the provision of essential raw materials and services for life support such as fiber, fuel, fertilizer and pharmaceuticals. Hence, biodiversity makes ecosystem stable, functional and environmentally sustainable.

The biodiversity found on earth today consisting of many millions of district biological species which is the product of nearly 3.5 billion years of evolution. During this past 3.5 billion years, a wild variety of plants came into existence, flourished and then vanished due to various reasons. India is twelfth mega biodiversity nation in the world and has the richest floristic diversity and harbors 17000 flowering plants. Himalaya and Western Ghat is the two hottest hotspots in India. Knowledge of forest structure and floristic is necessary for the study of forest dynamics, plant animal interactions and nutrient cycling. (Reddy and Pattnaik, 2009). It is therefore necessary to have proper knowledge regarding the various species of plants inhibiting of any particular area at that particular time period (Joshi *et al*., 2004).

The vegetation and flora of satpura region is rich and diverse. Satpura range in the Central region is a situated in the east part of Madhya Pradesh falls under tropical dry deciduous forest (Champion and Seth 1968). Chhindwara district is located on the South-West region of 'Satpura Range of Mountains'. It is spread from 21.28° to 22.49° North (latitude) and 78.40° to 79.24° East (longitude) and spread over an area of 11,815 km². The geographical height of district varies from 1,550 ft (470 m) to 3,820 ft (1,160 m) above sea level with an average elevation of 2215 feet (675 m). Around 4212.556 km² area of the district is covered under forest. Bamboo (Bamboo sp.), Teak (*Tectona grandis*), Harra (*Terminalia chebula*), Bija Sal (*Pterocarpus marsupium*), Chironji (*Buchnania lanzan*) and Tendu (*Diospyros melanoxylon*) are the major forest wealth.

Study area

Chhindwara district is divided into three forest division namely East forest division, West forest division and South forest division. Survey was carried out under forest division with compartment number.

S. N	Forest Division	Forest Range	Beat	Compt. No.	Latitude	Longitude
1	East Forest Division	Amarwada	Morkha	P1155	N 22° 25' 43.2″	E 79° 07' 45.6″
2	East Forest Division	Chindhi	Rated	813	N 22° 25' 46″	E78° 49' 8.90″
3	East Forest Division	Batkakhapa	Churikhurd	931	N22° 36' 36.7″	E79° 10' 28″
4	East Forest Division	Harrai	Siarkhed	80	N 22° 45' 41.5″	E 79° 10' 21.4″
5	East Forest Division	Chourai	Nawegaon	1352	N 22° 02' 42.7″	E 79° 13' 07.9″
6	East Forest Division	Chhindwara	Ghogri	1286	N 21° 50' 51.8″	E 78° 49' 18.1″
7	South Forest Division	Lawaghogri	Bamla	1787	N 22° 04' 52.4″	E 78° 52' 32.2″
8	South Forest Division	Ambada	Met	1854	N 22° 13' 57″	E 78° 37' 18.2″
9	South Forest Division	Pandhurna	Dudha	2010	N 22° 0.9' 25″	E 78° 24' 19.2″
10	South Forest Division	Sausar	Jamalpani	1941	N 22° 35' 0.4″	E 78° 36' 16.0″
11	South Forest Division	Bichuwa	Phulpuldoah	1494	N 22° 35' 04.9″	E 78° 36' 15.8″
12	West forest Division	Sawari	Manikhapa	652	N 22° 05' 14.8″	E 78° 52' 29.5″
13	West forest Division	Jamai	Tatarwada	465	N 22° 14' 49″	E 78° 58' 26.2″
14	West forest Division	Damua	Rampur	435	N 21° 55' 13.2″	E 78° 34' 40.7″

15	West forest Division	Zirpa	Anhoni	P33	N 21° 46' 45.9"	E78° 97' 34.6"
16	West forest Division	Delakhari	Delakhari	166	N 23° 33' 23.0"	E 78°30' 10.5"
17	West forest Division	Parasiya	Shankarpur	706	N21° 33' 49.7"	E 78° 30' 10.08"
18	West forest Division	Tamia	Lehgadua	236	N 21° 40' 19.2"	E 78° 41' 8.7"

Material and Methods

For the study of biodiversity status total eighteen ranges were selected randomly and sample point were laid out and general plot variable were recorded such as stand condition, Nested quadrates of 10 x10m, 3 x3m, and 1 x1m size for tree, shrub and herb layers respectively has been laid out in each sample point location. First nested quadrates with outermost edges 10 x10m, 3 x3m, and 1 x1m nested within, with the coordinates at the center. Direction of the maximum density of vegetation has been identified. One transect were laid in that direction and the other perpendicular to the transect line. Four quadrates has also been laid out similar to the first on each of the two transects on the either side of the point of intersection at a distance of 15m from each other, distance measured from the center of each quadrate. Thus total nine nested quadrates per sampling point have been studied and vegetation data was analysed for density, frequency and abundance according to formulae given by Curtis and Mclntosh (1950). The relative value of density, frequency and dominance were summed to get Importance Value Index (IVI) of individual species. The abundance to frequency ratio (A/E) of different species was determined for eliciting the distribution pattern. This ratio indicates regular (<0.025) random (0.025 to 0.050) and contiguous (>0.050) distribution (Curits and Cottam, 1956), the species diversity was calculated by using Shanon-Wiener diversity Index (H) (Shanon-Wiener, 1963).

$$\mathbf{H} = \sum_{i=1}^{S} (Ni / N) \ln (Ni / N)$$

Where Ni = Total number of individuals of species i and N = Total number of individuals of all the species. H = index of diversity.

Identification of biodiversity rich area:

The number of species present within a group in an indicator of species richness (Peet, 1974). The number of individuals also affects the species diversity and richness of a locality (Odum, 1974).

Floristic Diversity and Phyto-sociology of Study Area

Results and discussions

For the study of floristic diversity eighteen ranges were surveyed and data were collected on girth at breast height (GBH) of trees, number of tree, shrubs, herbs and bamboos.

