



# ASSESSMENT OF VEGETATIONAL DIVERSITY OF SAL (*SHOREA ROBUSTA* GAERTN.) DOMINATED SARANDA FOREST JHARKHAND, INDIA

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## Abstract

The knowledge on the structure and composition of the plant communities has enormous significance in conservation of managed forests, therefore, the plant species diversity, structure and importance value index (IVI) at various levels, viz., trees, shrubs and herbs were studied. The Sal (*Shorea robusta*) dominated forest vegetation of Saranda Forest, West Singhbhum, Jharkhand, India was explored to evaluate the diversity and vegetation structure through different phyto-sociological attributes. A total of 262 plant species (58 trees, 85 shrubs and 119 herbs) were recorded from the 80 random plots marked for sampling within the Forest division. The IVI was highest in *Shorea robusta* (160.95) and lowest in *Plumeria rubra* (0.27). Shannon-Weaver's diversity index was recorded highest in herbaceous species (4.276) than in shrub (4.273) and trees (1.676). Simpson's index was equal in herb, shrub and tree (1.00). Pielou's index was found highest in Shrubs (0.050) than in herb (0.034) and trees (0.019) which was within the range reported for different Indian forests and also which indicates that the Saranda Forest division exhibits species diverse forest. The result of plant species diversity and their quantitative features reveal that the overall community is homogeneous.

**Keywords:** Saranda Forest, Jharkhand, Sal Dominated Forest, Diversity, Dominance

## Introduction

In India, Sal forests are widely distributed in tropical regions and cover about 13.3% of total forest area of the country (Satya *et al.* 2005). Sal is one of the dominant tree species in the tropical moist and dry deciduous forests in India (Champion and Seth 1968).

Since the deciduous forests occur in such areas in India where the population heavily depends on forests for fuel wood hence they are most used and threatened ecosystem (Sagar and Singh 2004) and is changing into dry deciduous scrub, dry savannah and dry grasslands (Champion and Seth 1968; Singh and Singh 1989).

The studies on various aspects of Sal forests in India have been undertaken (Gupta and Shukla 1991; Singh *et al.* 1995; Uma Shankar *et al.* 1998; Pandey and Shukla 1999, 2003; Uma Shankar 2001; Kushwaha and Nandy 2012). However, the assessment of vegetation diversity in many Sal dominated forests has still not been made.

Therefore, the present study was initiated for the assessment of plant species diversity and vegetation structure in ecologically important Sal dominated forest area of Saranda Forest which was neglected in terms of ecological studies and biodiversity assessments.

## Study area

The West Singhbhum district, a part of the erstwhile Singhbhum district, came into existence when Singhbhum was bifurcated in 1991 to form Pashchimi and Purbi Singhbhum. The largest district of the State lies in the South Chhotanagpur division and is situated in the south eastern part of Jharkhand State falling under eastern plateau and hill region. It is with a geographical area of 5198 km<sup>2</sup>. The Saranda forest known as "The Land of Seven Hundred Hills" is situated in West Singhbhum district of Jharkhand, India. It is famous as Asia's largest Sal forests and is an important elephant habitat. It lies in between 22°00'45.04"-22°12'36.81" N and 85°08'18.8"- 85°24'37.21" E with an average elevation of 750 m. The Saranda division, carved out of Porahat division on 1 st April, 1924, covers an area of 858.82 km<sup>2</sup> (818.08km<sup>2</sup> of Reserved Forests, 39.88km<sup>2</sup> of Protected Forests, 0.86 km<sup>2</sup> of Unclassified). The

Saranda division comprises of four forest ranges namely, Gua, Koina, Samta and Sasangda. There are 42 revenue villages and 10 forest villages in the Saranda forest division. It is surrounded by Porahat and Kolhan divisions in the north, Chaibasa South and Kolhan divisions in the eastern side, Keonjhar district of Odisha state in the south eastern side and Sundergarh district of Odisha in the western and north-western side. The highest point in this hill range is 927m. There are at least 13 peaks whose elevations are above 600m. The lowest elevation is in the Samta valley near Jeraikela railway station. The landscape presents a beautiful view of hill upon hill with thickly wooded valleys and meandering live streams. Saranda forest is fed by two major rivers, Koina and Karo. The Koina is one of the most important rivers of this division. It originates in the extreme south above Bhangaon village on the Bonai border in Odisha. It flows for about 80 km through this division and drains into the Koel river at Manoharpur. Many of the rivers in the area dry up in the dry season. However, the Koina contains plenty of water in the height of the hot season even when no rain has fallen for many months. Karo river is sort of a perennial stream which drains only a small area in the Ghatkuri block. The area is abundantly rich in flora & fauna and has also huge iron and manganese ore deposits of good quality. Mining of these minerals is bound to have adverse impact on plants, wildlife and ecosystem of the area. The forest of the division supports two types of forest namely Moist Deciduous Peninsular Sal Forests and Dry Deciduous Peninsular Sal Forests (FSI; 2009- 10). Working Plan for Saranda Forest Division has listed 286 species of plants. These could be taken only as indicators of richness of the area and the area is definitely under-explored due to several reasons. The tribes predominantly found in the Saranda division are Santhals, Oraons, Mundas, Ho and Kharias. Among these tribes, „Ho“ is the most dominant. All these tribes are dependent on forest produce for centuries. The rituals, festivals, and their culture is always forest based. They worship trees like Sal and Karam and protect as custom.

The predominant species is *Butea frondosa*, either in pure stands or mixed with *Diospyros sp.*, *Madhuca longifolia var. latifolia* (Roxb.) *Schleichera oleosa*, *Shorea robusta*, *Phyllanthus emblica*. *Bombax sp.* and *Dalbergia sissoo*. *Vitex negundo*, *Anona squamosa*. *Acacia arabica*, *Zizyphus jujuba*, *Holarrhena antidysenterica* form the under growth especially towards the fringes. The climbers are *Ichnocarpus*, *Combretum decandrum*, and *Zizyphus oenopia*. Pure stands of sal are seen here and there, but most of them are young saplings or poles. A major part of the plateau is occupied by cultivated fields surrounding isolated villages, which are located mostly near the roads and railway lines. The northern and western faces of the hills are covered with almost pure stands of sal and other species. The condition in the North Kolhan and the South Porahat areas is reportedly poor in vegetation due to felling of trees and grazing. On the slopes of the hills, sal with *Gardenia sp.*, *Dillenia aurea*, *Phoenix acaulis*, *Terminalia chebula* and *Anogeissus latifolia* are seen. In the undulating valleys, sal is with *Careya arborea* and *Dillenia pentagyna* and *Pterocarpus marsupium*. On the even lands, a few *salai*, *dhaura*, *Cleistanthus collinus*, *Lannea grandis*, *Sterculia urens*, *Cochlospermum gossypium*, bamboo and khajur are seen. Evergreen trees are seen on the northern slope and the valleys. The lower hills and the undulated lands are now being protected and regeneration is evident.

### Sal forests in India

The Sal is slow growing tree with an average of 160 years of maximum life-span (Champion and Seth 1968). Sal forests have been under selective logging for the important source of timber since long time. Sal occupies two main regions - the northern and central Indian regions which are separated by Gangetic plains extending from Assam, West Bengal, Odisha and Jharkhand west to *Shivallik* hills of Haryana and east of Yamuna. Besides, it also extends through Western Ghats and to eastern *Vindhya* and *Satarupa* ranges of Central India. In the last few decades Sal forest density has significantly reduced to 42.11% of the total Sal forest area (Pyasi *et al.* 2013).

