Tree Diversity of Oko-Iroo Forest Reserve in Oyo State, Southwestern Nigeria

Oluwatoyin Opeyemi Akintola*; Tunde Adeniran; Emmanuel Kolawole Abodunrin; Olufunlola Odunayo Akinola; Adewale Opeyemi, Agbo-Adediran; Feyiropo Morenikeji Jayeoba; and Rebecca Titilayo Ibode.

Federal College of Forestry, P.M.B. 5054, Ibadan, Oyo State, Nigeria.

E-mail: toyinakintola73@gmail.com*

ABSTRACT

Deforestation and forest degradation are global concerns for development and conservation of forest ecosystems, thus information on changes in forest resources is needed for decision making and the planning of forest management regimes for rehabilitation purposes, since detailed information on the quantities and location of forest resources is the backbone of proper forest management planning. This study was thus designed to provide quantitative and qualitative base-line information on extent, state, use, and management of the Oko-Iroo forest reserve and enhance forest planning for sustainable management.

The enumeration, identification of individual trees species, and assessment of the distribution pattern of trees in the study area were carried out. Individual trees and species encountered in the study areas were counted *in situ* and identified where possible and by comparison with voucher specimen from the Forest Herbarium Ibadan (FHI), Forestry Research Institute of Nigeria, Ibadan. Flora species enumerated were categorized into families. A total number of 205 individuals, 11 species, and 7 families of trees were observed in the study area. Low numbers of individual trees, species and families observed is an indication of the extent of deforestation and over exploitation of the reserve.

The woody tree species found in the study area are small and immature. Species composition, dominance, and diversity showed that *Tectona grandis* was the most dominant species in the reserve. Low dominance and Shannon Wiener index suggested secondary regrowth natural forest in the study area.

The inventory of trees in the reserve has shown the extent of the human activities in the area, thus, there is need for introduction of indigenous and valuable tree species into the reserve. Human activities such as farming, hunting and others should be greatly reduced and silvicultural interventions that would promote natural regeneration and/or enrichment planting for habitat restoration should be encouraged in the reserves.

(Keywords: human activities, deforestation, habitat restoration, forest resources, forest management)

INTRODUCTION

Forest environments are parts of the Earth's most important resources and have rich territories crowded with many flora and fauna species as well as soil types (Carlson, *et al.,* 2010; Lan Thompson and Kimiko, 2010; Saadia, 2012; IUCN, 2015). Forest environments are habits for about 80% of the world's terrestrial biodiversity, and they also form the source of livelihood for many different human settlements, including 60 million indigenous people (Saadia, 2012; INTACT, 2016, Alo, 2017).

Biodiversity conservation is indispensable for ecosystem purposes and solidity as well as human survival and economic security (Singh, 2002). Magurran (2004) reported that biodiversity assessment is based on species richness, abundance, complementarily taxonomic and functional diversity at different scales and indices. Species richness and their relative abundances are elementary attributes of biotic communities that can be used as simple and integrative measures to assess the relationships between population structure and abiotic patterns of habitats, to quantify anthropogenic turbulences, and to monitor biodiversity management plans (Begon, *et al.*, 1996; Gotelli and Colwell, 2001),

Tree species diversity assessment which is the number of trees and abundance of each species that are in a particular location is very important in the area of research in providing relevant information about a particular forest estate (Sterba, 2006, Jayeoba, *et al*,, 2017), The study of tree diversity and forest structure is a key pre-requisite for understanding and managing forest ecosystems (Pommerening, 2006). It provides information about forest stands and help in decision making, proper management plan and better felling cycle (FAO, 2003). It is also important in predicting tree carbon storage in hyper diverse forest (Hunter, 1999). Floristic inventory is essential in assessing the extent of plant biodiversity in forest ecosystems. Species diversity assessment is therefore necessary to develop effective strategies for conservation of treesdue to rapid degradation, deforestation, destruction and conversion of forest ecosystems for other use (Jayeoba, *et al.*, 2017).

Deforestation and forest degradation are global concerns for development and conservation of forest ecosystems, thus information on changes in forest resources is needed for decision making and the planning of forest management regimes for rehabilitation purposes, since detailed information on the quantities and location of forest resources is the backbone of proper forest management planning. This study was thus designed to provide quantitative and qualitative base-line information on extent, state, use, management of the Oko-Iroo forest reserve and enhance forest planning for sustainable management.

