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OCCURRENCE AND DISTRIBUTION OF WOODY TREE SPECIES IN KUWAKKA – BANZA FOREST RESERVE OF KEBBI STATE, NIGERIA

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ABSTRACT

Occurrence and distribution study of woody tree species was conducted in Kuwakka-Banza Forest Reserve of Kebbi State, Nigeria using Point Center Quarter Method (PCQM). Three sample plots of 20 x 20 m each were systematically located at 10m intervals on each 300m transect in a relatively homogenous forest area for the study and three transects were used. At each sampling plot four quadrants (NE, SE, SW and NW) were established; in each quadrant the nearest tree to the centre was selected and variables recorded as follows: tree species, the distance from the sampling point to the tree, the diameter at breast height of the tree and its basal area. A total 40 trees were considered and enumerated on each transect. The study revealed that 20 woody tree species were encountered belonging to 14 families. The results revealed that the reserve had mean absolute and relative frequencies of 0.97 and 1.02 respectively. *Detarium microcarpum* recorded the highest absolute and relative densities of 60.76 and 13%, respectively, followed by *Acacia senegalensis* (47.74and 10%), *Lannea acida* (39.06 and 10%) and *Vitellaria paradoxa* (30.38 and 7%). Mean absolute and relative dominance of woody trees in the study area were 176,829.2 and 0.0504 respectively. Mean importance value was 0.1631. To ensure proper management and utilization of the tree diversity regeneration of the indigenous tree species should be emphasized.

Keywords: Occurance and distribution; woody species; Kuwakka-Banza

INTRODUCTION

Forest resources are important aspects of the dryland environments because they provide livelihood to humans and also protect soil resources against erosion. The progress from primitive cave dwellers to the present civilized state cannot be told without frequent reference to trees and their products (USDA, 1967). Trees provide these early inhabitants with food, medicine, fuel, shelter, protection, shade, tools and other needs. Trees are such crucial components of the ecosystem that have productive, protective and recreation functions. They stabilize regional and global climates, serve as carbon sink and act in pollution control (USAID/NIGERIA, 2008; Adamu, 2006). Forests are the dominant terrestrial ecosystem of the earth, and are distributed across the globe. Forests account for 75% of the gross primary productivity of the Earth's biosphere, and contain 80% of the Earth's

plant biomass. The distribution and abundance of tree species over a landscape constitute their diversity (Tripathi, 2009). Urbanization and changing life styles, globalization and market economies contribute indirectly to the loss of diversity. Such reductions have serious implications for food security in the long run (Rao, 2004). Trees are integral part of land resources that need careful management and sustainable utilization for future generation.

Encroachment into forests and their subsequent destruction mainly through rapid expansion of agricultural frontiers affect ecosystems functions and services, land-atmosphere interactions and climate and have caused land degradation and social tension. This has a profound effect upon the woody tree species of greater importance of the area by regulating their density, frequency and dominance. The negative effect of poor plant distribution causes desertification, high temperature, low humidity, and low rainfall in tropical environment. In Nigeria all forest reserves were subjected to human interference which resulted in serious depletion and reduction of forest woody species (Emeodilichi, 2018) Ecologically sustainable forest resources management calls for reliable database with a provision to update and retrieve for management decisions at various levels (Dutt *et al.,* 2009). Therefore, accurate data on woody tree species of the study area is desirable prior and after the disturbances, for proper planning and sustainable management of the forest reserve. This study was carried out to provide information about woody tree species frequency, density and dominance in the study area.

