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DIVERSITY AND COMPOSITION OF TREE SPECIES IN THE UNIVERSITY OF MAIDUGURI CAMPUS

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ABSTRACT

The research was carried out to determine the diversity of tree species in University of Maiduguri Campus. A stratified sampling technique was adopted for the study; the areas inventoried were divided into five categories namely; Administrative Area (ADA), Academic Area (ACA), Commercial Area (CMA), Recreational Area (RCA), and Residential Area (RDA). A grid line of 140 plots were drawn on the map with 25 % sampling intensity making 35 plots that were randomly selected. The plot sample adopted was circular plots of 12 m radius. One hundred and eighty-nine (189) trees were found in the campus, where sixty-two (62) were in the ADA, thirteen (13) in ADA, seventeen (17) in CMA, thirty-nine (39) in RCA, and fifty-seven (57) in RDA respectively. Azadirachta indica (104) and Eucalyptus camaldulensis (35) had the highest number of stand representation in the ACA, ADA, CMA, RCA and RDA respectively. More over Adansonia digitata (1), Sizygium cumini (1), Mangifera indica (1) and Zizipus mauritiana (2) had the lowest number of tree species in the campus. The diversity of tree species and its composition in University of Maiduguri campus revealed that composition and diversity of tree species in the campus are low. Azadirachta indica and Eucalyptus camaldulensis were the most abundant tree species in the campus, while Faidherbia albida had the highest basal area measurement. It is therefore concluded that, the diversity of tree species in the University of Maiduguri is generally low.

Keywords: tree species, diversity, composition, distribution, vegetation, campus

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INTRODUCTION

The changes in land use have been known to decrease species richness and diversity globally. Species richness ensures ecosystem sustainability and services such as the prevention of soil erosion, reduction in soil and nutrient loss, and maintenance of hydrological cycles (Hooper *et al.*, 2005; Spiegelberger et *al.*, 2006). Globally, land use change is one of the foremost and primary causes of rapid vegetation modification and threats to biodiversity loss and extinction. Land use change is a generic term that describes the continuous modification of the earth surface by humans to satisfy their insatiable quests for living (Iwara, 2012). However, since change in land use reduces ecosystem complexity and diversity by the replacement of more complex natural vegetation with less complex agro-ecosystems with fewer species, changes in ecosystem complexity could be measured by assessing the density and

diversities of tree/shrub species (Hooper *et al.*, 2005).

It is worthy of note to understand that land use change is one of the major determinants of vulnerability within the human-environment system. Besides the direct impact on the spatial extent of ecosystems through deforestation, fragmentation and land-use change modifies the spatial configuration of different land-use types (Verburg *et al.*, 2004). Composition is the floristic assemblage of plant species that characterize the vegetation (Iwara, 2012). Long-term management of forest ecosystems requires a detailed understanding of both the resources contained within the ecosystem as well as forest dynamic processes over time. Long-term monitoring is generally viewed as an appropriate way to capture both the static features of natural ecosystems as well as the dynamic processes within those ecosystems. Monitoring plots are important for an understanding of the ecological processes that take place in a forest. Basic measures of tree diversity, forest structure, tree growth, and forest turnover are important parameters to monitor ecological processes in a dynamic environment. Moreover, the impacts of human activity, conservation, and even invasive species can be addressed through a set of plots. Species composition refers to the contribution of each plant species to the vegetation. It is regarded as an important indicator of ecological and management processes at a site. Savannas occupy sixty percent vegetation cover of sub-Saharan Africa and they are typified by the coexistence of woody plants and grasses (Sankaran *et al.*, 2005).

Decline in biodiversity and composition in University of Maiduguri campus is already pronounced in many areas of the campus, especially where natural vegetation's are converted into structures, roads and other form of land use. this have cause seizure to supply of wildlife and other benefactors.

