

STAND STRUCTURE OF THE NATURAL FOREST OF ONIGAMBARI FOREST RESERVE

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Abstract

The stand structure of Onigambari forest reserve was evaluated to understand the intricate value of the natural forest in February 2021. Four 50 by 50 m transect line was laid systematically within the natural forest. One hundred and twelve tree stands were found within the study site. The following species recorded the highest diameter at breast height in the study site; Piptadeniastrum africanum, Triplochiton scleroxylon, Cola gigantean, Scotelia coriacea, Sterculia tracagantha, Cola gigantean and Pinus caribaea. The following species recorded the highest mean heights across the study plots; Piptadeniastrum africanum, Triplochiton scleroxylon, Alchornea laxiflora, Sterculia tracagantha, Scotelia coriacea, Cordia millenii, Ficus exasperata and Sterculia tracagantha, it is evident that these tree species have a major contribution to the structure of the natural forest. The diameter at breast height (DBH) class distribution was represented in an inverse J-shape which reflected the nature of the trees having a larger portion of the trees in the lower diameter class (91 out of 112 tree stands). In addition, the height distribution also recorded highest tree stands within the range of 15 to 30m height, this describes the structure of an average tropical rainforest, however, the lower number of trees encountered in the higher height class of trees signified a forest that is yet to attain its climax. The increased rate of logging and death of trees in the forest reserve is evident in its stand structure

Key Words: Flora, Forest, Girth, Dynamics, Species

Introduction

Human activities have a major effect on Nigeria's forest reserves. In many habitats, anthropogenic effects have transformed forest lands to savanna, resulting in biodiversity loss. Anthropogenic impacts do not only result in a substantial loss of biodiversity, but they also limit the ability of forest habitats

to perform their functions. According to Oke and Odebiyi (2007), continued over-exploitation depletes the forest ecosystem as well as its structure, putting current users' livelihoods in jeopardy. Local disturbances change the successional pattern of forest habitats, as well as their composition, diversity, and canopy structure. Nefarious enterprises in the

forest, dwindling manpower and efficiency in the Forestry Department, insufficient forest patrol, cessation of the payment of annual royalty (formerly 5% of total income) from logging activities to rural communities, and obsolete forestry laws and regulations are among the other factors responsible for the drastic reduction of Nigeria's rich floristic capital (Adekunle *et al.*, 2013).

The dynamics of a forest's biological diversity are depicted by its floristic structure (Taiwo *et al.*, 2020). The importance of gathering relevant data for biodiversity assessment cannot be overstated. Forest reserves provide the necessary data to formulate strategies and plan for the long-term usage and conservation of forest resources. A significant obstacle is a lack of data about the degree and importance of biological components in any given environment, which is critical for the formulation of effective policies and the long-term protection of such ecosystems (Adekunle, 2006). The degradation of Nigeria's lowland forest reserve estates, as well as its genetic and timber resources, through logging and conversion to agricultural plantations, is particularly troubling. According to Adekunle and Olagoke (2007), the greatest force for forest destruction in tropical regions is growing demand for wood and cropland pressure from agriculture which often leads to over-exploitation of the forest reserves.

As a result of overexploitation of forest resources, natural tree stands have been destroyed and scattered, causing

rainforest stand structure to be distorted. Despite rapid changes in forest composition and function, few natural forest reserves have been assessed in recent years (Akinyemi *et al.*, 2012). This study was conducted in the Onigambari forest reserve in the south-west of Nigeria with the aim of estimating the current tree stand structure through assessment of its diameter at breast height and tree height distribution among tree species in the study site as well as making recent and effective conservation recommendations for improved forest management.

Materials and Methods

Study Location

Gambari Forest Reserve is situated between the latitudes 7° 81' N and 7° 31' N and longitude 3° 49' E and 3° 22' E. The annual rainfall received by the forest reserve is a cumulative of 1337mm, which is spread across 114 days of the year and mostly falls between March and October. The average maximum temperature is 26.32°C, and the average minimum temperature is 21.31°C (Larinde and Olasupo, 2011). The relative humidity of the forest is 74.28 percent. The terrain is relatively flat. On crystalline acid rocks of undifferentiated basement complex gneisses, the soil is ferruginous. The decomposition of underlying schist and quartzite has resulted in a sandy-loam soil that covers the laterites gravels. The reserve is very close to the tropical semi-deciduous rainforest's northern boundary. (Akinyemi *et al.*, 2020).

