

An assessment of Floral Diversity of Makulakocha and Pindrabera area of Dalma Wildlife Sanctuary, Jharkhand

Anita Kumari, ¹Sanjeev Kumar and Jyoti Kumar

University Department of Botany, Ranchi University, Ranchi, Jharkhand

¹IFS, Chief Conservator of Forests, Jamshedpur, Jharkhand

ABSTRACT

The present paper reveals the study of the floristic diversity of Makulakocha and Pindrabera area of Dalma wildlife sanctuary. Today biodiversity is declining seriously on a global scale underscoring the importance of conservation planning. Forest is a key element of our terrestrial ecological systems. Dalma wildlife sanctuary is located on the ranges of Dalma Hills at a height of 3000 ft above sea level with dense forests & Subarnarekha River. The sanctuary covers a wide area of about 195 sq. km. The total density of tree was 1508 recorded for the site. It was found that among trees highest density was shown by *Shorea robusta* Gaertn (390/h) & *Terminalia tomentosa* (Roxb.ex DC.) (250/ha) followed by *Diospyros melanoxylon* Roxb. Of 162/ha, *Terminalia bellirica* Roxb. Of 149/ha. The examination of data showed that the abundance *Shorea robusta* Gaertn and *Terminalia tomentosa* (Roxb.ex.DC.) Wight and Arn were the most abundant species of 19.25 and 17.20 among trees where the least abundant species with value of 1.21 of *Acacia auriculiformis* A.cunn.Ex Benth, 1.09 of *Ficus glomerata* Roxb, 1.41 of *Ficus infectoria* Roxb. Etc. So we can conclude that the study site is naturally wild forest ecosystems of different plants, which can play a major role to balance the ecosystem of the Dalma Sanctuary. It is also necessary to study the seasonal variation in species richness and abundance of different floral species in future for the betterment of all living species. However, further exhaustive investigation are required to be undertaken to study detailed changes in the floristic composition in relation to various climatic, edaphic and anthropogenic factor.

Keywords : - – Floral, Diversity, Dalma, Wildlife Sanctuary

*Corresponding Author : ishanianita@gmail.com

INTRODUCTION :

Biodiversity, which is defined as the variety and variability among living organisms and the ecological complexes in which they occur, is measured at three levels the gene, the species, and the ecosystem. Forest is a key element of our terrestrial ecological systems.

Dalma wildlife sanctuary is located on the ranges of Dalma Hills, which is 13 km from the main city of Jamshedpur. Dalma Hills are located at a height of

3000 ft above sea level with dense forests and Subarnarekha River. There is a wild life Sanctuary in this range, which was inaugurated by Late Sanjay Gandhi in 1975. This wild life sanctuary covers a wide area of about 195 sq.km.

MATERIALS AND METHODS

The study area lies between latitudes 22°46'30" and 22°57' N and Longitude 86°3'15" and 86°26'30" E in the East Singhbhum and sarikela kharsawan districts of Jharkhand.

Climate : The climate of Dalma hill is of typical monsoon type. The minimum and maximum annual temperature varies from 24°C to 27°C mean. The winter is fairly severe during Dec.-Jan., temperature from 7°C to 20°C. The average rainfall varies from 1200-1400 mm.

Soil - The soil is full of grovels and red.

The vegetation : The forest type is mostly dry deciduous forest, a tropical and subtropical dry broad leaf forest. The vegetation in this area is predominated with species like *shorea robusta* Gaertn., *Terminalia tomentosa* Roxb.(ex.DC.) Wight & Arn, *Diospyros melanoxylon* Roxb. Etc.

Phytosociological studies : The vegetation survey in rehabilitated site was conducted during the month of April 2010-may 2012 to ascertain the floristic composition of that site using nested quadrat method. Five quadrats were laid randomly in the area. The quadrat size was 100x100m for trees in each quadrat, the data was recorded for no. of species, no. of individual of a species, diameter for trees was taken. The data obtained was tabulated and analyzed for frequency, density, dominance, IVI and diversity indices also calculated.

Data analysis : The vegetation data were quantitatively analysed for relative density, relative frequency and relative dominance. The importance value index (IVI) for the tree species was determined as the sum of the relative frequency, relative density and relative dominance.

