

TREE SPECIES COMPOSITION AND STRUCTURE IN THE NATURAL FOREST OF ONIGAMBARI FOREST RESERVE IN 2019

***TAIWO D. M., AKINYEMI O. D. ADEOYE O. T., WOGHIREN A. I., AINA- ODUNTAN O. A., AND OLOKETUYI A. J.**

Forest Conservation and Protection Department, Forestry Research Institute of Nigeria, Ibadan, Nigeria
damilolataiwomary@gmail.com; +2348167754312

ABSTRACT

The natural forest of Onigambari forest reserve was enumerated between the month of June to November, 2019 for its height and diameter class distribution and basal area. Systematic cluster sampling technique was used to allocate sample plots. 200m × 500m area referred to as clusters and partitioned into 100m × 100m tracts, each tract was separated at 20m interval from the other. The clusters were located within the reserve where human interference on the vegetation were relatively low. In each of the sample plots tree species ≥ 10 cm DBH were enumerated and recorded. Out of the thirty-five species enumerated, Triplochitin scleroxylon was the most abundant species, followed by Strombosia postulata. 10% of the entire tree stands were found with heights greater than 30 m height and 33% had heights that ranged between 5m < 10m. This means that the forest is undergoing recovery. 65% of the trees had DBH that is less than 20 cm which further confirms that most of the tree species were young and slender. The status of the tree species in the study plot were accessed based on their relative densities. 5.7% of the tree species were abundant with Triplochitin scleroxylon being the most abundant species in the study plot. The structure of the forest depicted a forest striving to survive after a major disturbance. Anthropogenic activities should be greatly prevented in order to maintain the ecological function and encourage natural forest regeneration in the forest.

Keyword: Anthropogenic, Class, Diameter, Distribution, Forest, Natural.

INTRODUCTION

The negative impact of man and their activities on the forest cannot be overemphasized. Anthropogenic activities do not only cause gradual loss or extinction of forest fauna and flora (Taiwo *et al.*, 2019), but it also has a profound effect on the structure and function of the forest. Natural Forest ecosystems are homes of biodiversity and they provide food and other important materials to survive on land. But they are threatened from time to time mainly as a result of anthropogenic activities such as deforestation for sales of fuelwood, commercial agricultural practices,

construction materials, timber production, road construction, charcoal production and medicinal values (Liaison 2013, Bajpai *et al.* 2018). These temporary benefit-oriented deforestation is followed by land degradation and soil erosion which result in biodiversity loss and extinction of flora and fauna (Feyera 2006, Feyera and Denich 2006, Tadesse 2008). Destruction of vegetation cover causes environmental degradation, climate change, drought, depletion of natural resources and food shortage. These are the major issues of national and global concern in recent years.

The structure of a forest describes the inherent attributes of the forest. It also helps to understand the distribution of species and their status. The structure of a natural forest largely depends on the ecological characteristics of sites, species diversity and regeneration status of tree species. Quantitative information on composition, distribution, or abundance of trees species is of key importance for understanding the status of a forest and also for decision-making, planning and implementation of conservation strategy of the forest.

Based on previous literatures and reports, Onigambari forest reserve has been undergoing frequent human activities which could have negative impact on the structure of tree species that serves as carbon sinks in the forest as well as other ecological functions. Hence, this study was carried out in order to understudy the structure of Onigambari forest reserve, taking into consideration the vertical and horizontal distribution of trees and the status of tree species within the natural forest.

MATERIALS AND METHODS

Study Site

Onigambari Forest Reserve is located between latitude 7° 81 N and 7° 31 N and longitude 3°491 E and 3° 221 E. Onigambari forest reserve is about 17km South East of Ibadan along Ibadan/Ijebu-Ode road. The mean total annual rainfall is 1337mm, spread over 114 days of the year and falling mainly between March and October. The mean maximum temperature is 26.32°C while the mean minimum is 21.31°C (Larinde and Olasupo, 2011). The topography is more or less flat. The soil is ferruginous on crystalline

acid rocks of undifferentiated basement complex gneisses. The soil is sandy-loam. The forest reserve is very close to the northern limit of the tropical semi-deciduous rainforests. The derived savannah vegetation is just north of the zone. The mean total annual rainfall is 1337 mm, spread over 114 days of the year and falling mainly between March and October. The mean maximum temperature is 26.32°C while the minimum is 21.31°C. Relative humidity is 74.28%.