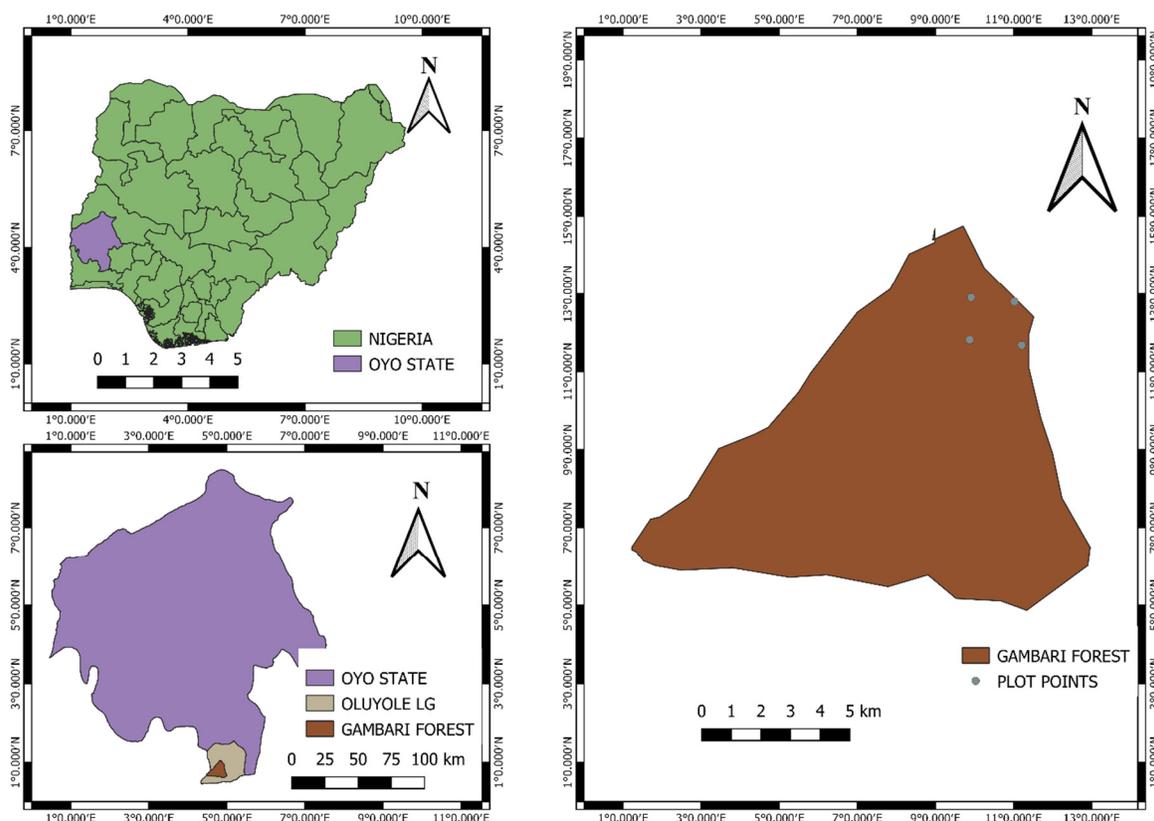


Fig. 1: Map of Onigambari Forest Reserve, Oyo State, Nigeria

Method and Data Collection

Sampling Technique

Data was collected in the month of February 2021. Systematic cluster sampling technique was adopted to allocate sample plots. 250 square meter area was partitioned into 50 × 50 m tracts. 10 m distance was considered before laying the plots for the purpose of edge effect. The tracts were 20m apart. The clusters were located within the reserve where human interference on the vegetation is relatively low. Four plots were demarcated and located at each corner of the area. In each of the sample plots species composition and abundance was recorded.

Tree Species Identification

The botanical names of every stands encountered in each sub-plot which was

equal or above 10 cm DBH was recorded. Each tree was recorded fully in the field with extra effort made not to omit any eligible tree in a plot. Tree species identification was carried out by taxonomists from the Taxonomy section of Forestry Research Institute of Nigeria and authenticated at Forest Herbarium Ibadan (FHI).

Materials

The diameter at breast height for each tree species was measured with DBH tape and the tree heights were taken with a relascope.

Data Analysis

Forest Structure

The distribution of stem diameter and height of tree species in the study area was used to examine the composition of the natural forest under investigation. The

total height and diameter of the tree species measured in the four plots were classified, and the frequency of each class was calculated with the use of Microsoft Excel.