1. **Chhindwara range:** Density / ha of tree varied from 622.22 to 11.11/ ha in this range. *Tectona grandis* was the dominant species followed by Lagerstroemia parviflora in terms of density, abundance, and frequency (Table-1). *Tectona grandis* recoded highest value in term of IVI (196.48) followed by Bauhinia purpures IVI (35.52). *Lagerstromia parviflora* IVI (47.78) and *Terminalia tomentosa* IVI (20.20). Shrub density/ ha was calculated and maximum (2098.50/ha) for *Diospyros melanoxylon* followed by *Butea monospperma* (1481/ha) in this range .
2. **Amarwada range:** Density / ha of tree was highest for *Tectona grandis* (833.33/ha) and lowest for *Terminalia bellarica, Anogeissus latifolia* and *Terminalia chebula* (11.11/ha) in this range and the total density was 1233/ ha. The basal area for tree species varied from site to site and maximum 30.59 m²/ha for *Tectona grandis* and minimum 0.19 m2/ha for *Diospyros melanoxylon*. The species diversity was 2.23 for tree layer. The degree of association of the species *Tectona grandis* recorded the highest value of IVI (102.2) followed by *Butea monosperma* IVI (29.07)in this range. Shrub density/ ha was calculated and maximum (2468/ha) for *Lantana*

camara followed by *Butea monospperma* (1932/ha).

3. **Chinndi range:** Density / ha of tree was highest for *Madhuca indica* (155/ha) and lowest for *Diospyros melanoxylon* (11.11/ha) in this range and the total density was 411/ ha. The basal area for tree species varied from site to site and maximum 9.22 m²/ha for *Terminalia tomentosa* and minimum 0.14 m2/ha for *Tectona grandis*. The species diversity was 1.90 for tree layer. *Madhuca indica* recorded the highest value of IVI (72.30) followed by *Terminalia tomentosa* IVI (69.65), *Terminalia chebula* IVI (46.95), and *Buchnania lanzan* IVI (40.47).Shrub density/ ha. was calculated and maximum (5431/ha) for *Lantana camara* followed by *Diospyros melanoxylon* (1234/ha).

4. **Batkakhapa range:** Density / ha of tree was highest for Tectona grandis (744.44/ha) and lowest for *Garuga pinnata, Diospyros melanoxylon* and *Terminalia chebula* (11.11/ha) in this range and the total density was 1022/ ha. The basal area for tree species varied from site to site and maximum 30.36 m²/ha for *Tectona grandis* and minimum 0.14 m2/ha for *Buchnania lanzan* and *Diospyros melanoxylon*. The species diversity was 1.81 for tree layer. The degree of association of the species was measured in term of importance value index (IVI). Perusal of (Table-1) reveals for *Tectona grandis* IVI (120.27/ha) followed by *Butea monosperma* IVI (27.36 /ha) and *Lannea coromandalica* IVI (31.37/ha) were the as major associates in this range. Shrub density/ ha. was calculated and maximum (1604/ha) for *Lannea coromandalica* followed by *Diospyros melanoxylon* (1234/ha).

5. **Harrai range:** Density / ha of tree was highest for *Chloroxylon swietenia* (100/ha and lowest for *Elaeodendron glaucum* and *Scheichera oleosa* (11.11/ha) in this range and the total density was 577.77/ ha. The basal area for tree species varied from site to site and maximum 4.39 m²/ha for Garuga pinnata and minimum 0.079 m2/ha for *Elaeodendron glaucum* 18.52 (m2/ha). The species diversity was 2.55 for tree layer. The degree of association of the species was measured in term of importance value index *Garuga pinnata* IVI (39). was the most dominant species with *Madhuca indica* IVI (36.89)., *Chloroxylon swietenia* IVI (35). and *Anogessus latifolia* IVI (29.02) were major associates in this range. Shrub density/ ha. was calculated and maximum (4814/ha) for *Lantana camara* followed by *Butea monospperma* (4073/ha).

6. **Chourai range :** Density / ha of tree was highest for *Tectona grandis* (155/ha) and lowest for *Careya arborea* and *Dalbergia sissoo* (11.11/ha) in this range and the total density was 377/ ha. The basal area for tree species varied from site to site and maximum 1.91 m²/ha for *Garuga pinnata* and minimum 0.302 m2/ha for *Dalbergia sissoo*. The species diversity was 1.52 for tree layer. The degree of association of the species Eucalyptus species was measured in term of importance value index IVI(85.05) followed by *Tectona grandis* IVI(79), *Butea monospperma* IVI(41) and *Dalbergia sissoo*.IVI(24.37) in this range. Shrub density/ ha. was calculated and maximum (4814/ha) for *Butea monospperma* followed by *Lantana camara* (246.88/ha).

7. **Sawari range:** Density / ha of tree was highest for *Tectona grandis* (422.22/ha) and lowest for *Knema attenuata* and *Azadiracta indica* (11.11/ha) in this range and the total density was 822/ ha. The basal area for tree species varied from site to site and maximum 9.86 m²/ha for *Tectona grandis* and minimum 0.10 m2/ha for *Knema attenuata* and *Azadiracta indica*. The species diversity was 1.95 for tree layer. The degree of association of the species was measured in term of importance value index for *Tectona grandis* IVI(88.55), was the most dominant species followed by *Chloroxylon swietenia* IVI(46.92), and *Knema attenuata* IVI(49.06) in this range. Shrub density/ ha. was calculated and maximum (4937/ha) for *Butea monosperma* followed by *Lantana camara* (4320/ha).

8. **Jamai range:** Density / ha of tree was highest for *Tectona grandis* (255/ha) and lowest for *Syzygium cumini* and *Buchnania lanzan* (11.11/ha). The basal area for tree species varied from site to site and maximum 10.39 m2/ha for *Tectona grandis* and minimum (0.17m²/ha) for *Syzygium cumini* and *Diospyros melanoxylon*. The species diversity was 2.15 for tree layer. The degree of association of the species was measured in term of importance value index (IVI). Perusal of (Table-2) reveals that *Tectona grandis* (76.50/ha) was the most dominant species with *Knema attenuata* IVI(45.86) and *Emblica officinalis* IVI (27.97) were the as major associates in this range. Shrub density/ ha. was calculated and maximum (3209/ha) for *Diospyros melanoxylon* followed by *Lantana camara* (740/ha).

9. **Damua range:** Density / ha of tree was highest for *Tectona grandis* (100/ha) and lowest for *Lagerstromia parviflora, Careya arborea* and *Adina cordifolia* (11.11/ha) in this range. The basal area for tree species varied from site to site and maximum 2.90 m²/ha for *Tectona grandis* and minimum 0.08 m2/ha for *Adina cordifolia*. The species diversity was 1.89 for tree layer. *Tectona grandis* recorded highest value in term of IVI (88.21) followed by *Lagerstromia parviflora* IVI(51.1)and *Dyospyros melanoxylon* IVI (56.2) were the as major associates in this range. Shrub density/ ha. was calculated and maximum (617.22/ha) for *Buchnania lanzan* followed by *Diospyros melanoxylon* (740/ha).

