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ASSESSMENT OF TREE SPECIES COMPOSITION AND DIVERSITY IN GALILEE PRAYING GROUND, KOSOBO, OYO STATE

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ABSTRACT

Tree diversity has been recognized as an inevitable tool guiding biodiversity conservation, but disturbance regimes dominated by natural and anthropogenic factors alters the composition, diversity and structure of the forest. This research focused on the tree species composition and diversity in Christian praying ground (Galilee) Oyo, Oyo State with the view to providing the database necessary for their sustainable management. An extensive reconnaissance survey was carried out thereafter; a complete enumeration was used. Data were collected on the measurable Tree Growth Characteristics (TGC) of Tree height (TH) and Diameter at breast height (DBH). The Basal area and Tree Volume were calculated while Species Diversity was estimated using diversity indices of Shannon-Wiener and Simpson's Dominance. A total of 281 trees belonging to 13 species in 9 families were encountered. *Gmelina arborea* and *Azadirachta indica* had the highest frequency of 116 and 66 respectively. *Cedrella ordorata*, *Ficus experata Milicia excels* had one individual each. *Gmelina arborea* had the highest mean DBH of 37.84cm while *Albizia zygea* had the highest mean tree height of 16.5m. The calculated Shannon-Wiener index of 1.65 indicates a moderate species richness and low evenness among the species evident by the value of 0.40. The study concludes that the competition among species is moderate and the pattern of distribution of plant species in the study area is not similar. It is therefore recommended that biodiversity conservation effort in the area should be directed towards species diversity to improve richness and abundance. This can be achieved through appropriate policy strategy that will include enrichment planting particularly in the study area.

Keywords: Tree Species, indigenous, Basal area, Specie Diversity

Introduction

A large portion of the diversity of plants and small animals resides in human-influenced areas (Barrett & Barrett, 2001). There are diverse field of emotional, spiritual, intellectual, and practical activities at the interface of religion and ecology can be observed at sacred natural places such as churchyards, Muslim praying grounds, cemeteries, sacred graves and temples. Therefore, within sacred sites, trees became protected without being the object of protection, as these areas play such a huge role in identifying the tribal group associated with them, for genealogy and spirituality (Deil et al., 2005).

The importance of tree to man is so diverse that it is not only useful economically, environmentally and industrially but also spiritually, historically and aesthetically, for they sustain human life through direct and indirect gains by providing a wide range of products for survival and prosperity. Out of all the terrestrial ecosystems, tropical forest ecosystems are the most diverse (Parmentier *et al.,* 2007). Tropical regions throughout the globe are covered with 52% forests and the major 34 global biodiversity hotspots are

identified as being in tropical forests (Kacholi, 2014).

Diversity of trees is described as the total number, variety and variability of the trees in a particular ecosystem (Krebs, 1999). Biodiversity is the relationship between species and their pattern of richness (Young and Swiacki, 2006). This is evident by the varieties of species found in the ecosystem in question. If the tree composition in the habitat is reduced, biotic and abiotic components and finally metabolic of the habitat will change (Oladoye, 2014). The study of floristic composition and structure of tropical forest therefore becomes imperative in the face of the ever increasing threat to the forest ecosystem.

One of the main indicators of ecosystem function is plant community composition and species function (Chaturvedi *et al*., 2021). It is therefore essential to assess the diversity of plant of a given forested land because plant diversity is associated with the composition, structure, function and stability of such a plant communities and indicate the changes of an ecosystem which has a great implication in maintaining the productivity and function of such ecosystem.

Biological diversity has currently taken the center stage in the field of science as a result of the rate of exploitation of our natural resources. This is because a change in the diversity of plant population will result in changes in the diversity of all other organisms present within the ecosystem as well as ecosystem services that are enjoyed. Consequently, understanding vegetation composition, diversity of species and the structure of a forest is seen as an essential feature in assessing the sustainability of forests, species conservation, ecological significance and the development of management policies for forest ecosystems (Kacholi, 2014). Unfortunately, since their establishment, the praying ground has not been assessed for composition, structure and diversity. Thus, there had been no data on tree growth characteristics and diversity for rational decision making and sustainable management. Therefore, the study seeks to assess the species composition and diversity of Galilee praying ground in Kosobo, Oyo state, Nigeria with the view to providing the database necessary for their sustainable management.

