Floristic Structure of Some Selected Plots in Olokemeji Forest Reserve, Ogun State, Nigeria

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Abstract

Deforestation disrupts forest structure and function with negative impacts on biodiversity and natural regeneration of the forests. In Nigeria, forests are lost through burning, shifting cultivation and logging of trees. These describe the state of degradation in Olokemeji forest reserve. Hence, a need to evaluate the species composition and floristic structure of the woody species in selected plots of the forest reserve. The forest reserve, situated in the lowland rain forest of south-western Nigeria occupies a total land area of 58.88 km^2. Six sample plots of 50 m^2 each were randomly selected and designated as Frequently Burnt Plot 1, Frequently burnt Plot 2, Harvested Plot, Unharvested unburnt Plot, Arable Plot 1 and Arable Plot 2. One hundred and eighty two stands were enumerated, with Unharvested unburnt plot having the highest number of trees at 50. The highest percentage cover was recorded at frequently burnt plot 1, Frequently burnt plot 2 and Unharvested unburnt plot which ranged from 21-50%. Trees in Unharvested Unburnt Plot had the highest mean diameters at breast height (78.46cm) and mean heights (14.44 m), while the Arable Plots had lowest mean diameters at breast height and mean heights. There is a high level of anthropogenic interference at the forest reserve, and the structure and composition of the tree species enumerated in the study plots reflected some of the nature of impact. Indiscriminate logging of trees as fuelwood should be greatly curtailed and improvised by the neighbouring communities.

Keywords: Floristic Structure, Forest Reserve, Burnt area, Olokemeji, Nigeria

INTRODUCTION

Tropical rainforest ecosystems are well known for their richness in biodiversity and species richness (Anning *et al.,* 2009). The forests of Nigeria comprise of swamp forests, tropical rainforest and secondary forest re-growths. The lowland tropical rainforest can be described as a complicated mosaic of communities of different status and floristic composition (Laurence *et al.*, 2008). Structurally, the forests consist of three layers, the tree layer, the shrub layer and the undergrowth. Deforestation and conversion of land to permanent cultivation is the primary cause of loss and dwindling of tropical biodiversity and the practice has already threatened a number of plant species (IBC, 2005). Forest trees serves as carbon sinks that sieves out excess carbon-iv-oxide (CO_2) from the atmosphere, this is crucial to global climate change.

The negative impacts of humans and natural disasters on forests are mitigated by reforestation, afforestation and natural regeneration (Makana and Thomas, 2006). There have been massive deforestation and degradation of forest reserves in Nigeria as a result of human activities and inefficient management of the reserves. This endangers the forest reserves and the ecological services they render. There is an urgent need to reforest these forest reserves naturally and through enrichment planting (Akinyemi *et al*., 2013).

Assessment of forest species dynamics and structure is essential in understanding the status of tree population, regeneration, and diversity for conservation purposes (Mishra *et al.* 2013). Forest structure mainly depends on the nature of ecosystem, species composition and woody

species dynamics in a particular area. Understanding of woody species composition and structure in a given forest is crucial for planning and implementation of conservation activities (Malik *et al.* 2014, Malik and Bhatt 2015).

Forest stands may change continuously as a result of small-scale chronic disturbances that do little to affect the system, or they may change considerably at large scales owing to severe disturbances (Adekunle *et al.,* 2006). Hence, a need to study the floristic structure of the forest reserve which is currently degraded due to human impacts such as logging, excessive burning and farming activities within the reserve, therefore the aim of this study is to access the woody flora structure of some selected plots of the forest reserve.

