Phytosociological study of Terrestrial plants of safari area of Jubilee park, Jamshedpur, Jharkhand.

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ABSTRACT

Phytosociological study was carried out in safari area of Jubilee Park Of Jamshedpur .We inventoried a total of 21 species of tree and 20 species of herbs and shrubs within a sampled area. The predominated tree species are *Peltophorum Petrocarpum* (DC) Baker exk. Heyne, *Cassia Fistula L ., Albizia lebbeck* (L.) Benth. etc having 100% frequency. It is found that highest density and abundance was shown by *Peltophorum Petrocarpun* (D.C) Baker ex K. Heyne and *Cassia Fistula L.* followed by *Lagerstroemia speciosa* (L.) pers., *Ficus religiosa* L., *Dalbergia latifolia* Roxb. etc. In case of Herbs and shrubs highest frequency and density was shown by *cyndon dactylon* (L.) Pers. *Evalvulus alsinoides* (L.) L., *Sida cordifoilia* L. followed by *Convolvulus nummalarius* L. *Calotropis* Procera (Ait.) R. Br. Etc.

Keywords : Importance value Index (IVI), Abundance, Basal area, diversity.

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INTRODUCTION

The study area Jubilee Park is located in chhotanagpur plateau. The area is situated nearly 86⁰ longitudes & 22⁰ latitude. Jubilee Park is the famous park of the city Jamshedpur which is situated near the bank of Swarnrekha River at an elevation 159 masl.

MATERIALS AND METHODS

Climate-The climate of Jubilee park is of typical monsoon type the minimum annual temperature Varies from 24⁰ C to 27 ⁰ C. The average rainfall varies from 750 mm to 1300 mm.

Soil – The soil is mostly laterite and red.

Phytosocialogical studies : The vegetation survey in rehabilated site was conducted during the month of April 2008-may2009 to as certain the floristic composition of that   site using nested quadrate method. Five quadrate   were   laid randomly   in   the area . The quadrate size was 100x 100m for trees in each quadrate 10mX10m for herbs and 1mX1m for shrubs . 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 tress). 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.

Average basal area $=$ πr^2

Where r (radius) $=$ diameter/2

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

Total basal area = Avg. Basal area × Density (per unit area)

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

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

Importance Value Index :

The Important Value index[2][3] has been developed to express the dominance an 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

These are calculated as:-

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

$$\text{Relative density} = \frac{\text{Density of the species}}{\text{Total density of all the species}} \times 100$$

$$\text{Relative dominance} = \frac{\text{Dominance (cover) of the species}}{\text{Total dominance of all the species}} \times 100$$

Diversity Index:

$\sum$ Diversity Index is calculated as   H' = pi In pi

Where pi $=$ ni/N

ni $=$ no. of individuals of a species .

N $=$ Total no of individuals of all species .

In $=$ natural logarithm (to the base)

H' $=$ diversity index.

The diversity index is always in positive values. The minus sign in the formula is nullified by the log pi, which is always a minus quantity. The unit of diversity index, calculated by the formula is pits per individuals.

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

H'max $=$ In 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 diversity[4].

Dominance Index : (Concentration of dominance)

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

Where , ni 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 : -

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

Where, **D** is Margalefs index,

S is no of species

N is total no. of individuals. ,

In is natural log. (to the base e)[5]

RESULT AND DISCUSSION

The data recorded from the "Safari area of Jubilee park" site for floristic structure and composition showed different species of trees, herbs and shrubs. All the species vary in their pattern of occurrence, density and abundance. Our works are in conformity with works of different scientist. Table-1 shows 21 species of trees. All the species vary in their pattern of occurrence, density and abundance.The examination of data recorded for trees showed that Peltophorum pterocarpum (DC.) Baker ex K. Heyne, Cassia fistula L., Albizia lebbeck (L.) Benth., Caesalpinia pulcherrima (L.) Sw. and Murraya koenigii of 100% followed by Largestomia speciosa (80%), Ficus benghalensis (80%), Tabebuia rosea (Bertal.) DC. (60%), Centaurium centauriodies (Roxb.) Rao & Hemadri

(60%) sps. and the minimum frequency is found in Centaurium centauriodies (Roxb.) Rao & Hemadri (60%) sps. and the frequency distribution shows the most of species belonged to the class E and C i.e. having frequency 81-100% and 40-60%. The examination of table-1 showed that the abundance of Peltophorum pterocarpum (DC.) Baker ex K. Heyne (16.3) was maximum followed by Cassia fistula L. (15.9), Albizia lebbeck (L.) Benth. (15.1) etc. and the least abundant sps. was Callistemon lanceolatus DC. (1.29) and Zizipus jujuba (L.) Gaerth. (1.39) followed by Ficus benghalensis L. (2.10).