Result

Diameter at Breast Height Distribution of Tree Species in the Natural Forest of Onigambari Forest Reserve

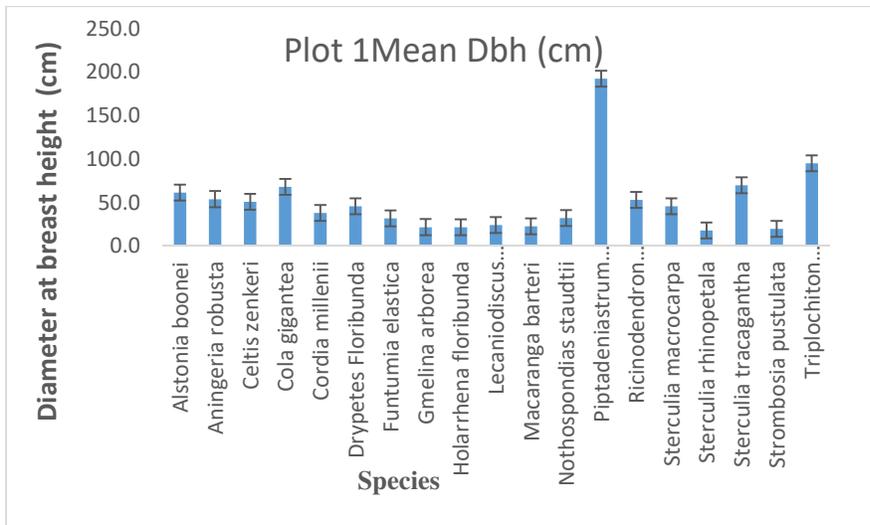
Out of the nineteen tree species encountered in the first study plot, the species with the most significant mean DBH is *Piptadeniastrum africanum* having a mean DBH of 192.6 cm, this is closely followed by *Triplochiton scleroxylon* with 95.3 cm DBH. Other species with moderately high DBH are *Sterculia tracagantha* (70.0), *Cola gigantea* (68.1) and *Alstonia boonei* (61.7). Species which recorded the least DBH are; *Gmelina arborea* (21.9 cm), *Holarrhena floribunda* (21.8 cm) and *Sterculia rhinopetala* (18.1 cm).

In the second study plot, Out of the nine species encountered in Plot 2,

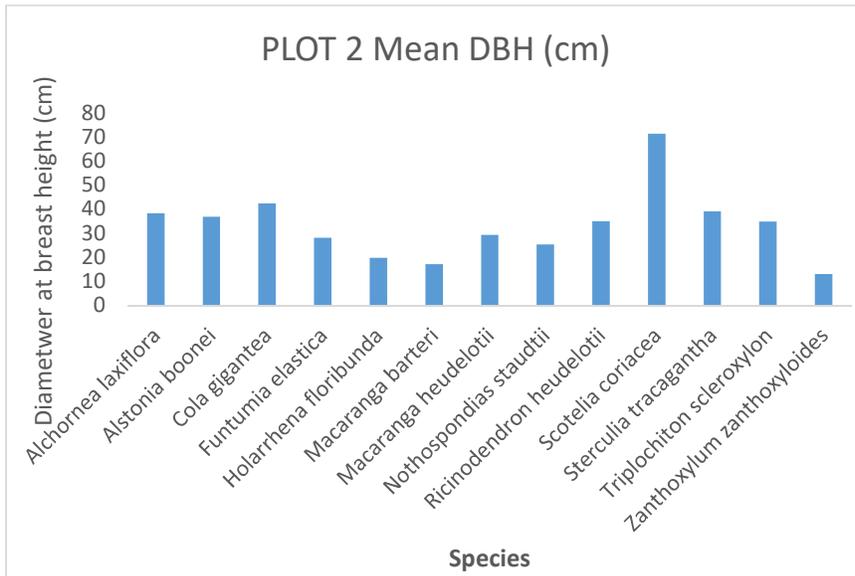
Scotelia coriacea had the highest DBH at 71.3 cm, this is followed by *Cola gigantea* (42.3 cm) and *Sterculia tracagantha* (39.1 cm). The lowest DBH in this study plot was found among the following species *Nothospondias staudtii* (25.4 cm), *Macaranga barteri* (17.2 cm) and the least *Zanthoxylum zanthoxyloides* (13 cm).