ABUNDANCE/FREQUENCY (A/F) RATIO : Abundance and frequency ratio gives an idea of the pattern of species distribution. This ratio indicates distribution pattern of a species as regular (<0.025), random (0.025-0.05) and contagious (>0.05)¹.

BASAL AREA : Basal area refers to ground actually penetrated by the stems. This is measured either at 2.5cm above ground level (herbs) or at breast height (for trees). Measuring tape was used for recording the circumference in the field. The circumference measured is converted into diameter.

$$2r = \frac{\text{circumference}}{\pi}$$

Diameter values thus obtained for trees were converted to basal area.

$$\text{Average basal area} = \pi r^2$$

$$\text{Where } r (\text{radius}) = \text{diameter}/2$$

Average basal area of species is calculated and the same multiplied by density to get total basal area of the species.

$$\text{Total basal area} = \text{Avg. Basal area} \times \text{Density (per unit area)}$$

For grasses and herbs the vegetation cover was plotted on graph paper to obtain their cover expression.

$$\text{Cover (\%)} = \frac{\text{Area occupied by a species in the quadrat}}{\text{Area occupied by all species in the quadrat}}$$

IMPORTANCE VALUE INDEX :

The Important Value index^{2,3} has been developed to express the dominance and ecological successes of any species at a given site. It is the sum of all the following:

- I. Relative frequency
- II. Relative density
- III. Relative dominance

Diversity Index :

$$\Sigma \text{ Diversity Index is calculated as } H' = \sum p_i \ln p_i$$

$$\text{Where } p_i = n_i/N$$

n_i = no. of individuals of a species.

N = Total no. of individuals of all species.

\ln = natural logarithm (to the base e)

H' = diversity index.

The diversity index is always in positive values. The minus sign in the formula is nullified by the $\log p_i$, which is always a minus quantity. The unit of diversity index, calculated by the formula is bits per individual.

The maximum possible diversity consisting K categories (no. of species here) was calculated by using the formula.

$$H'_{\text{max}} = \ln K$$

In addition to H' another parameter called J' was

calculated

$$J' = H'/H'^{\max}$$

J is termed as evenness. It may also be termed as homogeneity of relative diversity⁴.

Dominance Index: (Concentration of dominance)

It was calculated as: - $C = \sum(n_i/N)^2$

Where, n_i is no. of individuals in one species.

N is total no. of individuals of all species.

Richness Index: This is measure of no of species in a community. It was calculated as: -

$$D = \frac{S-1}{\ln(N)}$$

Where, **D** is Margalefs index,

S is no of species

N is total no. of individuals. ,

ln is natural log. (to the base e)⁵

RESULT AND DISCUSSION :

The data recorded from the Makulakocha and Pindrabera area of Dalma hill for floristic structure and composition showed species of trees. All the species vary in their pattern of occurrence, density and abundance. Our works are in conformity with the works of different scientist⁶ & ⁷.

Frequency:

The frequency of different tree forms of study site is presented in table-1, that are based on phytosociological studies. Among trees highest frequency was recorded for *shorea robusta* Gaertn, *Terminalia tomentosa* (Roxb.ex DC.) wight & Arn i.e 100% which was followed by *Diospyros melanoxyton* Roxb., *Terminalia bellirica* Roxb.(80%). The frequency distribution shows that most of species belonged to the class E & C i.e having frequency 81—100% and 40-6%.

Density:

The total density of tree was 1508 recorded for the site. It was found that among trees highest density was shown by *shorea robusta* Gaertn

(390/ha) and *Terminalia tomentosa* (Roxb.ex DC.) (250/ha) followed by *Diospyros melanoxyton* Roxb. of 162/ha, *Terminalia bellirica* Roxb. of 149/ha.

Abundance:

The examination of table -1 showed that the abundance *shorea robusta* Gaertn. and *Terminalia tomentosa* (Roxb.ex DC.) wight & Arn were the most abundant species of 19.25 and 17.20 among trees where the least abundant species with value of 1.21 of *Acacia auriculiformis* A, cunn. Ex Benth, 1.09 of *Ficus glomerata* Roxb., 1.41 of *Ficus infectoria* Roxb. etc.

A; F Ratio:

The data on abundance frequency ratio showed that among trees all species showed contagious distribution (100%) and only 4 species showed random distribution.