MATERIALS AND METHODS

Study Area

The study was carried out in the University of Maiduguri, located in Maiduguri along Bama Road. Borno State, North-East Nigeria. The University is located between latitude 11°52' N, and longitude 13°14' E. The University shares borders with Mairi, 202 Housing estate, 303 Housing estate and Dalori. The area is characterized by two distinct seasons namely; wet and dry seasons. The wet season occurs between April and October while and dry season subsequently. Dry season is said to be more pronounced over the wet season within this area (with at least four months of rainfall, it attains its peak between June and August). The vegetation of the University is an open savannah, characterized by predominantly fewer and dispersed trees, shrubs and predominantly covered by grasses and thus forest formations (Weether.com).

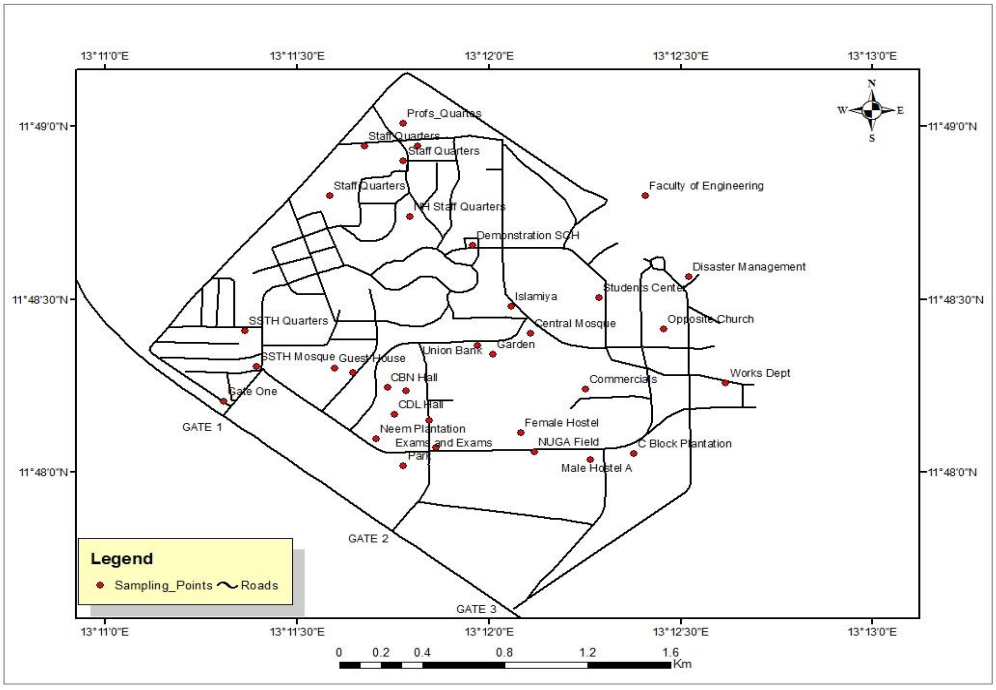

Figure 1: University of Maiduguri Map showing reference point

Sampling Procedure and Data Collection

A stratified sampling technique was adopted for the study; the areas inventoried were divided into five categories namely; Administrative Area (ADA), Academic Area (ACA), Commercial Area (CMA), Recreational Area (RCA), and Residential Area (RDA). A grid line of 140 plots were drawn on the map with 25 % sampling intensity given 35 plots randomly selected. The plot sample adopted was circular plots of 12 m radius using Global Positioning System by standing at the reference point on each of the plot.

From each sample plot a 12 m radius were taken and GPS recorded. All trees that fell within the plots are measured. The tree heights were measured with teleometer while the diameters were measured with tape.

Height Measurement (m) -The height of the trees was measured using teleometer by stretching the scale to the tip of the tree. Some of the trees were found to be taller than the teleometer. The teleometer was lifted up to reach the tip of the tree and the height of the teleometer were added to the height taken from the ground to the point where the teleometer has been lifted.

