



PROFILING TREE SPECIES COMPOSITION IN SONKPA FOREST RESERVE WUKARI, TARABA STATE, NIGERIA



Maiguru A.A and Hosea Aji

Department of Forestry and Wild Life Management, Federal University Wukari

Corresponding Author: sszaku@yahoo.com

Received: May 18, 2023 Accepted: July 10, 2023

Abstract

Profiling tree species composition in Sonkpa forest reserve is very useful in identifying important elements of plant composition and diversity and hence the need for the protection of threatened economic species and the monitoring of the forest communities among others. There is dearth of Information on the current status of Sonkpa Forest Reserve in terms of composition, stocking and density which provides information on trees species and families present, heights, diameter, number of tree, basal area and volume respectively. Therefore, profiling tree species composition in Sonkpa forest reserve was investigated. Simple random sampling technique was used in selecting plots for assessment. A total of 10ha land was demarcated out from the reserve. Sample plots of 50m x 50m (2500m²) were laid out from each hectare of plot. Data was collected based on name of the species, number, diameter breast height (dbh) and the total height of each tree species ≥ 5 cm diameter. The tree species identified were grouped according to their taxonomic families, frequency and percentages. The forest stand stocking was analyzed by distributing the tree species in diameter and height classes in the plots while density, number of trees per hectare, basal area and volume of trees per hectare were calculated using their respective formulae. The findings of the study showed that, 1732 trees from 18 families were found in Sonkpa forest reserve; basal area per hectare was 270.8248m² with volume of trees per hectare of 3395.3684m³ respectively. Based on the above; stocking, enrichment planting, afforestation and the planting of tree on farms and around the houses were recommended.

Keywords:

Composition; Forest Reserve; Tree Species; Profiling; Sonkpa

Introduction

Sonkpa forest reserve is rich in biodiversity with different species of trees. These trees are gradually been lost due to human activities in the forest reserve. The extent of the loss and the remaining species of trees left in Sonkpa forest reserve is not known and documented and hence profiling of tree species in Sonkpa forest reserve was investigated. Simple random sampling technique was used in selecting plots for assessment. A total of 10 hectare of land was demarcated out from Sonkpa forest reserve. Sample plots of 50m x 50m (2500m²) were laid out from each hectare of plot to collect data for this study.

Data on name of tree species, number, diameter breast height and the total height of each tree species were taken on tree species ≥ 5 cm diameter at breast height (dbh). Also taken were the basal area, volumes, density and distribution of trees in the reserve. Data collected were analyzed by means and simple percentages.

Sonkpa forest reserve is a forest reserve that has been accorded certain level of protection against unauthorized usage by individuals and groups of individuals (Zaku *et al.*, 2022a). Sonkpa forest reserves is protected by the laws of Nigeria where it is situated, in other words, activities such as hunting and grazing are strictly prohibited except by express permission from relevant traditional and or government bodies (TSME, 2016). It possesses a unique characteristic of woody species vegetation and the diversity of this vegetation seems to decrease in most of the ecological zones. Luscious vegetation has been cleared by the pressure mounted by human activities and this has resulted in decreasing size and quality of Sonkpa forest reserve at alarming rates leading to alteration in species composition (Zaku *et al.*, 2022a). Ecological study of species composition, stocking and density is necessary to understand the overall structure and function of the ecosystem (Turner,

2001; Ogunwole and Fagbean, 2016). Forest reserve plays an important role in the normal functioning of the biosphere, because they are the main origin of cultivated plants and animals (Adekunle, 2004; Zaku *et al.*, 2022a). Tree species composition in Sonkpa forest Reserve depends on environmental factors, such as temperature, humidity, nutrition, sunlight, topography, bedrock geology, soil characteristics, canopy structure, management objectives, land use history and exploitation (Adekunle, 2006, 2013; Neelo *et al.*, 2015; Mbaya and Hashidu, 2017). Profiling tree species composition in Sonkpa forest reserve is very useful in identifying important elements of plant composition and diversity and hence the need for the protection of threatened economic species and the monitoring the forest communities among others. To date, the current status of Sonkpa Forest Reserve is not adequately documented both in terms of composition, stocking and density, which provides information on trees species and families present, heights, diameter, number of tree, basal area and volume. Hence profiling tree species composition in Sonkpa forest reserve was investigated.

