

Plant Diversity, Edaphic Status and Population Structure in Different Forest Types of Madhya Pradesh and Chhattisgarh States in India

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Abstract

The present paper deals with the plant diversity, physico-chemical status of soil and population structure in different forest types/sub types of Madhya Pradesh and Chhattisgarh. The paper described the dominant and co-dominant status of tree, herbs, shrubs, climbers, and grasses species along with density, basal area, and population structure and biodiversity index in different forest types / sub types. Differences in the species composition from site to site could be attributed to climate change. The population structure in different forest types/sub types followed three categories viz; Greater proportion of individuals in the lower girth classes in forest types; Gap phase type, having absence of individuals in certain girth classes in forest type; More individuals in sapling stage and absence in higher classes in a forest type. There is a need to develop climate resilient forest management towards balancing the population structure of different species in different forest types / sub types for increasing the forest productivity.

Keywords: *Plant diversity, population structure, ecosystem stability, phyto-sociology, forest productivity*

1. Introduction

There are 309 preservation plots covering 207 different forest types of the country. Efforts are being made at the national level to develop ecological databases in the country. The States of Madhya Pradesh and Chhattisgarh are centrally located in India and lie between Latitude 17°48' to 26° 52' North and Longitude 74° 2' to 84° 24' East. The geographical area of both the states combined is 443000 sq. km's out of which 135000 sq. km area is under forest cover (as per the report of Forest Survey of India, 1995). The temperature during summer exceeds 40°C (except in Panchmarhi and Amarkantak) and may touch 48°C in western districts of M.P. The temperature during winters varies from 5°C to 14°C except in the plains of Chhattisgarh where winter is mild. Rainfall ranges between 1500 mm in the eastern and southern regions, to less than 800 mm in the western regions.

In both the states, there are 13 agro-climatic zones that precisely represent the natural regions, endowed with immense bio-diversity. Due to overexploitation, lack of *ex-situ* conservation, increase human and cattle population, fire incidence, depleting moisture regime, the bio-diversity resources have constantly been under pressure. Thus, on the recommendation of All India Silviculture Conference (1929,1939,1961) followed by NCA (1976), a large number of preservation plots were laid all over the country (including Madhya Pradesh and Chhattisgarh) with the objective of *in-situ* conservation of different forest types for regular ecological studies. The present paper deals with the plant diversity, edaphic status and population structure in different forest types of Madhya Pradesh and Chhattisgarh states in India (Table-1).

2. Materials and Methods

The climate of the study plots is Mansoonal with maximum and minimum rainfall occurring during mid June to mid September. May and June are the hottest months with temperature reaching up to 48⁰C, and December and January are the coldest months.

Studies on vegetation structure of the preservation plots were undertaken using quadrats method. In each plot, 11 quadrats of size 30x30 m, 45 quadrats of 5x5 m and 90 quadrats of 1x1 m were nested for enumeration of trees, shrubs and herbs, respectively. In each quadrat, gbh (girth at breast height at 1.37 m above ground level) of each tree (above 20 cm gbh) was measured and recorded, individually. Quantitative analysis of vegetation for frequency, density, abundance and basal area (basal cover) was calculated following Mishra (1989). Their relative values were calculated and summed to get Important Value Index (I.V.I) following Curtis and Cottom (1956). Shannon-Wiener diversity index (Shannon and Wiener, 1963) was calculated from the I.V.I values using the formula as given in Magurran (1988).

For determining population structure following gbh classes (in cm's) were arbitrarily established (a) 10-20 cm (saplings) (b) 21-30 cm (c) 31-45 cm (d) 46-60 cm (e) 61-90 cm (f) 91-120 cm (g) 121-150 cm (h) 151-180 cm, and (I) above 180 cm. Number of individuals present in each girth class, were divided by the total number of individuals in all girth classes of that forest type/sub types. The resultant values were multiplied by 100 to get percent density in each girth class for each forest type/sub types.

3. Results and Discussions

The both states covered 13 agro-climatic zones that precisely represent the natural regions, endowed with immense bio-diversity.

