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A SURVEY OF THE FLORISTIC COMPOSITION AND DENSITY IN KWESATI FOREST RESERVE USSA LOCAL GOVERNMENT AREA TARABA STATE, NIGERIA

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ABSTRACT

The study was conducted in Kwesati Forest reserve in Ussa Local Government Area of Taraba State, Nigeria. The floristic composition and density were assessed to determine the current status of the forest. Nineteen hectares of sample plot of lands were laid out in the forest. Each of the hectare plot was divided into four equal sizes of 50m x 50m (2,500m^2), one was randomly selected for the sampling. A total of 80 different tree species belonging to 23 families were encountered in the study area. Tree species in the family of Fabacaceae had the highest (9) representation in the forest. The predominant species are Cola mellinii, Phyllanthus discoides, Funtumia elastica, Tetrapleura tetraptera, Erythropheleum suavolens, and Macaranga burfolia. Density of trees per hectare were ranged from 56 to 136. A total of 4,172 were recorded with an average of 104 per hectare. The total basal area was 19.6774m^2 with an average of 1. 0356m^2 per hectare. The number of trees per hectare in the study area is very low which signified that there is high human interference. Massive enrichment planting with valuable species is recommended to increase stocking in the forest.

Keywords: Kwesati forest reserve, floristic composition, tree species, density, families, basal area.

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INTRODUCTION

Forest resources are very important to mankind due to the innumerable, invaluable and indispensable economic, social and environmental benefits they provide. The diversity of forest resources and their natural ability to renew themselves offer man a very great opportunity to tap these resources for his great benefits in perpetuity. This calls for a sound forest management strategy that would ensure the sustainability of the resources and their benefits. According to Higman et al. (2000), the basic requirement of a sound forest management strategy is the availability of reliable database that provides adequate information on the extent, state and potentials of the resources. Relevant information about forest resources provide forest managers with the necessary guides for national decision making (Akindele, 2001) and management planning as well as its implementation. For example, the calculation and implementation of sustained yield harvest and long-term planning of forest management operations, such as planting thinning, pruning and improvement cuttings, cannot be successful without reliable data on the stand density and growth rates of the trees. Stand density determines the amount of growing space available for individual trees on a site and the level of competition among them for light, soil moisture and nutrients. It therefore, has great effect on the rate and pattern of tree growth and can be manipulated by the forest manager to maintain a good balance between the site and the trees growing on it for desired economic and silvicultural benefits. According to Nuga and Chima (2010), foresters can influence the growth, quality and health of trees by altering stand

density. On its part, growth rates of trees determine the yield of forest stand and the rate of returns on forest investment.

Kwesati Forest Reserve was created in 1970 with the management plan to provide timber. It is located between the lowland rain forest zone and the southern guinea vegetation of the southern Taraba. The forest timber species has been cleared by illegal timber merchants and is presently encroached by farmers with farming activities. However, there is no idea about the floristic composition of the forest as it has never been assed of any kind. The reasons for carrying out this investigation is to find out if the forest is still essential as a biodiversity conservation. And to provide a database information that can be used to improve and sustain the forest reserve.

MATERIALS AND METHODS

Study Area

The study was conducted in Kwesati Forest Reserve located in Ussa Local Government area of Taraba State, Nigeria. The area lies at latitude 7^0 11' north and longitude 10^0 20' east. The Local Government Area (LGA) was created in the year 1996 with the headquarters in Lissam. Ussa borders the Republic of Cameroon in the south, the Donga River forms its northern boundary, south west by Takum local government area and on the north east by Kurmi. The LGA has eight District Councils namely, Lissam 1, Lissam 2, Kpambo, Rufu, Lumbu, Fikyu, Acha and Kpambo Puri. The LGA occupied a total land of 1,495 km2 and a population of 92, 017 people at the 2006 census. The major tribe is Kuteb and farming is the main occupation.