MATERIALS AND METHOD

Study Area

This Study was conducted at Kuwakka-Banza Forest Reserve in Danko Wasagu Local Government of Kebbi State, Nigeria. Danko Wasagu is a town located in the south east of the state between latitude $11.35 - 11.44°$N and longitude of $4.45-5.23°$E (KBSG, 2003). Kuwakka-Banza Forest Reserve covers an area of 2,308 hectares (KBSG, 2003). The villages surrounding the reserve are: Unguwan dodo, Tungan daudu, Danko town, Shindi, Sabon gari, Kele, Isgogo and Tungan mazuga. The topography of the area is sloping terrain surrounded with hills and nature of the soil is dark brown (KBSG, 2003). Kuwakka-Banza forest was surveyed and demarcated as reserve No. 196 gazetted by a colonial order No. 75 in December, 1959 (KBSG, 2003). The climate of the study area is characterized by a long dry season starting from October to May, while the rainy season last for five months (June to October). The annual rainfall ranges from 762 to 1016 mm with the heaviest rainfall in August (KBSG, 2003). The study area experiences harmattan associated with cold dusty wind blowing from November to February. During the harmattan period the temperature goes down to about 18° to 20°C (KBSG, 2003). The natural vegetation of the area is sparse with trees of about 10-12m tall widely spaced. The species found in this region are: *Vetillaria paradoxa, Sarcocephalus latifolius, Boswellia* spp, *Balanites* spp, *Parkia biglobosa, Tamarindus indica, Pseudocedrela spp, Ficus sycomorus, Ficus thonningii, Burkia africana, Annona senegalensis, Deterium microcarpum.*

Sampling and Tree Enumeration

The Point –Centered Quarter Method (PCQM) adopted by Mueller and Ellenberg (1974) was used for data collection in randomly selected sample sites in the study area. Three

sample plots of 20 x 20 m each were systematically located at 10 m intervals on each 300 m transect in a relatively homogenous forest area for the study and three transects were used. At each sampling plot four quadrants (NE, SE, SW and NW) were established. In each quadrant the nearest tree to the centre was selected and variables recorded as follows: tree species, the distance from the sampling points to the tree, the diameter at breast height of the tree and its basal area. A total of 40 trees were considered and enumerated on each transect.

Data Analysis

After data collection, the density and relative density, frequency and relative frequency, dominance and relative dominance and importance values for each woody tree species were determined using the following formulae as described by Mueller and Ellenberg (1974).

a. Absolute density of all trees:

Step 1. Total distance, dt(m): $dt = \sum_{i-1}^{n} di$

Where dt is the total distance, di is the distance to tree number i, and n is the total number of trees.

Step 2. Average distance between trees, d (m): $d = dt \div n$
Step 3. Average area occupied per tree, A (m^2): $A = d^2$
Step 4. Absolute density for all trees, Da, in trees/ha (ha): $Da = (104\ m^2) \div A$
Where one hectare is 100 x 100 meters or 10,000 m^2

b. Absolute frequency of species j, Faj: $Faj = Mj \div m$

Where Mj is the number of points where species j occurs, and m is the total number of points.

c. Relative frequency of species j, Frj, is the absolute frequency of species j divided by the sum of the absolute frequencies for all species:

$$Frj = Faj \div \sum_{k=1}^{P} Fak \text{ X } 100\%$$

Where the denominator is the sum of the absolute frequencies for all species, k is the species number, and p is the total number of species.

d. Relative density of species j, Drj, is the number of occurrences of species j divided by the total number of trees:

$$Drj = Nj \div n \text{ X } 100\%$$

Where Nj is the number of occurrences of species j and n is the total number of trees.

e. Absolute density of species j, Daj, is the relative density of species j times the absolute density of all trees:

$$Daj = Drj \text{ X } Da$$

Where Da is the absolute density for all trees (calculated in Step 4).

f. Absolute dominance for species j, Baj, is the mean basal area for species j times the absolute density of species j: Baj = Baj X Daj

Where k is an individual of species j, and t is the number of occurrences of species j.

g. Relative dominance of species j, Brj, is the absolute dominance of species j divided by the sum of dominance.

$$Brj = \frac{Baj}{\sum_{i=1}^{p} Baj} \quad X\ 100\%$$

Where the denominator is the sum of the absolute dominance (i.e., the sum of column F in Table 2) for all species, and p is the total number of species.

h. Importance value for species j, IVj, is the sum of the relative frequency, relative density and relative dominance for the species: IVj= Frj + Drj + Brj

RESULTS

The results described the information obtained on the distance in centimeter (cm), diameter at breast height in (cm) of the trees and their basal area (Table 1).