METHODOLOGY

Sampling Technique

Data collection was carried out in November 2019. Systematic cluster sampling technique was adopted to allocate sample plots. 200 m × 500 m area referred to as clusters was partitioned into 200 m × 200 m tracts. The tracts were 100m apart. The clusters were located within the reserve where human interference on the vegetation is relatively low. Each tract was further divided into temporary sample plots of 50 m × 50 m, eight plots were demarcated and located at each corner of the area. In each of the sample plots, species composition and abundance were recorded.

Tree Species Identification

The botanical names of every tree stands encountered in each sub-plot was recorded. Each tree names were recorded in the field with extra effort made not to omit any eligible tree in a plot. Herbarium specimen was collected for species that were difficult to identify in order to have them identified at Federal Herbarium Ibadan (FHI).

DATA ANALYSIS

Basal area

Basal area ($\text{m}^2 \text{ ha}^{-1}$) = $\frac{\pi d^2}{4}$ (Onyekachi and Johnson, 2018)

Where π is 3.142 and 'd' is the diameter at breast height (m)

The total basal area for each of the sample plots were obtained by summing the basal area of all trees in the plot while mean basal area for the plots was determined by dividing the total basal area by the number of trees in the sample plot.

RESULTS

Species Composition, Abundance and Distribution of Tree Species in Onigambari Forest Reserve

Species Composition of Tree Species in Onigambari Forest Reserve

One hundred and thirty-seven tree stands were enumerated, having twenty-two families and thirty-five species, with family Fabaceae being the family with the highest number of species. Species found under family Fabaceae are *Albizia zygia*, *Millettia thonningii*, *Pterocarpous osun*, *Pterocarpua angolensis* and *Tetrapleura tetraptera*. Family Malvaceae, Meliaceae and Sterculiaceae have three species each, Malvaceae has the following tree species *Bombax bounopozense*, *Cola gigantia* and *Sterculia tragacantha*. Family Meliaceae has the following species represented; *Cederela*

odorata, *Entandrophragma angolense* and *Trichilia monadelpha* while family Sterculiaceae has species *Cola milenii*, *Sterculia rhinopetala* and *Triplochitin scleroxylon*. *Triplochitin scleroxylon* being the most abundant tree species found in the study site this is followed *Strombosia postulata*.

Diameter at Breast Height, Basal Area and Tree Volume of Tree Species in Onigambari Forest Reserve

Astonei boonei had the highest mean height at 31 m among the tree species and this is closely followed by *Celtis zenkeri* which had a mean height of 28 m, the lowest mean of tree height was found among *Bombax bounopozense*, *Canthium hispidonervosum* and *Dryopteris gossweiler*.

The highest mean diameter class distribution among the tree species was found among *Albizia zygia* at 111.8 cm, this is closely followed by *Cederela odorata* with mean DBH of 75.87 cm, and the lowest mean DBH was found among *Maranta gibba*.

Triplochitin scleroxylon had the highest sum of basal area per species with $9.661 \text{ m}^2 \text{ ha}^{-1}$, *Pterocarpous Osun* had $0.20 \text{ m}^2 \text{ ha}^{-1}$ while the lowest sum of basal area was recorded as $0.007 \text{ m}^2 \text{ ha}^{-1}$ among species of *Maranta gibba*. The total sum of all tree species basal area in the natural forest enumerated for this study is $20.39 \text{ m}^2 \text{ ha}^{-1}$. Table 1, Figure 1 and 2.

Table 1: Species Composition, Abundance and Distribution of Tree Species in Onigambari Forest Reserve, Oyo State, Nigeria