Methodology

Study Area Description

Galilee is located in Kosobo; Oyo East Local Government Area, Oyo State, Nigeria (Figure 1) with the total area of One Hectare (6 Plots). It lies within Latitude 7°49' to 19.00"N and Longitude 3°57' to 4.69"E of the Greenwich meridian. The rainfall pattern is bimodal, with peaks around June and July to September to October. Mean annual rainfall is about 1190mm while the average temperature is 25.9°C (Adio *et al.,* 2011). The vegetation of the study area falls within the derived savanna part of the town, where man's impact on the forests has led to a considerable reduction of vegetation/plant species. The derived savanna ecological zone is the zone that evolved from the rain forest by human activities such as regular fire, deforestation, and farming (Adekiya *et al.*, 2018). It has an equatorial climate with dry and wet seasons and relatively high humidity. The dry season starts from November and last till March while the rainy season starts from April and ends in October. Average daily temperature in Oyo ranges between 25°C (77.0°F) and 35°C (95.0°F), almost throughout the year (https://en.wikivoyage.org/wiki/Oyo).

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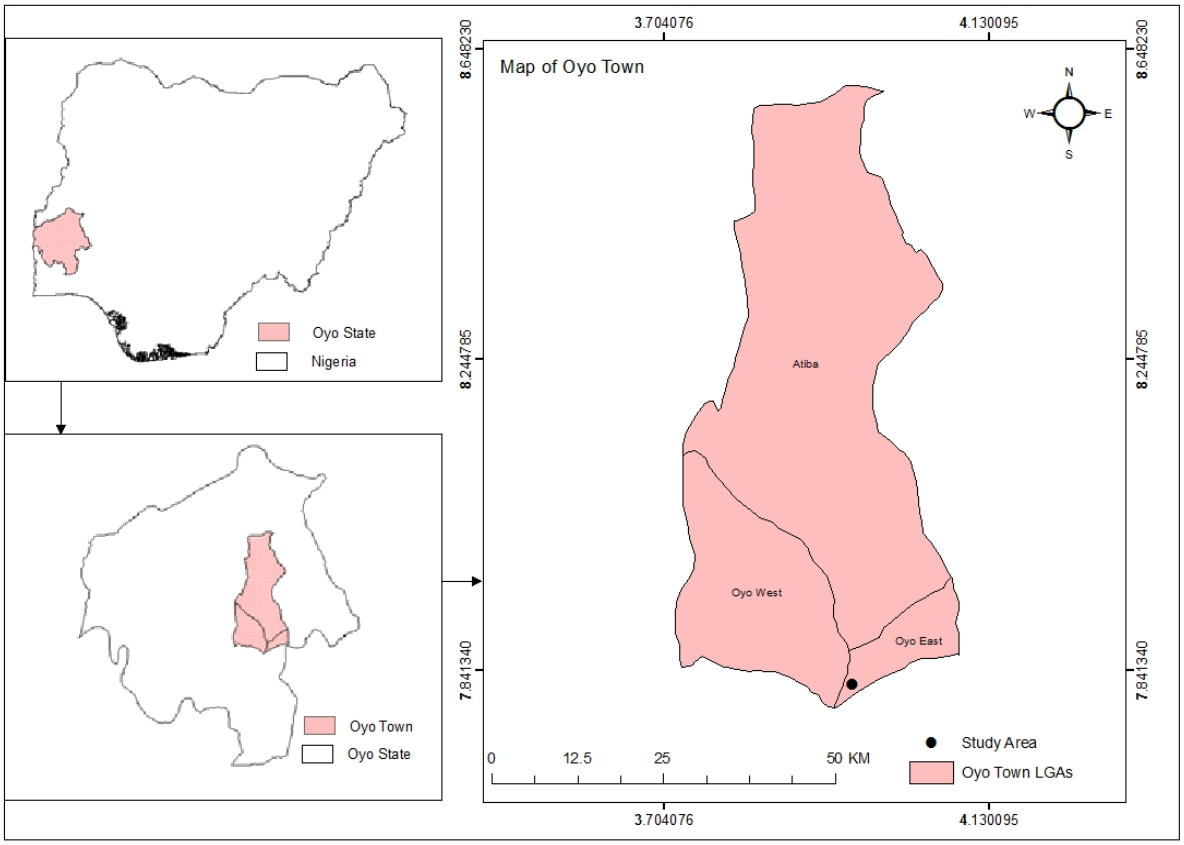