The mean diameter at breast height distribution of the five tree species encountered in the third study plot are quite equivalent. However, *Pinus caribaea* (38.1 cm) had the highest DBH. The following species had moderate DBH *Gmelina arborea* (31.0 cm), *Ficus exasperata* (30.8 cm), *Cordia millenii* (29.4 cm) and *Sterculia tracagantha* (28.8 cm)

In Plot 4, only two species were found in the fourth plot. Herbaceous flora, shrubs and climbers have dominated the plot as a result of degradation. *Triplochiton scleroxylon* had the highest mean DBH at 36.7 cm while *Piptadendrum africanum* had mean DBH of 22.8 cm (Figures 2a, 2b, 2c and 2d).



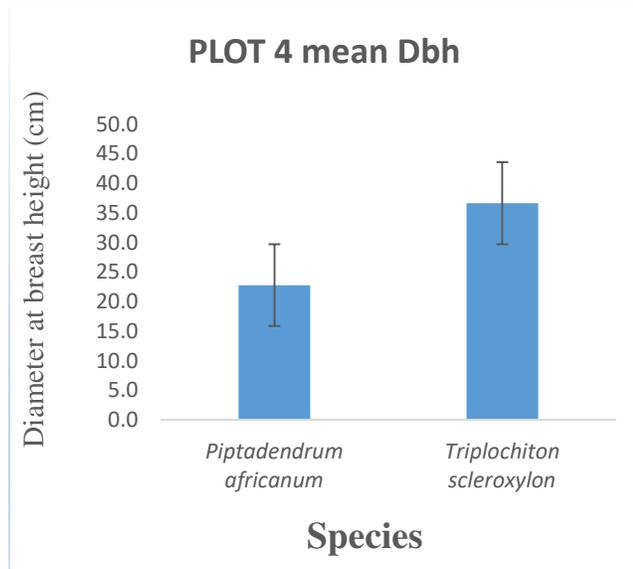
2a



2b



2c



2d

Fig. 2a, 2b, 2c, 2d: Mean Diameter at Breast Height of tree species in the Natural forest of Onigambari

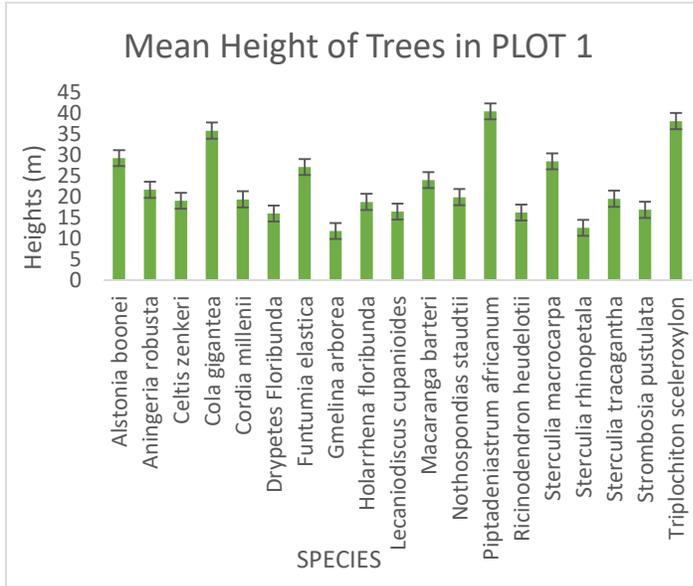
Mean Heights of Tree Species in the Natural Forest of Onigambari Forest Reserve

Piptadendrum africanum had the highest mean height of 40.4 m in Plot 1, followed by *Triplochiton scleroxylon* with a mean height of 38.01 m and *Cola gigantean* with a mean height of 35.8 m. In Plot 2, *Alchornea laxiflora* recorded the

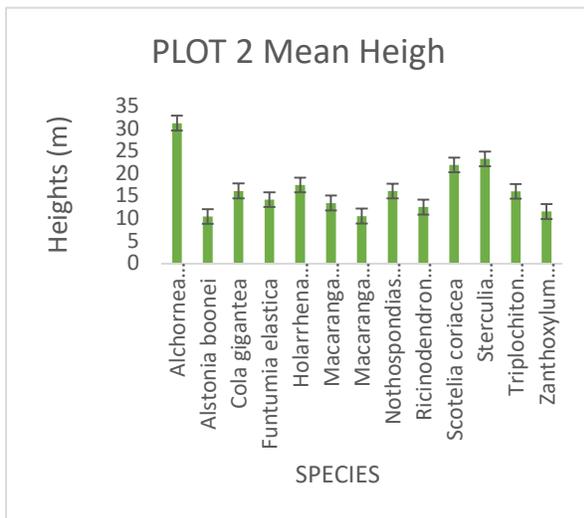
highest mean height at 31.2 m, this was followed by *Sterculia tracagantha* with 23.22 m mean height and *Scotelia coriacea* with 21.9 m mean height. In Plot 3, *Cordia millenii* had the highest mean height of tree species at 24.8 m, this was followed by *Ficus exasperata* with a mean height of 23.4 m and *Sterculia tracagantha* with a mean height of 23.15 m.