The Sal has tendency towards xerophilous structure, its leaves are nearly persistent, coriaceous and possess a polished surface which reflects the Sun's rays and thus they stand the hot dry winds of March to mid of May, while the new ones appear in May end or June when the relative humidity is very low. The Sal however, is neither long enough deciduous nor sufficiently xerophilous to grow in the driest parts (Haines, 1925). However, it has been considered as a deciduous species (Cooke 1903; Kirtikar and Basu 1933; Tiwari 1995), semi-deciduous species (Bor 1953), evergreen species (Krishnaswamy and Mathauda 1954; Singh and Singh 1992), and deciduous or borderline between evergreen and deciduous (Joshi 1980).

### Sal forests in Jharkhand

The forests of Jharkhand are primarily accomplished with Sal. Sal is the integral part of the socio-economic conditions of people of the state and it is related to economy of the state being the most important timber yielding tree. The forest covers spread over an area of 23605 km<sup>2</sup>, which constitute about 29.61% of the total area of Jharkhand. Moreover, out of the mentioned area, 82% of area falls under protected forests whereas, 17.5% of the area falls under reserved forests.

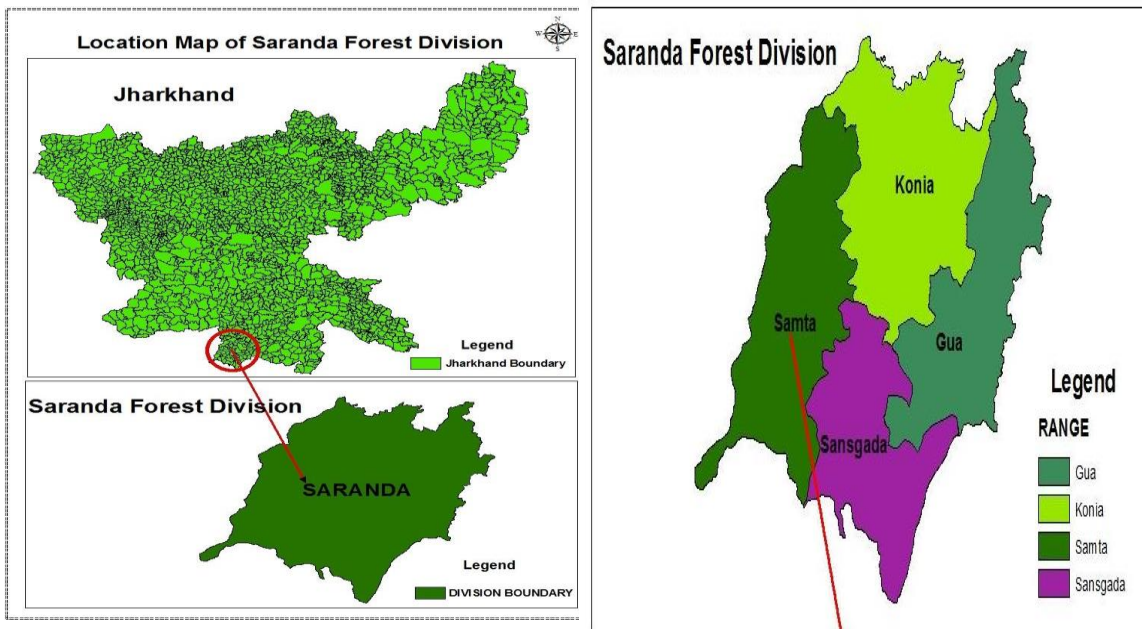


Fig. 1: Map showing Saranda forest Division

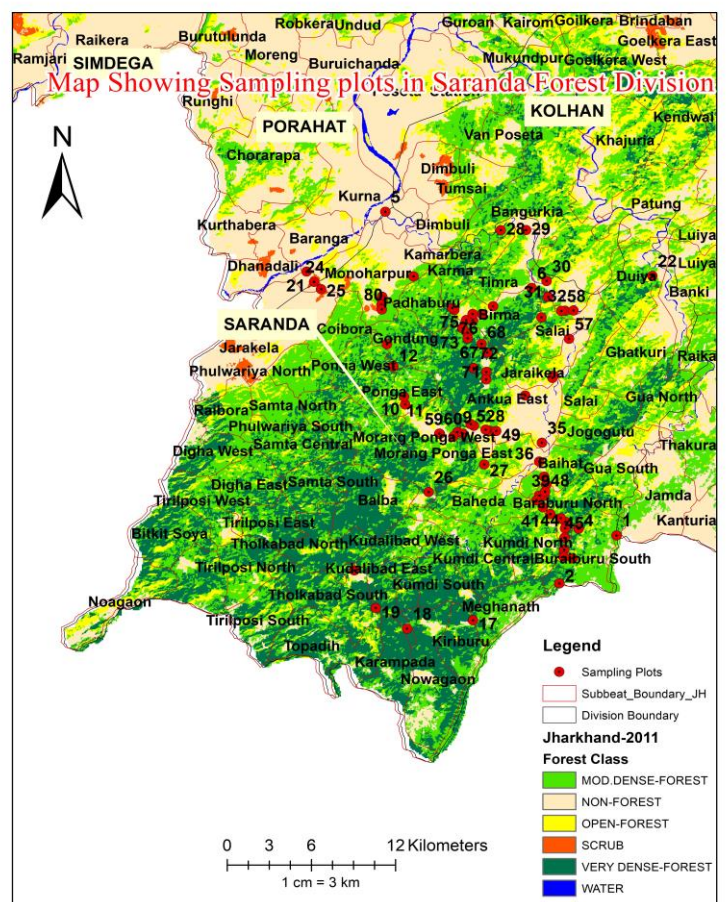
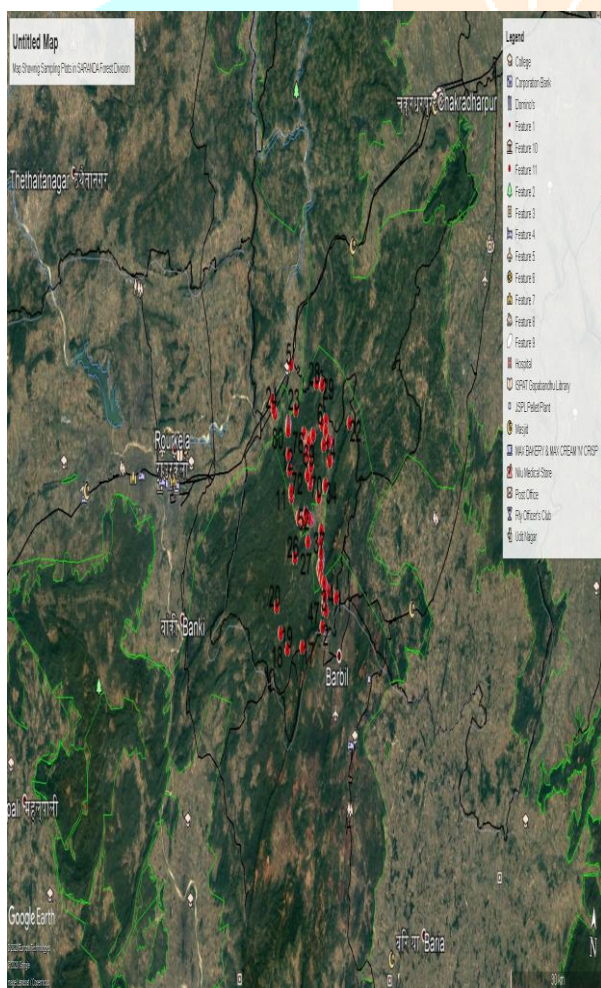