Figure 1: Map of the study area

Data collection

Total enumeration of all the stands was carried out using diameter tape and Haga altimeter. Data were collected on diameter at breast height (DBH) cm and Total height (m) of all the trees. Identification was done with the help of a taxonomist. Species which could not be identified on the field were taken to the FRIN herbarium, Ibadan for identification. Basal area and volume were computed. The data collected were analysed using descriptive statistics and Shannon – Wiener diversity index which was used to determine species diversity. The results were presented using tables and figures.

Basal Area Estimation

The basal areas of the trees in the plantation were calculated using this formula.

$$BA = \frac{\pi D^2}{4}$$ …….. Equation (1)

Where, BA = Basal Area (m^2), D = Diameter at breast height (cm), π = 3.142**Tree Volume Estimation**

The tree volume for each tree within the TSPs was estimated using Newton' equation

$$V = \frac{(g_b + 4g_m + g_u)L}{6}$$ …….. Equation (2)

Where V= Tree volume;
L= tree height/length;
gb, gm, gu=cross sectional area at the base, middle and at the top.

Species diversity

Species diversity was computed using Shannon – Wiener diversity index (Kent and Coker, 1992).

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$H' = -\sum_{i=1}^{s} Piln(Pi)$…… Equation (3)
H' = Species diversity index
S = Total number of species in the study area
Pi= Proportion of S made up of the it species
l= natural logarithm

$H = \frac{H'}{l}$…….. Equation (4)

E_H = equitability/evenness index
H = Shannon diversity index

Result and Discussion

Tree Growth Characteristics

A total of 281 trees belonging to 13 species and 9 families were encountered in the Christian praying ground (Galilee) in Oyo town, Oyo State.

Table 1 showed that *Gmelina arborea* had the highest frequency with 116 individuals. This is followed by *Azadirachta indica* having 66 individuals. *Cedrella ordorata, Ficus capensis, Hymenocardia acida,* and *Milicia excelsa have* one individual. *Albizia zygea* had the highest of 16.5 m and *Ficuscapensis* having minimum height of 4.2 m. Gmelinaarborea had the highest DBH with a value of 37.84 cm and *Anthocleista djalonensis* had the least with value of 7.16 cm. *Mangifera indica* has the maximum basal area of 0.13 m^2 with *Anthocleista djalonensis* has the least of 0.004 m^2. *Mangifera indica* has the highest volume of 1.35 m^3 while *Ficus capensis* has the least volume of 0.03 m^3. The estimated F-values of 11.11, 110.88, 32.67 and 3263.64 for mean height, DBH, BA and tree volume respectively were significant at 1% level of probability. The implication of this is that the tree species found in the area were not the same in terms of the growth parameters. However, the presence of different tree species in the area can make the area to serve as reservoir for both indigenous and exotic species thereby helping in reducing the climate change mitigation in the area. Gmelina arborea and *Azadirachta indica* are tree species with higher population and had comparatively higher frequency, this is due to human interference through selective utilization and conservation of such species and ecological adaptability of the same tree species (Ahn, 1970).