Diameter at Breast Height (Dbh)- The girth tape was used to measure the Dbh by taken the tape round the tree stem at 1.3 meter. The diameter was taken and recorded in meters.

$$\text{Basal area} = \frac{\pi D^2}{4} \quad \ldots\ldots\ldots\ldots [1]$$

Where π = is 3.142

r^2 =radius in n^{th} plot

$$P_v = \sum(\pi r^2_n h_n)$$

Where π= Constant

r^2 =radius in n^{th} plot

h_n= Mean height in n^{th} plot

D = Square of the tree diameter

Shannon- Wiener Diversity Index (H) accounts for how the species are distributed: Staudhammer and LeMay, (2001)

$$H = -\sum_{i=1}^{s} pi\ In\ pi \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [2]$$

H= Shannon – Weiner Index (summation of Pi × In Pi × (-1), Pi = the proportion of species in the population (Pi = $\frac{ni}{N}$), Where ni = number of individuals of a specie, N= the

total number of individuals, In Pi = the logarithmic proportion of the species.

Simpson`s Index

$D = \frac{\sum ni\ (ni-1)}{N(N-1)}$ …… [3]

Where:

D = Simpson`s index

n_i = number of individual species i

N = total number of all tree species in the entire community

Data Analysis

Data were analyzed using Analysis of Variance (ANOVA) on basal area, tree and volume through descriptive statistic such as frequency, tables and percentage.

Species Diversity of Trees in the Inventoried Areas

Eleven (11) species were widely distributed within the campus, where *Azadirachta indica* (104), *Eucalyptus cameldulensis* (35) experienced the highest spread or distribution of tree species diversity respectively among other tree species in the University of Maiduguri (Table 1).

Mean Diameter of Individual Tress Species

The mean volume of the individual tress species in the inventoried areas showed that; *Faidherbia albida (*77.79) and *Adansonia digitata* (34.84) had appreciable highest volume of tree diameter. While *Syzygium cumini* (0.88) and *Zizipus mauritiana* (0.26) (Table 2).

RESULTS

Table 1: Mean distribution of tree species in the inventoried areas of the University of Maiduguri Campus

Species	ACA	ADA	CMA	RCA	RDA	Total
Azadirachta indica	36	8	9	20	31	104
Adansonia digitata	0	0	0	0	1	1
Balanites aegypytiaca	3	0	0	1	0	4
Cassia siemia	2	0	4	2	0	8
Acacia sieberiana	2	0	0	1	3	6
Eucalyptus cameldulensis	9	5	0	12	9	35
Faidherbia albida	1	0	4	3	6	14
Khaya senegalensis	6	0	0	0	7	13
Mangifera indica	0	0	0	0	1	1
Syzygium cumini	1	0	0	0	0	1
Zizipus mauritiana	2	0	0	0	0	2

Table 2: Mean diameter of trees in different strata in the University Maiduguri campus

Species	ACA	ADA	CMA	RCA	RDA	Total
Azadirachta indica	7.34	0.28	10.89	2.72	8.20	29.43
Adansonia digitata	0	0	0	0	34.85	34.85
Balanites aegypytiaca	16.12	0	0	0.67	0	16.79
Cassia siemia	1.34	0	9.05	5.48	0	15.87
Acacia sieberiana	0.54	0	3.53	4.45	8.52	2.64
Eucalyptus cameldulensis	2.64	4.11	0	6.18	8.65	21.58
Faidherbia albida	24.18	0	20.01	8.14	25.46	77.79
Khaya senegalensis	1.58	0	0	0	12.68	14.26
Mangifera indica	0	0	0	0	11.02	11.02
Syzygium cumini	0.88	0	0	0	0	0.88
Zizipus mauritiana	0.26	0	0	0	0	0.26

Tree Species Diversity in the Study Area

A. indica had the highest frequency of trees (104) with Shannon-Weiner index (-0.14275) and Simpson's index (0.301), while, next to it was *E. camaldulensis* that had frequency of trees (35) with Shannon-Weiner index (-0.13563) and Simpson's index 0.033) respectively (Table 3).

Tree Basal Area Distribution in the Study Area

F. albida had the heighest basal area of 30.3 m^3 and followed by *E. camaldulensis* with 27 m^3 among other tree species in the University (Figure 1).