MATERIALS AND METHODS

Study Area

Olokemeji forest reserve occupies a total land area of 58.88 km^2 .The reserve, which was established in 1899 is the second forest reserve in Nigeria. The forest reserve is situated between latitude 70" 25° N 30° to 70" 39° N and Longitude 30" 32°E to 30" 44°E. The site lies approximately 32km west of Ibadan, and 35km north-east of Abeokuta. The forest reserve is among the forest reserves in the country where relics of tropical rain forest could be found. Already forest plantation establishment, bush burning, shifting cultivation and other development features have occurred in the reserve resulting in loss of biodiversity (Ogunleye *et. al*., 2004). The forest reserve is in a lowland rain forest in south-western Nigeria. The annual rainfall ranges between 1200mm to 1300mm spreading over March to November (Mackay, 1956). The dry season is severe and the relative humidity is low. The soils of the area are derived from the dissected plain of the precambian basement complex rocks (Wilson, 1922: Hopkins, 1972). It is composed of banded biotite gneisses with granitoid intrusions. The soils are derived mainly from these old crystalline rocks which are buried beneath alluvial sands. The forest reserve lies on the margin of the lowland rain forest and derived savanna zones (Keay, 1952). Moist forest of several types covers the reserve, except for the areas of plantation. Along the eastern side of the reserve is a dry type of lowland rain forest rich in Sterculiaceae, Ulmaceae and Moraceae (Keay, 1953). On the alluvial soils are found a floristically distinct vegetation type dominated by an abundance of *Manilkara multinervis*, *Diospyros mespiliformis* and *Nesogordonia papaverifera*. The derived savanna found north and west of the reserve, consists of species such as *Danellia oliveri*, *Vitellaria paradoxa*, *Parkia biglobosa*, *Lophira lanceolata* and *Pterocarpus erinaceous* (Ogunleye *et al.,* 2004).

Data Collection

A plot each of dimension 50 m X 50 m was established in six randomly chosen locations in the Forest Reserve, sample plots were laid out using a measuring tape demarcated with wooden pegs. In all the six sample plots, all tree heights ≥5 m with girth size ≥ 10 cm were identified following Hutchinson and Dalziel (1954) and enumerated to determine the mean diameter at breast height and mean heights. The composition of woody species data of the forest reserve was collected and each species were recorded and counted.

Data Analysis Tools

Two way indicator species (TWINSPAN) was used to carry out data analysis with respect to the objective of this study. Mean Diameter at breast height and Mean heights of trees were assessed through the use of Microsoft excel.

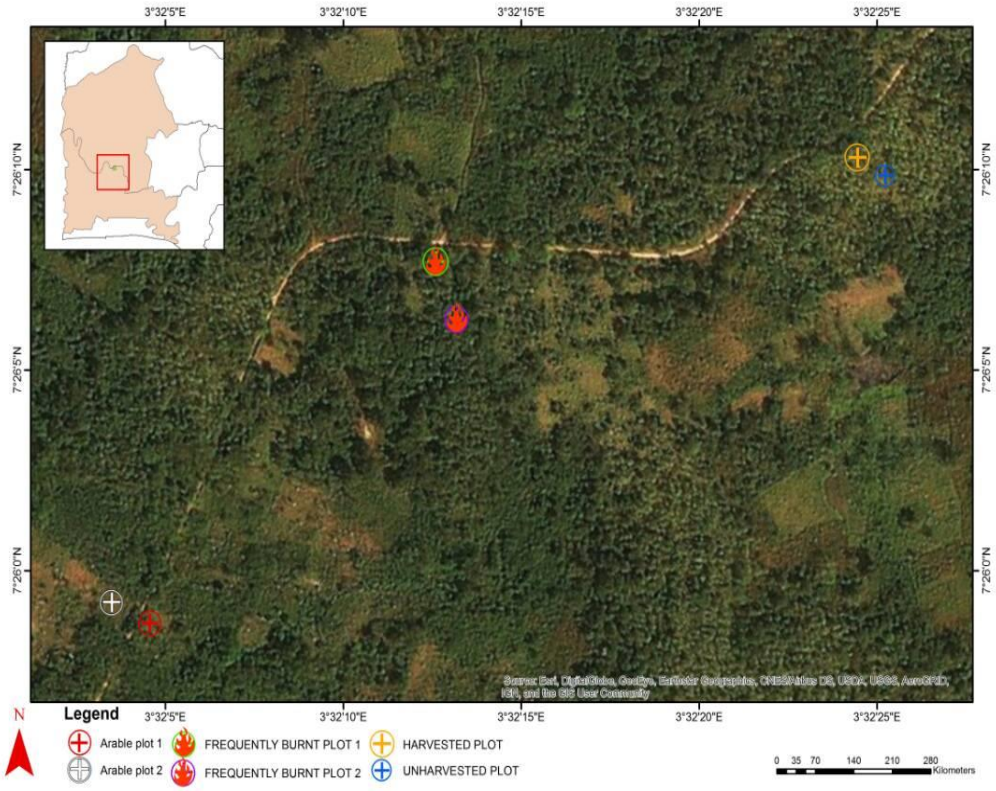


Figure 1: Location of study plots in Olokemeji forest reserve, Ogun State, Nigeria