Species	Family	Abundance	Mean Height	Mean DBH	Sum of BA
<i>Albizia zygia</i>	Fabaceae	4	12.2	111.8	0.088
<i>Aningeria robusta</i>	Sapotaceae	1	7	13.8	0.015
<i>Astonei boonei</i>	Alismataceae	1	31.5	66	0.342
<i>Blighia sapida</i>	Sapindaceae	3	14.06	16.23	0.011
<i>Bombax bounopozense</i>	Malvaceae	1	6	10.6	0.009
<i>Canthium hispidonervosum</i>	Rubiaceae	1	6	12	0.011
<i>Cederela odorata</i>	Meliaceae	6	17.73	75.87	0.169
<i>Celtis mildbreadii</i>	Cannabaceae	1	10	12	0.011
<i>Celtis zenkeri</i>	Ulmaceae	2	28.75	68.75	0.083
<i>Cola gigantia</i>	Malvaceae	2	17	27.5	0.021
<i>Cola milenii</i>	Sterculiaceae	7	9.83	12.42	0.015
<i>Cordia millenii</i>	Boraginaceae	1	25.5	38	0.113
<i>Dryopteris gossweiler</i>	Dryopteridoideae	1	6	13.5	0.014
<i>Drypetes glliana</i>	Putranjivaceae	4	16.12	13.12	0.032
<i>Entandrophragma angolense</i>	Meliaceae	4	12.12	27.38	0.018
<i>Ficus exasperate</i>	Moraceae	3	13.83	31.5	0.023
<i>Funtumia elastic</i>	Apocynaceae	6	13.96	17.25	0.055
<i>Gmelina arborea</i>	Lamiaceae	2	17.5	21	0.041
<i>Holarrhena floribunda</i>	Apocynaceae	2	7.7	11.9	0.013
<i>Irvingia wombolu</i>	Irvingiaceae	1	26.5	27.5	0.059
<i>Lecaniodiscus cupanoides</i>	Sapindaceae	2	6.65	12.5	0.012
<i>Maranta amplifolia</i>	Marantaceae	2	15.5	16.5	0.025
<i>Maranta gibba</i>	Marantaceae	1	9	10	0.007
<i>Millettia thonningii</i>	Fabaceae	5	15.72	20.78	0.014
<i>Piptadeniastrum africanum</i>	Leguminosae-mimosoideae	2	19.05	70.75	0.636
<i>Psidium guajava</i>	Myrtaceae	1	7.5	51.5	0.013
<i>Pterocarpous Osun</i>	Fabaceae	2	14.25	42.5	0.201
<i>Pterocarpua angolensis</i>	Fabaceae	2	21.25	44.75	0.015
<i>Ricinodendron heudelotii</i>	Euphorbiaceae	4	17.05	37.77	0.041
<i>Sterculia rhinopetala</i>	Sterculiaceae	4	15.75	16.62	0.007
<i>Sterculia tragacantha</i>	Malvaceae	5	10.46	36.5	0.015
<i>Strombosia postulate</i>	Strombosiaceae	15	13.12	15.27	0.013
<i>Tetrapleura tetraptera</i>	Fabaceae	1	24	35.7	0.1
<i>Trichilia monadelpha</i>	Meliaceae	2	17.4	16.5	0.022
<i>Triplochitin scleroxylon</i>	Sterculiaceae	36	24	46.33	9.669

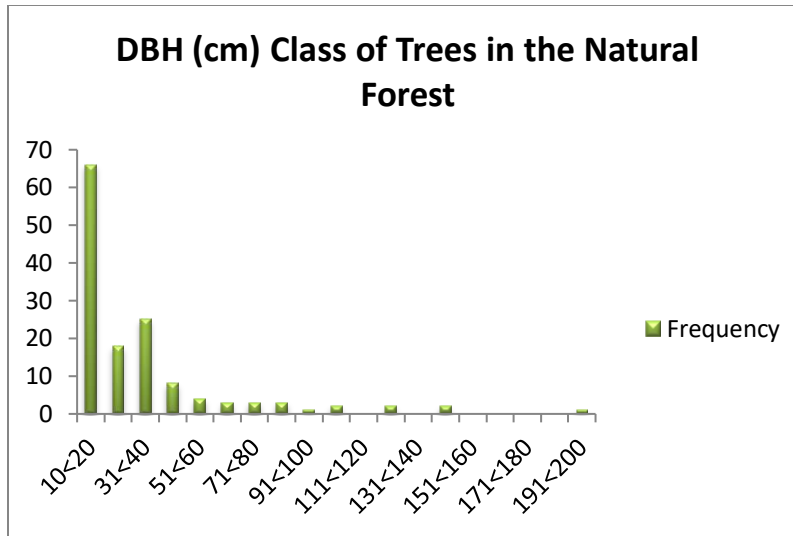


Figure 1: Diameter at Breast Height Distribution of Trees in Onigambari Forest Reserve, Oyo state, Nigeria