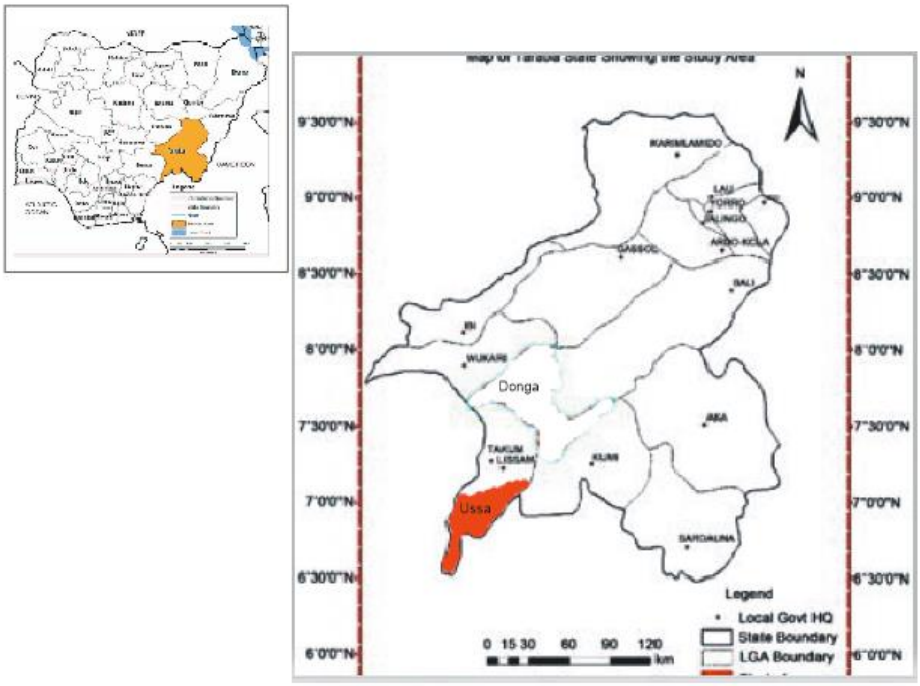

Figure 1: Map of Taraba State showing Ussa Local Government Area

Sampling technique

A total of 19 hectares' sample plots were laid out in the forest. Each hectare plot was redemarcated into four equal sizes of 50 m x 50 m (2,500m^2) out of which one was randomly selected for data collection. Only tree species from ≥ 5cm diameter were enumerated. The total land area used for the study was 4.75ha

Data collection

Tree species enumerated from the selected sampled plot were identified, their diameter at breast height and total heights were measured and recorded.

Data analysis

Data collected were analyzed by grouping the tree species into their taxonomic families, frequency and percentage. The number of tree species enumerated in each plot was extrapolated to obtain estimated number of trees per hectare using this formula provided by Avery and Burkhart (2002).

$$N = \frac{h}{a} \times c \ldots\ldots (1)$$

Where:
h = one hectare , a = area of plot in hectare.
c = number of trees counted in the plot.
N = estimated number of trees/hectare.
The total basal area of each tree enumerated in each plot was calculated using Avery and Burkhart (2002) formula as follows:

$$BA = \frac{\pi D^2}{4(100)^2} \text{ -----(2)}$$

Where:
BA = Basal Area (m^2)
π = constant (3.142)
D = Diameter at breast height (dbh)

To obtain the total basal area of trees per hectare, the total per plot was extrapolated using this formula:

$$BA = \frac{h}{a} \times d \text{----(3)}$$

Where:
BA = basal area per hectare.
h = One hectare
a = Area of plot in hectare.
d = Basal area in each plot
VTH= Basal area of tree x total height -----(4)

RESULTS

Species Composition

A total of 80 different tree species were encountered comprising 23 taxonomic families in the study area (Table 1). The family of Fabacaceae was found to have the highest (9) different tree species representation with a total frequency of (270) 17.6% of the total tree species enumerated, followed by families of Moraceae, Rubiaceae, and Euphobiaceae with (7) different species each with frequencies of (175) 11.4%, (69) 4.5%, and (255) 16.6% respectively. Families of Sterculiaceae and Mimosaceae had (6) different species each with frequencies of (257) 10.2% and (120) 7.8%, Meliaceae, Papillionaceae, and Combretaceae had (4) with frequencies of (19) 1.2%, (16) 1.0% and (45) 2.9%. Others are families of Sapotaceae and Uimaceae had (3) each with (12) 0.7% and (29) 1.8%, Irvingiaceae, Caesalpiniodae, Guttiferae and Verbenaceae had (2) different species each with frequencies of (32) 2.0%, (8) 0.5%, (22) 1.4% and(29) 1.8%, while the rest Dipterocarpaceae, Pandaceae, Burseraceae, Myristicaceae, Ebenaceae, Simaroubaceae and Chrysobalanaceae had (1) tree species each with frequencies of (25) 1.6%, (40) 2.6%, (12) 0.7%, (27) 1.7%, (7) 0.5%, (30) 1.9% and (10) 0.6% respectively. The most predominant tree species in the reserve are *Cola mellinii, Phyllanthus discoideus, Funtumia elastica, Tetrapleura tetraptera, Erythropheleum suavolens, Dialium guinense, Myrianthus arboreus,* and *Macaranga hurifolia* (Table 2). The study revealed that *Cola mellinii* in the family of Sterculiaceae had the highest (95) 6.22% distribution in the reserve, followed by *Phyllanthus discoideus* with (5.23%), *Funtumia elastica* (75) 4.91%, and *Tetrapleura tetraptera* with (4.32%).