Table 1: Average distance, Dbh and basal area (BA) of woody tree species

S/no	Species code	Distance (m)	Dbh (cm)	BA (m^2)
1	*A. longifolia*	2.9	16.6	0.021843
2	*A. nilotica*	5.3	15.7	0.019788
3	*A. stenocarpa*	4.2	13.1	0.013542
4	*A. senegalensis*	2.8	19.0	0.031589
5	*B. costatum*	3.7	48.0	0.180956
6	*B. daiziela*	6.7	28.5	0.072453
7	*B. africana*	5.3	48.6	0.235865
8	*D. oliveri*	5.9	41.5	0.144238
9	*D. microcarpum*	3.8	16.4	0.028677
10	*F. sycomorus*	6.8	32.0	0.080425
11	*F. thonnigii*	5.9	38.9	0.137922
12	*L. acida*	4.5	36.8	0.133073
13	*P. biglobosa*	7.4	51.4	0.209434
14	*P. reticulatum*	3.6	16.5	0.023955
15	*P. Kotschy*	3.3	28.5	0.079836
16	*S. setigera*	8.7	64.8	0.365544
17	*S. latifolius*	3.1	27.0	0.061183
18	*T. macroptera*	4.2	31.8	0.100147
19	*V. paradoxa*	4.9	43.6	0.179504
20	*X. americana*	5.4	15.0	0.0177895

Source: Forestry Survey, 2017

The species encountered, their families, frequencies and percentages are presented in Table 2. *D. microcarpum* had the highest frequency and percentage values of 24 and 20% followed by *A. senegalensis* that had 13 and 10.83%, respectively.

Table 2: Woody tree species encountered in Kuwakka-Banza Forest Reserve

Botanical Name	Family Name	Frequency	Percentage
A. longifolia	Fabaceae	2	1.67
A. nilotica	Fabaceae	2	1.67
A. stenocarpa	Fabaceae	2	1.67
A. senegalensis	Annonaceae	13	10.83
B. costatum	Bombacaceae	1	0.83
B. daiziela	Burseraceae	2	1.67
B. Africana	Legumnoceae	8	6.67
D. oliveri	Caesalpiniaceae	6	5.00
D. microcarpum	Caesalpiniaceae	24	20.00
F. sycomorus	Moraceae	3	2.50
F. thonningii	Moraceae	11	9.16
L. acida	Annacardiaceae	9	7.50
P. biglobosa	Mimosaceae	5	4.16
P. reticulatum	Caesalpineaceae	3	2.50
P. kotschyi	Moraceae	3	2.50
S. latifolius	Naucleceae	3	2.50
S. setigera	Steculiaceae	3	2.50
T. macroptera	Combretaceae	9	7.50
V. paradoxa	Sapotaceae	8	6.67
X. americana	Olacaceae	3	2.50

Source: Field Survey, 2017

The results obtained for density and relative density, frequency and relative frequency, dominance and relative dominance and importance value for each tree species are presented in Table 3.

Table 3: Frequency, density and dominance of woody tree species in Kuwakka-Banza Forest Reserve