10. **Zirpa range:** Density / ha of tree was highest for *Tectona grandis* (488.88/ha) and lowest for *Beutea monosperma* and *Buchnania lanzan* (11.11/ha) in this range. The basal area for tree species varied from site to site and maximum 27.16 m²/ha for *Tectona grandis* and minimum 0.32 m2/ha for *Buchnania lanzan*. The species diversity was 1.71 for tree layer. The degree of association of the species was measured in term of importance value index IVI (124.7). Perusal of (Table- 2) reveals that *Tectona grandis* was the most dominant species with *Madhuca indica,* IVI (61.62). and *Chloroxylon swietenia* IVI (29.33). were the as major associates in this range. Shrub density/ ha. was calculated and maximum (5184/ha) for *Diospyros melanoxylon* followed by *Lagerstromia parviflora* (740/ha).

11. **Delakhari range:** Density / ha of tree was highest for *Shorea robusta* (688/ha) and lowest for *Lagerstromia parviflora* (11.11/ha) in this range. The basal area for tree species varied from site to site and maximum 27.55 m2/ha for *Shorea robusta* and minimum 0.08 m²/ha for *Lagerstromia parviflora*. The species diversity was 1.60 for tree layer. The degree of association of the species was measured in term of importance value index (IVI). Perusal of (Table-2) reveals that *Shorea robusta* (112.06) was the most dominant species with *Madhuca indica* IVI (83.25), *Butea monosperma* IVI (41.5). and *Buchnania lanzan* IVI (24.8). were the as major associates in this range. Shrub density/ ha. was calculated and maximum (5184/ha) for *Diospyros melanoxylon* followed by *Lantana camara* (740/ha).

12. **Parasia range:** Density / ha of tree was highest for *Tectona grandis* (511.11/ha) and lowest for *Buchnania lanzan* and *Careya arborea* (11.11/ha) in this range. The basal area for tree species varied from site to site and maximum 19.24 m²/ha for *Tectona grandis* and minimum for *Lagerstromia parviflora* 0.24 m2/ha. The species diversity was 2.16 for tree layer. The degree of association of the species was measured in term of importance value index (IVI). Perusal of (Table-2) reveals that *Tectona grandis* (103.94) was the most dominant species with *Butea monosperma* IVI(33.78), and *Terminalia bellirica* IVI (23.13) were the as major associates in this range. Shrub density/ ha. was calculated and maximum (4320/ha) for *Lantana camara* followed by *Butea monosperma* (1234.44/ha).

13. **Tamia range:** Density / ha of tree was highest for *Tectona grandis* (577.77/ha) and lowest for *Madhuca indica* (11.11/ha) in this range. The basal area for tree species varied from

site to site and maximum 55.73 m2/ha for *Tectona grandis* and minimum 0.18 m²/ha for *Madhuca indica*. The species diversity was 0.77 for tree layer. The degree of association of the species was measured in term of importance value index *Tectona grandis* (202.07) was the most dominant species with *Madhuca indica* IVI (82.97) and *Diospyros melanoxylon* IVI (14.95), in this range. Shrub density/ ha. was calculated and maximum (4320/ha) for *Lantana camara* followed by *Butea monosperma* (1234.44/ha).

14. **Lawaghogri range:** Density / ha of tree was highest for *Tectona grandis* (355.55/ha) and lowest for *Knema attenuata* (22.22/ha) in this range. The basal area for tree species varied from site to site and maximum 10.42 m2/ha for *Lagerstromia parviflora* and minimum 0.91 m²/ha for *Knema attenuata*. The species diversity was 1.51 for tree layer. *Lagerstromia parviflora* recorded highest value in term of IVI (99.39) followed by Tectona grandis IVI (83.04) and Knema attenuata IVI (40.78) in this range. Shrub density/ ha. was calculated and maximum (3826.77/ha) for *Lantana camara* followed by *Chloroxylon swietenia* (1234.44/ha).

15. **Ambada range:** Density / ha of tree was highest for Tectona grandis (500/ha) and lowest for Terminalia tomentosa and *Diospyros melanoxylon* (33.33/ha) in this range. The basal area for tree species varied from site to site and maximum 16.91 m2/ha for *Tectona grandis* and minimum 0.34 m²/ha for *Diospyros melanoxylon*. The species diversity was 1.65 for tree layer. *Tectona grandis* recorded highest value in term of IVI (98.07) followed by *Terminalia tomentosa* IVI (51.6) and *Butea monosperma* IVI (67.83) were the as major associates in this range. Shrub density/ ha. was calculated and maximum (4937/ha) for *Butea monosperma* followed by *Lantana camara* (1357/ha).

16. **Pandhurna range:** Density / ha of tree was highest for *Tectona grandis* (588/ha) and lowest for *Terminalia tomentosa* (11.11/ha) in this range. The basal area for tree species varied from site to site and maximum 5.98 m²/ha for *Tectona grandis* and minimum 0.08 m2/ha for *Terminalia tomentosa*. The species diversity was 2.1 for tree layer. *Tectona grandis* recorded highest value in term of IVI (78.08) followed by *Acacia leucophloea* IVI (31.09) and *Soymida febrifuga* IVI (29.87) in this range. Shrub density/ ha. was calculated and maximum (2715/ha) for *Lagerosromia parviflora* followed by *Diospyros melanoxylon* (2098/ha).

17. **Sausar range:** Density / ha of tree was highest for *Tectona grandis* (544.4/ha) and lowest for *Lagerstromia parviflora* (33.33/ha) in this range. The basal area for tree species varied from site to site and maximum 22.56 m2/ha for *Tectona grandis* and minimum 0.10 m²/ha for *Lagerstromia parviflora*. The species diversity was 1.32 for tree layer. *Tectona grandis* recorded highest value in term of IVI (137.13) followed by *Butea monosperma* IVI (82.93) and *Cloroxylon swietenia* IVI (45.9) in this range. Shrub density/ ha. was calculated and maximum (4093/ha) for *Diospyros melanoxylon* followed by *Lantana camara* (1481/ha).

18. **Bichua range:** Density / ha of tree was highest for *Tectona grandis* (644.44/ha) and lowest for *Butea monosperma* (22.22/ha) in this range. The basal area for tree species varied from site to site and maximum 25.86 m²/ha for *Tectona grandis* and minimum 0.19 m2/ha for *Butea monosperma* . The species diversity was 1.54 for tree layer. *Tectona grandis* recorded highest value in term of IVI (121) followed by *Terminalia tomentosa* IVI (55.38) and *Buchnania lanzan* IVI (58.06) in this range. Shrub density/ ha was calculated and maximum (6912/ha) for *Terminalia tomentosa* followed by *Diospyros melanoxylon* (864/ha).