Table 1: Tree Species Composition in Kwesati Forest Reserve

S/No.	Species Family	Number of Species	Frequency	Percentage (%)
1	Fabaceae	9	270	17.6
2	Moraceae	7	175	11.4
3	Rubiaceae	7	69	4.5
4	Euphorbiaceae	7	255	16.6
5	Sterculiaceae	6	157	10.2
6	Mimosaceae	6	120	7.8
7	Apocynaceae	5	98	6.4
8	Meliaceae	4	19	1.2
9	Papillionaceae	4	16	1.0
10	Combretaceae	4	45	2. 9
11	Sapotaceae	3	12	0.7
12	irvingiaceae	2	32	2.0
13	Longamiaceae	2	8	0.5
14	Guttiferae	2	22	1.4
15	Ulmaceae	3	29	1.8
16	Verbenaceae	2	48	3.1
17	Dipterocarpaceae	1	25	1.6
18	Pandaceae	1	40	2.6
19	Burseraceae	1	12	0.7
20	Myristicaceae	1	27	1.7
21	Ebenaceae	1	8	0.5
22	Simaroubaceae	1	30	1.9
23	Chrysobalanaceae	1	10	0.6
Total		80	1527	100

Source: Field Survey (2024)

Table 2: Individual tree species encountered in the study area.

S/No	Name Of Species	Family	Frequency	Percentage
1	Erythrophyleum suavolens	Fabacaceae	59	3.86
2	Brachystegea eurycoma	“	25	1.63
3	Dialium guinense	“	50	3.27
4	Anthonotha macrophylla	“	36	2.35
5	Afzelia africana	“	20	1.30
6	Daniellia ogea	“	10	0.65
7	Berlina grandiflora	“	21	1.37
8	Hydrodendron gabonensis	“	21	1.37
9	Daniellia oliverii	“	28	1.83
10	Treculia africana	Moraceae	40	2.61
11	Myrianthus arboreus	‘’	60	3.92
12	Musanga cecropoides	“	7	0.45
13	Sacrocephalus probeguini	“	8	0.52
14	Ficus exaperata	“	16	1.04
15	Antiaris africana	“	18	1.17
16	Bosquia angolensis	“	12	0.78
17	Mitragyna ciliate	Rubiaceae	16	1.04
18	Rothmania hispida	“	23	1.50
19	Rothmania longiflora	“	13	0.85