Table 1: Growth characteristics of trees in the study area

S/N	Freq.	Species	Family	Mean Height	Mean DBH	Mean B.A	Mean Vol.
1	2	*Albizia zygea*	Fabaceae	16.5	31.70	0.07	1.16
2	23	*Anacardium occidentale*	Anacardiaceae	7.46	25.94	0.06	0.44
3	2	*Anthocleista djalonensis*	Loganiaceae	9.75	7.16	0.004	0.04
4	66	*Azadirachta indica*	Meliaceae	9.55	31.23	0.09	0.85
5	1	*Cedrella ordorata*	Meliaceae	7.8	21.01	0.03	0.27
6	2	*Elaeis guineensis*	Arecaceae	6.65	35.53	0.11	0.78
7	1	*Ficus capensis*	Moraceae	4.2	9.71	0.01	0.03
8	116	*Gmelina arborea*	Lamiaceae	11.88	37.84	0.11	1.67
9	1	*Hymenocardia acida*	Phyllanthaceae	6.4	13.72	0.01	0.09
10	17	*Mangifera indica*	Anacardiaceae	10	35.88	0.13	1.58
11	1	*Milicia excels*	Moraceae	14.9	25.94	0.05	0.79
12	40	*Tectona grandis*	Lamiaceae	11.11	32.65	0.10	1.37

13	9	*Terminalia schimperiana*	Combretaceae	7.5	26.55	0.06	0.57
The Average values				9.52	25.76	0.06	0.74
F-value				11.11*	110.88*	32.67*	3263.6*
Total 281							

*= P<0.05

Tree diversity and abundance

The diversity indices were computed to show the level of diversity and abundance of species in study area. The typical value of Shannon-Weiner ranges from 1.5 to 3.5 in most ecological studies. It rarely exceeds 4 (Magurran,2004). The implication of this is that the area could be described as moderate diversity in terms of tree plant species abundance and distribution

Result in Table 2 shows Shannon- Weiner index value of 1.65. This is slightly higher than the minimum typical range of 1.5. Consequently, the species diversity of the study area can be adjudged moderate. Species diversity affects the dominance as well as the evenness. As species richness increases, evenness is affected. The value of species dominance ranges from 0-1. The value of 1 which is the highest indicates the dominance of an area by one species. Therefore, a dominance value of 0.26 indicates no dominance by any individual species. Species evenness is a reflection of close in number of each species in an environment is. Subsequently, an evenness of 0.40 implies that no species dominate the area. This means that relative abundance varies within species. This corroborates the finding of Salami and Akinyele (2018) on floristic composition structure and diversity in Omo forest reserve. The study area had a Shannon Weiner index (H') of 3.04. This value obtained in the study area is in the range of values reported for tropical forest ecosystem (Akindele, 2013 and Onyewkwelu *et al*., 2010).

Table 2: Diversity indices of the study area

Diversity indices	Value
Species	13
Individuals	281
Dominance_D	0.26
Simpson_1-D	0.74
Shannon_H	1.65
Evenness_e^H/S	0.40

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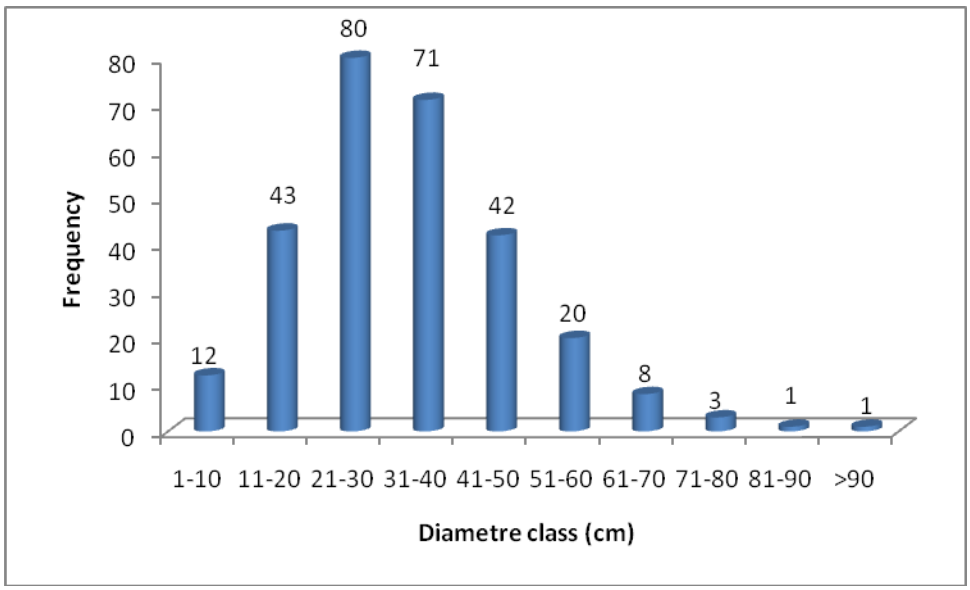