Table-1: Distribution of plants species in East forest division of Chhindwara Division

Sl. No.	Forest Range	Species	Abundance	Frequency %	Density/ ha	Total Basal area m²/ha	A/F	IVI
1	Chhindwara	*Bauhinia purpures*	1	11.11	11.11	0.266	0.090	35.523
		Lagerstroemia parviflora	1.66	33.33	55.55	0.913	0.050	47.782
		Terminalia tomentosa	1	11.11	11.11	0.114	0.90	20.209
		Tectona grandis	6.22	100.0	622.2	24.037	0.062	196.48
	Total		9.88	155.55	700.00	25.329	1.102	300.00
2	Amarwada	*Terminalia tomentosa*	1	11.11	11.11	1.062	0.090	21.275
		Terminalia belerica	1	11.11	11.11	0.371	0.090	10.049
		Boswellia serrata	1	22.22	22.22	1.936	0.045	23.768
		Buchnania lanzan	1.66	33.33	55.55	1.097	0.050	17.443
		Anogeissus latifolia	1	11.11	11.11	0.792	0.090	16.891
		Terminalia chebula	1	11.11	11.11	0.418	0.090	10.813
		Bridelia retusa	1	11.11	11.11	0.316	0.090	9.158
		Lagerstroemia parviflora	1	44.44	44.44	0.597	0.023	18.529
		Madhuka indica	4	22.22	88.88	3.565	0.180	20.694
		Butea monosperma	2.66	33.33	88.88	6.155	0.080	29.078
		Tectona grandis	8.33	100.00	833.33	30.597	0.083	102.31
		Terminalia tomentosa	1	22.22	22.22	0.281	0.045	10.333
		Diospyros melanoxylon	1	22.22	22.22	0.197	0.045	9.652
	Total		25.65	355.3	1233.2	47.3	1.001	299.993
3.	Chindhi	*Semecarpus anacardium*	1	11.11	11.11	0.002	0.090	7.097
		Buchnania lanzan	1.75	44.44	77.77	1.554	0.039	40.970
		Anogeissus latifolia	1	22.22	33.33	1.858	0.045	29.807
		Terminalia chebula	1	33.33	33.33	3.687	0.030	46.956
		Bridelia retusa	1	11.11	22.22	0.396	0.090	13.911
		Madhuka indica	2.33	66.66	155.55	5.587	0.035	72.303
		Terminalia tomentosa	1.25	44.44	55.55	9.228	0.028	69.650
		Tectona grandis	1	11.11	11.11	0.140	0.090	9.999
		Diospyros melanoxylon	1	11.11	11.11	0.108	0.090	9.308
	Total		1.26	28.39	45.68	2.51	0.06	33.33
4.	Batkakhapa	*Buchnania lanzan*	1	11.11	11.11	0.140	0.090	8.909
		Anogeissus latifolia	2.5	22.22	55.55	1.709	0.113	22.804
		Lannea coromandalica	1	33.33	33.33	1.756	0.030	31.374
		Terminalia chebula	1	11.11	11.11	0.430	0.090	17.110
		Garuga pinnata	1	11.11	11.11	0.219	0.090	11.146
		Lagerstroemia parviflora	1.71	77.77	133.33	5.149	0.022	52.115
		Butea monosperma	1	11.11	11.11	0.792	0.090	27.362
		Tectona grandis	7.44	100.00	744.44	30.361	0.074	120.27
		Diospyros melanoxylon	1	11.11	11.11	0.140	0.090	8.909
	Total		17.7	288.9	1022.2	40.7	0.7	300.0

5.	Harrai	*Emblica officinalis*	1.25	55.55	55.55	1.982	0.023	27.079
		Chloroxylon swietenia	1.80	100.00	100.00	2.740	0.018	35.930
		Buchnania lanzan	3.00	33.33	33.33	0.632	0.090	17.414
		Anogeissus latifolia	1.50	66.66	66.66	2.388	0.023	29.028
		Elaeodendron gloucum	1.00	11.11	11.11	0.079	0.090	5.952
		Miliusa tomentosa	1.00	11.11	11.11	0.237	0.090	8.609
		Garuga pinnata	1.80	100.00	100.00	4.391	0.018	39.010
		Acacia catechu	1.50	33.33	33.33	1.170	0.045	17.722
		Scheichera oleosa	1.00	11.11	11.11	0.455	0.090	12.262
		Lagerstroemia parviflora	1.00	22.22	22.22	0.643	0.045	14.644
		Madhuka indica	1.00	11.11	11.11	1.923	0.090	36.893
		Nyctanthes arbortrostis	1.00	11.11	11.11	0.108	0.090	6.430
		Gardenia latifolia	1.00	11.11	11.11	0.295	0.090	9.581
		Terminalia tomentosa	1.00	22.22	22.22	0.396	0.045	12.575
		Diospyros melanoxylon	1.75	77.77	77.77	1.084	0.023	26.871
	Total		20.6	577.7	577.74	18.52	0.87	300
6.	Chourai	*Careya arborea*	1	11.111	11.111	0.968	0.090	69.994
		Eucalyptus sp.	1.75	55.556	66.667	0.822	0.031	85.059
		Butea monosperma	1.25	44.444	44.444	0.590	0.028	41.472
		Dalbergia sissoo	1	22.222	22.222	0.302	0.045	24.373
		Tectona grandis	1.5	88.889	155.56	1.910	0.017	79.101
	Total		6.5	222.2	300.0	4.6	0.2	300.0

Table-2: Distribution of plants species in west forest division of Chhindwara Division

		Species	Abundance	Frequency %	Density/ha	Total Basal area m^2/ha	A/F	IVI
1	Sawari	*Cassia fistula*	3	22.22	33.33	0.354	0.135	13.995
		Chloroxylon swietenia	15	66.66	166.66	3.597	0.225	46.923
		Buchnania lanzan	1	11.11	11.11	0.360	0.090	14.660
		Anogeissus latifolia	6	44.44	66.66	3.042	0.135	35.508
		Knema attenuata	1	11.11	11.11	1.600	0.090	49.069
		Azadiracta indica	1	11.11	11.11	0.108	0.090	7.668
		Butea monosperma	4	22.22	44.44	0.527	0.180	15.729
		Acacia leucophloea	5	44.44	55.55	1.406	0.113	27.892
		Tectona grandis	38	100.00	422.22	9.869	0.380	88.557
	Total		74.0	333.3	822.2	20.9	1.4	300.0
2	Jamai	*Emblica officinalis*	1.5	22.22	33.33	3.034	0.068	27.976
		Semecarpus anacardium	1	33.33	33.33	1.327	0.030	21.989
		Buchnania lanzan	1	11.11	11.11	1.264	0.090	25.031
		Anogeissus latifolia	1.5	22.22	33.33	1.602	0.068	20.410