The degree of association of the species was measured in terms of I.V.I values. **Southern Moist Mixed Deciduous forest type** has *Tectona grandis* as the most dominant species while the common associates were evergreen component viz; *Syzygium cumini*, *Lagerstroemia parviflora*, *Butea monosperma*, *Cleistanthus collinus*, *Shorea robusta*, *Buchanania lanzan*, *Terminalia tomentosa*, *Saccopetalum tomentosum* and *Ougeinia oojeinensis*, irrespective of specific plots. As per Champion and Seth (1968), the presence of teak, in this forest type is an indicator of secondary succession. Within these plots, prominent associations were of *Cleistanthus collinus* - *Shorea robusta* - *Buchanania lanzan*; *Tectona grandis* - *Butea monosperma* - *Aegle marmelos*; *Tectona grandis* - *Syzygium cumini* - *Butea monosperma*; *Tectona grandis* - *Lagerstroemia parviflora* - *Syzygium cumini*; *Terminalia tomentosa* - *Tectona grandis* - *Lagerstroemia parviflora*; *Tectona grandis* - *Saccopetalum tomentosum* - *Ougeinia oojeinensis*. For this forest type species richness for trees ranged from 14 to 36. Tree density ranged from 136 ha⁻¹ to 594 ha⁻¹, while total basal cover was ranged from 19.58 m² ha⁻¹ to 29.03 m² ha⁻¹. For the herb layer species richness ranged from 19 to 29 while density ranged from 8600 ha⁻¹ to 638327 ha⁻¹.

Another forest type, **Moist Peninsular Sal forest** is characterized by the dominant status of *Shorea robusta* while *Terminalia tomentosa* - *Buchanania lanzan* - *Diospyros melanoxylon*; *Ixora parviflora* - *Cleistanthus collinus* - *Lannea coromandelica* are the common associates irrespective of specific plots. Within plots, there were prominent associations of *Shorea robusta* - *Buchanania lanzan* - *Ixora parviflora*; *Shorea robusta* - *Cleistanthus collinus* - *Lannea coromandelica*; *Shorea robusta* - *Terminalia tomentosa* - *Buchanania lanzan*; *Shorea robusta* - *Buchanania lanzan* - *Diospyros melanoxylon*. In this forest type, tree species richness ranged from 16 to 27. Tree density was ranged from 241 ha⁻¹ to 1860 ha⁻¹ while total basal cover was ranged from 10.54 m² ha⁻¹ to 56.47 m² ha⁻¹. For the herb layer, species richness ranged from 13 to 31 while density varied from 18020 ha⁻¹ to 154312 ha⁻¹. Mooney (1947) and Waheed Khan (1953) regarded the moist

peninsular sal forests of Madhya Pradesh as a climax community with 80-90 percent representation of sal, and the Moist mixed miscellaneous forest as biotic sub climax. In the present case, representation of sal in terms of percent density (37.6 to 43.8 per cent) and percent basal cover indicates that sal is being replaced by miscellaneous forests. The representation of *Cleistanthus collinus* in the co-dominant status at Risgaon, South Raipur (Chhattisgarh) reflects the occurrence of repeated fire and biotic interference at this site.

The **Southern Dry Mixed Deciduous forest**, represented by the dominant status of *Tectona grandis* along with co-dominant species such as *Buchanania lanzan* - *Shorea robusta* - *Diospyros melanoxylon*; *Butea monosperma* - *Hardwickia binnata* - *Boswellia serrata*. Within plots prominent associates were *Tectona grandis* - *Shorea robusta* - *Buchanania lanzan*; *Tectona grandis* - *Diospyros melanoxylon* - *Butea monosperma*; *Tectona grandis* - *Hardwickia binnata* - *Boswellia serrata*. In this forest type tree species richness ranged from 12 to 35. Tree density ranged from 807 ha⁻¹ to 890 ha⁻¹, while total basal cover ranged from 15.10 m² ha⁻¹ to 18.88 m² ha⁻¹. For the herb layer, species richness ranged from 17 to 38, while density varied from 5315 ha⁻¹ to 248880 ha⁻¹. The Southern dry mixed deciduous forest type differs from the dry teak forest type mainly floristically, though some typical species (notably *Boswellia serrata*) are more conspicuous. Bamboos were absent, however grasses were conspicuous. The presence of *Hardwickia binata* and *Boswellia serrata* also help to separate this forest type from moist deciduous forests, but their occurrence is rather sporadic and traceable to soil factors.