Materials and Methods

Location of the Study Area

Sonkpa forest reserve is located in Wukari. It is about 3km away from Wukari town and is located between Latitude 7°58'56" to 8°40'55" N and Longitude 10°02'24" to 10°11'50" E of the Greenwich. It has an area of a 4308Km². It is bounded to the North by Hyuku, West by Gidan Idi, South by Tsokundi and East by Bye-pyi respectively

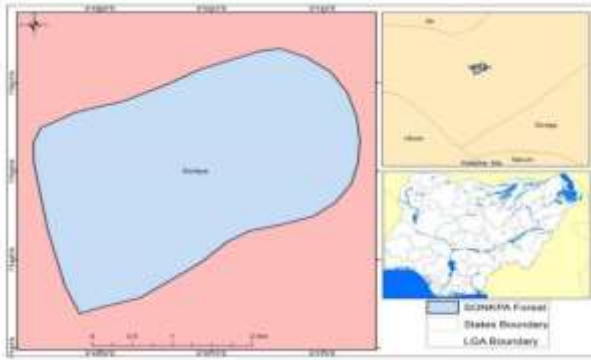


Fig. 1: Sonkpa Forest Reserve Source: Taraba State Ministry of Environment (2016)

Sampling technique and Sample size

Simple random sampling technique was used in selecting plots for assessment. A total of 10ha land was demarcated out from the reserve. Sample plots of 50m x 50m (2500m²) were laid out from each hectare of plot. Data was collected based on name of the species, number, diameter breast height (dbh) and the total height of each tree species ≥5cm diameter. The tree species identified were grouped according to their taxonomic families, frequency and percentages. The forest stand stocking was analyzed by distributing the tree species in diameter and height classes in the plots. For density, Number of trees per hectare, basal area and volume of trees per hectare were calculated to obtain the forest stocking while the estimated number of trees per hectare was calculated using the formula;

$$N = \frac{h \times c}{a}$$

Where:

h= One hectare

a= Area of plots in hectare

c= Number of trees counted in plots

N= Estimated number of trees per hectare.

Similarly the Basal Area per Tree (BAT) was calculated using the formula.; $BA = \frac{\pi D^2}{4(100)^2}$

Where:

BA= Basal area (m²)

π= Constant (3.142)

D= Diameter at breast height (cm)

The total basal area of trees per plot was extrapolated to per hectare using the formula;

$$BA = \frac{h \times D}{a}$$

Where:

BA= basal area per hectare

H= One hectare

A= Area of plot in hectare

D= Basal area in each plot

Volume of trees per hectare (VTH)

The volume of trees per hectare was obtained by multiplying the basal area of a tree and its height. The basal area of trees per plot was converted to per hectare.

VTH=Basal area x height.