Location, Climate, and Physiographic Description of the Study Area

Oko-Iroo Forest Reserve which lies between Latitude 8°08'N and Longitude 4°15'E is located between Oko and Iro villages within Ogo Oluwa Local Government Area in Ogbomosho, Oyo State, Nigeria. The reserve is accessible through Iresa/Iko and Ejigbo to Iko Road. The reserve is surrounded by villages such as Iresa, Tafon, Ijado, Ilogbo, Iganna, Alagbayu, etc. Ogbomosho (Figure 1a and b), Oyo State and also close to Ejigbo in Osun State. The forest reserve belongs to Oyo State Government. The Oko-Iroo forest reserve is about 50km^2 (5,000ha) and roughly triangular in shape, 75.07km^2 (7,507Ha). However, with the level of depletion and deforestation through illegal felling and encroachment of individual forest reserve in the state as reported by Sanwo, *et al.,* (2015) and Ige, (2017), the actual area of land covered in forest reserve would have become far less than the land area (5,000ha).

The climate is characterized by alternation of wet season lasting from April to October and dry season from November to March with annual rainfall ranges from 1,300 – 1,500mm and average humidity of about 65%, the average temperature is about 26^{0}C. The topography of the study area is undulating with elevation values ranging from 328m-412m and average values of 364m above sea level. (Figure 2). The study area is well drained by a stream with tributaries jointly forming a dendritic drainage pattern. (Figure 3). The major drainage pattern is dendritic and it is drained by river Aduniyi, Ogegun and Ora.

Geologically, the study area is located within the southwestern Nigeria basement complex. The rocks unit is made up of ancient gneiss-migmatite series and meta-sedimentary series (Afolabi, *et al.,* 2013). The former series is represented by gneisses occurring mainly as granite gneiss (Figure 3) with medium to coarse grained textures and no definite foliation pattern. They contain biotite, hornblende, quartz, plagioclase, microcline and rarely pyroxene. Those gneisses with high content of mafic minerals may yield clayey soils while the coarse grained, more granitic components may account for soils with varying textures with less clay (Afolabi, *et al.*, 2013).

The meta-sedimentary series include quartzite and quartz-schists. The quartzite occurs as long elongated ridges trending NW-SE and mostly massive schistose quartzites with micaceous minerals alternating withquartzo-feldspathic rocks which are common in the southwestern part of Ogbomosho (Figure 4). The integrated, network of fractures, joints and plane of schistocyte present in quartzites enhances weathering process. The older granites consist of medium to coarse-grained porphyritic granites, granodiorites, biotite granites and affiliated minor rocks such as pegmatites. Pegmatites are common as intrusive rocks occurring as dykes filling the shear and joints. They are coarse grained and weathered easily to clay and sand size particles, which serve as water bearing horizon of the regolith (Oladunjoye *et al*, 2013).

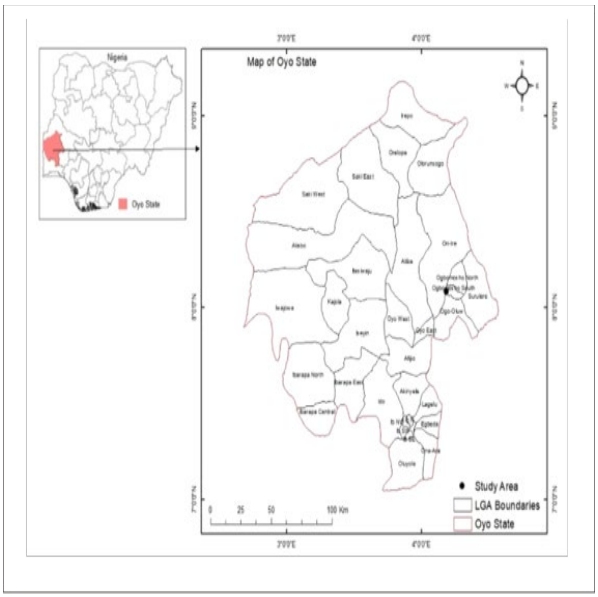

Figure 1a: Map of Oyo State showing the Study Area.