The **Dry Peninsular Sal forest type** represented by the dominant status of *Shorea robusta* along with co-dominant species viz; *Terminalia tomentosa* - *Diospyros melanoxylon* - *Buchanania lanzan*; *Embllica officinalis* - *Mallotus phillipenses* - *Saccopetalum tomentosum*. Within plots prominent associates were *Shorea robesta* - *Mallotus phillipenses* - *Terminalia tomentosa*; *Shorea robesta* - *Terminalia tomentosa* - *Embllica officinalis*; *Shorea robesta* - *Terminalia tomentosa* - *Diospyros melanoxylon*; *Diospyros melanoxylon* - *Saccopetalum tomentosum* - *Buchanania lanzan*; *Shorea robesta* - *Buchanania lanzan* - *Terminalia tomentosa*. In this forest type, tree species richness ranged from 19 to 44. Tree density ranged from 282 ha⁻¹ to 976 ha⁻¹ while total basal cover ranged from 14.66 m² ha⁻¹ to 25.9 m² ha⁻¹. For the herb layer, species richness ranged from 18 to 45 while density varied from 167324 ha⁻¹ to 386800 ha⁻¹. As per Champion and Seth (1968), the presence of *Shorea robusta* may represent a post climax association on moister and deeper soils, to the prevailing dry deciduous forests. The presence of *Shorea robusta* appeared to be the highest limit for dry Sal. The forest type here is edaphically conditioned, occurring on dry sandy pebbly soil derived from Pachmarhi sandstones, and conglomerates, in prevailing climate where the natural vegetation should be Sub-Tropical Wet Hill forests.

The **Dry Teak Forest Type**, occurring at north Betul forest division is characterized by an association of *Tectona grandis* - *Chloroxylon swietenia* - *Lagerstroemia parviflora*. The total tree density of 24 species present in this plot was 1089 ha⁻¹ with a basal cover of 32.73 m² ha⁻¹. The species richness of the herbaceous layer was 55 amounting to a total density of 319832 ha⁻¹. In this forest type the canopy was fairly complete and the trees were sufficiently large, tall and well grown to yield sawn timber. This forest type favors dry shallow porous soil on hill slopes, and the change from the moist deciduous forest is often quite sharp as one leaves the moister valleys.

The **Hardwickia forest type** occurring at Jhirpa (west Chhindwara forest division) is characterized by the association of *Terminalia tomentosa* - *Chloroxylon swietenia* - *Hardwickia binata*. The total tree density of 29 species present in this plot was 336 ha⁻¹ with a basal cover 7.63 m² ha⁻¹. The species richness of the herbaceous layer was 23 amounting to a total density of 422350 ha⁻¹. In this forest type the predominance of *Hardwickia binata* which is nearly evergreen gives this forest type a character of its own.

Pure consociations of such type are, often found but are quite restricted within the dry deciduous forest types. This forest type was scattered in blocks and patches in the drier regions.

The **Moist Tropical Deciduous Valley Sal forest type** occurring in Kanger forest division is characterized by *Shorea robusta* - *Pterocarpus marsupium* - *Terminalia tomentosa*. The total tree density of 35 species present in this plot was computed to be 347 ha⁻¹ with a basal cover of 24.41 m² ha⁻¹. The species richness of the herbaceous layer was 38 amounting to a total density of 8021 ha⁻¹.

The **Slightly Moist Teak forest type** occurring in Hoshangabad forest division was characterized by *Tectona grandis* - *Acacia leucophloea* - *Aegle marmelos*. In this plot, tree species richness was quite low, consisting of only 4 species. However, density was computed to be 510 ha⁻¹ with basal cover of 31.65 m² ha⁻¹. The species richness of the herbaceous layer was 20 amounting to a total density of 127770 ha⁻¹. This forest type could be differentiated from the moist teak forest due to higher proportion of dry deciduous associates in the tree association. Teak usually forms the major portion of the over wood.

The **Slightly Moist Mixed Deciduous forest type** occurring in South Betul forest division is characterized by *Tectona grandis* - *Terminalia tomentosa* - *Syzygium cumini*. In this plot tree species richness was 19, constituting a total density of 822 ha⁻¹ and a basal cover of 51.94 m² ha⁻¹. The species richness of the herbaceous layer was 32, amounting to a total density of 259512 ha⁻¹. The evergreen component in this forest type was higher than in the case of slightly moist teak forests. The presence of *Tectona grandis* in this forest type is an indicator of secondary succession as per Champion and Seth (1968).