Results and Discussion

Individual Tree Species composition in Sonkpa Forest Reserve

Tree species of *Nauclea latifolia* and *Piliostigma thonnigii* were the most dominant tree species in the study area with a total frequency of 48 each, followed by *Annona senegalensis* with a total frequency of 40, *Crossopteryx febrifuga* with 32 frequency and *Stereospermum kunthianum* with total frequency of 21. Others are *Daniellia oliverii* and *Parkia biglobosa* with 17 and 16 frequencies respectively, *Lophiralanceolata* with 15, *Vitellaria paradoxa* with 12, *Terminalia glaucescens* with 11, *Gardenia aqualla*, *Vitex doniana* and *Isobertina doka* with 10 each, *Acacia seyal*, *Cussonia bateri* and *Azelia africana* with total frequency of 8 each, *Burkea africana*, *Lanneaschimperi*, *Annogetis leocarpus*, *Phoenix reclinata*, *Prosopis africana*, *Borassus aethiopicum*, *Pterocarpus erinaceus*, *Ficus sycamorosus*, *Parinari excelsa*, *Newbouldia laevis*, *Ziziphys abyssinia*, *Ficus sur*, *Combretum glutinosum*, *Maytems senegalensis*, *Terminalia glaucescens* and *Strychno sinnocua* all having lower representation in plots with 7 or less frequencies. Similarly on Family composition of trees in Sonkpa Forest Reserve, a total of 33 tree species belonging to 18 families were encountered in the reserve. The family of Fabaceae had the highest (141) number of tree species, followed by the family of Rubiaceae with 109, Annonaceae with 40. The families of Bignoniaceae had 21, Euphorbiaceae 18, and Ochnaceae 15. Others are families of Combretaceae, Sapotaceae and Moraceae with 13, 12, and 11 tree species respectively, families of Lamiaceae and Celastraceae had 10 and 9 respectively, Leguminosae and Araliaceae had 8 each, Loganiaceae and Chrysobalanaceae had 7 each while the families of Arecaceae and Anacardiaceae had 4 and 2 respectively.

A total of 433 trees stands were encountered within the ten (10) randomly sampled plots in the reserve. All the stands were distributed into eighteen (18) taxonomic families. This implied that, Sonkpa forest reserve is highly diverse in terms of tree species which is contrary to that reported by Zaku *et al.* (2022a). This finding disagrees with the submission of Zaku *et al.* (2022a). The difference in the findings could be due to the differences in the time of conducting the research by which time a lot of trees had been felled. The dominance of Rubiaceae and Fabaceae implied that, most of the tree species are from the two families. The thirty three different tree species of Sonkpa forest reserve is far lower than that of Amboi forest reserve with 111 tree species as documented by Maiguru *et al.* (2019) which are comparatively different. The difference confirms the variability between the two forest sites in terms of weather and climate which is a major factor for distribution and richness of varieties of species. The tree species composition shows that the study area is of typical West African Guinea savannah species. This corroborates the submission of Zaku *et al.* (2022a) on Sonkpa Forest reserve.

Distribution of Trees to Diameter Classes (cm)

The result of the distribution of trees to diameter classes shows that, the lower diameter class of 10cm-19cm has the

highest number of stems recording up to 128 stems, which is about 29.5% of the total stems followed by 22cm-29cm ; 30cm-39cm with 22.86% and 22.63% of stem respectively. Only one individual tree had diameter at breast height classes 70cm-79cm. Individual trees greater than 90cm in diameter at breast height, which are very large trees that are scattered on the different plot has 21 individual stems representing 4.85% of the forest reserve. The findings of the study corroborate Maiguru *et al.* (2019) on his study of Stand Composition and Structure of Amboi Forest Reserve in Taraba State. The result on height distribution of trees among the plots, indicated that, the highest height class <10 has highest stems of up to 339 stems representing 78.29% of the population followed by 10m-19m height class with 76 stems representing 17.55% of the plots then followed by 20m-29m classes representing 3.93% of the plot, only one individual tree was encountered in the highest class of <30m. Tree that could be referred to as emergency trees (height up to 40m) were not found in the sample plots. The findings of the study disagreed with the submission of Maiguru *et al.* (2019) where he encountered a lot of emergency trees on his study of Stand Composition and Structure of Amboi Forest Reserve in Taraba State. The difference in the findings could be as a result of the differences in the vegetation of the two forest reserves.

Tree density, basal area and volume in Sonkpa Forest Reserve.

