

## Vegetation Analysis in Relation to Availability of Food Plants for Migratory Elephants in Uthan Nayagram and Kuilibandh Forests of South Bengal

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### Abstract

A total of 9,399 trees belonging to 41 species were recorded in two forests. *Shorea robusta* was found to be the predominant species in both Uthan Nayagram (3,073.07/ha) and Kuilibandh (2,975.64/ha) forests. The overall other dominant trees species were *D. melanoxylon* (1,594.87/ha), *B. latifolia* (216.02/ha) and *M. latifolia* (280.12/ha). Out of total recorded tree species only eleven species together accounted for 95.15%. A total of 3,208 major food plants comprising seven plants species recorded 34.13% of the total plants in the forests. These plant species were consumed by the migratory elephants. The biomass utilization by elephants through these food plants was observed to be less. That could be one of the possible reasons for elephants to depend more on agricultural crops in south West Bengal.

**Key words :** Vegetation, Migratory elephants, Food plants.

The vegetations in south West Bengal comprise predominantly of sal (*Shorea robusta*) coppice forest and scrub jungle in lateritic areas and in most outer parts of hilly tracts. The usual associates of *S. robusta* are *Aegle marmelos*, *Careya arborea*, *Terminalia tomentosa* and *Pterocarpus marsupium*. The undergrowth consists of *Hollarrhena antidysenterica*, *Gardenia gummifera*, *Flacourtia* spp. and *Zizyphus, xylopyrus*. The forests in this area are found in disjointed and isolated patches of varying sizes. In many instances, forests look like islands amongst cultivated fields and habitations. Lack of compactness of forest together with increasing biotic pressure over the years brought about general degradation of forests. Because of the dry climate and poor soil, the growth of trees is normally poor (Roy Choudhury 1966). The shape and size of forest belts vary widely from place to place depending on the configuration of the terrain. In south West Bengal forests the elephant depredation is a burning problem for more than two decades. There has been a routine phenomenon of migration of elephants from Dalma Wildlife Sanctuary, Jharkhand to South West Bengal forests and causes havoc damage in terms of human death and monetary loss. These migratory elephants primarily consumed the agricultural crops, though some food plants found in the forests also

form the part of their daily diet schedule. The present study, therefore was conducted to find out the availability of food plants consumed by the migratory elephants in relation to vegetation analysis in south West Bengal forests.

### Methods

#### *Vegetation Analysis*

Two representative major forests (Uthan Nayagram and Kuilibandh) of the study area were subjected to vegetation analysis following the method described by Sivaganesan (1991). A strip transects of 20 m × 15 m each covering a total of 1.56 hectare forest area was brought under study. Species and number of all trees falling within the transect were recorded. Trees with more than 20 cm girth at breast height (1.3 m) were considered as matured trees (>20 cm gbh). For each forest number of tree species, density, relative frequency, relative density, relative dominance and importance value indices were calculated based on the following formulae :

$$\text{Density} = \frac{\text{Total number of individuals of particular species}}{\text{Total number of sampling units studied}}$$

$$\text{Relative frequency (RF)} = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \times 100$$

$$\text{Relative density (RD)} = \frac{\text{Density of a species}}{\text{Total density of all species}} \times 100$$

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

Importance value indices (IVI) = RF + RD + RDO

#### Identification of Food Plants

Different plant species consumed by elephants

was recorded through evidences of branch breaking, main-stem breaking, stem twisting, bark peeling, up-rooting and tusk markings (Ishwaran 1983).

## Results and Discussion

### Composition of Tree Species

Composition of tree species are summarized in the Tables 1 and 2. The composition represents distribution of various plant species in the forest. A total of 9,399 trees belonging to 41 species were recorded. *Shorea robusta* was the predominant species with density of 3,073.07 and 2,975.64 per hectare in Uthan

**Table 1.** Vegetation analysis with availability of elephant's food plants in Uthan Nayagram forest (sampled area 0.78 ha).