The **Northern Dry Mixed Deciduous forest type** occurring in Noradehi Wild Life Sanctuary in Madhya Pradesh is characterized by *Terminalia tomentosa* - *Tectona grandis* - *Aegle marmelos*. In this plot tree species richness was 28 constituting a total density of 666 ha⁻¹ and a basal cover of 9.1 m² ha⁻¹ constituting a relatively young standing crop. The species richness of the herbaceous layer was 15 amounting to a total density of 2210 ha⁻¹. The transition between this forest type and the moist deciduous forest type was usually drawn out but it was often sharp on varied terrain where any change of soil or topographical position resulted in drier soil conditions and caused a change in forest type.

The **Dry Bamboo Brake forest type** occurring in Madla range of Panna Tiger Reserve in Madhya Pradesh was characterized by *Dendrocalamus strictus* - *Tectona grandis*. The tree density of 19 species present in this plot was computed to be 923 ha⁻¹ having a basal cover of 14.22 m² ha⁻¹. The species richness of the herbaceous layer was 14 amounting to a total density of 14010 ha⁻¹. In this forest type, *Dendrocalamus strictus* formed relatively dense brakes, along with scattered over wood of the hardier species of the dry deciduous forest, indicating the dominance of bamboo to be only secondary. The soil in this forest type is dry most of the year and was shallow and stony. As per Champion and Seth (1968) biotic factors certainly influence the occurrence of this forest type.

The **Anogeissus pendula forest type** occurring in Sheopurkala forest division of Madhya Pradesh was characterized by *Anogeissus pendula* - *Acacia catechu* - *Soymida febrifuga*. The total tree density of 10 species present in this plot was computed to be 401 ha⁻¹ having a basal cover 4.95 m² ha⁻¹. The species richness of the herbaceous layer was 12, amounting to a total density of 12340 ha⁻¹. This forest type was largely determined by the presence of *Anogeissus pendula*. The associated species were of southern dry deciduous type with more thorn forest species found in drier habitats. The forest was mostly leafless from March to June.

Besides the above major forest types, there are other degraded and edaphic forest types having representative preservation plots. The **Ravine thorn forest type** occurring in

Datia forest division of Madhya Pradesh was characterized by *Acacia leucophloea* and *Prosopis juliflora*, **Anogeissus pendula forest scrub** (5/E₁/DS₁) occurring in Seonda range of Datia forest division was dominated by *Anogeissus pendula* scrubs, **Riparian fringing forest** (4E/RS₁) occurring in Shahpur range of North Betul forest division was dominated by *Chloroxylon swietenia*, *Madhuca latifolia*, **Dry grassland forest** (5/DS₄) type occurring in Sheopur range of Sheopur division and Raisen range of Raisen division were dominated by *Anogeissus pendula*, *Diospyros melanozylon*, *Lannea coromandelica* and *Bothriochloa pertusa*, *Cassia tora* and *Cyperus iria*, respectively, **Butea forest** (5/E₅) occurring in Garhakota range of South Sagar division was dominated by *Butea monosperma*, *Tectona grandis*, **Dry savannah forest** (5/DS₂) occurring in Indore range of Indore division was dominated by *Tectona grandis*, *Butea monosperma*, **Boswellia forest** (5/E₂) type occurring in Badhar range of Sheopur division and Gopharu range of North Shahdol division were dominated by *Boswellia serrata* - *Lannea coromandelica*; *Boswellia serrata* - *Lagerstroemia parviflora* - *Diospyros melanozylon*, respectively, **Southern tropical riverain forest** (5/1S₁) and **Secondary dry deciduous forest** (5/2S₁) types occurring in Khurai range of North Sagar division were dominated by *Tectona grandis* - *Terminalia arjuna* - *Syzygium cumini*; *Tectona grandis* - *Butea monosperma* - *Diospyros melanozylon*, respectively. **Khair forest** (5/1S₁) types occurring in Pohri range of Shivpuri division; Raghavgarh range of Guna division and Bamori range of Guna division were dominated by *Acacia catechu* - *Anogeissus latifolia*; *Acacia catechu* - *Tectona grandis*; *Acacia catechu* - *Anogeissus latifolia*, respectively. **Ziziphus scrub forest** (6B/DS₁) type occurring in Pohri range of Shivpuri division was dominated by *Acacia catechu* - *Anogeissus pendul* - *Acacia leucophloea*. **Very dry teak forest** (5A/C1a) type occurring in Guna range of Guna division was dominated by *Tectona grandis* - *Butea monosperma* - *Diospyros melanozylon*. **Dry deciduous scrub forest** (5/DS₁) type occurring in Rajgarh rang of Rajgarh division was dominated by *Acacia catechu* - *Anogeissus latifolia* - *Acacia leucophloea*. Similarly, a preservation plot was established to **conserve a threatened species** i.e. *Dillenia indica* occurring in Delakhadi range of West Chhindwara division.