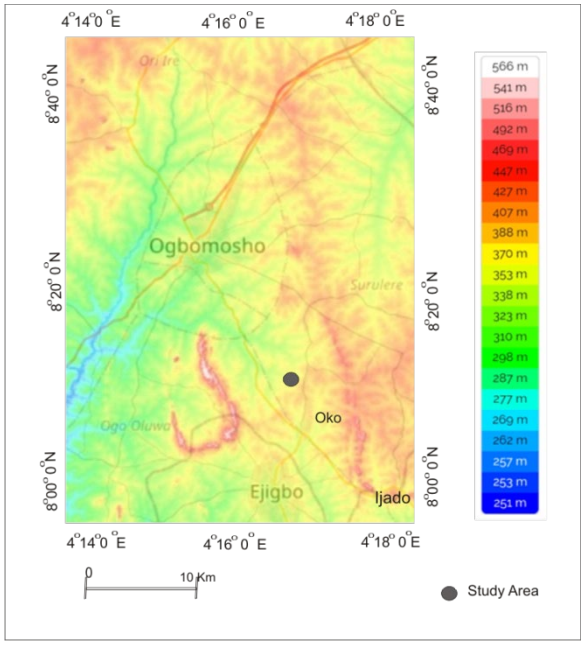

Figure 2: Elevation Map of the Study Area.

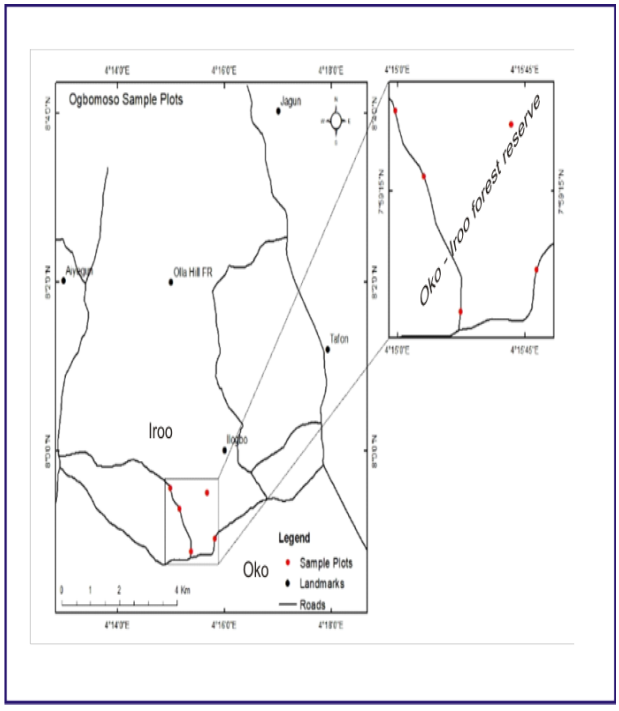

Figure 1b: Location Map of the Study Area.

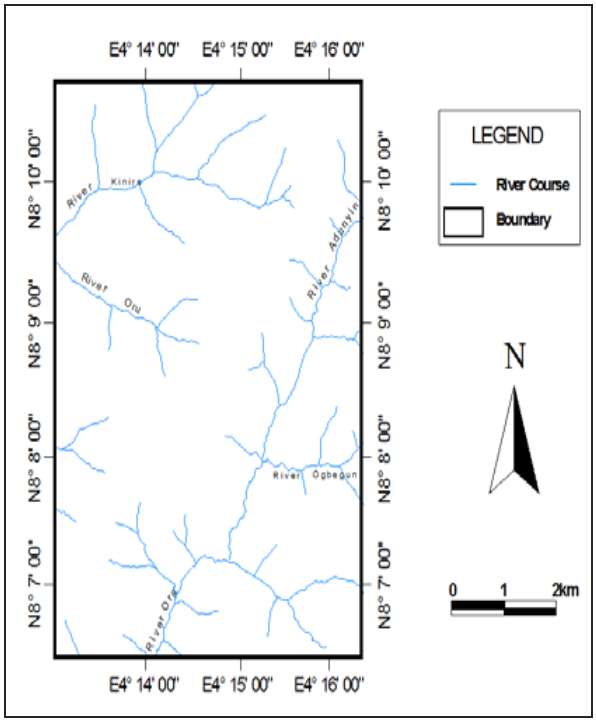

Figure 3: Drainage Network of the Study Area (After Oladunjoye, *et al*., 2013).