Figure 2: Diameter class distribution of trees in the study area

The result in figure 2 showed that the trees in the diameter class of 21-30 cm have the highest value with 80 individuals. This closely followed by the diameter class of 31-40 cm with 71

Individuals while the least was found in the diameter classes of 81-90 and 90with 1 individual respectively. The high number of trees within the diameter class of less than 50 cm (21- 30 cm and 31-40 cm) indicates absence of large trees and clearly shows high disturbance and degradation (Olajuyigbe *et al.,* 2018). This corroborates the finding of Olajuyigbe and Jeminiwa (2018) who opined that more trees in the lower diameter class indicate a degraded forest in the process of recovery. This is however a good indication of good regeneration ability and a good forest health (Olajuyigbe and Jeminiwa, 2018).

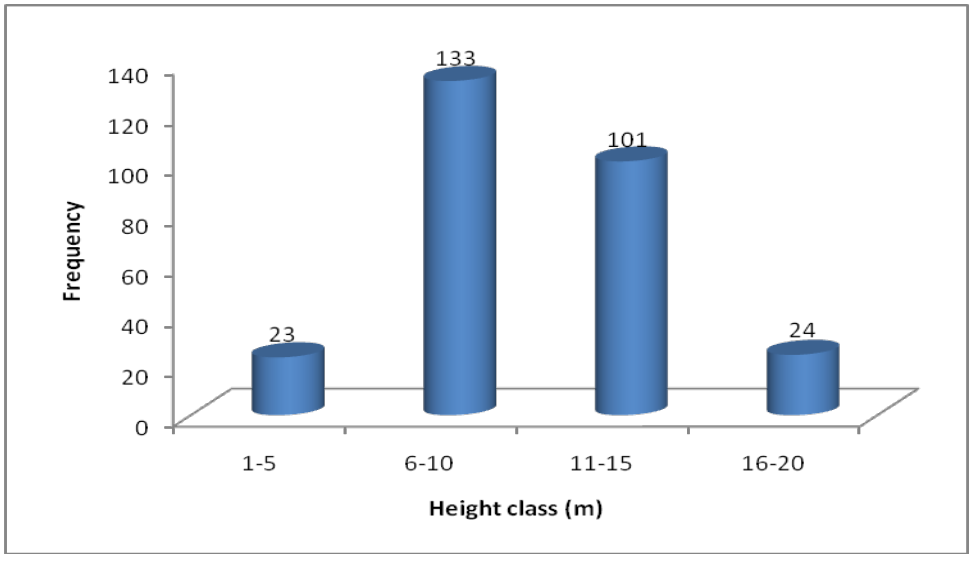

Figure 3: Height class distribution of trees in the study area

The result presented in figure 3 showed that the trees in the height class of 6-10 m have the highest value of 133 individuals. This is followed by the height class of 11- 15 m with 101 individuals while the least was found in the diameter classes of 1-5 m with 23 individuals. Based on Koch *et al*. (2009) classification of tree height class, a large percentage of the trees fall within the sapling (< 3 >10 m) and pole (< 10 > 15 m) class. None of the trees fell within the category of mature tree (<15 > 25 m) height or old trees with height class of > 25 m. Consequently, all the trees are emergent tree which is typical of secondary re-growth (Addo-Forfjour *et al.*, 2009; Olajuyigbe *et al.,* 2018). The estimated F-value for the average height across different tree species was 11.11. This value was statistically significant at 1% level of probability which implies that there is significant difference in the height of different tree species found in the study area

Conclusion

The outcome from the research could be useful for planning, monitoring and sustaining the forest resources and also helps to prevent loss of biodiversity and mitigation from climate change. A moderate diversity index with low evenness was observed. The low diameter class observed in the study area is indicative of a good forest health with good vigour and regenerative potential. Hence, the study recommends public enlightenment through relevant agencies associated with the mandate of biodiversity and environmental conservation on the need to conserve nature by protecting trees. Also, there is need for intervention by relevant stakeholders and other non-governmental organisations through enrichment planting.

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