Table-1 : Structural Attributes of the Trees of "Jubilee park" (Upwan)

Sl. No.	Species	% Frequency	Density	Abundance	A/F
1	*Peltophorum pterocarpum (DC.)* Baker ex K. Heyne	100	18.4	7.04	0.163
2	*Cassia fistula* L.	100	18.6	7.04	0.159
3	*Albizia lebbeck* (L.) Benth.	100	18.8	15.1	0.151
4	*Gossypium arboreum L.*	40	3.6	4.2	0.105
5	*Dalbergia latifolia* Roxb.	60	4.2	3.0	0.05
6	*Lagerstroemia speciosa* (L.) Pers.	80	8.6	4.9	0.06
7	*Pithecellobium dulce* (Roxb.) Benth.	60	7.2	4.7	0.08
8	*Gmelina arborea* Roxb.	60	2.6	3.12	0.05
9	*Shorea robusta* Gaerth.	40	4.0	3.9	0.09
10	*Saraca indica auct.* non L.	40	4.8	3.5	0.08
11	*Callistemon lanceolatus* DC.	60	6.0	1.29	0.02
12	*Acacia pennata (L.)* Willd.	40	4.0	2.22	0.05
13	*Ficus religiosa* L.	60	0.8	3.21	0.05
14	*Ficus benghalensis* L.	80	1.0	2.10	0.03
15	*Caesalpinia pulcherrima* (L.) Sw.	100	9.0	7.8	0.078
16	*Murraya koenigii* (L.) Spreng.	100	9.8	6.12	0.0612
17	*Zizipus jujuba* (L.) Gaerth.	60	2.4	1.39	0.023
18	*Pongamia pinnata* (L.) Pierre	60	7.6	4.0	0.06
19	*Bombax malabarica* DC.	60	6.8	3.21	0.05
20	*Tabebuia rosea* (Bertal.) DC.	60	9.2	6.22	0.11
21	*Centaurium centauriodies* (Roxb.) Rao & Hemadri	60	7.0	3.1	0.05

A/F Ratio

The data on abundance frequency ratio showed that 7 species showed contagious distribution and only 13 species showed random distribution.

Basal Area

The average basal area was calculated by taking DBH or collar diameter for trees. The data shows that highest basal area per tree was recorded for *Peltophorum pterocarpum (DC.) Baker ex K. Heyne*, *Cassia fistula* L., *Albizia lebbeck (L.) Benth.* etc.

Importance Value Index (IVI)

From the analysis of phytosocialogical data the importance value index (IVI) values for each sps. were calculated. They are presented in table-2 ,Among the trees it is found that *Peltophorum pterocarpum (DC.) Baker ex K. Heyne, Cassia fistula* L. and *Albizia lebbeck (L.) Benth.* are dominant sps. having IVI value of 33.09, 32.87 and 32.31.The minimum IVI found in *Zizipus jujuba (L.) Gaerth.* is 6.98 and *Acacia pennata* (L.) Willd. is 7.34 etc.

Table-2 :Importance Value Index of Trees

Sl. No.	Species	Relative Frequency	Relative Density	Relative Abundance	IVI
1	*Peltophorum pterocarpum* (DC.) Baker ex K. Heyne	7.04	11.91	14.14	33.09
2	*Cassia fistula* L.	7.04	12.04	13.79	32.87
3	*Albizia lebbeck* (L.) Benth.	7.04	12.17	13.10	32.31
4	*Gossypium arboreum* L.	2.82	2.33	3.64	8.79
5	*Dalbergia latifolia* Roxb.	4.22	2.72	2.61	9.55
6	*Lagerstroemia speciosa* (L.) Pers.	5.63	5.57	4.25	15.45
7	*Pithecellobium dulce* (Roxb.) Benth.	4.22	4.66	4.08	12.96
8	*Gmelina arborea* Roxb.	4.22	1.68	2.71	8.61
9	*Shorea robusta* Gaerth.	2.82	2.59	3.38	8.79
10	*Saraca indica auct.* non L.	2.82	3.11	3.04	8.97
11	*Callistemon lanceolatus* DC.	4.22	3.88	1.12	9.22
12	*Acacia pennata* (L.) Willd.	2.82	2.59	1.93	7.34
13	*Ficus religiosa* L.	4.22	0.52	2.78	7.52
14	*Ficus benghalensis* L.	5.63	0.64	1.82	8.09
15	*Caesalpinia pulcherrima* (L.) Sw.	7.04	5.82	6.77	19.63
16	*Murraya koenigii* (L.) Spreng.	7.04	6.34	5.31	18.69
17	*Zizipus jujuba* (L.) Gaerth.	4.22	1.55	1.21	6.98
18	*Pongamia pinnata* (L.) Pierre	4.22	4.93	3.47	12.62
19	*Bombax malabarica* DC.	4.22	4.41	2.78	11.41
20	*Tabebuia rosea* (Bertal.) DC.	4.22	5.95	5.40	15.57
21	*Centaurium centauriodies* (Roxb.) Rao & Hemadri	4.22	4.53	2.69	11.44