Basal Area - The average basal area was calculated by taking DBH collar diameter for tree. The data shows that highest basal area per tree was recorded for *shorea robusta* Gaertn of 255.6cm, *Terminalia tomentosa* (Roxb.ex DC.) wight & Arn of 225.5cm etc.

IVI:

From the analysis of phytosociological data the IVI values for each species were calculated under trees. They are presented in table -2. Among the trees it is found that *shorea robusta* Gaertn and *Terminalia tomentosa* (Roxb.ex DC.) wight & Arn are dominant species having IVI value of 48.68 and 37.78. It was followed by another most dominant species *Diospyros melanoxyton* Roxb. with IVI 22.03. The minimum IVI of *ficus glomerata* Roxb. of 2.67 and *ficus infectoria* Roxb. of 2.99.

Diversity index:

The diversity of the study sites as indicated by Shannon wiener function (H') represented in table-3. The diversity was recorded for *shorea robusta* Gaertn with its value -0.350 followed by *Terminalia tomentosa* (Roxb.ex DC.) wight & Arn with its value -0.298 *Diospyros melanoxyton* Roxb

TABLE-1 : Structural Attributes of the Trees of Dalma Sanctuary

Sl. No.	Species	Frequency	Density	Abundance	A/F
1	<i>Shorea robusta</i> Gaertn	100%	78	19.25	0.1925
2	<i>Terminalia tomentosa</i> (Roxb.exDc)	100%	50	17.2	0.172
3	<i>Diospyros melanoxylon</i> Roxb.	80%	32.4	7.18	0.0897
4	<i>Terminalia bellirica</i> Roxb.	80%	28.6	8.12	0.1015
5	<i>Emblica officinalis</i> Gaertn.	60%	16.4	7.11	0.1185
6	<i>Terminalia chebula</i> Retz.	60%	15	6.9	0.115
7	<i>Madhuca indica</i> Gmel.	40%	5	2.93	0.0732
8	<i>Azadirachta indica</i> A.Juss.	20%	1.6	1.11	0.0555
9	<i>Syzygium Cumini</i> (L) skeels	40%	4	2.8	0.07
10	<i>Pithecellobium dulce</i> (Roxb.)Benth	60%	10.4	6.1	0.1016
11	<i>Bombax ceiba</i> L	40%	4	2.7	0.0675
12	<i>Pongamia pinnata</i> (L) pierre	60%	8.6	6.5	0.1083
13	<i>Aegle marmelos</i> (L) corr.	20%	1	1.1	0.055
14	<i>Anthocephalus cadamba</i> (Roxb.)	60%	9.6	6.8	0.1133
15	<i>Bauhinia tomentosa</i> L	40%	3.6	2.2	0.055
16	<i>Albizia lebbek</i> (L)Benth	60%	6	5.9	0.0983
17	<i>Butea monosperma</i> (Larn.) Taub.	40%	4.4	2.1	0.0525
18	<i>Ziziphus jujuba</i> (L) Gaerth.	40%	3.6	2.5	0.0625
19	<i>Albizia stipulata</i> Bolivin	20%	1.8	1.3	0.065
20	<i>Acacia auriculiformis</i> A.cunn.ex Benth	20%	1.4	1.21	0.0605
21	<i>Ficus glomerata</i> Roxb.	20%	0.8	1.09	0.0545
22	<i>Ficus infectoria</i> Roxb.	20%	1	1.41	0.0705
23	<i>Tamarindus indica</i> L	40%	3	1.66	0.0415
24	<i>Terminalia catappa</i> L.	20%	1.2	1	0.06
25	<i>Gossypium arboreum</i> L.	40%	3	2.21	0.055
26	<i>Mimusops elengi</i> L.	20%	0.8	1.5	0.075
27	<i>Centaurium centaurioides</i> (Roxb.) Rao	20%	1.2	1.9	0.095
28	<i>Jacaranda mimosifolia</i> D.Don	20%	1.6	1.92	0.096
29	<i>Cedrela toona</i> Roxb.	40%	2.4	2.5	0.0625
30	<i>Cassia siamea</i> Lam.	20%	1.2	1.12	0.056