Furthermore, Plot 4 which had only two tree species recorded highest mean height (26.3 m) in species *Piptadendrum*

africanum while *Triplochiton scleroxylon*, its counterpart had a mean height of 25.3 m (Figure 3a, 3b, 3c and 3d).



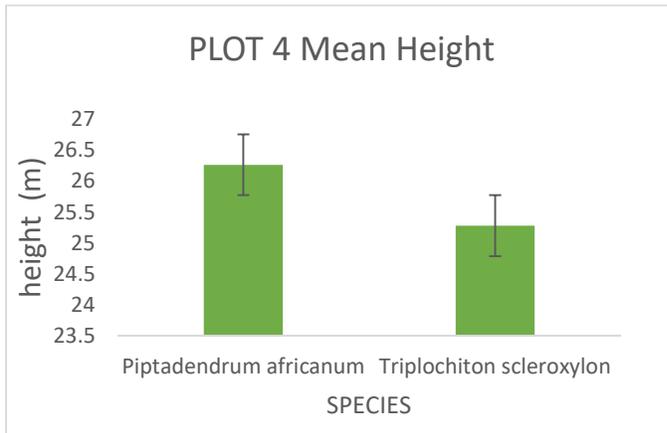
3a



3b



3c



3d

Fig. 3a, 3b, 3c, and 3d: Mean Height of tree species in the Natural forest of Onigambari

DBH and Height Class Distribution of Trees in the Natural Forest of Onigambari Forest Reserve

The inverse J-shape of the DBH class revealed that there are more tree species found in the lower class and only few species found in the higher class. 92 tree stands were recorded within the DBH class between 10 and 50 cm, 15 tree stands were found within the DBH class between 50.1 and 100 cm. 4 tree stands were found in the class between 101 and 151 cm and only 1

tree stand was found with DBH between 251 and 300 cm (Figure 4).

The tree height classification revealed that 61 tree stands which is the most abundant class were found within the height range of 15.1 to 30 m as expected of a rainforest, this was followed by the class 0 to 15 m where 35 tree stands were found. Between the class 30.1 and 45 m, 14 tree stands were found and between the class 45 and 60 m only 2 tree stands were found (Figure 5).