Common or local name	Species	Total number	Density/ha	Relative frequency (%)	Relative density (%)	Relative dominance (%)	Importance value indices
Sal	<i>Shorea robusta</i>	2397	3073.07	57.71	58.80	93.51	160.02
Dhaw	<i>Anogeissus latifolia</i>	106	137.17	4.74	2.60	0.39	7.73
Sidha	<i>Lagerstroemia parviflora</i>	76	97.43	5.34	1.86	0.39	7.59
Kend	<i>Diospyros melanoxylon</i>	449	575.64	7.12	11.01	1.13	19.26
Piyal	<i>Buchanania latifolia</i>	198	253.84	7.71	4.85	0.88	13.44
Asan	<i>Terminalia tomentosa</i>	59	75.64	4.74	1.44	0.29	6.47
Kumbhi	<i>Careya arborea</i>	24	30.76	2.67	0.58	0.19	3.44
Jiyal	<i>Lannea grandis</i>	9	11.53	1.78	0.22	0.04	2.04
Mohul	<i>Madhuca latifolia</i>	250	320.51	7.41	6.13	0.93	14.47
Siris	<i>Albizia lebbek</i>	2	2.56	0.29	0.04	0.00	0.33
Chanlai	<i>Wendlandia exserta</i>	7	8.97	1.48	0.17	0.04	1.69
Rahara	<i>Soymida febrifuga</i>	26	33.33	2.37	0.63	0.04	3.04
Kalajam	<i>Eugenia jambolana</i>	19	24.35	2.67	0.46	0.04	3.17
Haldu	<i>Adina cordifolia</i>	21	26.92	2.37	0.51	0.09	2.97
Bahera	<i>Terminalia belerica</i>	73	93.58	6.82	1.79	0.14	8.75
Piasal	<i>Pterocarpus marsupium</i>	166	212.82	7.71	4.07	0.64	12.42
Sonalu	<i>Cassia fistula</i>	20	25.64	2.67	0.49	0.04	3.20
Bel	<i>Aegle marmelos</i>	26	33.33	4.74	0.63	0.64	6.01
Neem	<i>Azadirachta indica</i>	3	3.84	0.59	0.07	0.00	0.66
Haritaki	<i>Terminalia chebula</i>	6	7.69	1.18	0.14	0.04	1.36
Bhela	<i>Semecarpus anacardium</i>	45	57.69	4.45	1.10	0.14	5.69
Parasi	<i>Cleistanthus colinus</i>	26	33.33	2.37	0.63	0.04	3.04
Kusum	<i>Schlichera trijuga</i>	4	5.12	0.59	0.09	0.00	0.68
Kaj	<i>Bridelia retusa</i>	7	8.97	0.59	0.17	0.00	0.76
Lathikaram	<i>Hymenodictyon excelsum</i>	11	14.10	1.78	0.26	0.00	2.04
Amla	<i>Phyllanthus emblica</i>	5	6.41	0.89	0.12	0.04	1.05
Chhatim	<i>Alstonia scholaris</i>	2	2.56	0.29	0.04	0.00	0.33
Setisal	<i>Dalbergia latifolia</i>	6	7.69	0.59	0.14	0.00	0.73
Kuchila	<i>Strychnos nux-vomica</i>	9	11.53	2.07	0.22	0.00	2.29
Palash	<i>Butea frondosa</i>	6	7.69	1.18	0.14	0.00	1.32
Pola	<i>Kydia calycina</i>	2	2.56	0.29	0.04	0.00	0.33
Neuri	<i>Elaeodendron glaucum</i>	5	6.41	0.89	0.12	0.00	1.01
Barmalla	<i>Callicarpa arborea</i>	7	8.97	0.89	0.17	0.00	1.06
Dumur	<i>Ficus hispida</i>	2	2.56	0.29	0.04	0.04	0.37
Gamar	<i>Gmelina arborea</i>	1	1.28	0.29	0.02	0.04	0.35
Golgoli	<i>Cochlospermum gossypium</i>	1	1.28	0.29	0.02	0.00	0.31