Diversity Index

In this table-3, the highest diversity index was recorded for *Albizia lebbeck (L.) Benth.* with its value -0.0256 followed by *Cassia fistula L.* (-0.255), *Peltophorum pterocarpum (DC.) Baker ex K. Heyne* (-0.254) etc. and lowest diversity index was observed for *Ficus religiosa* L. with its value -0.027 followed by *Saraca indica auct. non L. (-0.108), Shorea robusta Gaerth. (-0.095) etc.*

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

Sl. No.	Species	Dominance Index	Diversity Index	Richness Index
1	*Peltophorum pterocarpum* (DC.) Baker ex K. Heyne	0.0142	-0.254	13.686
2	*Cassia fistula* L.	0.0145	-0.255	13.837
3	*Albizia lebbeck* (L.) Benth.	0.0148	-0.256	13.987
4	*Gossypium arboreum* L.	0.0005	-0.088	2.557
5	*Dalbergia latifolia* Roxb.	0.0007	-0.098	3.008
6	*Lagerstroemia speciosa* (L.) Pers.	0.0031	-0.161	6.317
7	*Pithecellobium dulce* (Roxb.) Benth.	0.0022	-0.143	5.264
8	*Gmelina arborea* Roxb.	0.0003	-0.069	1.805
9	*Shorea robusta* Gaerth.	0.0007	-0.095	2.858
10	*Saraca indica* auct. non L.	0.0010	-0.108	3.459
11	*Callistemon* lanceolatus DC.	0.0015	-0.126	4.362
12	*Acacia pennata* (L.) Willd.	0.0007	-0.095	2.858
13	*Ficus religiosa* L.	0.0000	-0.027	0.451
14	*Ficus benghalensis* L.	0.0000	-0.033	0.602
15	*Caesalpinia pulcherrima* (L.) Sw.	0.0034	-0.166	6.618
16	*Murraya koenigii* (L.) Spreng.	0.0040	-0.175	7.219
17	*Zizipus jujuba* (L.) Gaerth.	0.0002	-0.065	1.654
18	*Pongamia pinnata* (L.) Pierre	0.0024	-0.148	5.565
19	*Bombax malabarica* DC.	0.0019	-0.138	4.963
20	*Tabebuia rosea* (Bertal.) DC.	0.0036	-0.168	6.768
21	*Centaurium centauriodies* (Roxb.) Rao & Hemadri	0.0021	-0.140	5.114

Concentration of Dominance/Dominance Index

The concentration of dominance was highest in *Albizia lebbeck* (L.) Benth. with its value 0.0148 followed by Peltophorum pterocarpum (DC.) Baker ex K. Heyne (0.0142), Cassia fistula L. (0.0145) etc. and lowest in Ficus religiosa L. with its value 0.00 followed by Ficus benghalensis L. (0.0000) etc.

Richness Index

In the Table-3 , species richness was highest in *Albizia lebbeck* (L.) Benth. with its value 13.987 followed by

Cassia fistula L. (13.837), Murraya koenigii (L.) Spreng. (7.219) etc. and lowest in Ficus religiosa L. with its value 0.451 followed by Ficus benghalensis L. (0.602). Table-4 shows 20 species of herbs and shrubs. All the species vary in their pattern of occurrence, density and abundance.The examination of data recorded for herbs and shrubs showed that *Cynodon dactylon* (L.) Pers., *Dichanthium annulatum* (Forssk.) Stapf and *Evolvulus alsinoides* (L.) L. (100%) frequency followed by *Convolvulus nummularius* L., *Boerhavia diffusa* L., *Euphorbia hirta* L. (80%) and *Argemone mexicana* L. (60%). The frequency distribution shows that most of species belonged to the class E and D i.e. having frequency 81-100% and 60-80%. The plants (herbs and shrubs) density of 1055 was recorded for this site. It was found that highest density were shown by *Cynodon dactylon* (L.) Pers. (344/ha) followed by *Dichanthium annulatum* (Forssk.) Stapf (219/ha), *Evolvulus alsinoides* (L.) L. (89/ha) and *Argemone mexicana* L. (11/ha) followed by *Oldenlandia corymbosa* L. (13/ha), *Oxalis corniculata* L. (18/ha), *Cassia occidentalis* L. (19/ha) etc. The examination of table-4 showed that the abundance *Cynodon dactylon* (L.) Pers. (49.9) was maximum followed by *Dichanthium annulatum* (Forssk.) Stapf (35.2), *Evolvulus alsinoides* (L.) L. (18.5), *Convolvulus nummularius* L. (10.3) etc. and the least abundant sps. was *Argemone mexicana* L. (1.9) followed by *Cassia occidentalis* L. (2.9), *Calotropis procera* (Ait.) R. Br. (2.5), *Oxalis corniculata* L. (2.9) etc.