Fig. 2: Map showing Sampling quardat plots of Saranda forest Division

## Methodology

The stratified random sampling approach was followed for phyto-sociological survey in the study area. A total of 80 plots of 0.1h each were randomly laid. GPS was used to record the longitude and latitude of each sampling plot and also the coordinates of plants collected during the study. Sampling was done for all the life-forms *i.e.*, trees, shrubs and herbs. The size of the quadrat for sampling of trees, shrubs and herbs was determined by species-area-curve method (Misra 1968; Mueller-Dombois and Ellenberg 1974). Random quadrats were laid (S1-S80) in the forest area to ensure maximum representation of various types of vegetation. Accordingly, quadrats of 31.63 × 31.63 m for trees, inside which, four quadrats of 5 × 5 m at each corner were laid for analysis of shrubs and 1 × 1 m for herbaceous species (Fig.3).

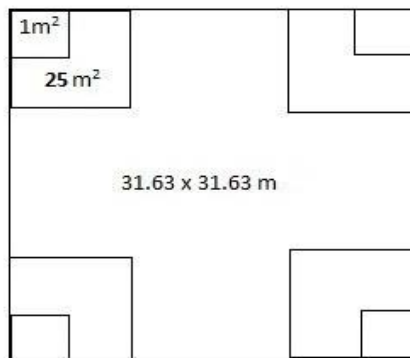


Fig.3: Designing of sampling plot

Soils were collected from the sampling plots and analyzed which reveals that the pH is 6.55, *i.e.*, slightly acidic in nature. The soils contain 0.90% organic carbon, 350 kg/ha available nitrogen, 39.5 kg/ha available phosphorous and 250 kg/ha available potash.

The girth (at breast height) of each individual tree was recorded at 1.37 m above the base of each tree. All individuals with girth > 30 cm were considered as trees and < 30 cm as shrubs. All the plant species were collected from all the sample sites. Specimens of all the plants were collected, processed, made into herbarium specimens and identified through literature for future reference. The field data were quantitatively analyzed for abundance, density and frequency (Curtis and McIntosh 1950).

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

$$\text{Density} = \frac{\text{Total No. of individuals of the species in all the sampling units}}{\text{Total No. of sampling units studied}}$$

$$\text{Abundance} = \frac{\text{Total No. of individuals of the species in all the sampling units}}{\text{No. of sampling units in which the species occurred}}$$

$$\text{Relative Frequency (R.F.)} = \frac{\text{Frequency of the species}}{\text{Total frequency of all the species}} \times 100$$

$$\text{Relative Density (R.D.)} = \frac{\text{Density of species}}{\text{Total density of all the species}} \times 100$$

$$\text{Relative Dominance (R.Do.)} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all the species}} \times 100$$

The importance value index (IVI) (Curtis, 1959) for tree species was also worked out. Species diversity of each site was determined using Diversity Index.

$$H = -\sum [(n_i/N) \ln(n_i/N)]$$

where,  $n_i$  is the total number of individuals of species  $i$  and  $N$  is the total number of individuals of all species in that stand;  $\log$  implies to natural logarithm.

The concentration of dominance (Cd), known as Simpson index, was measured according to Simpson (1949):

$$\text{Index of dominance (Cd)} = \frac{\sum n(n-1)}{\sum N(N-1)}$$

The equitability or evenness ( $e$ ) refers to the degree of relative dominance of each species in that area. It was calculated according to Pielou (1966) as:

$$\text{Equitability (e)} = |H| / \log S$$

where,  $|H|$  = Shannon-Weaver index and  $S$  = number of species.

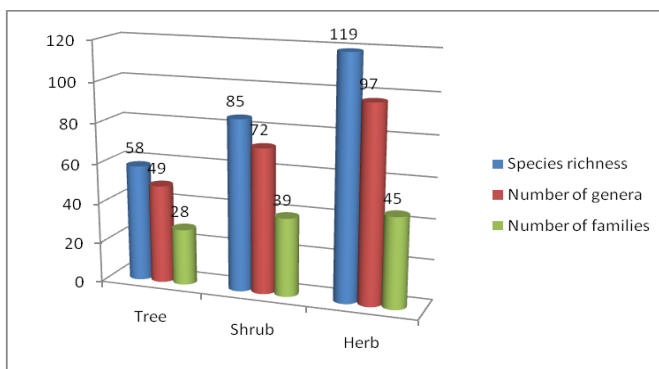
## Results

The study revealed following information on the diversity and vegetation structure in Sal dominated forests of Saran

da Forest Division, Jharkhand (Table 1).

**Table 1:- Showing general floristic diversity characteristics of the forest vegetation**

Variables	Tree	Shrub	Herb
Species richness	58	85	119
Number of genera	49	72	97
Number of families	28	39	45
Density/ha		<b>94737</b>	<b>386000</b>



**Fig 4. Showing general floristic diversity characteristics of the forest vegetation**

## Taxonomic Diversity

Specimens of 262 plant species were collected from sampling sites. Among 262 species, 58 are tree species belonging to 49 genera of 28 families, 85 species of shrubs belonging to 72 genera of 36 families and 119 species of herbs belonging to 97 genera of 45 families. Fabaceae is the dominant family (40 spp.), followed by Asteraceae (12), Apocynaceae and Poaceae (11 spp.), Malvaceae (09 spp.) each. The list of plants is appended in the table given below:

**Table 2: Quantative analysis with IVI, diversity index of Tree species**

Sl. No.	Name of species	Family	Relative frequency (RF)	Relative density (RD)	Relative B. area (RBA)	Importance Value Index (IVI)	Diversity index
1.	<i>Adina cordifolia</i> (Roxb.) Hook. f.	Rubiaceae	2.49	0.66	0.19	3.34	-0.050
2.	<i>Aegle marmelos</i> (L.) Corrêa	Rutaceae	1.60	0.29	0.07	1.97	-0.033
3.	<i>Ailanthus altissima</i>	Simaroubaceae	2.22	0.44	0.15	2.82	-0.044
4.	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	1.78	0.38	0.02	2.18	-0.036
5.	<i>Alangium salviifolium</i> (L.f.) Wangerin	Cornaceae	1.60	0.50	0.17	2.27	-0.037
6.	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	2.31	0.59	0.38	3.28	-0.049
7.	<i>Annona reticulata</i> L.	Annonaceae	0.36	0.07	0.02	0.45	-0.010
8.	<i>Annona squamosa</i> L.	Annonaceae	0.71	0.12	0.12	0.95	-0.018
9.	<i>Anogeissus latifolia</i> (Roxb. ex DC.) Wall. ex Guillem. & Perr.	Combretaceae	6.04	2.88	2.28	11.20	-0.123
10.	<i>Bauhinia racemosa</i>	Fabaceae	0.18	0.06	0.15	0.39	-0.009
11.	<i>Bauhinia semla</i> Wunderlin	Fabaceae	0.89	0.27	0.11	1.26	-0.023
12.	<i>Bauhinia vahlii</i> Wight & Arn.	Fabaceae	2.22	0.37	0.16	2.75	-0.043
13.	<i>Bauhinia variegata</i> L.	Fabaceae	2.49	0.41	0.22	3.12	-0.047
14.	<i>Bombax ceiba</i> L.	Malvaceae	1.60	0.37	0.04	2.01	-0.034