Tree Basal Area Distribution Among the Strata

Academic Area (ACA) was observed to have the highest (51 %) followed by Administrative Area (ADA) (47 %) and the Residential Area (RDA) had the least percentage (43 %) among the surveyed areas (Figure 2).

Tree Basal Area Distribution Among the Strata

Academic Area (ACA) was observed to have the highest (51 %) followed by Administrative Area (ADA) (47 %) and the Residential Area (RDA) had the least percentage (43 %) among the surveyed areas (Figure 2).

Table 3: Species diversity on the University of Maiduguri campus

S/No.	Species Name	Family Name	Frequency	Shannon index (H)	Simpson's index (D)
1	*Azadirachta indica*	***Meliaceae***	104	-0.14275	0.301
2	*Adansonia digitata*	*Malvaceae*	1	-0.01204	0.000
3	*Balanites aegypytiaca*	*Balanitaceae*	4	-0.03544	0.000
4	*Senna siamea*	*Fabaceae*	8	-0.05813	0.002
5	*Acacia sieberiana*	*Leguminoceae*	6	-0.04757	0.001
6	*Eucalyptus camaldulensis*	*Myrtaceae*	35	-0.13563	0.033
7	*Faidherbia albida*	*Fabaceae*	14	-0.08373	0.005
8	*Khaya senegalensis*	*Meliaceae*	13	-0.07996	0.004
9	*Mangifera indica*	*Anacardiaceae*	1	-0.01204	0.000
10	*Syzygium cumini*	*Myrtaceae*	1	-0.01204	0.000
11	*Zizipus mauritiana*	*Rhamnaceae*	2	-0.0209	0.000
	∑		189	0.002304	0.346