**Table 2.** Vegetation analysis with availability of food plants in Kuilibandh forest (sampled area 0.78 ha).

Common of local name	Species	Total number	Density/ha	Relative frequency (%)	Relative density (%)	Relative dominance (%)	Importance value indices
Sal	<i>Shorea robusta</i>	2321	2975.64	8.41	43.60	91.16	143.17
Dhaw	<i>Anogeissus latifolia</i>	39	50.00	6.14	0.73	0.22	7.09
Sidha	<i>Lagerstroemia parviflora</i>	187	239.74	7.76	3.51	0.57	11.84
Kend	<i>Diospyros melanoxylon</i>	2039	2614.10	8.41	38.30	3.23	49.94
Piyal	<i>Buchanania latifolia</i>	139	178.20	6.47	2.61	1.07	10.15
Asam	<i>Terminalia tomentosa</i>	16	20.51	2.58	0.30	0.13	3.01
Kumbhi	<i>Careya arborea</i>	11	14.10	1.61	0.20	0.04	1.85
Jiyal	<i>Lannea grandis</i>	49	62.82	4.20	0.92	0.20	5.32
Mohul	<i>Madhuca latifolia</i>	187	239.74	7.76	3.51	1.51	12.78
Siria	<i>Albizia lebbek</i>	15	19.23	1.61	0.28	0.08	1.97
Chanlai	<i>Wendlandia exserta</i>	18	22.78	1.94	0.33	0.08	2.35
Rahara	<i>Soymida febrifuga</i>	15	19.23	3.23	0.28	0.13	3.64
Kalajam	<i>Eugenia jambolana</i>	27	34.61	3.26	0.50	0.04	2.8
Haldu	<i>Adina cordifolia</i>	17	21.79	2.58	0.31	0.08	2.97
Bahera	<i>Terminalia belerica</i>	70	89.74	6.14	1.31	0.71	8.16
Piasl	<i>Pterocarpus marsupium</i>	40	51.28	4.85	0.75	0.51	6.11
Sonalu	<i>Cassia fistula</i>	2	2.56	0.64	0.03	0.06	0.73
Bel	<i>Aegle marmelos</i>	2	2.56	0.64	0.03	0.04	0.71
Bangab	<i>Diospyros montana</i>	6	7.69	0.64	0.11	0.00	0.75
Akashmoni	<i>Acacia auriculiformis</i>	13	16.66	0.64	0.24	0.00	0.88
Neuri	<i>Elaeodendron glaucum</i>	4	5.12	0.97	0.07	0.00	1.04
Haritaki	<i>Terminalia chebula</i>	8	10.25	2.26	0.15	0.00	2.41
Bhela	<i>Semecarpus anacardium</i>	29	37.17	4.53	0.54	0.00	5.07
Parasi	<i>Cleistanthus colinus</i>	20	25.64	2.58	0.37	0.04	2.99
Kusum	<i>Schlichera trijuga</i>	6	7.69	1.61	0.11	0.00	1.72
Lathikaram	<i>Hymenodictyon excelsum</i>	10	12.82	2.58	0.18	0.00	2.76
Amla	<i>Phyllanthus emblica</i>	4	5.12	1.29	0.07	0.00	1.36
Chhatim	<i>Alstonia scholaris</i>	1	1.28	0.32	0.01	0.00	0.33
Kaj	<i>Bridelia retusa</i>	7	8.97	1.29	0.13	0.00	1.42
Barmalla	<i>Callicarpa arborea</i>	5	6.41	0.64	0.09	0.00	0.73
Neem	<i>Azadirachta indica</i>	1	1.28	0.32	0.01	0.00	0.33
Simul	<i>Bombax malabaricum</i>	1	1.28	0.32	0.01	0.00	0.33
Palash	<i>Butea frondosa</i>	8	10.25	0.64	0.15	0.00	0.79
Bat	<i>Ficus bengalensis</i>	1	1.28	0.32	0.01	0.00	0.33
Pitali	<i>Trewia nudiflora</i>	3	3.84	0.97	0.05	0.00	1.02
Setisal	<i>Dalbergia latifolia</i>	2	2.56	0.64	0.03	0.00	0.67