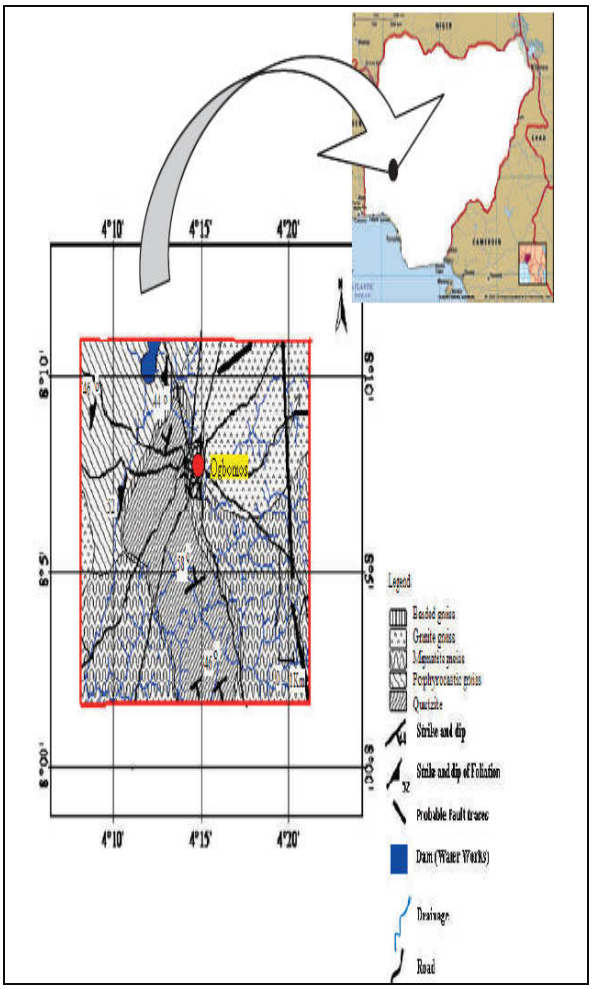

Figure 4: Geological Map of Ogbomosho Area (After, Oladunjoye, *et al.*, 2013).

MATERIALS AND METHODS

A reconnaissance survey of the reserves was carried out in August, 2019. This involved collection of relevant materials such as permission letter into the reserve and existing information from the Oyo state Government. Also, an extensive study of the area was done to be familiar with the road networks, identify more promising routes to the area and collection of existing maps.

Sampling technique employed in this study was systematic cluster sampling as employed by Akindele, *et al.* (2001) in the Forest Resources Study (FRS) of Nigeria. It involved establishment of a cluster in the Reserve. The cluster consisted of a half-kilometer (500 m) base line with 200 meters square transect at either end (Figure 5). A distance of 100 meters therefore separated the two transect in the cluster. Each transect contained within its corners four sample plots of 50m x 50m to cover as much as possible, the variations observed within the reserve. Thus, a total of 8 sample plots in the study area (Figure 5) within a total area of 20,000m^2 (i.e., 2 ha) were established.

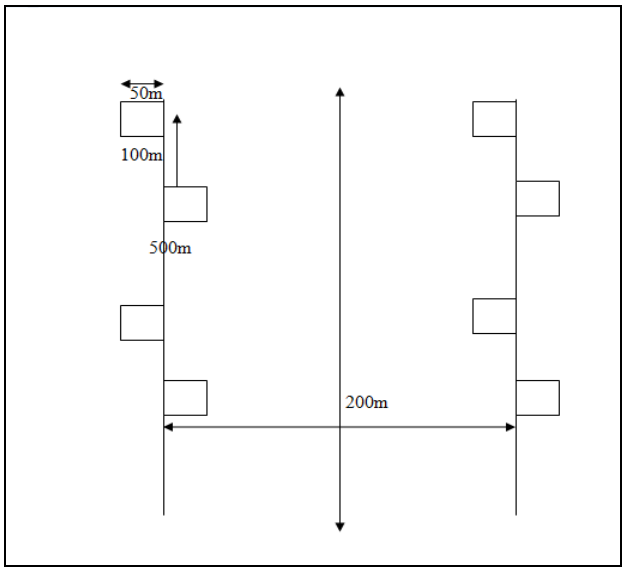

Figure 5: Plot Layout with Systematic Line Transects Sampling Technique.

Different species of trees, were identified and counted *in situ* where possible and by comparison with voucher specimen from the Forest Herbarium Ibadan (FHI), Forestry Research Institute of Nigeria, Ibadan. Flora species enumerated were categorized into families and frequency of the species were used to determine species composition.

Measurement of tree growth variables such as Diameter at Breast Height (DBH), Diameter at 0.5, 0.7, and 0.9, Crown Diameter, Height, and Density of Trees were taken.