The nature of plant community at a place is determined by the species that grow and develop in such an environment - a reason responsible for the variation of floristic. Differences in the species composition from site to site could be attributed to climate change. Thus, it is quite clear that the marked variations in the association types and on the community composition as a whole were dependent upon the dominant species.

Bio-diversity index values ranged from 0.87 (Hoshangabad, Slightly Moist Teak Forest) to 2.85 (Jhirpa, West Chhindwara, Degraded Miscellaneous without Bomboo Forest). Low diversity value at Hoshangabad (Slightly Moist Teak Forest) was probably due to cumulative effect of heavy biotic interference, faulty forest management, the state of succession and the tendency to safeguard the important timber yielding tree species (example-Teak) at the cost of other economically unimportant species. Knight (1975) reported high diversity values for tropical forests (5.06 and 5.40 for young and old stands, respectively), whereas for Indian forests the same ranged between 0.83 and 4.1 (Singh *et.al.* 1984; Parthasarthy *et.al.*1992; Visalakshi 1995). These values were reported in between 1.16 and 3.40 for temperate forests (Braun, 1950; Monk, 1967; Risser and Rice, 1971; Singhal *et.al.*1986; Pande *et.al.* 1996, 2000). The values reported for diversity index in the present studies of central Indian preservation plots of Madhya Pradesh and Chhatisgarh lie well within the reported range for the Indian Tropical Forests.

Many workers were previously undertaken arrangement of population structure by size class distribution. The information derived from them, used to understand regeneration and the intensity of disturbances and future sustainability of tree species population in forest communities (Schmelz and Lindsey 1965; Robertson 1978; Upreti 1982). In the present study, following patterns of population structures, in different girth classes (on percent basis) were recognized.

3.1. Greater Proportion of individuals in the Lower Girth Classes in Forest Types

This pattern of population structure was indicative of progressive regeneration in following forest types-

- Moist Peninsular Sal forest
- Southern Dry Mixed Deciduous forest
- Dry Peninsular Sal forest type
- Dry Teak forest type
- Moist Tropical Deciduous Valley Sal
- Northern Dry Mixed Deciduous Forest

3.2. Gap phase type, having absence of individuals in certain girth classes in forest type

This pattern of population structure was related with alternate periods of stressful and favorable periods in following forest types-

- Southern Moist Mixed Deciduous forest
- Degraded Miscellaneous Without Bamboo
- Slightly Moist Teak forest
- Slightly Moist Mixed Deciduous forest

3.3. More individuals in sapling stage and absence in higher classes in a forest type

Such population structure indicated towards a young forest and recent invaders in following forest types-