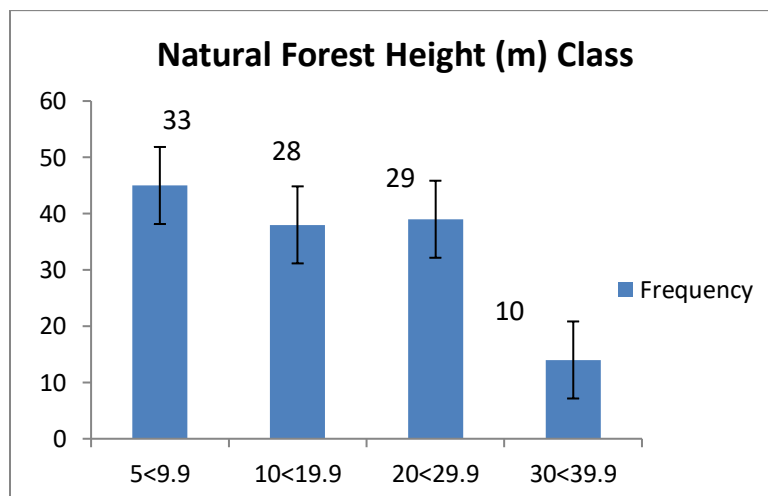


Figure 2: Height Distribution of Trees in Onigambari Forest Reserve, Oyo state, Nigeria

Status of Tree Species in Onigambari Forest Reserve

Out of the thirty-five tree species enumerated in this study, eleven species were endangered, ten species were Rare, nine species were Occasional, three species were Frequent while only two were abundant among the tree species. The two abundant

species are *Triplochitin scleroxylon* and *Strombosia postulate*. Species categorized as Frequent were *Cederela odorata*, *Cola milenii* and *Funtumia elastic*. 31.4% of the total number of species enumerated were endangered, 28.6% are Rare, 25.7% are Occasional, 8.6% were Frequent and only 5.7% were Abundant as shown in Table 2.

Table 2: The Status of Tree Species in Onigambari Forest Reserve

Species	Relative Density	Status
<i>Albizia zygia</i>	2.94	Occasional
<i>Aningeria robusta</i>	0.74	Endangered
<i>Astonei boonei</i>	0.74	Endangered
<i>Blighia sapida</i>	2.21	Occasional
<i>Bombax bounopozense</i>	0.74	Endangered
<i>Canthium hispidonervosum</i>	0.74	Endangered
<i>Cederela odorata</i>	4.41	Frequent
<i>Celtis mildbreadii</i>	0.74	Endangered
<i>Celtis zenkeri</i>	1.47	Rare
<i>Cola gigantea</i>	1.47	Rare
<i>Cola milenii</i>	4.41	Frequent
<i>Cordia millenii</i>	0.74	Endangered
<i>Dryopteris gossweiler</i>	0.74	Endangered
<i>Drypetes glliana</i>	2.94	Occasional
<i>Entandrophragma angolense</i>	2.94	Occasional
<i>Ficus exasperata</i>	2.21	Occasional
<i>Funtumia elastica</i>	4.41	Frequent
<i>Gmelina arborea</i>	1.47	Rare
<i>Holarrhena floribunda</i>	1.47	Rare
<i>Irvingia wombolu</i>	0.74	Endangered
<i>Lecaniodiscus cupanoides</i>	1.47	Rare
<i>Maranta amplifolia</i>	1.47	Rare
<i>Maranta gibba</i>	0.74	Endangered
<i>Millettia thonningii</i>	3.68	Occasional
<i>Piptadeniastrum africanum</i>	1.47	Rare
<i>Psidium guajava</i>	0.74	Endangered
<i>Pterocarpous Osun</i>	1.47	Rare
<i>Pterocarpus angolensis</i>	1.47	Rare
<i>Ricinodendron heudelotii</i>	2.94	Occasional
<i>Sterculia rhinopetala</i>	2.94	Occasional
<i>Sterculia tragacantha</i>	3.68	Occasional
<i>Strombosia postulata</i>	11.03	Abundance
<i>Tetrapleura tetraptera</i>	0.74	Endangered
<i>Trichilia monadelpha</i>	1.47	Rare
<i>Triplochitin scleroxylon</i>	26.47	Abundance