15	<i>Boswellia serrata</i> Roxb. ex Colebr.	Burseraceae	0.80	0.18	0.08	1.06	-0.020
16	<i>Bridelia retusa</i> (L.) A.Juss.	Phyllanthaceae	0.89	0.22	0.04	1.15	-0.021
17	<i>Buchanania lanzan</i> Spreng.	Fabaceae	6.40	2.96	0.29	9.65	-0.111
18	<i>Bursera serrata</i>	Burseraceae	0.27	0.10	0.03	0.40	-0.009
19	<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	0.53	0.18	0.04	0.75	-0.015
20	<i>Careya arborea</i>	Lecythidaceae	0.18	0.12	1.07	1.36	-0.025
21	<i>Cassia fistula</i> L.	Fabaceae	3.73	1.99	0.40	6.12	-0.079
22	<i>Cleistanthus collinus</i> (Roxb.) Benth. ex Hook.f.	Phyllanthaceae	2.84	0.91	0.33	4.09	-0.059
23	<i>Dalbergia sissoo</i> DC.	Fabaceae	0.27	0.07	0.02	0.36	-0.008
24	<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae	0.53	0.18	0.06	0.77	-0.015
25	<i>Diospyros melanoxylon</i> Roxb .	Ebenaceae	3.47	1.18	0.29	4.94	-0.068
26	<i>Emblica officinalis</i> Gaertn.	Phyllanthaceae	2.67	0.46	0.06	3.19	-0.048
27	<i>Erythrina indica</i> Lam.	Fabaceae	0.71	0.15	0.09	0.95	-0.018
28	<i>Ficus racemosa</i> L.	Moraceae	0.44	0.12	0.09	0.65	-0.013
29	<i>Ficus semicordata</i> Buch.-Ham. ex Sm.	Moraceae	0.71	0.15	0.06	0.92	-0.018
30	<i>Helicteres isora</i> L.	Malvaceae	0.44	0.13	1.07	1.64	-0.029
31	<i>Holarrhena pubescens</i> Wall. ex G.Don	Apocynaceae	2.93	0.62	0.09	3.65	-0.054
32	<i>Indigofera pulchella</i> Roxb.	Fabaceae	0.62	0.10	0.04	0.77	-0.015
33	<i>Lagerstroemia parviflora</i> Roxb.	Lythraceae	3.82	1.64	0.56	6.02	-0.078
34	<i>Madhuca latifolia</i> (Roxb.) J.F.Macbr.	Sapotaceae	4.71	2.32	2.94	9.97	-0.113
35	<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	Euphorbiaceae	0.44	0.12	0.07	0.64	-0.013
36	<i>Mangifera indica</i> L.	Anacardiaceae	1.07	0.25	0.20	1.52	-0.027
37	<i>Michelia champaca</i> L.	Magnoliaceae	0.53	0.09	0.02	0.64	-0.013
38	<i>Miliusa velutina</i> (A.DC.) Hook.f. & Thomson	Annonaceae	0.71	0.18	1.07	1.96	-0.033
39	<i>Mitragyna parvifolia</i> (Roxb.) Korth.	Rubiaceae	0.44	0.12	0.02	0.58	-0.012
40	<i>Morinda tinctoria</i> Roxb.	Rubiaceae	0.44	0.15	0.02	0.61	-0.013
41	<i>Plumeria rubra</i> L.	Apocynaceae	0.09	0.03	0.15	0.27	-0.006
42	<i>Pterocarpus marsupium</i> Roxb .	Fabaceae	1.78	0.52	0.07	2.37	-0.038
43	<i>Radermachera xylocarpa</i> (Roxb.) Roxb. ex K.Schum.	Bignoniaceae	1.60	0.37	0.19	2.16	-0.035
44	<i>Schleichera oleosa</i> (Lour.) Merr.	Sapindaceae	3.11	0.63	0.35	4.10	-0.059
45	<i>Semecarpus anacardium</i> L.f.	Anacardiaceae	0.71	0.12	0.12	0.95	-0.018
46	<b><i>Shorea robusta</i> Gaertn.</b>	<b>Dipterocarpaceae</b>	<b>7.11</b>	<b>69.18</b>	<b>84.66</b>	<b>160.95</b>	<b>-0.334</b>
47	<i>Spondias pinnata</i>	Anacardiaceae	0.71	0.22	0.15	1.08	-0.020
48	<i>Sterculia villosa</i>	Sterculiaceae	0.18	0.03	1.07	1.27	-0.023
49	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	3.91	1.11	0.62	5.63	-0.075

50	<i>Tamarindus indica</i> L.	Fabaceae	1.07	0.27	0.04	1.38	-0.025
51	<i>Tectona grandis</i> L.f.	Lamiaceae	0.98	0.28	0.07	1.33	-0.024
52	<i>Terminalia chebula</i>	Fabaceae	0.44	0.19	0.07	0.71	-0.014
53	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Fabaceae	2.67	0.86	0.22	3.74	-0.055
54	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Fabaceae	1.33	0.32	0.20	1.86	-0.031
55	<i>Terminalia tomentosa</i> Wight & Arn.	Fabaceae	4.89	2.92	2.28	10.09	-0.114
56	<i>Trewia nudiflora</i>	Euphorbiaceae	0.18	0.18	1.07	1.42	-0.025
57	<i>Trichilia connaroides</i> (Wight & Arn.) Benth.	Meliaceae	1.96	0.52	0.33	2.80	-0.044
58	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	0.18	0.18	0.01	0.37	-0.008
			<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>300.00</b>	<b>-2.431</b>

Table 3: Quantative analysis with IVI, and density per Hectare of Shrubs species

Sl. No.	Name of species	Family	Relative Frequency	Relative Density	Relative Abundance	IVI	Density/ha
1.	<i>Abelmoschus moschatus</i> Medik.	Malvaceae	0.92	1.39	1.63	3.95	1319
2.	<i>Acacia nilotica</i> (L.) Delile	Fabaceae	1.93	2.64	1.48	<b>6.05</b>	2500
3.	<i>Acacia pinnata</i> Link (sapling)	Fabaceae	2.31	2.20	1.03	5.54	2083
4.	<i>Achyranthes aspera</i> L.	Amaranthaceae	1.43	1.65	1.25	4.33	1562
5.	<i>Adhatoda vasica</i> Nees	Acanthaceae	0.66	0.66	1.09	2.40	625
6.	<i>Adina cordifolia</i> (Roxb.) Hook. f. (sapling)	Rubiaceae	0.77	1.10	1.54	3.41	1042
7.	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	0.62	0.59	1.03	2.23	556
8.	<i>Alangium salviifolium</i> (L.f.) Wangerin	Cornaceae	0.92	0.95	1.11	2.99	903
9.	<i>Alstonia scholaris</i> (L.) R. Br. (sapling)	Apocynaceae	0.92	0.62	0.73	2.28	590
10.	<i>Amaranthus spinosus</i> L.	Amaranthaceae	1.54	1.47	1.03	4.04	1389
11.	<i>Anogeissus latifolia</i> (Roxb. ex DC.) Wall. ex Guillem. & Perr. (sapling)	Combretaceae	1.43	1.58	1.19	4.20	1493
12.	<i>Argemone mexicana</i> L.	Papaveraceae	0.73	1.65	2.44	4.82	1562
13.	<i>Barleria cristata</i> L.	Acanthaceae	0.81	1.55	2.07	4.42	1465
14.	<i>Barleria prionitis</i> L.	Acanthaceae	1.26	1.30	1.11	3.68	1233
15.	<i>Bauhinia vahlii</i> Wight & Arn. (sapling)	Fabaceae	2.20	1.75	0.86	4.81	1656
16.	<i>Bidens pilosa</i> L.	Asteraceae	1.60	1.10	0.75	3.45	1045
17.	<i>Bixa orellana</i> L.	Bixaceae	0.54	0.47	0.94	1.95	444
18.	<i>Bombax ceiba</i> L. (sapling)	Malvaceae	0.39	0.58	1.64	2.60	552
19.	<i>Buchanania lanzan</i> Spreng.	Anacardiaceae	1.97	2.13	1.17	5.26	2014