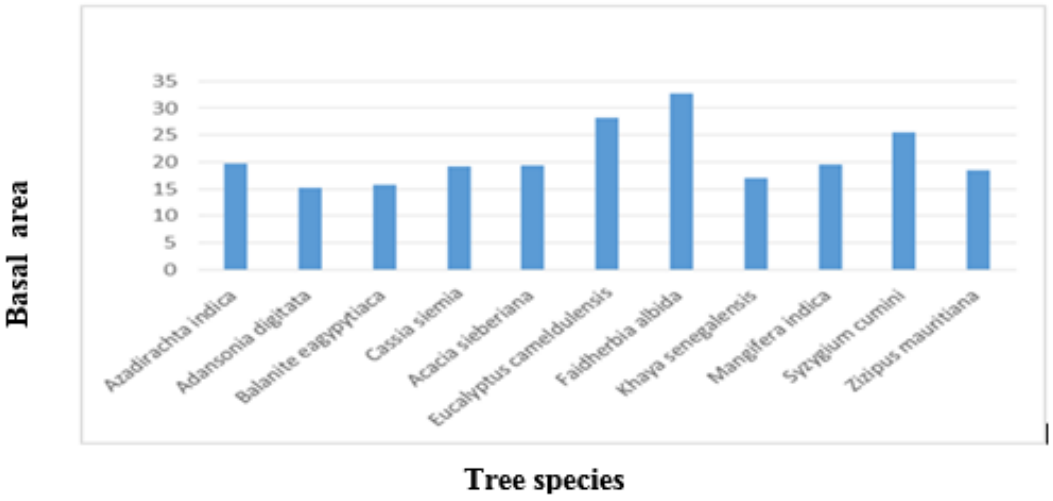

Figure 1: Basal area variation among individual tree species

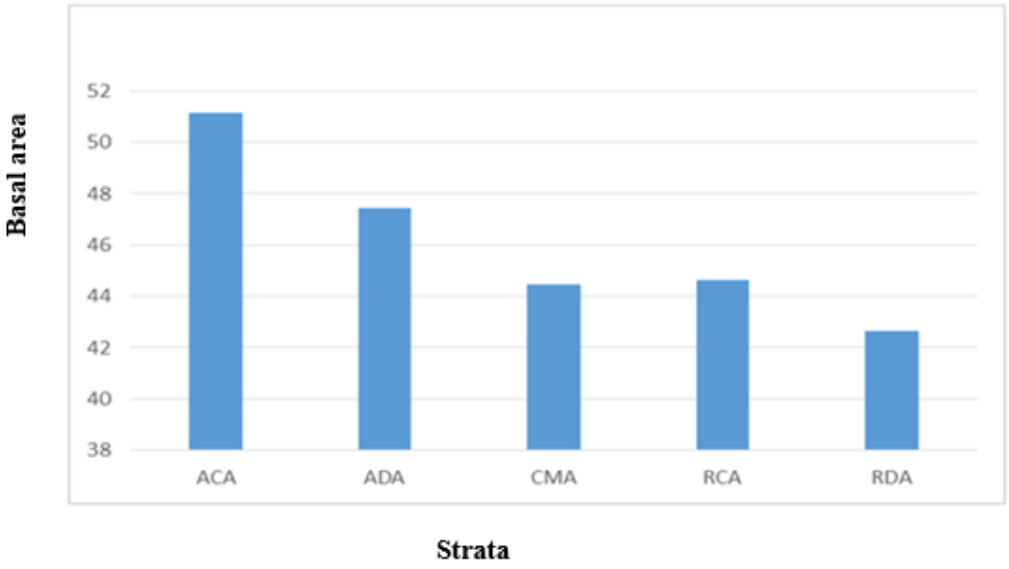

Figure 2: Tree basal area distribution

DISCUSSION

The species abundance estimated from the five (5) plots studied revealed the diversity status of the vegetation of University of Maiduguri Campus. The existence of some cultivated plant species such as *M. indica* proved that the vegetation had experienced human activities in the past. Over exploitation of forest ecosystem results in the decimation of tree species as also pointed by (Iroko *et al.*, 2008). However, despite the effect of this human activities, the overall abundance of species in the campus indicates growth of less appreciable number of species with an exception of a few numbers of individual tree species which are a bit abundant (e.g., *A. indica, E. cameldulensis*). *F. albida* and *E. cameldulensis* had almost appreciable basal areas of 30.3 m^3 and 27 m^3 respectively among others due to having at least measurable bole to reckon with. Generally, Simpson index ranges from 0 to 1. Mature and stable communities have high diversity value (0.6 to 0.9), while the community under stress conditions, exhibiting low diversity, usually show close to zero value (Dash, 2003). Simpson diversity index is always higher where the community is dominated by a smaller number of species and when the dominance is shared by large number of species (Whittaker, 1965) in this study Simpson was (0.301). The lower diversity associated with University of Maiduguri Campus as ascribed by Shannon, and Simpson index could be attributed to lesser number of species which is due to road construction, emerging departments and administrative buildings. A low Shannon-Weiner index (0.002304) generally suggests a site with species and a few dominant species, while, a low Shimpson's index value (0.346) also suggests considerably distribution of fewer tree species across the study area. The low distribution of trees in terms of their diversity and composition also fell in line with the findings of Ikyaagba, (2008) and Maohuama, (2006) who said that human activities have greater influence on tree species distribution and composition. Human being through various developmental activities have rendered valuable economic trees endangered in the study area. Meanwhile, these have equally resulted to decrease in species diversity and richness (Spiegelberger *et al.*, 2006).

CONCLUSION

The diversity and composition of tree species composition in University of Maiduguri were very few with a total of eleven (11) enumerated tree species. *A. indica* and *Eucalyptus camaldulensis* are the most abundant tree species in the campus, and *Faidherbia albida* is the highest in terms of basal area. However,

Azadirachta indica and E. cameldulensis were the leading tress in terms of diversity and composition in the University of Maiduguri Campus. *F. albida* was also considered as the only with highest diameter in terms of volume in the area.

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Recommendation

The alteration of the floristic composition of the University campus has affected the diversity richness and distribution of the species; therefore, any enrichment of planting within the University should take all of broad-spectrum planting.

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