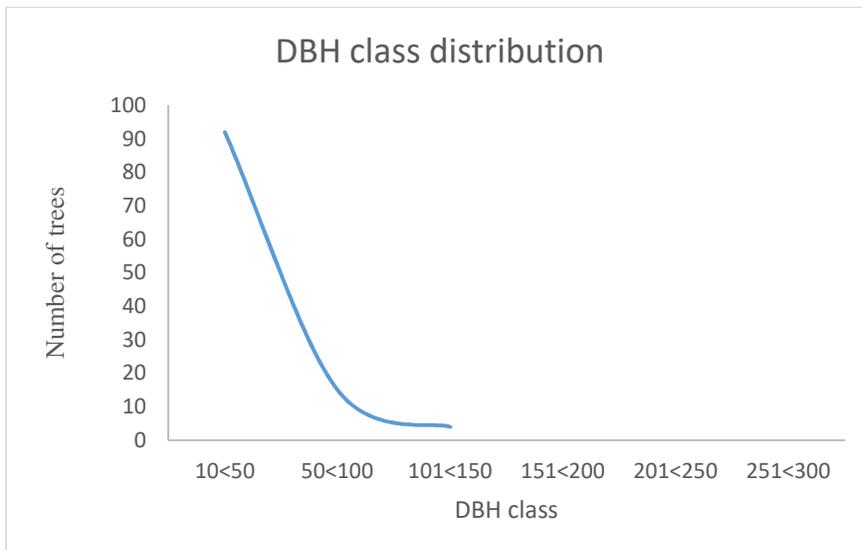


Fig. 4: DBH Class of trees in the natural Forest of Onigambari Forest Reserve

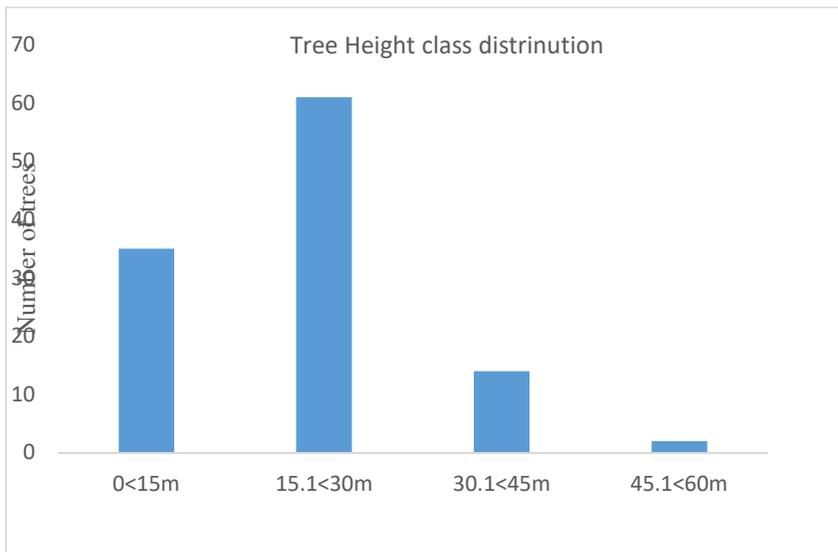


Fig. 5: Tree height Distribution in the natural Forest of Onigambari Forest Reserve

Discussion

The structure of trees in the natural forest of Onigambari forest reserve was demystified in this study. As we can see, deforestation has set into the natural forest. Climbers, shrubs and herbaceous flora has dominated some parts of the impoverished forest reserve, leading to the death of few tree species striving for survival. This study was carried out to understand the nature, diameter at breast height and height distribution of tree species in the natural forest.

The diameter at breast height distribution according to the study plots revealed the following species have highest DBH across the four plots; *Piptadeniastrum africanum*, *Triplochiton scleroxylon*, *Cola gigantean*, *Scotelia coriacea*, *Sterculia tracagantha*, *Cola gigantean* and *Pinus caribaea*. The following species recorded the highest mean heights across the study plots; *Piptadeniastrum africanum*, *Triplochiton scleroxylon*, *Alchornea laxiflora*, *Sterculia tracagantha*, *Scotelia coriacea*, *Cordia millenii*, *Ficus exasperate* and *Sterculia tracagantha*, the species composition is similar to the report given by

Akinyemi *et al.*, 2020. These species have a profound impact on the structure and function of the natural forest ecosystem.

The reverse J-shape of the DBH class distribution depicted a forest that is trying to recuperate after series of disturbance. This also means that the forest is still growing and yet to attain climax, just as expected of a secondary regrowth natural forest. This is in agreement with the report of Sanwo *et al.* 2015 who stated that the DBH class distribution of tree stands in Onigambari forest reserve was an inversed J-shape, this also depicts a healthy recruitment potential of the forest reserve. This also corroborates the findings of Adekunle *et al.* (2013) who stated that only 12% of the trees in Akure forest reserve can be referred to as mature species because they had DBH greater than 40 cm, while the trees with smaller diameters have a privilege to grow into larger stems if they are properly maintained.

The vertical distribution among the tree stands depicted the structure of a typical rainforest that is still in its growing phase, this can be seen from the arrangement of the tree stands in the classes, where majority of

the tree stands were found within the height range of 15.1 to 30 m, this is in contrast to the report of Adekunle *et al.*, 2013 who stated that majority of the tree species in Akure forest reserve were found within the height class of $5 < 15$ m. This also corroborates that the forest though mature is still transitioning and should be given a chance to attain climax, However, this can only be made possible if human activities are restricted to the barest minimum within the natural forest reserve.

Conclusion

The structure of trees in the natural forest of Onigambari clearly depicted a forest thriving in the midst disturbances ranging from natural disturbances such as pest, invasion of herbaceous floras and climbers and deforestation. It is surprising to find the tree stands that were encountered in this study despite all the odds that this forest reserves has been faced with. The rate of deforestation in the forest reserve needs to be strictly put to an end for the survival of the forest.

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