Species	Absolute frequency	Relative frequency	Absolute density	Relative density	Absolute dominance	Relative dominance	Importance value
A. longifolia	0.02	0.03	13.02	0.02	1,833.5	0.0005	0.0505
A. nilotica	0.02	0.02	8.68	0.02	2,256.4	0.0007	0.0407
A. senegalensis	0.10	0.11	47.74	0.10	183,269.5	0.0545	0.2645
A. stenocarpa	0.02	0.02	8.68	0.02	1,217.6	0.0004	0.0404
B. Africana	0.07	0.07	30.38	0.07	551,865.6	0.1643	0.3043
B. costatum	0.07	0.07	31.28	0.07	550.756.7	0.1872	0.0534
B. daiziela	0.09	0.09	39.06	0.09	51,631.5	0.0153	0.1953
D. microcarpum	0.13	0.14	60.76	0.13	654,846.6	0.1949	0.4649
D. oliveri	0.05	0.05	21.7	0.05	149,392.6	0.0044	0.1744
F. sycomorus	0.02	0.02	8.68	0.02	49,329.3	0.0146	0.0546
F. thoningii	0.09	0.09	39.06	0.09	607,883	0.1809	0.3609
L. acida	0.08	0.09	39.06	0.08	454,807.3	0.1353	0.3053
P. biglobosa	0.04	0.04	17.36	0.04	155,598.4	0.0463	0.1263
P. kotschyi	0.03	0.03	13.02	0.03	36,653.5	0.0109	0.0709
P. reticulatum	0.02	0.03	13.02	0.02	1,222.9	0.0004	0.0404
S. lantifolius	0.03	0.03	13.02	0.03	15,706	0.0046	0.0646
S. setigera	0.03	0.03	13.02	0.03	8,016.6	0.0023	0.0623
T. macroptera	0.08	0.09	39.06	0.08	9,531.5	0.0028	0.1728
V. paradoxa	0.07	0.07	30.38	0.07	423,621.4	0.1260	0.2660
X. americana.	0.02	0.03	13.02	0.02	1,071.6	0.0003	0.0403
Total	1.01	1.05	455.7	1.01	3,359754.7	0.9594	3.0993
Mean	0.97	1.02	23.98	0.97	176,829.2	0.0504	0.1631

Source: Field survey, 2017

DISCUSSION

Study of occurrence and distribution of woody tree species in Kuwakka-Banza Forest Reserve revealed that 20 woody tree species were encountered belonging to 14 families. In similar studies, Shinkafi (1990) recorded a total of 21 species in Zamfara Forest Reserve and Zaki (2004) recorded 17 and 15 species in Dogon Daji and Dabagi respectively. The research work revealed that the reserve had mean absolute and relative frequencies of 0.97 and 1.02 respectively with *D. microcarpum* having the highest absolute frequency and relative frequency of 0.13 and 14% respectively followed by *A. senegalensis* with absolute frequency of 0.10 and relative frequency 11%. The dominance of the two species in the reserve could be attributed to their adaptability to the area and are not palatable as browse species for the animals. This was also illustrated by the importance values of 0.4649 and 0.3609 for *D. microcarpum* and *F. thonningii*. In a related study by Ambursa *et al.* (2018), *Guiera sengalensis* and *Combretum nigricans* recorded the highest density and frequency in Kwari-kwara Forest Reserve of Kebbi State, Nigeria.

The study also revealed that Kuwakka-Banza Forest Reserve had mean absolute and relative densities of 23.98 and 0.97 respectively and *D. microcarpum* recorded the highest absolute density and relative density of 60.76 and 13% respectively followed by *A. senegalensis* (47.74and 10%), *Lannea acida* (39.06 and 10%) and *V. paradoxa* (30.38 and 7%). In a related study by Ambursa *et al*. (2018) Guiera sengalensis recorded the highest density followed by *C. nigricans* in Kwari-kwara Forest Reserve of Kebbi State, Nigeria.

Mean absolute and relative dominance in the study area were 176,829.2 and 0.0504 respectively. *D. microcarpum* recorded the highest absolute dominance of 654,846.6 followed by *F. thoningii* (607,883) and *B. africana* (551,865.6). This finding agreed with the findings of Danjibo (2015) in the same forest reserve, where *D. microcarpum* was recorded as the most dominant tree species in the forest reserve. Salisu (2010) in a similar ecological zone discovered *Detarium microcarpum* and *Ficus thoningii* being the dominant species in Magama Local Government Area of Niger State, Nigeria.