Table 1: Location and Weather of study plots in Olokemeji Forest Reserve, Ogun State, Nigeria

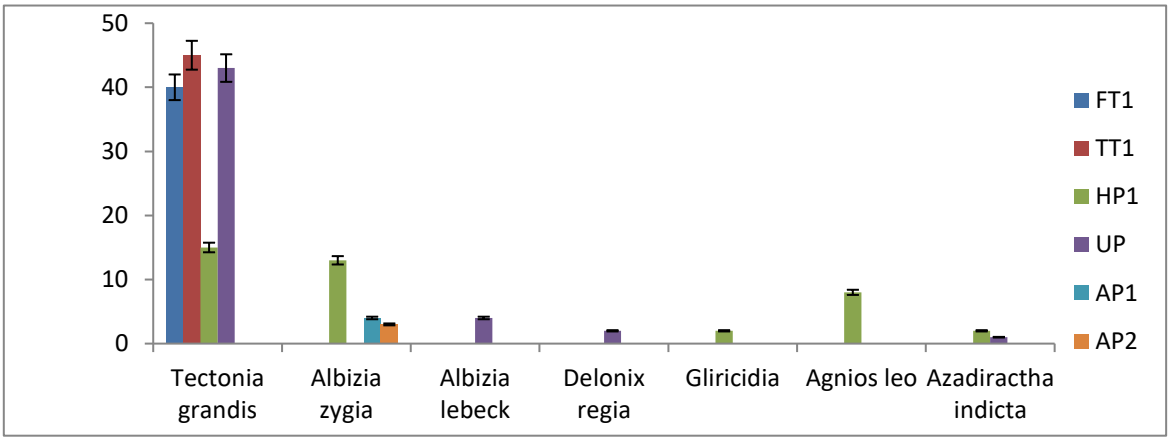
Study plots	W.S (max)	Temperature	Relative Humidity	D.P.	Coordinate	Elevation (m)
Frequently Burnt Plot 1 (FT1)	0.9	90.2° F	82.8	77.2	N 07.43547° E 003.53684°	133
Frequently Burnt Plot 2 (FT2)	0.9	87.8°F	85.2	83.4	N 07.4350° E 003.5370°	128
Harvested Plot (HP)	0.9	91.8°F	67.6	80.8	N 07.4361° E 003.5401°	131
Unharvested Unburnt Plot (UP)	0.9	92.3°F	66.4	79.5	N 07.4360° E 003.5403°	128
Arable Plot 1 (AP1)	1.6	96.4°F	70.8	84.7	N 07.4329° E 003.53460°	106
Arable Plot 2 (AP2)	1.7	97.0° F	68.5	8	N 07.4333° E 003.53504°	108

RESULT AND DISCUSSION

Composition of woody flora

A total of seven species were enumerated belonging to five families in the quadrats laid in six plots. Three woody species were enumerated in Fabaceae family, Verbaceae and Combretaceae family had one species as well as family Leguminoseae and Meliaceae Members of the Fabaceae families enumerated were *Delonix regia, Albizia lebbeck, Albizia zygia. Gliricidia*

sepium belongs to family Leguminoseae and *Tectona grandis* belongs to Verbaceae family, *Tectona grandis* was dominant in Frequently Burnt Plot 1, Frequently Burnt Plot 2, Harvested Plot and Unharvested unburnt Plot. (Figure 2)



Footnote: *Frequently burnt Plot = FT; Frequently burnt plot 2 =TT ; Harvested Plot = HP; Unharvested unburnt Plot = UP; Arable Plot = AP*

Figure 2: Populations of woody species enumerated in sample plots of the Forest Reserve

Numerical classification of woody flora

The hierarchical division showed that the six quadrats (plots) of woody flora were divided into four and two quadrats of negative and positive groups with six negative preferentials and one positive preferential. The order of six sample plot (Frequently Burnt Plot 1, Frequently Burnt Plot 2, Harvested sample plot, Unharvested sample plot, Arable Plot 1 and Arable Plot 2) were enumerated for woody flora of the forest reserve and 7 woody species were found which were: *Tectona grandis, Albizia zygia, Albizia lebbeck, Gliricidia sepium, Azadirachta indica, Anogeissus leiocarpus* and *Delonix regia*.