- Dry Bamboo Brake
- *Anogeissus pendula* forest

Due to difference in parent material, topography, intensity of erosion, and other factors the soil showed variation in physico-chemical properties such as soil pH, electrical conductivity, organic matter contents, available nutrients, exchangeable cation's and water holding capacity etc. The soil was acidic in most of the plots but showed alkaline values at Kathiwarra, Jhabua (representing Southern Moist Mixed Deciduous Forest), Behrasi, Manendragarh (Moist Peninsular low level Sal With bamboo), Udainagar, Dewas (Southern Dry Mixed Deciduous Forest) and at Khairi, Narsingpur (Dry Peninsular Sal Forest). Across all plots, pH values ranged from 5.35 at Kurai, South Seoni (Southern Moist Mixed Deciduous forest) to 8.2 Khairi, Narsingpur (Dry Peninsular Sal forest). Electrical conductivity (ms cm^{-1}) ranged from 0.034 at Bori, Hoshangabad (Southern Moist Mixed Deciduous forest) to 0.89 at Amla, South Betul (Slightly Moist Mixed Deciduous forest). Organic matter ranged from 0.49 percent at Dugli, South Raipur to 3.41 percent at Bori, Hoshangabad, both representing Southern Moist Mixed Deciduous forest type. Nitrogen content (kg ha^{-1}) in the soil ranged from 143 kg ha^{-1} at Kurai, South Seoni (Southern Moist Mixed Deciduous forest) to 590 kg ha^{-1} at Lamni, Bilaspur (Dry Peninsular Sal forest). Phosphorus content ranged from 3.5 kg ha^{-1} at Kurai, South Seoni (Southern Moist Mixed Deciduous forest) to 61.2 kg ha^{-1} at Amla, South Betul (Slightly Moist Mixed Deciduous forest). Potassium content ranged from 25.7 kg ha^{-1} at Jhirpa, West Chhindwara (Degraded Miscellaneous without Bamboo forest) to 419.2 kg ha^{-1} at Bandhavgarh Tiger Reserve (Moist Peninsular Sal forest). The soil texture was sandy loam in all the plots except in Bori, Hoshangabad (Southern Moist Mixed Deciduous forest) where it was loamy. Exchangeable cations (Ca^{++}) ranged from 5.31 ppm at Jhirpa, West Chhindwara (Degraded Miscellaneous Without Bamboo forest) to 100.2 ppm at Sarasdol, Bilaspur (Dry Peninsular Sal forest) while exchangeable cation's (Na^{++}) ranged from 4.07 ppm at Khairi, Narsingpur (Dry Peninsular Sal forest) to 45.75 ppm at Jhirpa, West Chhindwara (Degraded Miscellaneous Without Bamboo forest). Water holding capacity ranged from 27.03 percent Sarasdol, Bilaspur (Dry Peninsular Sal forest) to 47.68 per cent at Behrasi, Manendragarh (Moist Peninsular low level Sal with Bamboo).

4. Conclusions

Following conclusions were drawn:

1. Plant diversity and biodiversity index were well within the reported range for the Indian Tropical Forests.
2. Most of the forest types with reference to population structure were under progressive trend.
3. The soil was acidic in most of the plots, but showed alkaline values in some forest types.
4. Differences in the species composition from site to site could be attributed to climate change.
5. The climate resilient forest management towards balancing the population structure of different species was needed for increasing forest productivity.

Table 1. Preservation plots established in different forest types/sub types of Madhya Pradesh and Chhattisgarh states in India

S.N.	Forest types/ sub types	Division	Range	Comptt. no.	Year of Formation	Area (ha)
MADHYA PRADESH						
1	<i>Anogeissus pendula</i> forest (5/E ₁)	Sheopur	Karhal	P528	2002	10
2	<i>Anogeissus pendula</i> forest scrub (5/E ₁ /DS ₁)	Datia	Seonda	115	2004	10
3	<i>Boswellia</i> forest (5/E ₂)	Sheopur	Badhar	213	2004	10
4	<i>Boswellia</i> forest (5/E ₂)	North Shahdol	Gopharu	295	2004	10
5	<i>Butea</i> forest (5/E ₅)	South Sagar	Garhakota	896	2003	10
6	Dillenia pp in Southern tropical dry deciduous forest (5A/C ₃)	West Chhindwara	Delakhadi	89 A	2006	01
7	Dry bamboo brake (5/E ₉)	Panna tiger reserve	Madla	227	2001	10
8	Dry deciduous scrub (5/DS ₁)	Rajgarh	Rajgarh	314	2004	10
9	Dry grassland (5/ DS ₄)	Raisen	Raisen	387	2004	10
10	Dry grassland (5/DS ₄)	Sheopur	Sheopur	RF 229	2002	10
11	Dry peninsular sal forest (5B/C ₁ C)	Satpura tiger reserve	Pachmarhi	298	2002	10
12	Dry peninsular sal forest (5B/C ₁ C)	Narsinghpur	Gadarwara	418A/ 309	1931	02
13	Dry peninsular sal forest (5B/C ₁ C)	Satpura tiger reserve	Pachmarhi	302	1999	10
14	Dry sal (5B/C ₁ C)	North Shahdol	Gopharu	RF281	2004	10
15	Dry savanah (5/DS ₂)	Indore	Indore	256	2003	10
16	Dry teak forest (5A/C ₁ B)	North Betul	Betul	248	1937	10
17	<i>Hardwickia</i> forest (5/E ₄)	West Chhindwara	Jhirpa	35	1961	04
18	Khair forest (5/1S ₁)	Shivpuri	Pohri	P75/P765	2004	10
19	Khair forest (5/1S ₁)	Guna	Raghavgarh	458	2004	10
20	Khair forest (5/1S ₁)	Guna	North Guna	P473/ P481	2004	10
21	Moist peninsular sal forest (3C/C ₂)	Bandhavgarh tiger reserve		324	1999	10