	(sapling)						
20.	<i>Butea monosperma</i> (Lam.) Taub. (sapling)	Fabaceae	0.76	1.30	1.86	3.92	1233
21.	<i>Butea superba</i> Roxb.	Fabaceae	0.35	0.45	1.42	2.22	431
22.	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Fabaceae	0.50	0.29	0.63	1.43	278
23.	<i>Calotropis procera</i> (Aiton) Dryand.	Apocynaceae	0.58	0.49	0.93	2.00	469
24.	<i>Calotropis gigantea</i> (L.) Dryand.	Apocynaceae	1.17	0.87	0.81	2.85	826
25.	<i>Carissa carandas</i>	Apocynaceae	0.68	0.50	0.79	1.97	472
26.	<i>Casearia tomentosa</i> Roxb.	Salicaceae	0.35	1.21	3.76	5.31	1142
27.	<i>Cassia occidentalis</i>	Fabaceae	0.66	1.18	1.94	3.77	1114
28.	<i>Cassia alata</i> L.	Fabaceae	1.19	1.56	1.42	4.17	1479
29.	<i>Cassia fistula</i> L. (sapling)	Fabaceae	0.31	0.44	1.54	2.29	417
30.	<i>Cassia sophera</i> L.	Fabaceae	0.50	1.28	2.77	4.55	1215
31.	<i>Cipadessa baccifera</i>	Meliaceae	1.55	1.69	1.18	4.42	1604
32.	<i>Cleistanthus collinus</i> (Roxb.) Benth. ex Hook.f. (sapling)	Phyllanthaceae	2.35	2.64	1.21	<b>6.20</b>	2500
33.	<i>Clerodendrum indicum</i> (L.) Kuntze	Lamiaceae	2.30	1.21	0.57	4.08	1146
34.	<i>Clerodendrum infortunatum</i> L.	Lamiaceae	0.27	0.44	1.76	2.47	417
35.	<i>Colebrookea oppositifolia</i>	Lamiaceae	0.63	0.55	0.94	2.12	521
36.	<i>Cordia dichotoma</i> G.Forst.	Boraginaceae	0.96	1.10	1.23	3.30	1042
37.	<i>Crotalaria albida</i> Roth	Fabaceae	0.69	0.81	1.27	2.76	764
38.	<i>Croton oblongifolius</i> Delile	Euphorbiaceae	0.85	1.04	1.33	3.22	989
39.	<i>Datura metel</i> L.	Solanaceae	0.85	0.77	0.99	2.61	733
40.	<i>Desmodium pulchellum</i> (L.) Benth.	Fabaceae	1.93	1.92	1.08	4.92	1816
41.	<i>Desmodium gangeticum</i> (L.) DC.	Fabaceae	1.54	1.48	1.04	4.07	1406
42.	<i>Diospyros melanoxylon</i> Roxb. (sapling)	Ebenaceae	0.23	0.27	1.29	1.79	260
43.	<i>Emblica officinalis</i> Gaertn.	Phyllanthaceae	0.27	0.13	0.51	0.91	122
44.	<i>Eupatorium odoratum</i> L.	Asteraceae	2.43	1.83	0.81	<b>5.07</b>	1729
45.	<i>Ficus glomerata</i> Roxb.	Moraceae	0.27	0.31	1.25	1.83	295
46.	<i>Flemingia macrophylla</i>	Fabaceae	2.39	2.42	1.10	<b>5.90</b>	2291
47.	<i>Flemingia chappar</i> Benth.	Fabaceae	0.17	0.16	1.05	1.39	156
48.	<i>Gmelina arborea</i> Roxb. (sapling)	Lamiaceae	0.58	0.48	0.89	1.95	451
49.	<i>Helicteres isora</i> L. (sapling)	Malvaceae	0.65	0.73	1.22	2.60	694
50.	<i>Heteropogon androphilus</i> (Stapf) Roberty	Poaceae	0.73	0.55	0.81	2.09	521
51.	<i>Holarrhena pubescens</i> Walp. ex G.Don (sapling)	Apocynaceae	2.31	2.38	1.11	5.81	2257
52.	<i>Hyptis suaveolens</i> (L.) Poir.	Lamiaceae	1.19	0.95	0.86	3.01	903
53.	<i>Ichnocarpus frutescens</i> (L.)	Apocynaceae	0.63	0.37	0.63	1.63	347



	W.T.Aiton						
54.	<i>Lagerstroemia parviflora</i> Roxb. (sapling)	Lythraceae	1.25	1.28	1.11	3.64	1215
55.	<i>Lantana camara</i> L.	Verbenaceae	2.39	2.60	1.18	<b>6.17</b>	2465
56.	<i>Lantana indica</i> Roxb.	Verbenaceae	1.97	2.38	1.31	5.66	2257
57.	<i>Leea asiatica</i>	Vitaceae	1.93	1.83	1.03	4.79	1736
58.	<i>Leonotis nepetifolia</i> (L.) R.Br.	Lamiaceae	0.92	0.92	1.07	2.91	868
59.	<i>Madhuca latifolia</i> (Roxb.) J.F.Macbr. (sapling)	Sapotaceae	0.77	0.77	1.08	2.62	729
60.	<i>Mangifera indica</i> L. (sapling)	Anacardiaceae	0.92	1.21	1.41	3.55	1146
61.	<i>Miliusa tomentosa</i> (Roxb.) J.Sinclair (sapling)	Annonaceae	0.67	0.81	1.30	2.78	764
62.	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	0.35	0.37	1.14	1.86	347
63.	<i>Morus alba</i> L.	Moraceae	1.54	0.90	0.63	3.07	851
64.	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae	2.22	2.38	1.16	5.76	2257
65.	<i>Parthenium hysterophorus</i> L.	Asteraceae	2.12	2.27	1.16	5.55	2153
66.	<i>Phoenix sylvestris</i> (L.) Roxb. (sapling)	Aracaceae	1.54	0.92	0.64	3.10	868
67.	<i>Rauvolfia tetraphylla</i> L.	Apocynaceae	1.39	1.32	1.03	3.74	1250
68.	<i>Schleichera oleosa</i> (Lour.) Merr. (sapling)	Sapindaceae	2.39	3.09	1.40	<b>6.87</b>	2923
69.	<i>Shorea robusta</i> Gaertn. (sapling)	Dipterocarpaceae	1.62	1.06	0.71	3.39	1007
70.	<i>Sida cordifolia</i> L.	Malvaceae	1.17	1.01	0.93	3.11	955
71.	<i>Solanum xanthocarpum</i> Schrad. & H. Wendl.	Solanaceae	2.31	2.24	1.05	<b>5.59</b>	2118
72.	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	0.85	0.73	0.94	2.52	694
73.	<i>Tectona grandis</i> L.f. (sapling)	Lamiaceae	2.23	1.43	0.69	4.36	1354
74.	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	2.27	1.65	0.78	4.71	1562
75.	<i>Terminalia tomentosa</i> Wight & Arn. (sapling)	Combretaceae	1.16	0.95	0.89	3.00	903
76.	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn. (sapling)	Combretaceae	2.23	1.17	0.57	3.97	1111
77.	<i>Thespesia lampas</i> (Cav.) Dalzell	Malvaceae	0.23	0.37	1.71	2.31	347
78.	<i>Trema orientalis</i> (L.) Blume	Cannabaceae	0.27	0.44	1.76	2.47	417
79.	<i>Trewia nudiflora</i> L. (sapling)	Euphorbiaceae	1.27	1.47	1.25	3.98	1389
80.	<i>Triumfetta rhomboidea</i> Jacq.	Malvaceae	0.31	0.44	1.54	2.29	417
81.	<i>Urena lobata</i> L.	Malvaceae	1.54	0.88	0.62	3.04	833
82.	<i>Woodfordia fruticosa</i> (L.) Kurz	Lythraceae	2.31	2.02	0.94	<b>5.27</b>	1910
83.	<i>Xanthium strumarium</i> L.	Asteraceae	0.66	0.60	1.00	2.26	573
84.	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	0.54	0.37	0.73	1.64	347
85.	<i>Ziziphus oenopolia</i> (L.)	Rhamnaceae	0.92	0.95	1.11	2.99	903