TABLE-2 : IVI of Trees of Dalma Sanctuary

Sl. No.	Species	Relative Frequency	Relative Density	Relative Abundance	IVI
1	<i>Shorea robusta</i> GaertnT	7.69	25.87	15.12	48.68
2	<i>erminalia tomentosa</i> (Roxb.exDc)	7.69	16.581	13.15	37.78
3	<i>Diospyros melanoxylon</i> Roxb.	6.16	0.75	5.64	22.55

4	<i>Terminalia bellirica</i> Roxb.	6.16	9.49	6.38	22.03
5	<i>Emblica officinalis</i> Gaertn.	4.62	5.44	5.59	15.65
6	<i>Terminalia chebula</i> Retz.	4.62	4.98	5.42	15.02
7	<i>Madhuca indica</i> Gmel.	3.076	1.66	2.31	7.046
8	<i>Azadirachta indica</i> A.Juss.	1.54	0.54	0.88	2.96
9	<i>Syzygium Cumini</i> (L) skeels	3.076	1.33	2.19	6.59
10	<i>Pithecellobium dulce</i> (Roxb.)Benth	4.62	3.45	4.79	12.86
11	<i>Bombax ceiba</i> L	3.076	1.33	2.13	6.54
12	<i>Pongamia pinnata</i> (L) pierre	4.62	2.86	5.11	12.59
13	<i>Aegle marmelos</i> (L) corr.	1.54	0.34	0.87	2.75
14	<i>Anthocephalus cadamba</i> (Roxb.)	4.62	3.19	5.35	13.16
15	<i>Bauhinia tomentosa</i> L	3.076	1.19	1.73	5.99
16	<i>Albizia lebbek</i> (L)Benth	4.62	1.99	4.64	11.25
17	<i>Butea monosperma</i> (Larn.) Taub.	3.076	1.46	1.65	6.19
18	<i>Ziziphus jujuba</i> (L) Gaerth.	3.076	1.19	1.97	6.24
19	<i>Albizia stipulata</i> Bolivin	1.54	0.59	1.03	3.16
20	<i>Acacia auriculiformis</i> A.cunn.ex Benth.	1.54	1.33	0.96	3.89
21	<i>Ficus glomerata</i> Roxb.	1.54	0.27	0.86	2.67
22	<i>Ficus infectoria</i> Roxb.	1.54	0.34	1.11	2.99
23	<i>Tamarindus indica</i> L	3.076	0.99	1.31	5.38
24	<i>Terminalia catappa</i> L.	1.54	0.39	0.79	2.72
25	<i>Gossypium arboreum</i> L.	3.076	0.99	1.74	5.81
26	<i>Mimusops elengi</i> L.	1.54	0.27	1.18	2.99
27	<i>Centaurium centaurioides</i> (Roxb.) Rao Hemadri	1.54	0.99	1.49	3.42
28	<i>Jacaranda mimosifolia</i> D.Don	1.54	0.53	1.51	3.58
29	<i>Cedrela toona</i> Roxb.	3.076	0.79	1.97	5.84
30	<i>Cassia siamea</i> Lam.	1.54	0.39	0.88	2.81

TABLE-3 : Dominance Index, Diversity Index and Richness Index of Trees

Sl. No.	Species	Dominance Index	Diversity Inde	Richness Index
1	<i>Shorea robusta</i> Gaertn	0.0669	-0.350	53.1530
2	<i>Terminalia tomentosa</i> (Roxb.exDc)	0.0275	-0.298	34.0230
3	<i>Diospyros melanoxylon</i> Roxb.	0.0115	-0.240	21.9990
4	<i>Terminalia bellirica</i> Roxb.	0.0090	-0.223	19.4030
5	<i>Emblica officinalis</i> Gaertn.	0.0030	-0.158	11.0680
6	<i>Terminalia chebula</i> Retz.	0.0025	-0.149	10.1110