The number of trees per hectare in the study area ranges between of 120 to 260 trees per hectare, with a mean of 173 trees per hectare. Plot 3 has the highest number of trees per plot with 65 trees, estimated to be 260 trees per hectare, followed by plot 3 having 228 trees per hectare, plot 6 having 196 trees per hectare, plot 5 having 196 trees per hectare, plot 4 having 176 trees per hectare, plot 7 having 152 trees per hectare, plot 10 having 148 trees per hectare, plot 1 having 132 trees per hectare, plot 2 having 128 trees per hectare while plot 8 had the least of 120 trees per hectare. This shows that the total number of trees for all the ten sample plots is estimated to be 1732 trees.

For diameter class distribution it was observed that, the forest reserve has more trees in the lower dbh which is a good regeneration behavior to get high dbh in the future making succession of the forest reserve achievable. This is consistent with the work of Adekunle, *et al.* (2004) and Adekunle, (2006) respectively that reported positive skewness distribution pattern for tropical Rain forest ecosystem of South-west Nigeria. This may be due to the fact that, only few trees grow naturally to large dbh classes and also previous selective harvesting of trees species with large dbh (Osabiya *et al.*, 2022). This is a clear indication that forest is striving to regenerate, which is crucial to describing the forest health (Zaku *et al.*, 2022b).

The result for tree height distribution in Sonkpa Forest Reserve revealed that, majority of the trees are in the lowest height classes, with fewer trees in the higher height classes. The result implies that, trees of Sonkpa forest reserve are dominated by younger ones which would need longer time to mature. Trees in the higher height class are difficult to find in the Nigerian forest presently due to logging activities with higher proportion of the trees in the middle canopy (Maiguru *et al.*, 2019).

Similarly, the basal area is the average amount of an area occupied by tree stems. The result of the tree basal area indicated that, plot 5 had the highest tree basal area of 15.1743m² followed by plot 6 with 7.7712m², plot 1 with 7.5257m², plot 2 with 6.6092m² plot 10 with 6.5667m², plot 8 with 5.8705m², plot 7 with 5.4396m² and plot 4 with 5.3607m², plot 9 with 4.7614m², plot 3 has the least basal area of 2.6269m². The total basal area of trees in all the plots was 67.5667m² with means of 6.7706m². The findings of the study corroborates Maiguru, *et al.* (2019) respectively.

Also, the result on volume of trees per Ha⁻¹ indicated that, it ranges between 26.5150m³ to 186.9037m³ in plots and 106.0600m³ to 747.6148m³ in hectares. The total volume in plots was m³ extrapolated to 848.8421m³ with a mean of 84.8841m³. The plot with the highest volume per hectare was plot 5 with 747.6148m³, followed by plot 2 with 580.9568m³ then plot 6 with 388.9324m³, plot 10 having 384.6940m³, plot 8 with 260.0492m³, plot 9 with 245.7580m³, plot 7 with 208.8944m³ and plot 1 with 187.1644m³, the plot with the least volume per hectare was plot 3 with 106.0600m³ respectively. The number of trees per/ha recorded in Sonkpa forest reserve ranges from 120-260 trees/ha for this research was very low compared to the number recorded from Tree Species diversity and density pattern in Amboi Forest Reserve. This may be attributed to forest degradation activities which may have removed large individual trees as well as the fact that some large-sized trees would have been removed through logging and farming activities (Zaku *et al.*, 2022b). The purpose of this profiling is to determine the density of trees in the area. This is in line with the mandate of protected ecosystem that employs the use of number of trees per hectare as a measure of assessment of stocking. The number of trees per hectare is used to compare results with established benchmark for forest stocking in Guinea savannah. The recommended stocking density for Guinea savanna forest is between 300 and 500 trees per hectare (Mbaya and Hashidu, 2017). From results of trees per hectare, the Sonkpa forest reserve is under stocked, this may be due to illegal farming, mining and logging activities going on in the forest reserve (Zaku *et al.*, 2022b). Similarly the result of basal area (m²/ha) obtained was within the range 10.5m²-60.7m² respectively. This is in line with the findings of Osabiya *et al.* (2022) on basal area of trees in Akure forest reserve and Okumu National park respectively. This low basal area/ha recorded could be as a result of bush burning and excessive felling of trees in Sonkpa forest reserve as well as the differences in the vegetation of the forest reserves.