Mill.							
			100	100	100	300	94737

Table 4: Quantative analysis with IVI, and density per Hectare of Herbs species

Sl. No.	Name of species	Family	Relative Frequency	Relative Density	Relative Abundance	IVI	Density / ha
1.	<i>Abrus precatorius</i> L.	Fabaceae	1.54	0.65	0.32	2.50	2500
2.	<i>Abutilon indicum</i> L.	Malvaceae	0.29	0.49	1.28	2.06	1875
3.	<i>Acalypha indica</i> L.	Euphorbiaceae	4.80	3.24	0.51	<b>8.55</b>	12500
4.	<i>Acorus calamus</i> L.	Acoraceae	2.88	2.83	0.75	6.46	10937.5
5.	<i>Adiantum lanceolatum</i> (Labill.) Poir.	Lindsaeaceae	5.95	4.05	0.52	<b>10.51</b>	15625
6.	<i>Aeginetia indica</i> L.	Orobanchaceae	0.29	0.36	0.96	1.62	1406.25
7.	<i>Ageratum conyzoides</i> (L.) L.	Asteraceae	2.30	2.02	0.67	5.00	7812.5
8.	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	3.84	4.86	0.96	<b>9.66</b>	18750
9.	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Amaranthaceae	4.03	5.83	1.10	<b>10.96</b>	22500
10.	<i>Alternanthera tenella</i> Colla	Amaranthaceae	1.44	1.21	0.64	3.30	4687.5
11.	<i>Amaranthus spinosus</i> L.	Amaranthaceae	0.86	0.97	0.86	2.69	3750
12.	<i>Amaranthus viridis</i> L.	Amaranthaceae	0.38	1.62	3.21	5.21	6250
13.	<i>Ammannia baccifera</i> L.	Lythraceae	0.77	1.30	1.28	3.35	5000
14.	<i>Ampelocissus latifolia</i> (Roxb.) Planch.	Vitaceae	0.46	0.53	0.87	1.86	2031.25
15.	<i>Andrographis paniculata</i> (Burm.f.) Nees	Acanthaceae	1.54	2.15	1.06	4.74	8281.25
16.	<i>Asparagus racemosus</i> Willd	Asparagaceae	0.86	0.74	0.66	2.27	2875
17.	<i>Bacopa monnieri</i> (L.) Wettst.	Plantaginaceae	0.58	0.81	1.07	2.46	3125
18.	<i>Balsamina impatiens</i>	Balsaminaceae	0.86	1.21	1.07	3.15	4687.5
19.	<i>Basella alba</i> L.	Basellaceae	0.36	0.36	0.76	1.49	1406.25
20.	<i>Basella rubra</i> L.	Basellaceae	0.19	0.17	0.67	1.04	656.25
21.	<i>Bidens pilosa</i> L.	Asteraceae	0.88	1.15	0.99	3.02	4437.5
22.	<i>Biophytum sensitivum</i> (L.) DC.	Oxalidaceae	0.48	0.89	1.41	2.78	3437.5
23.	<i>Blechnum orientale</i> L.	Blechnaceae	0.73	1.00	1.04	2.76	3843.75
24.	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	0.86	1.70	1.50	4.06	6562.5
25.	<i>Boerhavia repens</i> L.	Nyctaginaceae	0.86	1.62	1.43	3.91	6250
26.	<i>Cajanus scarabaeoides</i>	Fabaceae	2.88	2.02	0.54	5.44	7812.5
27.	<i>Canna indica</i> L.	Cannaceae	0.77	0.61	0.60	1.98	2343.75
28.	<i>Cassia tora</i> L.	Fabaceae	1.06	2.43	1.75	5.24	9375

29.	<i>Catharanthus roseus</i> (L.) G.Don	Apocynaceae	0.19	0.21	0.84	1.24	812.5
30.	<i>Celastrus paniculatus</i> Willd	Celastraceae	0.38	0.37	0.74	1.49	1437.5
31.	<i>Celosia argentea</i> L.	Amaranthaceae	0.77	1.38	1.37	3.51	5312.5
32.	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	0.40	1.70	3.21	5.32	6562.5
33.	<i>Chenopodium album</i> L.	Chenopodiaceae	0.54	1.62	2.29	4.45	6250
34.	<i>Cleome diandra</i> Burch.	Cleomaceae	0.67	0.81	0.92	2.40	3125
35.	<i>Cleome gynandra</i> L.	Cleomaceae	0.77	1.25	1.24	3.25	4812.5
36.	<i>Cleome rutidosperma</i> DC.	Cleomaceae	0.77	1.21	1.20	3.19	4687.5
37.	<i>Cleome viscosa</i> L.	Cleomaceae	0.58	1.34	1.77	3.68	5156.25
38.	<i>Clitoria ternatea</i> L.	Fabaceae	0.10	0.16	1.28	1.54	625
39.	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	0.77	0.76	0.75	2.28	2937.5
40.	<i>Colocasia esculenta</i> (L.) Schott	Araceae	0.67	0.62	0.70	1.98	2375
41.	<i>Commelina benghalensis</i> L.	Commelinaceae	0.38	0.73	1.45	2.56	2812.5
42.	<i>Commelina erecta</i> L.	Commelinaceae	0.19	0.36	1.45	2.00	1406.25
43.	<i>Costus speciosus</i> (J.Koenig) Sm.	Costaceae	0.29	0.32	0.86	1.47	1250
44.	<i>Crotalaria albida</i> Roth	Fabaceae	0.81	0.66	0.63	2.10	2562.5
45.	<i>Croton bonplandianus</i> Baill.	Euphorbiaceae	1.25	1.26	0.77	3.28	4875
46.	<i>Curculigo orchioides</i> Gaertn.	Hypoxidaceae	5.76	5.67	0.75	<b>12.17</b>	21875
47.	<i>Curcuma amada</i> Roxb.	Zingiberaceae	0.67	0.53	0.60	1.79	2031.25
48.	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	0.19	0.16	0.64	1.00	625
49.	<i>Cyanotis cristata</i> (L.) D.Don	Commelinaceae	0.48	0.57	0.90	1.95	2187.5
50.	<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	0.19	0.49	1.93	2.60	1875
51.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	1.63	3.40	1.59	<b>6.62</b>	13125
52.	<i>Cyperus rotundus</i> L.	Cyperaceae	0.96	0.69	0.55	2.19	2656.25
53.	<i>Dactyloctenium aegyptium</i>	Fabaceae	0.96	0.81	0.64	2.41	3125
54.	<i>Desmodium triflorum</i> (L.) DC.	Fabaceae	1.92	1.62	0.64	4.18	6250
55.	<i>Dioscorea alata</i>	Dioscoreaceae	0.04	0.08	1.61	1.73	312.5
56.	<i>Dioscorea oppositifolia</i>	Dioscoreaceae	0.10	0.16	1.28	1.54	625
57.	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	0.29	0.28	0.75	1.32	1093.75
58.	<i>Dioscorea pentaphylla</i> L.	Dioscoreaceae	0.19	0.08	0.32	0.59	312.5
59.	<i>Eclipta alba</i> (L.) Hassk.	Asteraceae	0.86	0.49	0.43	1.78	1875
60.	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	0.38	0.16	0.32	0.87	625
61.	<i>Elephantopus scaber</i> L.	Compositae	0.77	0.97	0.96	2.70	3750
62.	<i>Emilia sonchifolia</i> (L.) DC. ex DC.	Compositae	0.48	0.20	0.32	1.00	781.25
63.	<i>Eriocaulon cinereum</i> R.Br.	Eriocaulaceae	0.06	0.08	1.07	1.21	312.5
64.	<i>Eulaliopsis binata</i> (Retz.) C.E.Hubb.	Poaceae	0.13	0.53	2.98	3.64	2031.25