Table-4 : Structural Attributes of the Herbs and Shrubs of "Jubilee park" (Safari area)

Sl. No.	Species	% Frequency	Density	Abundance	A/F
1	*Cynodon dactylon* (L.) Pers.	100	68.8	49.9	0.499
2	*Dichanthium annulatum* (Forssk.) Stapf	100	43.8	35.2	0.352
3	*Evolvulus alsinoides* (L.) L.	100	17.8	18.5	0.185
4	*Convolvulus nummularius* L.	80	8.2	10.3	0.129
5	*Boerhavia diffusa* L.	80	6.8	7.9	0.099
6	*Euphorbia hirta* L.	80	6.0	6.7	0.084
7	*Cyperus compactus* Retz.	80	5.2	5.6	0.07
8	*Cyperus corymbosus* Rottb.	80	8.2	9.2	0.12
9	*Blumea aromatica* DC.	80	4.4	3.9	0.049
10	*Oldenlandia corymbosa* L.	80	2.6	2.0	0.025
11	*Oxalis corniculata* L.	80	3.6	2.9	0.037
12	*Phyllanthus niruri* acut. non L.	80	4.0	3.9	0.049
13	*Heteropogon contortus* (L.) P. Beauv.	80	5.6	4.0	0.05
14	*Achyranthes aspera* L.	80	4.0	3.1	0.039
15	*Sida cordifolia* L.	80	3.2	2.8	0.035
16	*Scirpus grossus* L.	80	4.4	3.8	0.048
17	*Calotropis procera* (Ait.) R. Br.	80	3.6	2.5	0.032
18	*Cassia occidentalis* L.	80	3.8	2.9	0.037
19	*Argemone mexicana* L.	60	2.2	1.9	0.032
20	*Indigofera linifolia* (L.f.) Retz.	80	4.8	3.0	0.038

A/F Ratio

The data on abundance frequency ratio showed that contagious distribution (70.05).

Basal Area

The data shows that highest basal area was observed of *Cynodon dactylon* (L.) Pers. followed by *Dichanthium annulatum* (Forssk.) Stapf, *Evolvulus alsinoides* (L.) L. etc.

Importance Value Index (IVI)

From the analysis of phytosociological data the importance value index (IVI) values for each species were calculated. They are presented in table-5. The most dominant species was *Cynodon dactylon* (L.) Pers. of IVI value 66.88 followed by *Dichanthium annulatum* (Forssk.) Stapf of IVI value 46.67, *Evolvulus alsinoides* (L.) L. of IVI value 24.94, *Convolvulus nummularius* L. (14.48). The minimum IVI value, found in *Argemone mexicana* L. of IVI value 6.52 followed by *Oxalis corniculata* L. of IVI value 8.24, *Cassia occidentalis* L. (8.34), *Achyranthus aspera* L. (8.52).

Table-4 : Structural Attributes of the Herbs and Shrubs of "Jubilee park" (Safari area)