20	Carpolobia alba	“	3	0.19
21	Gardenia imperialis	“	2	0.13
22	Rothmania whitefield	“	9	0.58
23	Nauclea latifolia	“	3	0.19
24	Antidesma lacniadum	Euphorbiaceae	14	0.91
25	Macaranga hurifolia	“	46	3.01
26	Mallotus oppositifolius	“	28	1.83
27	Hymonicardia acida	“	18	1.17
28	Spondianthus preussii	“	39	2.55
29	Phyllanthus discoideus	“	80	5.23
30	Ricinodendron heudelotii	“	30	1.96
31	Cola mellinii	Sterculiaceae	95	6.22
32	Sterculia tragacantha	“	9	0.58
33	Cola hispida	“	15	0.98
34	Pterygota macrocarpa	“	10	0.65
35	Mansonia altissima	“	12	0.78
36	Cola gigantean	“	16	1.04
37	Albizia adianthifolia	Mimosaceae	6	0.39
38	Parkia biglobosa	“	18	1.17
39	Tetrapleura teraptera	“	66	4.32
40	Prosopis africana	“	7	0.45
41	Borassus aethiopum	“	18	1.17
42	Albizia zigia	“	5	0.32
43	Funtumia elastic	Apocynaceae	75	4.91
44	Vocanga africana	“	2	0.13
45	Alstonia boonei	“	8	0.52
46	Holarrhena floribunda	“	10	0.65
47	Anglintus arborea	“	3	0.19
48	Trechilia heudelotii	Melliaceae	4	0.26
49	Khaya senegalensis	“	8	0.52
50	Quarea thompsonii	“	4	0.26
51	Trichilia preuriana	“	3	0.19
52	Pterocarpus macrocarpus	Papilllionaceae	10	0.65
53	Afromosia laxiflora	“	2	0.13
54	Pterocarpus mildbread	“	1	0.06
55	Pterocarpus erinaceus	“	3	0.19
56	Terminalia glaucescens	Combretaceae	15	0.98
57	Terminalia superba	“	12	0.78
58	Anogeissus leiocarpus	“	13	0.85
59	Combretum imberbe	“	5	0.32
60	Synsepallum stipulatum	Sapotaceae	1	0.06
61	Chrysophyllum albidum	“	4	0.26
62	Pandamus candelabrum	“	7	0.45
63	Irvingia gabonensi	Irvingiaceae	14	0.91
64	Klainedoxa gabonensis	“	18	1.17
65	Anthocleista vogelli	Longamiaceae	5	0.32
66	Anthocleista djalonensis	“	3	0.19
67	Mammea africana	Guttiferae	15	0.98
68	Garcinia spp	“	7	0.45
69	Celtis duranti	Ulmaceae	10	0.65
70	Holoptelea grandis	“	8	0.52

71	Celtis brownie	"	11	0.72
72	Vitex doniana	Verbenaceae	28	1.83
73	Vitex simplicifolia	"	20	1.30
74	Monotes kerstingii	Diptorecarpaceae	25	1.63
75	Pandamus candelabrum	Pandaceae	40	2.61
76	Dacryodes cleineana	Burseraceae	32	2.09
77	Pycnathus angolensis	Myristicaceae	27	1.76
78	Diospyros mespiliformis	Ebenaceae	8	0.52
79	Hanoa klaianpan	Simaroubaceae	30	1.96
80	Parinari curatellifolia	Chrysabalanaceae	10	0.65
Total		**23**	**1527**	**100**

Source: Field Survey (2024)

Tree Density.

The species density in Table 2 were in ranged from 56 to 136 trees per hectare. A total of 4,172 trees were enumerated with an average of 104 trees per hectare. Plots 18 and 31 had the highest (136) number of trees, followed by plots 1, 16 and 28 with (132) trees each, plots 19 and 33 had (128) trees each, and plots 6 and 10 had (124) trees each, plot 22 and 35 had (120). The study further revealed that plots that have the estimated average of 104 trees and above were higher (21) 52.5% while those below the estimated average were (19) 47.5%.

Table 2: Density of trees per hectare in the study area.

Plot Number	Number of Trees per Plot	Number of Trees Per Hectare
1	33	132
2	26	104
3	14	56
4	31	124
5	34	136
6	31	124
7	22	88
8	25	100
9	27	108
10	31	124
11	32	128
12	24	96
13	25	100
14	19	76
15	25	100
16	24	96
17	26	116
18	27	108
19	20	80
Total	**499**	**1996**
Mean	**26.2**	**105.**

Source: Field survey (2024)

Basal area of trees.

A total of 19.6774m^2 of trees basal area was recorded in the study with a mean of 1.0356m^2 per hectare. Plot 7 had the highest (1.4664m^2) basal area per ha, followed by plot 13 with (1.4080m^2), plots 5 and 16 had (1.3952m^2) each,

plot 15 had (1.3444m2 and plot 17 with (1.2524m^2. Others are plot 10 (1.1216m^2), plot 4 with (1.098m^2) and plot 2 with (1.0932m^2) while plot 19 had the least (0.02757m^2). The number of plots that had the estimated mean of 1.0356m2 and above per hectare were (11) 57.8%, while plots with less were only (8) 42.2%.