7	<i>Madhuca indica</i> Gmel.	0.0003	-0.068	3.2790
8	<i>Azadirachta indica</i> A.Juss.	0.0000	-0.028	0.9560
9	<i>Syzygium Cumini</i> (L) skeels	0.0002	-0.057	2.5960
10	<i>Pithecellobium dulce</i> (Roxb.)Benth	0.0012	-0.116	6.9690
11	<i>Bombax ceiba</i> L	0.0002	-0.057	2.5960
12	<i>Pongamia pinnata</i> (L) pierre	0.0008	-0.101	5.7390
13	<i>Aegle marmelos</i> (L) corr.	0.0000	-0.019	0.5470
14	<i>Anthocephalus cadamba</i> (Roxb.)	0.0010	-0.110	6.4220
15	<i>Bauhinia tomentosa</i> L	0.0001	-0.053	2.3230
16	<i>Albizia lebeck</i> (L)Benth	0.0004	-0.078	3.9630
17	<i>Butea monosperma</i> (Larn.) Taub.	0.0002	-0.062	2.8690
18	<i>Ziziphus jujuba</i> (L) Gaerth.	0.0001	-0.053	2.3230
19	<i>Albizia stipulata</i> Bolivin	0.0000	-0.031	1.0930
20	<i>Acacia auriculiformis</i> A.cunn.ex Benth.	0.0000	-0.025	0.8200
21	<i>Ficus glomerata</i> Roxb.	0.0000	-0.016	0.410
22	<i>Ficus infectoria</i> Roxb.	0.0000	-0.019	0.547
23	<i>Tamarindus indica</i> L	0.0001	-0.046	1.913
24	<i>Terminalia catappa</i> L.	0.0000	-0.022	0.6830
25	<i>Gossypium arboreum</i> L.	0.0001	-0.046	1.9130
26	<i>Mimusops elengi</i> L.	0.0000	-0.016	0.4100
27	<i>Centaurium centauroides</i> (Roxb.) Rao Hemadri	0.0000	-0.022	0.6830
28	<i>Jacaranda mimosifolia</i> D.Don	0.0000	-0.028	0.9560
29	<i>Cedrela toona</i> Roxb.	0.0001	-0.038	1.5030
30	<i>Cassia siamea</i> Lam.	0.0000	-0.022	0.6830

with -0.240 and lowest with its value -0.016 of *Mimusops elengi* L., *Ficus glomerata* Roxb.etc.

Concentration of Dominance / Dominance index :

Among trees the concentration of dominance was highest in *shorea robusta* Gaertn with its value 0.0669 followed by *Diospyros melanoxylon* Roxb.(0.0115) , *Terminalia bellirica* Roxb. (0.090) etc. and lowest with its value 0.0001 of *cedrela toona* Roxb. , *Tamarindus indica* L. etc.

Richness index :

The data on the species richness is represented in table -3. The value of richness index were found to be highest in *shorea robusta* Gaertn

with its value of 53.153 followed by *Terminalia tomentosa* (Roxb.ex DC.) wight & Arn (34.023) , *Diospyros melanoxylon* Roxb. (21.999)etc. and lowest with value 0.410 and 0.683 of *Mimusops elengi* L and *cassia siamea* Lam.

So we can conclude that the study site is naturally wild forest ecosystem of different plants ,which can play a major role to balance the ecosystem of the Dalma Sanctuary.

It is also necessary to study the seasonal variation in species richness and abundance of different floral species in future for the betterment of all living species.However , further exhaustive investigation are required to be

undertaken to study detailed changes in the floristic composition in relation to various climatic, edaphic and anthropogenic factors.

ACKNOWLEDGMENT

Authors are thankful to the Forest Department of East Singhbhum, Jamshedpur for providing map of the Dalma Sanctuary and also thankful to local villagers for providing important information about plants.

REFERENCES:

Cottam , G . and J . T . Curtis , (1956) . The use of distance measurement in phytosocio logical sampling, *Ecology* . 37 : 451 – 460 .

Simpson , E . M . (1949) Measurement of Diversity . *Nature* , 163 : 688 .

Curtice J . T . (1959) . The Vegetation of Wisconsin . An Ordination of Plant communities , *University Wisconsin Press* , Madision Wisconsin , P . 657 .

Shannon , C . E . , and Wiener , W . 1963 . The Mathematical theory of Communication. *University of Illinois press* , Urbana 117 PP .

Risser , P . G & E . L . Rice (1971) . Diversity in tree Species in oklahome upland forest . *Ecology* , 52 : 876 – 880 .

Jeet , R. Kumar, A. and Bhatt, J (2004) . Plant diversity in Six forest types of Uttaranchal , Central Himalaya . India . *Currsci* 86 (7) 975 – 978 .

Magurran , A . E . (1988). Ecological Diversity and its Measurements . *Princeton University Press* , New Jersey , PP . 1 – 192 .