Importance values are the sum of relative frequency, relative density and relative dominance. In Kuwakka-Banza Forest Reserve, *D. microcarpum* had the highest importance value of 0.4649 followed by *F. thoningii* (0.3609), *L. acida* (0.3053) and *B. africana* (0.3043). Adamu (2006) in his assessment of importance value in Kwiambana game reserve, reported highest value of 1.03 for woody tree species in the game reserve. Atiku (2008) in a biodiversity assessment of two forest reserves in North Western Nigeria obtained 0.23 as the highest importance value among the woody tree species encountered.

CONCLUSION

Although, the reserve is rich in terms of biodiversity, the tree species were sparsely distributed at an average distance of 4.75 cm. The study observed that most of the woody tree species found in the study area were of family *Fabaceae* and *Caesalpinaceae*. *D. microcarpum* was found to be the most dominant tree species followed by *Ficus thoningii* in the forest reserve.

To ensure proper management and utilization of forest resources in the state, the study recommends the improvement and the use of indigenous tree species (*D. microcarpum, F. thoningii, A. senegalensis, L. acida* and *V. paradoxa*) that have promise for the regeneration of degraded forest reserve.

REFERENCES

Adamu, I.A. (2006). An assessment of floristic composition of Kwiambana game reserve. M.sc dissertation. Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto, Nigeria, 53p.

Atiku, M. (2008). Biodiversity assessment of two forest reserves in North western Nigeria. M.sc dissertation submitted to the Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto. 123pp

Ambursa, A.S., Bello, A.G. and Mansur, M.A (2018). Assessment of the floristic composition of woody tree species in Kwari-Kwasa forest reserve, Kebbi state, Nigeria. *IOSR Journal of Environmental Sciences, Toxicology and Food Technology* 12(3): 42-46

Danjibo, M. (2015). Assessment of floristic composition of Kuwakka Banza in North-West Nigeria. M.Sc. Dissertation submitted to the Department of Forestry and Environment, Usmanu Danfodiyo University, Sokoto. 113pp

Dutt, C.B.S., V. Udayalakshmt and A. S. Sadhasivaiah (2018). Role of Remote Sensing in Forest Management. http://geospatialmedia.net/ doi:10.5923/j.re.20180804.03

Emeodilichi, H.M. (2018) Assessment of environmental impact of deforestation in Enugu, Nigeria. *Resources and Environment*, 8(4): 207-215

KBSG (2009). Kebbi State Government. Kebbi State diary prepared by ministry of information, Kebbi State. 212pp

Mueller, D. and H. Ellenberg (1974). *Aims and Methods of Vegetation Ecology*. John Wiley and Sons, New York.

Rao, N. K. (2004). Plant genetic resources. Advancing conservation and use through biotechnology. *Africa Journal of Biotechnology*, 3:136-145.

Salisu, M. (2010). Study on guinea savanna ecological zone of Nigeria, Magma local Government of Niger State. *Annual Research and Review in Biology*, 4(3):

Shinkafi, M.A. (1990). A vegetation study of Zamfara Forest Reserve, floristic composition. (MSc Dissertation) University of Ibadan, Ibadan, Nigeria. 79pp.

Tripathi, D. (2009). Effect of disturbance, habitat fragmentation and a line invasive plants on floral diversity in dry tropical forest of Vindhyan Highlands. *Tropical Ecology*, 50:57-69

USAID/NIGERIA (2008). Nigeria Biodiversity and Tropical Forestry Assessment. Chemonics International Inc. 90pp

USDA (1967). Agricultural Information Bulletin NO. 278 washington D .C

Zaki, M.A. (2004). Floristic composition of Dogondaji and Dabagi Forest Reserves in Sokoto State. An MSc. Dissertation submitted to the Department of Forestry and Fisheries, Usmanu Danfodiyo University, Sokoto. Pp 25-39.