Data collected were subjected to descriptive statistic. Volume of trees, basal area and species diversity indices (Dominance$_{-D}$ and Simpson $_{1-D}$) were determined.

The most difficult challenge experienced by the research team was the road network. The roads especially during the rainy season could be very slippery and impedes movement of vehicles. In

such cases, only AT Vehicles could move through such areas or take a motorcycle to get to the reserve.

RESULTS AND DISCUSSION

Species Richness

Tree species encountered in the study area were identified and counted in – situ where possible and by comparison with voucher specimen from the Forest Herbarium Ibadan (FHI), Forestry Research Institute of Nigeria, Ibadan. Flora species enumerated were categorized into families as shown in Table 1.

A total number of 205 individual trees and 13 tree species were counted and identified in the reserve. They were in the following order: *Tectonagrandis* (10), *Delonix regia (16), Acacia nilotica* (15), *Triplochytonscleroxylon* (14), *Adansoniadigitata* (13), *Senna siamea* (13), *Azadirachta indica* (12), *Tetrapleuratetraptera* (11), *Cedrela odorata* (10), *Terminaliasuperba* (9), *Spondiasmombin* (8), *Albizialebbeck* (7) *and Treculia Africana* (6),

Family Composition

A total of 6 families with more than one or two species were observed in the reserve. They were: Fabaceae (5), Malvaceae (4), and Meliaceae (4), Moraceae (1), Anacardiaceae (1) and Combretaceae families (I)with different trees species each (Table 1).

Table 1: Tree Species, Families, Number Encountered in Oko-Iroo Forest Reserve.

Tree species	Family	Frequency
Acacia nilotica	Fabaceae	15
Albizia lebbeck	Fabaceae	7
Senna siamea	Fabaceae	13
Azadirachta indica	Meliaceae	12
Cedrela odorata	Meliaceae	10
Triplochyton scleroxylon	Malvaceae	14
Tectona grandis	Lamiaceae	70
Adansonia digitate	Malvaceae	13
Delonix regia	Fabaceae	16
Treculia Africana	Moraceae	6
Tetrapleura tetraptera	Fabaceae	11
Spondiasmombin	Anacardiaceae	8
Terminalia superba	Combretaceae	9

Table 2: Basal Area and Volume Estimation in Oko-Iroo Forest Reserve.

Plots	Oko-iro Ba(m^2)	Vol(m^3)
1	8.35015.233	
2	8.406	18.311
3	10.341	22.144
4	13.250	24.038
5	7.432	11.554
6	9.685	18.592
7	12.367	23.989
8	11.428	22.437

Table 3: Biodiversity Indices and Tree Growth Variables.

Indices/Growth Variables	Oko-Iro
Taxa-s	13
Individuals	205
Family	7
Dominance-D	0.1015
Mean Height	13.97
Mean Basal area	2.09
Mean volume	13.18
Shannon – Weiner Index (H)	0.8241

Volume and Basal Area of Trees in the Reserve

Table 2 showed the average basal area and volume of the trees assessed in the study area. Plot 4 gave the highest basal area and volume with an average value of 13.25m^2 and 24.04m^3 respectively. This was followed closely by trees in plot 7 with an average basal area and volume of 12.37$m^2$and 23.99m^3respectively. The least basal area and volume were recorded for trees in plot 5 with an average value of 7.43$m^2$and 11.55m^3, respectively.

Diversity Indices

Table 3 showed biodiversity indices and tree growth variables. The Dominance -D and Shannon wiener index was 0.1015 and 0.8241 respectively. Low dominance index suggested secondary regrowth natural forest (Salami, *et al*., 2016). Also, the Dominance -D and Shannon wiener index showed that *Tectona grandis* was the most dominant species in the reserve. Shannon and Dominance index also indicated that teak dominance increases while diversity of woody species decreases.

The woody species found in the reserve were small indicating the extent of human activities in the study area. It was noticed that most of the area are cultivated with both annual and cash crops.

CONCLUSION

This study evaluated the tree species in Oko-Iroo forst reserve. Low numbers of individual trees, species and families observed is an indication of the extent of deforestation and over exploitation of the reserve. Also, low dominance and Shannon wiener index suggested secondary regrowth natural forest in the study area. This calls for an urgent resolution so as not to coerce the threatened tree into extinction. It is recommended that Government and Research Institution such as Forestry Research Institute of Nigeria (FRIN) should embark on regeneration of both exotic and indigenous woody species and encourage intensive monitoring within the Reserve.

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SUGGESTED CITATION

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