Nyagram (Table 1) and Kuilibandh (Table 2) forests respectively. On overall basis most dominant tree species were *Diospyros melanoxylon* (1,594.87/ha), *Buchanania latifolia* (216.02/ha), *Madhuca latifolia* (280.12/ha), *Terminalia belerica* (91.66/ha), *Pterocarpus marsupium* (132.05/ha), *Anogeissus latifolia* (92.94/ha) and *Lagerstroemia parviflora* (168.58/ha). Further analysis indicated that *S. robusta* alone constituted 58.80% in Uthan Nayagram and 43.60% in Kuilibandh forests. However, relative dominance of *S. robusta* was 93.51 and 91.16% in Uthan Nayagram and Kuilibandh forests respectively. Out of total tree species recorded only eleven species viz.,

*S. robusta* (50.19%), *A. latifolia* (1.54%), *L. parviflora* (2.79%), *D. melanoxylon* (26.47%), *B. latifolia* (3.58%), *Terminalia tomentosa* (0.79%), *Lannea grandis* (0.61%), *M. latifolia* (4.64%), *T. belerica* (1.52%), *P. marsupium* (2.19%) and *Semecarpus anacardium* (0.78%) together accounted for 95.15% in this zone of south Bengal forests. Tree species such as *Butea frondosa* was found to be 0.14 and 0.15% in Uthan Nayagram and Kuilibandh respectively. *Terminalia chebula* was recorded to be 0.14 and 0.15% in Uthan Nayagram and Kuilibandh respectively. Both the tree species were almost uniformly distributed in the studied forests. Highest relative dominance of *S. robusta*

among all the recorded tree species was due to even distribution of higher girth class. Although the common associates of sal such as *D. melanoxylon*, *B. latifolia*, *M. latifolia* and *P. marsupium* have high relative density after *S. robusta*, their low relative dominance value can be attributed to their lower mean stem girth. These associates were frequently cut by the local villagers for pole woods (Anonymous. 1975) resulting lower relative dominance. Out of all species recorded in the studied forests only six tree species had the importance value indices (IVI) that score greater than 10.0. After sal, *D. melanoxylon* ranked higher in IVI score (49.94) in Kuilibandh than that in Uthan Nayagram (19.26). The overall similarity in composition of vegetation in both the forests is due to similar physical features of the area. The findings of vegetation analysis are not corroborated with the results in the dry deciduous forest of south India (Kumar 1995).

#### *Major Food Plants Available for Elephants*

A total of 3,208 major food plants comprising seven plants species accounted for 34.13% of the total plants present in the studied two forests (Tables 1 and 2). Seven tree species namely *D. melanoxylon*, *B. latifolia*, *L. grandis*, *A. lebbeck*, *P. marsupium*, *A. marmelos* and *S. anacardium* were found to be consumed mainly by the migratory elephants. The dominant food plant was *D. melanoxylon* accounting for 11.01 and 88.15% in Uthan Nayagram and Kuilibandh respectively. Overall distributions of different food plants in two forests were 26.47, 3.58, 0.06, 0.18, 2.19, 0.29, and 0.78% for *D. melanoxylon*, *B. latifolia*, *L. grandis*, *A. lebbeck*, *P. marsupium*, *A. marmelos* and *S. anacardium* respectively. Densities of major matured food tree species with higher girth class consumed by elephants were considerably found less in the present studied forests. Therefore, the biomass

utilization by migratory elephants through these food plants in the forests would be less. That could be one of the possible reasons for elephants to depend more on agricultural crops. Moreover, forest users cut and collect many of these plants for their different uses. Many elephant's food plants such as *D. melanoxylon*, *B. latifolia* and *P. marsupium* were gradually wiped out from the forests of south Bengal due to repeated cuttings. (Anonymous. 1975). Therefore, as a management strategy, these plants should be protected by dissuading people from cutting. The preferred food plants consumed by migratory elephants in forests of other parts of India do not corroborate with the present findings (Srivastava 2002). This is possibly due to heavy reliance of elephants on agricultural crops in south Bengal to meet their major food requirements.

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