Tectona grandis was present in Frequently Burnt Plot 1, Frequently Burnt Plot 2, Harvested Plot and Unharvested Unburnt Plot. It was absent in the Arable plot 1 and Arable plot 2. In the Frequently Burnt Plot 1 the percentage plant cover ranged from 21-50%, which was same for Frequently Burnt Plot 2 and Unharvested Unburnt Plot, while in Harvested Plot the percentage plant cover ranged from 11-20% cover. *Tectonia grandis* is a negative preferential for Frequently Burnt Plot, Harvested Plot and Unharvested Plot. *Albizia zygia* was found present in Harvested Plot, Arable Plot 1 and Arable Plot 2. It was absent in the Frequently Burnt Plot 1, Frequently Burnt Plot 2 and Unharvested Unburnt Plot. The percentage plant cover of *Albizia zygia* in the Unharvested Unburnt Plot is 11-20%, while in the two Arable Plots percentage plant cover ranged from 2-5%. *Albizia zygia* is a positive preferential for the Arable Plot and negative preferential for Unharvested Unburnt Plot. *Anogeissus leiocapous* was present in the Harvested Plot and absent in the other study plots. In the Harvested Plot, *Anogeissus leiocarpous* had percentage plant cover which ranged from 6-10%. It is a negative preferential for the harvested sample plot. *Azadirachta indica* was found present in harvested sample plot and Unharvested Unburnt Plot. *Azadiractha indica* is absent in the other sample plots. In the Harvested sample plot, *Azadiractha indica* had percentage cover which ranged from 2-5% plant cover and in the Unharvested Unburnt Plot, it was found to have 1-2% plant cover. It is a negative preferential for harvested and Unharvested Unburnt Plot. *Gliricidia sepium* was found to be present in Harvested Plot only and absent in the rest of the sample plots. It had percentage cover of 2-5% plant cover in the Harvested Plot. It is a negative preferential for Harvested Plot. *Delonix regia* and *Albizia lebbeck* were both found present in Unharvested Unburnt Plot only

and absent in the rest. It had percentage range of 2-5% plant cover. They are both negative preferential for Unharvested Unbburnt plot. (Table 1)

Table 1: Two Ways Indicator Species Analysis (TWINSPAN) revealing percentage cover of woody species in study plots of the Forest Reserve

Sample Plots

123456

1 Tect ona 5545-- 0
3 Albi zia ---2-- 0
4 Delo nix ---2-- 0
5 Glir icid --2--- 0
6 Agni os l --3--- 0
7 Azad irac --21-- 0
2 Albi zia --4-22 1

000011

Preferential

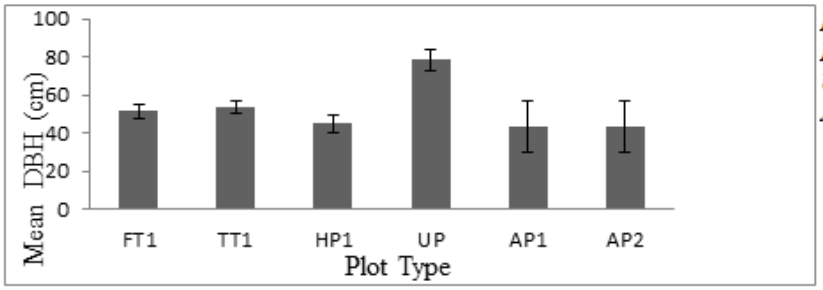
Groups

Scale

- Represent species absent; 1 represents 1-2% cover; 2 represents 2-5% cover, 3 represents 6-10% cover; 4 represents 11-20% cover; 5 represents 21-50% cover, 6 represents 51-100% , coverGroup and Preferencial: 0 represents negative and 1 represents positive

Mean Diameter at Breast Height of trees in the forest reserve

Among the six sample plots enumerated, the Unharvested Unburnt Plot had the highest mean diameter at breast height (DBH) at 78.46cm, followed by Frequently Burnt Plot 2 at 53.56cm, Frequently Burnt Plot 1 had a mean diameter at breast height of 51.56 cm, Harvested Plot had 45.09 cm mean DBH, while the Arable Plot1 and Arable Plot 2 had 43.28 cm and 29.25 cm mean DBH respectively. (Figure 3)