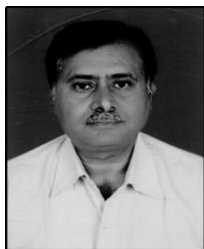
S.N.	Forest types/ sub types	Division	Range	Comptt. no.	Year of Formation	Area (ha)
22	Northern dry mixed deciduous forest (5B/C ₂)	Noradehi Wildlife Sanctuary	Mohli	RF 107	2001	10
23	Ravine thorn forest (6B/C ₂)	Datia	Goraghat	202	2002	10
24	Riparian fringing forest (4E/RS ₁)	North Betul	Shahpur	P419	2002	10
25	Secondary dry deciduous forest (5/2S ₁)	North Sagar	Khurai	P 69	2004	04
26	Slightly moist teak forest (3B/C ₁ C)	Hoshangabad	Banapura	261	1931	10
27	Southern dry mixed deciduous forest (5A/C ₃)	Badwaha	Badwaha	910/284	1955	10
28	Southern dry mixed deciduous forest (5A/C ₃)	Dewas	Udainagar	633	1955	10
29	Southern dry mixed deciduous forest (5A/C ₃)	West Chhindwara	Delakhari	P157	1961	4.5
30	Southern dry mixed deciduous forest (5A/C ₃)	West Chhindwara	Delakhari	P163	1961	4.5
31	Southern dry mixed deciduous forest (5A/C ₃)	Panna tiger reserve	Hinouta	521	2001	10
32	Southern moist mixed deciduous forest (3B/C ₂)	South Seoni	Kurai	181	1980	4.45
33	Southern moist mixed deciduous forest (3B/C ₂)	North Betul	Amla	327 / 508	1947	10
34	Southern moist mixed deciduous forest (3B/C ₂)	Satpura tiger reserve	Bori	52	1947	10
35	Southern moist mixed deciduous forest (3B/C ₂)	Satpura tiger reserve	Bori	45	1947	10
36	Southern moist mixed deciduous forest (3B/C ₂)	Alirajpur	Kathiwara	137/ 525	1953	10
37	Southern tropical riverain forest (5/1S ₁)	North Sagar	Khurai	RF71	2004	10
38	Very dry teak forest (5A/C ₁ a)	Guna	Guna	404	2004	10
39	Ziziphus scrub (6B/DS ₁)	Shivpuri	Pohri	P69	2004	10
CHHATTISGARH						
40	Dry Peninsular Sal Forest (5B/C ₁ C)	Bilaspur	Sarasdol	121	1961	04
41	Dry Peninsular Sal Forest (5B/C ₁ C)	Bilaspur	Lamni	351C	1931	26
42	Dry Peninsular Sal Forest (5B/C ₁ C)	Bilaspur	Khudia	431B	1931	16.6

S.N.	Forest types/ sub types	Division	Range	Comptt. no.	Year of Formation	Area (ha)
43	Moist Peninsular Sal Forest (3C/C ₂)	North Raipur	South Loan	104/141	1960	08
44	Moist Peninsular Sal Forest (3C/C ₂)	Wild Life sanctuary (South Raipur)	Risgaon	186	1970	0.266
45	Moist Peninsular Sal Forest (3C/C ₂)	Wild life sanctuary (south Raipur)	Sitanadi	308	1938	12.24
46	Moist tropical deciduous valley sal	Kanger National Park	-	76P	1999	10
47	Southern moist mixed deciduous forest (3B/C ₂)	South Raipur	North Nagri	416	1938	08

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