		Syzygium cumini	1	11.11	11.11	0.178	0.090	7.809
		Lagerstroemia parviflora	1	22.22	22.22	1.773	0.045	24.038
		Knema attenuata	1.16	66.66	77.77	6.162	0.017	45.864
		Terminalia tomentosa	1	33.33	33.33	1.548	0.030	23.153
		Tectona grandis	2.87	88.88	255.55	10.390	0.032	76.503
		Diospyros melanoxylon	1	55.55	55.55	0.716	0.018	27.227
	Total		13.0	366.6	566.6	28.0	0.5	300.0
3	Damua	*Chloroxylon swietenia*	1	11.11	11.11	0.108	0.090	9.199
		Buchnania lanzan	1	33.33	33.33	1.728	0.030	39.166
		Adina cordifolia	1	11.11	11.11	0.090	0.090	8.393
		Careya arborea	1	11.11	11.11	0.494	0.090	26.838
		Boswellia serrata	1	11.11	11.11	0.090	0.090	8.393
		Lagerstroemia parviflora	2.57	77.77	77.77	1.285	0.033	51.186
		Butea monosperma	1	11.11	11.11	0.178	0.090	12.406
		Tectona grandis	4.33	100.00	100.00	2.905	0.043	88.216
		Diospyros melanoxylon	2.62	88.88	88.88	1.189	0.029	56.205
	Total		15.5	355.5	355.5	8.1	0.6	300.0
4	Zirpa	*Chloroxylon swietenia*	1.5	22.22	33.33	2.055	0.068	29.338
		Buchnania lanzan	1	11.11	11.11	0.327	0.090	13.518
		Miliusa tomentosa	3	11.11	33.33	0.573	0.270	13.629
		Bauhinia variegata	1	22.22	22.22	0.988	0.045	23.429
		Madhuka indica	1.2	55.55	66.66	7.796	0.022	61.629
		Butea monosperma	1	11.11	11.11	0.605	0.090	19.805
		Tectona grandis	4.88	100.00	488.88	27.163	0.049	124.70
		Diospyros melanoxylon	3	11.11	33.33	0.615	0.270	13.944
	Total		2.07	30.55	87.50	5.02	0.11	37.50
5		*Buchnania lanzan*	1	22.22	22.22	0.742	0.045	24.482
		Syzygium cumini	1	33.33	33.33	0.387	0.030	18.117
		Lagerstroemia parviflora	1	11.11	11.11	0.090	0.090	8.081
	Delakhari	*Madhuka indica*	1.62	88.88	144.44	13.348	0.018	83.252

		Moyan	1	22.22	22.22	0.191	0.045	12.496
		Butea monosperma	1.85	77.77	144.44	1.819	0.024	41.509
		Shorea robusta	6.88	100.00	688.88	27.559	0.069	112.06
	Total		16.4	386.1	1154.1	49.2	0.4	337.5
6	Parasia	*Buchnania lanzan*	1	11.11	11.11	0.711	0.090	17.097
		Careya arborea	1	11.11	11.11	0.406	0.090	11.853
		Scheichera oleosa	1	11.11	11.11	0.494	0.090	13.363
		Lagerstroemia parviflora	1	22.22	22.22	0.174	0.045	11.251
		Madhuka indica	1	22.22	22.22	1.054	0.045	18.815
		Butea monosperma	1.16	66.66	77.77	1.260	0.017	33.784
		Terminalia belerica	1	11.11	11.11	1.062	0.090	23.132
		Acacia leucophloea	1	11.11	11.11	0.247	0.090	9.115
		Terminalia tomentosa	1.5	22.22	33.33	2.903	0.068	27.815
		Tectona grandis	5.11	100.00	511.11	19.248	0.051	103.94
		Diospyros melanoxylon0.380	2	22.22	44.44	0.627	0.090	15.304
		Ougeinia oojeinensis	1	11.11	11.11	0.562	0.090	14.532
	Total		17.8	322.2	777.8	28.7	0.9	300.0
7	Tamia	*Madhuca indica*	1	11.11	11.11	3.004	0.090	82.975
		Tectona grandis	5.77	100.00	577.77	55.733	0.058	202.07
		Diospyros melanoxylon	2	11.11	22.22	0.185	0.180	14.951
	Total		8.8	122.2	611.1	58.9	0.3	300.0

Table-3: Distribution of plants species in south forest division of Chhindwara Division

		Species	Abundance	Frequency %	Density/ha	Total Basal area m²/ha	A/F	IVI
1	Lawaghogri	*Chloroxylon swietenia*	2.25	44.44	100.00	1.688	0.051	39.401
		Acacia catechu	1.75	44.44	77.77	1.325	0.039	37.378
		Lagerstroemia parviflora	4.77	100.00	477.77	10.426	0.048	99.391
		Knema attenuata	2	11.11	22.22	0.910	0.180	40.788
		Tectona grandis	4	88.88	355.55	7.477	0.045	83.043
	Total		14.8	288.9	1033.3	21.8	0.4	300.0
2	Ambada	*Anogeissus latifolia*	1	11.11	11.111	0.776	0.090	34.434
		Lagerstroemia	1.2	55.55	66.66	0.966	0.022	30.020