Table 3: Basal area of trees per plot per hectare

Plot Number	Basal area per Plot(m^2)	Basal area per hectare (m^2)
1	0.2137	0.8548
2	0.2733	1.093
3	0.1534	0.6136
4	0.2745	0.098
5	0.3666	1.4664
6	0.1890	0.756
7	0.3666	1.4664
8	0.2620	1.0480
9	0.1512	0.6048
10	0.2804	1.1216
11	0.1686	0.6744
12	0.2346	0.9384
13	0.3520	1.4080
14	0.1938	0.7752
15	0.3361	1.3444
16	0.3488	1.3952
17	0.3131	1.2524
18	0.2684	1.0736
19	0.1938	0.2757
Total	**4.9193**	**19.6772**
Mean	**0.2589**	**1.0356**

Source: Field survey (2024)

Tree Volume

In the study a total of 129.0386m^3 of volume of trees was recorded with a mean of 6.7915m^3 per hectare (Table 4). Plot 7 had the highest (10.2163m3) volume of trees, followed by plot 13 with (9.8420m3), plot 15 with (9.7259m^3), and plot 15 with (9.7259m^3) and plot 16 with (9.5496m^3). Plot 17 had (8.9606m^3), plot 29 (8.9606m^3), plot 2 with (7.6563m^3), and plot 4 (7.6211m3) while, plot 3 had the least with (3.3844m3). Only 5 plots (26.3%) had the estimated mean volume of trees of 6.7915m^3 and above per ha, while plots with less were higher (14) 73.6%.

Table 4: Tree volume in the study area

Plot Number	Volume per Plot(m^3)	Volume per Hectare(m^3)
1	401925	5.6077
2	1.914075	7.6563
3	0.8461	3.3844
4	1.905275	7.6211
5	1.29715	5.1886
6	1.1515	4.6060
7	2.554075	10.2163
8	1.9236	7.6944
9	0.910325	3.6413
10	1.63105	6.5242

11	1.0815	4.326
12	1.611275	6.4451
13	2.4605	9.8420
14	1.264025	5.0561
15	2.431475	9.7259
16	2.3874	9.5496
17	2.24015	8.9606
18	1.932725	7.7309
19	1.315275	5.2611
Total	**32.25965**	**129.0386**
Mean	**1.697876**	**6.7915**

Source: Field survey (2024)

DISCUSSION

The essence of the study is to investigate the current status of the forest using species composition and density. A total of 80 different tree species were encountered and classified into 23 families. The results indicated that the tree species composition of the study area was high when compared to studies conducted by Maiguru (2023) in the forests of Bisaula and Wasaji where 48 different tree species were identified each classified into 26 and 17 families respectively. Other studies conducted by Hossain (2004), Rahman and Hossain (2003), Jashimuddin and Inoue (2012) and Maiguru (2019) have reported species composition of 85, 92, 163 and 111 higher than the present study. There is no previous record to compare this result with however, tree species composition in the study area is not bad. The average number of (105) of trees per hectare recorded was lower than the average of (118) and (110) recorded in Gangume and Amboi forest reserves as reported by (Maiguru 2023 and 2019) respectively. The increase in human population and the unsustainable land use practices particularly shifting cultivation which has great impact on the forest is probably the root cause of trees density reduction in the forest. In order to safeguard and allow the forest to regenerate and develop its density, human activities in the forest should be regulated. The study revealed that the basal area of trees was ranged from $0.02757m^2$ to $1.4664m^2$. When compared with the standard range of $9.18m^2$ to $22.96m^2$ for a fully stocked forest recommended by (Holland et al. 1990) showed that the basal area of trees in the study area is very low.

CONCLUSION

The study revealed that farming activities are carried out very close to the forest as a result when they cleared and burn their farms the reserve is usually affected annually. The communities living around the forest engage in collection of forest produce for consumption, construction, and for income generation. These activities are responsible for the decrease in number of tree species in the reserve. Plant species in the forest are under threat due to human interference, government who owns the forest should enforce management plans that are aimed to develop and protect the forest. Forest guards should be stationed at strategy points to patrol and arrest illegal exploiters and offenders. Government should embark on massive enrichment planting in order to improve the forest stocking. The inhabitants should be involved because they are the people who benefit more from the forest.

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