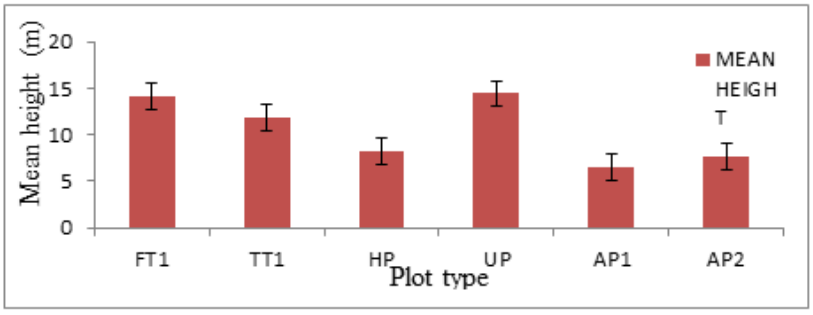


Frequently burnt Plot = FT;
Harvested Plot = HP;
Unharvested Unburnt Plot = UP;
Arable Plot = AP

Figure 3: Mean Diameter at Breast Height (cm) (DBH) of woody flora of study Plots at the Forest Reserve

Mean heights of woody species in sample plots at the Forest Reserve

Among the sample plots enumerated, the Unharvested Unburnt had the highest mean height of 14.44 m, close to it was the Frequently Burnt Plot 1with a mean height of 14.17 m, next to it was Frequently Burnt Plot 2 with a mean height of 11.84 m. The sample plot with the least mean height of 6.45 m was the Arable Plot 1. (Figure 5).



Frequently burnt Plot = FT;
Harvested Plot = HP;
Unharvested Unburnt Plot = UP;
Arable Plot = AP

Figure 4: Mean of tree heights (m) at Study Plots of the Forest Reserve in 2016

The structure of the plantation forest revealed widespread abundance of *Tectona grandis* as the dominant woody species within the Frequently Burnt Plot 2 as expected for a sole plantation. Frequently Burnt Plot 2, Unharvested Unburnt Plot, Frequently Burnt Plot 1 and Harvested Plot also had forty five, forty three, forty and fifteen abundance of *Tectona grandis* respectively. Other woody flora encountered at the study plots are; *Albizia zygia, Albizia lebbeck, Delonix regia, Gliricidia sepium, Anogeissus leiocarpus* and *Azadirachta indica*.

The TWINSPAN results revealed that *Tectona grandis* had the highest percentage cover across all the sample plots except the Arable plots 1 and Arable plot 2 where it is completely absent. This could be attributed to the monoculture system practised in the plantation forest. The absence of *Tectona grandis* in Arable plot 1 and Arable plot depicts clearly the impact of logging and farming activities in the forest reserve. This is in agreement with the findings of Agbo-Adeniran *et al*., 2016

However, the Unharvested Unburnt Plot had the highest tree mean diameter at breast height and mean height this could be attributed to the undisturbed nature of the study plot unlike the other plots, while the Arable Plot 1 and Arable Plot 2 had the lowest mean diameter at breast height and lowest mean height. This is in contrast to the report of Olajuyigbe and Adaja (2014). These reveals the high impact of logging (disturbance and degradation) for farming activities and the poor state of recovery of the tree population. (Addo-Fordjour *et al.,* 2009; Anning *et al*., 2009).

CONCLUSION

There is a high level of anthropogenic interference at Olokemeji forest reserve, and the structure and composition of the woody flora reflected the nature of impact. Anthropogenic activities should be greatly curtailed. Shifting cultivation should be strictly prohibited and encourage agroforestry in selected parts/zones of the forest reserve. Indiscriminate logging of trees as fuelwood should be greatly curtailed and improvised by the neighbouring communities. Burning activities should be properly regulated to prevent the loss of biodiversity. The government should subsidise the price of other fuel sources for the populace in order to reduce the rate at which trees are logged for fuelwood by the neighbouring communities.

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Appendix

Plate 1: Anthropogenic Impacts in Olokemeji Forest Reserve

Plate 2: Impact of Burning and Deforestation on the Forest Reserve