		parviflora						
		Butea monosperma	2.88	100.00	288.88	4.637	0.029	67.831
		Terminalia tomentosa	1	33.33	33.33	2.959	0.030	51.606
		Tectona grandis	5	100.00	500.00	16.918	0.050	98.070
		Diospyros melanoxylon	1	33.33	33.33	0.348	0.030	18.040
	Total		12.1	333.3	933.3	26.6	0.3	300.0
3	Pandhurna	*Chloroxylon swietenia*	3.25	88.89	288.88	3.073	0.037	51.334
		Buchnania lanzan	1	11.11	11.111	0.140	0.090	11.077
		Anogeissus latifolia	1.5	44.44	66.667	0.929	0.034	24.456
		Zizyphus xylopyra	2	11.11	22.222	0.174	0.180	9.139
		Lagerstroemia parviflora	1.33	33.33	44.444	0.500	0.040	18.368
		Knema attenuata	1	22.22	22.222	0.531	0.045	21.337
		Acacia leucophloea	1.6	55.55	88.889	1.559	0.029	31.094
		Soymida febrifuga	1	11.11	11.111	0.494	0.090	29.879
		Terminalia tomentosa	1	11.11	11.111	0.090	0.090	8.387
		Tectona grandis	5.88	100.00	588.88	5.985	0.059	78.081
		Diospyros melanoxylon	3.5	22.22	77.778	0.675	0.158	16.842
	Total		23	411	1233	14	1	300
4	Sausar	*Chloroxylon swietenia*	2	11.11	22.22	1.124	0.180	45.916
		Lagerstroemia parviflora	1	11.11	11.11	0.108	0.090	13.276
		Butea monosperma	2.33	100.00	233.33	4.383	0.023	82.933
		Tectona grandis	5.44	100.00	544.44	22.563	0.054	137.13
		Diospyros melanoxylon	1.5	22.22	33.33	0.335	0.068	20.738
	Total		12.3	244.4	844.4	28.5	0.4	300.0
5	Bichuwa	*Buchnania lanzan*	1.33	66.66	88.88	3.392	0.020	58.069
		Anogeissus latifolia	1.5	22.22	33.33	0.259	0.068	15.836
		Lagerstroemia parviflora	1	44.44	44.44	0.904	0.023	33.356
		Butea monosperma	1	22.22	22.22	0.197	0.045	15.659

		Terminalia tomentosa	3	77.77	233.33	3.048	0.039	55.389
		Tectona grandis	6.44	100.00	644.44	25.864	0.064	121.69
	Total		14.3	333.3	1066.6	33.7	0.3	300.0

As per our survey we observed that in studied ranges (18 Nos in different divisions) accommodates more than 78 plant species of which 37 are tree, 38 shrubs and herbs and 6 grasses and bamboos in study area. In East forest division 14 tree species, West forest division 21 and in South forest division 12 tree has been recorded. In case of shrub lantana camera and Tendu (*Diospyros melanoxylon*) density is higher in all the ranges and varieties of medicinal and aromatic plants are available in this area.

The existence development of an organism in an ecosystem depends not only upon its ecological adaptation but also on its relation with associated species and the nonliving environment. Hence quantitative relationship between dominant and rare species an important structural property at the community, in the present study, density / ha of trees varied from 377.77 to 1233.33 / ha and basal area (m^2/ha) varied from 5.631 to 47.384 in East forest division, 355.55 to 1066.66/ ha and 8.064 to 44.135 in West forest division and 844.44 to 1233 density/ ha and 14.150 to 33.664 in South forest division. The density and basal area are in accordance with the values reported by other authors (Singal *et. al* 1993, Mishra *et al* 1993) for tropical dry deciduous forests.

The high importance value index (IVI) of the species indicated its dominance and ecological success, its good power of regeneration and greater ecological aptitude. In the present study the value for tree layer showed that *Tecona grandis* was a dominant species in all the divisions. The maximum IVI (196) for Chhindwara range of East division with associate species were *Lagerstromia parviflora* and *Terminalia tomentosa* followed by 202.074 (IVI) for Tamia range of West forest division with associate species were *Madhuca indica* and *Diospyros melanoxylon* and 137.136 (IVI) for Sausar range of South forest division with associate species were *Butea monosperma* and *Cloroxylon swietenia* .

In general, highest basal area indicates more mature forest and lower basal area indicates younger stage of maturity. In addition, low total basal area and less density values indicated the effect of greater biotic interference. Forest soil is sandy loam with pH ranged from 6.49 to 6.83, electric conductivity from 63 to 70.20 mmhos/cm, Nitrogen from 344.45 to 658.56 Kg/ha, Phosphorous from 8.32 to 11.70 Kg/ha, Potassium from 268.00 to 472.25 Kg/ha, Calcium from 12.40 to 23.20 meq/100gm, Magnesium from 0.80 to 2.80 meq/100gm and organic carbon 0.39 to 1.24% was estimated.

Nature of vegetation:

In the present study, frequency of all the species was used to determine the nature of the vegetation. The data were analyzed following Raunkiaer (1934) and the nature of trees, shrub and herbs was determined. The nature of vegetation was predominantly heterogeneous at all the three divisions for trees, shrubs and herbs.

Species diversity:

Species diversity index was work out for tree species and maximum species diversity (2.551) was observed in Harrai range at East forest division of Chhindwara and minimum 0.771 at Tamia range, West Forest Division Chhindwara. The values lie within the range reported for other tropical forests from central India. Knight (1975) reported species diversity between 5.06 and 5.40 for tropical forests. However, the values of the species diversity obtained in the present study are comparable with the values generally reported for other tropical forests. Saxsena (1990) reported

diversity values from 1.0989 to 1.223. The highest value of tree diversity indicated less disturbances at this range.

Biodiversity rich Areas:

The species richness was calculated by simply the number of species per unit area (Whittaker 1960 and 1972). Data presented inTable 4 shows that of the 78 plants species occurring in the surveyed area of Chhindwara district of which 37 species maximum (21) trees species. are trees , 35 are shrubs and herbs and 6 species of grasses and bamboos. On the basis of data West forest division dominated by the plant species are *Tectona grandis, Buchnania lanzan, Maduca indica* and *Shorea robusta* seems to be biodiversity rich area as it harbors

Table 4 : Number of trees, shrub and herbs and grasses observed under Chhindwara district.

Sl. No.	Communities	Numbers of species
1.	Trees	37
2.	Shrubs and herbs	35
3.	Grasses and bamboos	6
	Total	78

Population distribution: The population distribution of tree shrub and herb species in all the forest divisions mainly showed contagious distribution pattern followed by random distribution.

Trees:

In the east forest division 56.36 % species showed contagious distribution, 30.09 % random distribution and rest regular distribution. In west forest division 63.15 % species showed contagious distribution, 26.31 % random distribution and 10.52 % species showed regular distribution and in South forest division 48.50 % contagious distribution, 45.45 % showed random distribution and 6.06 % species showed regular distribution. A/F ratio of tree species in the study site indicated random to contagious distribution pattern.