65.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	0.61	0.65	0.80	2.06	2500
66.	<i>Euphorbia thymifolia</i> L.	Euphorbiaceae	0.58	0.49	0.64	1.70	1875
67.	<i>Evolvulus alsinoides</i> (L.) L.	Convolvulaceae	0.67	0.49	0.55	1.71	1875
68.	<i>Evolvulus nummularius</i> (L.) L.	Convolvulaceae	0.67	0.63	0.72	2.02	2437.5
69.	<i>Gomphrena serrata</i> L.	Amaranthaceae	0.31	0.21	0.52	1.04	812.5
70.	<i>Hedyotis corymbosa</i>	Rubiaceae	0.10	0.12	0.96	1.18	468.75
71.	<i>Heliotropium indicum</i> L.	Boraginaceae	1.15	0.53	0.35	2.03	2031.25
72.	<i>Hemidesmus indicus</i> (L.) R. Br. ex Schult.	Apocynaceae	0.81	0.69	0.65	2.14	2656.25
73.	<i>Heteropogon contortus</i>	Poaceae	0.35	0.36	0.80	1.51	1406.25
74.	<i>Heteropogon leptocladus</i> (Hack.) Roberty	Poaceae	0.08	0.20	2.01	2.29	781.25
75.	<i>Hygrophila auriculata</i> (Schumach.) Heine	Acanthaceae	0.15	0.12	0.60	0.88	468.75
76.	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	0.15	0.19	0.96	1.31	750
77.	<i>Ipomoea quadrangularis</i> Bojer ex Choisy	Convolvulaceae	0.12	0.08	0.54	0.73	312.5
78.	<i>Jatropha curcas</i> L.	Euphorbiaceae	0.15	0.16	0.80	1.12	625
79.	<i>Lathyrus sativus</i> L.	Fabaceae	0.48	0.32	0.51	1.32	1250
80.	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	0.58	0.36	0.48	1.42	1406.25
81.	<i>Lindenbergia indica</i> Vatke	Plantaginaceae	0.48	0.40	0.64	1.53	1562.5
82.	<i>Lindernia ciliata</i>	Scrophulariaceae	0.19	0.20	0.80	1.20	781.25
83.	<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven	Onagraceae	0.29	0.15	0.41	0.85	593.75
84.	<i>Martynia annua</i> L.	Martyniaceae	0.48	0.24	0.39	1.11	937.5
85.	<i>Mazus pumilus</i>	Scrophulariaceae	0.42	0.40	0.73	1.56	1562.5
86.	<i>Melochia corchorifolia</i> L.	Malvaceae	1.15	0.70	0.46	2.31	2687.5
87.	<i>Mentha arvensis</i> L.	Lamiaceae	0.23	0.20	0.67	1.10	781.25
88.	<i>Mimosa pudica</i> L.	Fabaceae	0.38	0.32	0.64	1.35	1250
89.	<i>Momordica dioica</i> Roxb. ex Willd.	Cucurbitaceae	0.19	0.08	0.32	0.59	312.5
90.	<i>Mucuna pruriens</i> (L.) DC.	Fabaceae	0.58	0.24	0.32	1.14	937.5
91.	<i>Oldenlandia corymbosa</i> L.	Rubiaceae	0.38	0.20	0.40	0.99	781.25
92.	<i>Oplismenus burmannii</i>	Asteraceae	2.30	1.62	0.54	4.46	6250
93.	<i>Oxalis corniculata</i> L.	Oxalidaceae	0.96	0.81	0.64	2.41	3125
94.	<i>Oxalis latifolia</i> Kunth	Oxalidaceae	0.50	0.36	0.56	1.42	1406.25
95.	<i>Pennisetum pedicellatum</i> Trin.	Poaceae	1.63	0.97	0.45	3.06	3750
96.	<i>Phyllanthus amarus</i> L.	Phyllanthaceae	1.15	0.81	0.54	2.50	3125
97.	<i>Phyllanthus virgatus</i> G.Forst.	Phyllanthaceae	0.96	0.53	0.42	1.90	2031.25
98.	<i>Physalis angulata</i> L.	Solanaceae	0.96	0.40	0.32	1.69	1562.5
99.	<i>Piper umbellatum</i> L.	Piperaceae	0.08	0.08	0.80	0.96	312.5
100.	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Apocynaceae	0.58	0.24	0.32	1.14	937.5
101.	<i>Ruellia tuberosa</i>	Acanthaceae	0.23	0.24	0.80	1.28	937.5
102.	<i>Rungia parviflora</i> Nees	Acanthaceae	0.36	0.24	0.51	1.11	937.5
103.	<i>Saccharum spontaneum</i> L.	Poaceae	0.38	0.40	0.80	1.59	1562.5