Conclusion

The findings of the study showed that, 1732 trees from 18 families were found in Sonkpa forest reserve; basal area per hectare was 270.8248m² with volume of trees per hectare of 3395.3684m³ respectively.

Recommendations

Based on the above; stocking, enrichment planting, afforestation and the planting of tree on farms and around the houses are recommended.

Reference.

Adekunle V.A.J. (2006) Conservation of tree species diversity in tropical rainforest ecosystem of southwest Nigeria. *Journal of Tropical Forest Science* 18(2): 91-101.

Adekunle VAJ, Olagoke AO, Akindele SO (2013). Tree species diversity and structure of a Nigerian strict nature reserve. *Tropical Ecology* 54(3):275-389.

Maiguru A. A., Zaku S.S. and Idiege D.A, 2019: Stand Composition and Structure of Amboi Forest Reserve in Taraba State, Nigeria. *International journal of Wildlife and Endangered Species Conservation (IWESC)* Vol.2 (02), 11 August, 2019, pp61-69
www.academiasholarlyjournal.org/ijwesc/index-ijwesc.htm indexed in:

Directory of Research Journals Indexing-
<http://www.drj.org>

Also available @; Internet-Archive @Maiguru – et al.
Open access.

Mbaya, L. A., & Hashidu, M. S. (2017). Status of forest reserves (savanna woodland) biodiversity and rural livelihoods in Gombe state. *Int J Dev Sustain*, 6, 2173-92.

Neelo, J., Teketay, D., Kashe, K., & Masamba, W. (2015). Stand structure, diversity and regeneration status of woody species in open and exclosed dry woodland sites around Molapo farming areas of the Okavango Delta, Northeastern Botswana. *Open Journal of Forestry*, 5(04), 313.

Ogunwole, J. O., & Fagbenro, O. A. (2016). Tree species diversity and canopy cover in Guinea savanna woodland of Nigeria. *Journal of Forestry Research*, 27(3), 555-560.

Omoró, L.M.A., Pellikka, P.K.E. and Rogers, P.C. (2010). Tree species diversity, richness, and similarity between exotic and indigenous forests in the cloud forests of Eastern Arc Mountains, Taita Hills, Kenya. *Journal of Forestry Research* 21(3): 255–264

Osabiya O. S., 2Adeduntan S. A. and 3Akinbi O. J. (2022). A Survey of Tree Species Diversity in Akure Forest Reserve and Okomu National Park. *Journal of Research in Forestry, Wildlife & Environment*, 14(1): 119 – 127

TSME, (2016): Taraba State Ministry of Environment

Turner, I. M. (2001). *The ecology of trees in the tropical rain forest*. Cambridge University Press.

V.A.J Adekunle. S.O Akindele and J.A Fuwape. Structure and yield models of tropical lowland rainforest ecosystem of southwest Nigeria. *Food, Agriculture and Environment* 2 (2) 395-399, 2004.

Zaku S.S., Maiguru A.A., DCA Amadi and Nocha Zakka, 2022 a: Evaluation of Non-Timber Forest Products harvesting methods in the buffer zone of Sonkpa Forest Reserve Wukari, Taraba State. *FUW Trends in Science & Technology Journal*.

www.ftstjournal.com. E-ISSN:24085162: P-ISSN:20485170.

August, 2022: Vol.7 No.2 pp872-877

Zaku S.S., Maiguru A.A., DCA Amadi and Ezekiel Fyafa, 2022 b: Evaluation of Forest Policy Implementation in Gashaka-Gumti National Park Serti, Taraba State. *Nigerian Journal of Science and Environment*, Vol. 20(1) 2022. Pp 41-49