Shrubs:

In the east forest division 77.77 % species showed contagious distribution, 18.51 % random distribution and rest regular distribution. In west forest division 66.66 % species showed contagious distribution, 24.35 % random distribution and 8.97 % species showed regular distribution and in South forest division 66.07 % contagious distribution, 28.57 % showed random distribution and 5.35% species showed regular distribution. A/F ratio of shrub species was calculated for eliciting the distributional pattern. Hubbell et al. (1999) reported that the dispersal limitation is an important ecological factor for controlling species distribution pattern and a connection between biotic and abiotic ecological factors. A/F ratio ascertained that several shrub species of the study area showed contagious distribution while the others follow random distribution and regular distribution. According to Odum (1971) contagious distribution is commonest in nature, random distribution is found only in very uniform environment and regular distribution occurs where severe competition exists between individuals.

Herbs:

In the east forest division 80.95 % species showed contagious distribution, 14.28 % random distribution and rest regular distribution. In west forest division 80.50 % species showed contagious distribution, 13.25 % random distribution and 6.25 % species showed regular distribution and in South forest division 72.77 % contagious distribution, 20.00 % showed random distribution and 7.23% species showed regular distribution. A/F ratio of herb species in the study site indicated random to contagious distribution pattern. According to Odum (1971), the study area was not

completely uniform because of several species showed contagious distribution (Table- 5).

Table-5: Distribution pattern (%) of tree and shrub in surveyed ranges of Chhindwara

Division	Tree			Shrub			Herb		
	R	r	C	R	R	C	R	R	C
East forest division	12.72	30.92	56.36	3.70	18.51	77.77	4.76	14.28	80.95
West forest division	10.52	26.31	63.15	8.97	24.35	66.66	6.25	13.25	80.50
South forest division	6.06	45.45	48.50	5.35	28.57	66.07	7.23	20.00	72.77

R – Regular r - Random C - Contagious

Table 6: List of Trees, shrubs, herbs and grasses and bamboo species available in the surveyed area of Chhindwara district.

Sr. No.	Botanical name	Local name	Family
	1. Trees		
1.	*Acacia catechu (L.F.) Willd*	Khair	Mimosaceae
2.	*Albizia lebbeck (L.) Benth.*	Chichawa	Mimosaceae
3.	*Acacia leucophloea Willd*	Reunja	Mimosaceae
4.	*Adina cordifolia Hook.*	Haldu	Rubiaceae
5.	*Anogessus latifolia Wall.*	Dhawa / Dhawda	Combretaceae
6.	*Azadiracta indica A. Juss.*	Neem	Meliaceae
7.	*Bridelia retusa (L)*	Kasai	Euphorbiaceae
8.	*Butea monosperma (Lam.)*	Palash	Fabaceae
9.	*Buchnania lanzan Spreng.*	Chironji	Anacardiaceae
10.	*Cassia fistula Linn.*	Amaltas	Caesalpiniaceae
11.	*Careya arborea Roxb.*	Kumbhi	Myrtaceae
12.	*Chloroxylon swietenia DC.*	Bhirrah	Meliaceae
13.	*Dalbergia sissoo Roxb.*	Sisam	Papilionaceae
14.	*Diospyrous melanoxylon L.*	Tendu	Ebenaceae
15.	*Elaeodendron glaucum Rottb*	Jamrashi	Celastraceae
16.	*Emblica officinales Gaertner*	Aonla	Euphorbiaceae
17.	*Eucalyptus spp*	Nilgiri	Myrtaceae
18.	*Gardenia latifolia Aiton, Hort.*	Papda	Rubiaceae
19.	*Garuga pinnata Roxb.*	Kekda	Burseraceae
20.	*Knema attenuata Hook.f. & Th.*	Moyan	Myristicaceae
21.	*Lagerstromia parviflora Roxb*	Lendiya	Lythraceae
22	*Lannea coromandalica Houtt. Merr.*	Gunja	Anacardiaceae
23.	*Madhuca indica J. F. Gmel*	Mahua	Sapotaceae
24.	*Nyctanthes arbor-tristis Linn.*	Harsingar	Oleaceae
25.	*Ougeinia oojeinensis (Roxb.)*	Tinsa	Papilionaceae
26.	*Pithecellobium dulce Benth*	Jangal jlebi	Leguminoseae
27.	*Scheichera oleosa (Lour.)*	Kusum	Sapindaceae
28.	*Semecarpus anacardium Linn.f.*	Bhilwa	Anacardiaceae

29.	*Shorea robusta Gaertn.*	Sal	Dipterocarpaceae
30.	*Soymida febrifuga Roxb.*	Rohan	Meliaceae
31.	*Syzygium cumini (Linn.)*	Jamun	Myrtaceae
32	*Tectona grandis Linn.*	Teak	Verbenaceae
33.	*Terminalia tomentosa (Roxb).*	Saja	Combretaceae
34	*Terminalia arjuna (Roxb)*	Arjun	Combretaceae
35.	*Terminalia belerica Roxb.*	Behada	Combretaceae
36	*Terminalia chebula Retz.*	Harra	Combretaceae
37.	*Zizyphus jujuba P.Mill.*	Ber	Rhamnaceae
2. Shrubs, herbs, grasses and bamboo available in surveyed area			
1.	*Abution indicum (Linn.)*	Atibala	Malvaceae
2.	*Achyranthes aspera L.*	Apamarg	Amaranthaceae
3.	*Antidesma diandrum, Roth.*	Khatua	Euphorbiaceae
4.	*Anona squamosa Linn*	Sitafal	Anonaceae
5.	*Andrographis paniculata Nees*	Kalmegh	Acanthaceae
6.	*Asparagus racemosus Willd.*	Satawar	Liliaceae
7.	*Boswellia Serrata*	Sarata	Bruseraceae
8.	*Calatropis procera (Aiton)*	Akada	Asclepiadaceae
9.	*Canarium strictum Roxb.*	Dhoop	Burseraceae
10.	*Carissa opaca Stapf*	Karvand	Apocynaceae
11.	*Cassia tora Linn.*	Chirota	Verbenaceae
12.	*Croton tiglium Willd*	Jamalgota	Euphorabiceae
13.	*Curuligo orchioides Gaertn.*	Kalimusali	Amaryllidaceae
14.	*Clematis gouriana Roxb.*	Bandarsiti	Ranunculaceae
15.	*Enhydra fluctuans Lour.*	Jaljamini	Asteraceae
16.	*Euphorbia antiquorum L.*	Dhudhi	Euphorbiaceae
17.	*Embelia robusta Roxb.*	Baibiding	Myrsinaceae
18.	*Eclipta prostrata L.*	Bringraj	Asteraceae
19.	*Eranthemum purpurescens Wight*	Jangli tulsi	Acanthaceae
20.	*Gymnema sylvestris R.*	Gudmar	Asclepiadaceae
21.	*Hemidesmus indicus R.*	Anantamul	Asclepidlaceae
22.	*Helicteres isora L.*	Aethi	Sterculiaceae
23.	*Miliusa tomentosa, Roxb .*	Kari	Anonaceae
24.	*Lantana camara L.*	Lantana	Verbenaceae
25.	*Leea macrophylla Roxb.*	Hatpan	Leeaceae
26.	*Randia dumetorum Thunb.*	Manhar	Rubiaceae
27.	*Mimosa pudica Linn.*	Chuimui	Mimosaceae
28.	*Phoenix acaulis Roxb*	Chind	Palmaceae
29.	*Phyllanthus amarus L.*	Bhuiaonla	Euphorbiaceae
30.	*Solanum nigrum Linn.*	Makoi	Solanaceae
31.	*Sida spinosa Linn.*	Mahabala	Malvaceae
32.	*Ventilago caliculata Gaertn.*	Keoti	Rhamnaceae
33.	*Woodfordia Fruticosa (L) Kurz.*	Dhawai	Lythaceae