Sl. No.	Species	Relative Frequency	Relative Density	Relative Abundance	IVI
1	*Cynodon dactylon* (L.) Pers.	6.09	32.6	28.19	66.88
2	*Dichanthium annulatum* (Forssk.) Stapf	6.09	20.7	19.88	46.67
3	*Evolvulus alsinoides* (L.) L.	6.09	8.4	10.45	24.94
4	*Convolvulus nummularius* L.	4.87	3.8	5.81	14.48
5	*Boerhavia diffusa* L.	4.87	3.2	4.46	12.53
6	*Euphorbia hirta* L.	4.87	2.8	3.78	11.45
7	*Cyperus compactus* Retz.	4.87	2.5	3.16	10.53
8	*Cyperus corymbosus* Rottb.	4.87	3.8	5.19	13.86
9	*Blumea aromatica* DC.	4.87	2.1	2.2	9.17
10	*Oldenlandia corymbosa* L.	4.87	1.3	1.12	7.29
11	*Oxalis corniculata* L.	4.87	1.7	1.67	8.24
12	*Phyllanthus niruri* acut. non L.	4.87	1.9	2.2	8.97
13	*Heteropogon contortus* (L.) P. Beauv.	4.87	2.6	2.25	9.72
14	*Achyranthes aspera* L.	4.87	1.9	1.75	8.52
15	*Sida cordifolia* L.	4.87	1.5	1.58	7.95
16	*Scirpus grossus* L.	4.87	2.1	2.14	9.11
17	*Calotropis procera* (Ait.) R. Br.	4.87	1.7	1.41	7.98
18	*Cassia occidentalis* L.	4.87	1.8	1.67	8.34
19	*Argemone mexicana* L.	3.65	1.8	1.07	6.52
20	*Indigofera linifolia* (L.f.) Retz.	4.87	2.3	1.69	8.86

Diversity Index

In this table-6, the highest diversity index was recorded for *Cynodon dactylon* (L.) Pers. with its value -0.365 followed by *Dichanthium annulatum* (Forssk.) Stapf (-0.326), *Evolvulus alsinoides* (L.) L. (-0.209) etc. and lowest diversity index was observed for *Argemone mexicana* with its value -0.048 followed by *Cassia occidentalis* L. (-0.072), ***Indigofera linifolia (L.f.) Retz. (-0.086) etc***.

Table-6 : Dominance Index, Diversity Index and Richness Index of Herbs and Shrubs

Sl. No.	Species	Dominance Index	Diversity Index	Richness Index
1	*Cynodon dactylon* (L.) Pers.	0.1063	-0.365	49.272
2	*Dichanthium annulatum* (Forssk.) Stapf	0.0431	-0.326	31.316
3	*Evolvulus alsinoides* (L.) L.	0.0071	-0.209	12.641
4	*Convolvulus nummularius* L.	0.0015	-0.126	5.746
5	*Boerhavia diffusa* L.	0.0010	-0.111	4.740
6	*Euphorbia hirta* L.	0.0008	-0.101	4.166
7	*Cyperus compactus* Retz.	0.0006	-0.091	3.591
8	*Cyperus corymbosus* Rottb.	0.0015	-0.126	5.746
9	*Blumea aromatica* DC.	0.0004	-0.081	3.017
10	*Oldenlandia corymbosa* L.	0.0002	-0.054	1.724
11	*Oxalis corniculata* L.	0.0003	-0.069	2.442
12	*Phyllanthus niruri* acut. non L.	0.0004	-0.075	2.729
13	*Heteropogon contortus* (L.) P. Beauv.	0.0007	-0.096	3.879
14	*Achyranthes aspera* L.	0.0004	-0.075	2.729
15	*Sida cordifolia* L.	0.0002	-0.064	2.155
16	*Scirpus grossus* L.	0.0004	-0.081	3.017
17	*Calotropis procera* (Ait.) R. Br.	0.0003	-0.069	2.442
18	*Cassia occidentalis* L.	0.0003	-0.072	2.586
19	*Argemone mexicana* L.	0.0001	-0.048	1.437
20	*Indigofera linifolia* (L.f.) Retz.	0.0005	-0.086	3.304

Concentration of Dominance/Dominance Index

The concentration of dominance was highest in *Cynodon dactylon* (L.) Pers. with its value 0.1063 followed by *Dichanthium annulatum* (Forssk.) Stapf (0.0431), *Evolvulus alsinoides* (L.) L. (0.0071) etc. and lowest in *Argemone mexicana* L. with its value 0.0001 followed by Sida cordifolia L. (0.0002), Calotropis procera (Ait.) R. Br. (0.0003) etc.

Richness Index

In this table-6 , species richness was highest in *Cynodon dactylon* (L.) Pers. with its value 49.272 followed by *Dichanthium annulatum* (Forssk.) Stapf (31.316), *Evolvulus alsinoides* (L.) L. (12.641) etc. and lowest in *Argemone mexicana* L. with its value 1.437 followed by Oldenlandia corymbosa L. (1.724),

Calotropis procera (Ait.) R. Br. (2.442) etc. According to ecological data , our study site area reflects a picture of man made forest ecosystem or mixed plantation or mixed forest. So, we can conclude that the study site in a man made forest ecosystem reflecting absolutely a natural as well as cultural diversity of different plants, Which can play a major role to balance the ecosystem of the safari area of Jubilee park.

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