104.	<i>Scoparia dulcis</i> L.	Plantaginaceae	0.44	0.22	0.38	1.04	843.75
105.	<i>Sida cordifolia</i> L.	Malvaceae	0.58	0.28	0.37	1.23	1093.75
106.	<i>Smithia conferta</i>	Poaceae	0.96	0.49	0.39	1.83	1875
107.	<i>Solanum nigrum</i> L.	Solanaceae	0.38	0.16	0.32	0.87	625
108.	<i>Sonchus arvensis</i> L.	Compositae	0.38	0.16	0.32	0.87	625
109.	<i>Sonchus oleraceus</i> (L.) L.	Asteraceae	0.23	0.12	0.40	0.75	468.75
110.	<i>Sphaeranthus indicus</i> L.	Asteraceae	0.38	0.32	0.64	1.35	1250
111.	<i>Synedrella nodiflora</i> (L.) Gaertn.	Compositae	0.48	0.37	0.59	1.44	1437.5
112.	<i>Thysanolaena sps</i>	Poaceae	0.86	0.52	0.46	1.84	2000
113.	<i>Tridax procumbens</i> (L.) L.	Compositae	1.54	0.97	0.48	2.99	3750
114.	<i>Uraria lagopoides</i>	Fabaceae	0.96	0.40	0.32	1.69	1562.5
115.	<i>Uraria picta</i> (Jacq.) DC.	Fabaceae	0.86	0.65	0.57	2.08	2500
116.	<i>Vernonia aspera</i> (Roxb.) Buch.-Ham.	Asteraceae	0.23	0.16	0.54	0.93	625
117.	<i>Vernonia cinerea</i> (L.) Less.	Compositae	0.52	0.36	0.54	1.42	1406.25
118.	<i>Vetiveria zizanioides</i> (L.) Nash	Poaceae	0.19	0.12	0.48	0.80	468.75
119.	<i>Wedelia chinensis</i> (Osbeck) Merr.	Asteraceae	0.86	0.65	0.57	2.08	2500
			<b>100</b>	<b>100</b>	<b>100</b>	<b>300</b>	<b>386000</b>

### Importance value index (IVI)

Among tree species, the *Shorea robusta* had highest IVI (160.95), followed by *Anogissus latifolia* (11.20). *Schleichera oleosa* sapling (6.87), *Cleistanthus collinus* (6.20), *Lantana camara* (6.17), *Flemingia macrophylla* (5.90) and *Woodfordia fruticosa* (5.27) were dominant shrub species. Among herbs, *Curculigo orchoides* (12.17), *Alternanthera sessilis* (10.96), *Adiantum lanceolatum* (10.51) were found to have highest IVI. One RET species *Pterocarpus marsupium* (2.37) IUCN status 2017 Near Threatened was recorded.

### Species richness, diversity, evenness and dominance

In the Sal dominated forest of Saranda, 58 trees species, 85 shrubs and 119 herbs were recorded. The Shannon-Weaver's diversity index was recorded highest in herbaceous species (4.276) than in shrub (4.273) and trees (1.676). Simpson's index was equal in herb, shrub and tree (1.00). Pielou's index was found highest in Shrubs (0.050) than in herb (0.034) and trees (0.019) (Fig.5). The dominance of trees was recorded highest than herbs and shrubs. Density per hectare was highest in herbs than in shrubs.

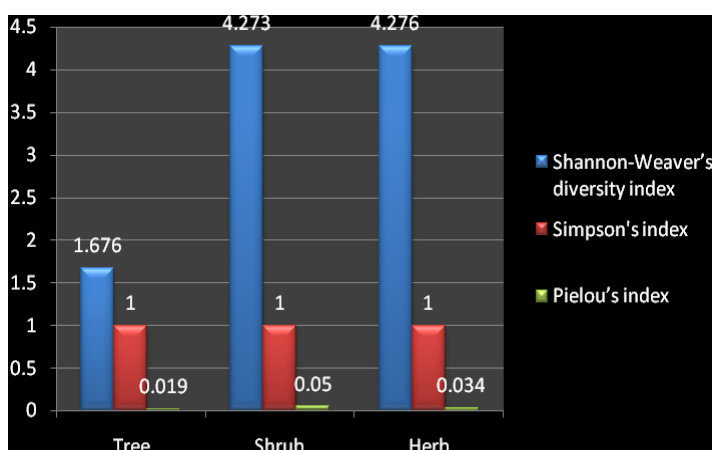


Fig.5: Showing different diversity indices of the forest vegetation.

## Frequency class of Vegetation

Raunkiaer introduced the frequency which indicates the number of sampling units in which a given species occurs; and thus express the distribution of various species in a vegetation community. Raunkiaer prepared the following frequency diagram based on the species % frequency and number of species belonging to concerned frequency class. On the basis of percent values various species are distributed into five classes:

Frequency Percentage	Class
0-20	A
21-40	B
41-60	C
61-80	D
81-100	E

The normal species occurrence ratio given by Raunkiaer is  $A > B > C > D < E$  and stated that if frequency is matched with Raunkiaer normal frequency diagram (J-shaped), it means that the particular plant community is homogenous. Our result indicates homogenous community in nature. A graph is plotted (histogram) with frequency class on x-axis and frequency percentage on y-axis and compared with Raunkiaer's value (Raunkiaer 1934).

Table 5:- Frequency diagram of the study area compared to Raunkiaer's diagram

Frequency class	Class value (%)	Raunkiaer's value	Frequency class of vegetation Present study
A	0-20	53	150
B	21-40	14	54
C	41-60	9	18
D	61-80	8	19
E	81-100	16	21

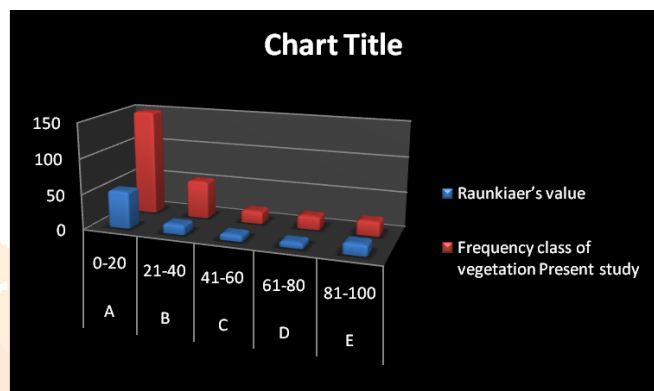


Fig.6: Frequency diagram of the study area compared to Raunkiaer's diagram

## Discussion and Conclusion

The deciduous phase of Sal forest is long and the forest floor gets dry and hot during summer in the study area. Long dry period, less rainfall and humidity has an effect on floristic composition. The present study indicates that change in diversity, composition and vegetation structures could be chiefly attributed to variation in climatic conditions (especially rainfall), biotic interferences and management practices.

The Shannon-Weaver's index of diversity was 1.676 in tree species which is slightly lower than the Sal dominated forest (3.59) in the eastern Himalayan lowlands (Uma Shankar 2001).

The Simpson index, which measures the degree of concentration when individuals are classified into types (Simpson, 1949) was considerably low in all the life forms. It was equal in herb, shrub and tree (1) 1 represents infinite diversity, which falls within the reported range of other Sal forests in India (Pande 1999).

The value of evenness (Pielou's index) expresses how evenly the individuals are distributed among the different species and was highest in shrubs (0.050) followed by herbs (0.034) and trees (0.019). According to Pielou (1984), values closer to 1 indicate very even abundance of species. A higher number of species and more even distribution increase the diversity. In fact, a high value of evenness index also reflects much of the value of diversity which is attributed to the species that are relatively rare.

The importance Value Index (IVI) was highest in *Shorea robusta* (160.95) in trees, *Lantana camara* (6.17) in shrubs and *Curculigo orchioides* (12.17) in herbaceous species which determines the overall importance of each species in the community structure and how dominant a species is in a given forest area.

The frequency diagram clearly reveals that it match with that of Raunkiaer and hence can be concluded that the vegetation community under study is homogenous in nature. It is also evident from the current observation that the forest of Saranda Forest Division exhibits significant diversity of wild plant species. Their management as a forest ecosystem is necessary for the conservation of group of species occurring in different niche within the forest. A group of such species may be identified, selected and used for reforestation of degraded forest sites within the Forest.

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