34.	*Xenthium strumerium L.*	Gokhru	Compositeae
35.	*Zizyphus xylopira Retz.*	Ghatol	Rhamnaceae
3. Grasses and bamboo			
1.	*Andropogon pumilus Roxb.*	Dal phulia	Poaceae
2.	*Cynodon dactylon Pers.*	Dub grass	Poaceae
3.	*Cyperus scariosus*	Nagarmotha	Cyperaceae
4.	*Dendrocalamus strictus Nees*	Bamboo	Poaceae
5.	*Vetiveria zinzanioides Linn.*	Khus grass	Poaceae
6.	*Eragrostis tenella*	Bhurbhusi	Poaceae

Discussion:

The concept of phyto-sociology for studying vegetation of an ecosystem is much older. Phytosociology is defined as the study of composition, development, geographic distribution and environmental relationship of plant communities (Muller-Dombois and Eilenberg, 1974). Braun- Blanguet (1932) elaborated concept of community structure further and paved the way of modern study of plant sociology. Oosting (1956) described phytosociology as one of the major aspect of vegetational study. Smith and Cottam (1967) stated that if two species are significantly positively associated with a fairly stable environment then this species must not be competing to the extent that one will eliminate other, but it is possible that associated species will have slightly different needs at different time.

Saxena and Singh (1982) carried out phytosociological analysis of woody species in forest communities of a part of Kuman Himalaya. Sharma (1984) studied floristic composition and phytosociology of the vegetation of Shahajahanpur district in U.P. Joshi and Tiwari (1990) carried out phytosociological analysis of woody vegetation in a mountain flank in Garhwal Himalaya. They observed that the dominant species were different at different elevation. Ramprasad and Pandey (1993) carried out the ethno-medico-botanical studies on the indigenous medicinal plants of Achanakmar forest in Madhya Pradesh. They emphasized the need of survey of the natural habitats of wild medicinal plants and their mode of use for various ailments by tribal people of the locality. Gogte and Kumar (1993) carried out the ecological study in teak plantations and compared natural forest for different parameters. They suggested that it is inappropriate to discard the clear felling system and plantation practices altogether on the ground that the clear felling system results in the loss of plant diversity. Further they observed that at least in the initial stages there is no loss of plant diversity and the characteristics of original crop are preserved Varghese *et. al.* (1994) carried out ecological reconnaissance of Kulathupezha in Kerala. They observed that firing in the forest edges prevents regeneration of tree species, that affects the composition and structure of the forest. Soni and Vasistha (1991) studied vegetation structure of under storey in Eucalyptus plantation. They concluded that it is capable to providing hospitable conditions for other species to grow under it.Simpson (1949) proposed diversity index. Shannon and Weaver (1949) proposed diversity index as a proportional abundance of a species out of total species. Indices of diversity based on information theory were introduced into ecology by Margalfer (1957) McIntosh (1967) derived the index of diversity, based on different reasoning closely related to Simpson index. Different measures of heterogeneity differ in their response the changes in relative abundance of rare and common species (Hill, 1973). Peet (1974) quoted that Shanon index accord more than general concept of diversity.

Vegetation ecology is the study of structure of the vegetation and the vegetation systematic. This

includes the species composition and the sociological interaction of the species in communities. (Muller Dombois and Ellenberge, 1974). It emphasizes on study of composition, development, geographic distribution and environmental relation of the plant communities. Plants growing together have mutual relationship among themselves and with the environment. Such a group of plants in one area forms a stand. Several similar stands represent a community. Community is a part of an ecological system. In which transformation, accumulation and flow of energy involved. The functioning of this system is intimately related with the component of the community (Mishra, 1968).

Recommendations

1. Establish preservation plot in each range so that biodiversity can be conserved.
2. Eliminate all forms of human exploitation and biotic disturbances in the buffer and core area of the forest.
3. Improve the soil conservation activity so that soil moisture can be increased.
4. Ensure the involvement of local people participation for conservation of biodiversity.
5. Organize training programme on conservation of biodiversity for local people and frontline staff.

Conclusion

Major plant species in three forests divisions of Chhindwara is *Tectona grandis*. Critical analysis of physiochemical properties of soil indicated that *Tectona grandis* trees favours well drain sandy loam soil with high amount of exchangeable calcium and magnesium and also cataion exchange capacity. Thus, teak prefers soil which is rich in calcium and magnesium and high in cataion exchange capacity. Teak soil is relatively fertile with high calcium (Ca), phosphorus (P), potassium (K), nitrogen (N) and organic matter (OM) contents (Bhatia, 1954; Seth and Yadav, 1958; Samapuddhi, 1963; Kiatpraneet, 1974; Sahunalu, 1970; Kaosa-ard, 1981; Bunyavejchewin, 1987; Srisuksai, 1991). Several studies indicate that teak requires relatively large amounts of calcium for its growth and development, and teak has been named as a calcareous species (Seth and Yadav, 1958; Kaosa-ard, 1981; Tewari, 1992). The amount of calcium content in the soil is also used as an indicator of teak site quality. That is, the greater the proportion of teak to other associate species, the higher the calcium content in the forest soil (Bunyavejchewin, 1983, 1987). Also *Buchnania lanzan*, *Butea monosperma*, *Diospyrous melanoxylon*, *Lagerstroemia parviflora* and *Madhuca indica* plant species seems to prefer physiochemical properties of soil like that of *Tectona grandis*. It is concluded that the Chhindwara district is harboring a variety of flora. However, the biotic interference and lack of management system may create threat to the ecosystem which may results even in the extinction of some valuable species of plants.

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