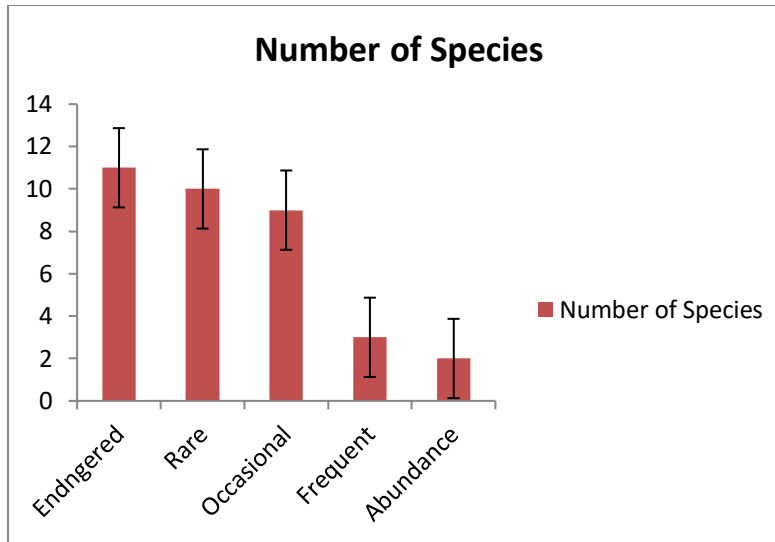


Figure 3: Status of Tree Species in Onigambari Forest Reserve, Oyo State, Nigeria

DISCUSSION

Onigambari forest reserve has numerous tree species, thirty-five species were enumerated in this study belonging to twenty-two families. *Triplochitin scleroxylon*, *Strombosia postulate*, *Funtumia elastic*, *Cola milenii* *Cederela odorata* and *Funtumia elastic* are just a few among the tree species encountered during this study with *Triplochitin scleroxylon* being the most abundant species. This could be attributed to the fast propagation of *Triplochitin scleroxylon* as a pioneer species that survives in open forests (Akinngbe *et al.*, 2019).

Astonei boonei, *Celtis zenkeri*, *Irvingia wombolu*, *Cordia millenii*, *Triplochitin scleroxylon* had mean heights that ranged from 31 m height to 25 m height in an ascending order. Only 10% of the entire tree stands were found with heights greater than 30 m height, 33% had heights that ranged between 5m < 10m, which depicts a lower storey of tree canopy. 28% of the tree stands had between 10m < 20m height, while 29% of the tree stands were found within the range

of 20m < 30m heights. This depicts a mature forest growing simultaneously with regenerating tree stands. This reveals the high impact of logging (disturbance and degradation) and the state of recovery of the tree population (Olajuyigbe and Adaja, 2014). Addo-Fordjour *et al.* (2009) and Anning *et al.* (2009) reported that when the number of trees in the lower layers (understorey and lower canopies) were higher than those in the upper strata, it suggests that the forest is in the process of recovery.

The diameter at breast height class distribution shows a reversed J-shape which is a characteristic of a perturbed forest, the disturbed forest with this inverse “J” shaped are generally said to show active regeneration and recruitment (Jew *et al.*, 2016). With lesser number of species found within 30m < 40m DBH class, majority of the tree species were found within DBH range of 10 cm < 20 cm this clearly depicts young slender growing trees, while the rest of the trees were sparsely distributed over the larger DBH

scale. This further implies that this disturbed forest community has potential to recover over time, provided deforestation is stopped (Nath *et al.*, 2005; Adekunle *et al.*, 2013; Olajuyigbe and Adaja, 2014)

Triplochiton scleroxylon had the highest sum of basal area per species with $9.661 \text{ m}^2 \text{ ha}^{-1}$ out of the total basal area of $11.93 \text{ m}^2 \text{ ha}^{-1}$ evaluated for all the tree stands and species in this study. This clearly depicts that *Triplochiton scleroxylon* has a major contribution to the entire tree structure in the study site and natural forest at large, in addition, this means that *Triplochiton scleroxylon* can be used for enrichment planting in other deforested parts of the forest. The status of the tree species enumerated in this study as a result of their relative density depicts that only 5.7% were abundant which are mainly *Triplochiton scleroxylon* and *Strombosia postulata*.

CONCLUSION

The species composition and structure of trees in Onigambari natural forest clearly indicated the advent of a major disturbance which had a profound impact on the forest. However, this study revealed that there is a hope for the forest to regenerate naturally and if the forest is further protected, there is a high tendency for the forest to attain climax. It is therefore expedient to ensure that anthropogenic activities, especially felling of trees, are strictly prevented from taking place in the natural forest as well as other degraded areas of the forest reserve in order to serve ecological functions.

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