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ANALYSIS OF COMPOSITION AND DIVERSITY OF TREE SPECIES IN TARABA STATE UNIVERSITY (TSU) MAIN CAMPUS JALINGO, TARABA STATE, NIGERIA.

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Abstract
Trees are very important component of the ecosystem providing some basic needs of life that include food, fuel, wood, soil fertility and conservation. The study therefore was designed to assess the composition and diversity of tree species in Taraba State University (TSU) Main campus ATC, Jalingo. The University campus was divided into uneven plots numbered A, B, C, and D based on the three (3) roads that traverse the school, and tree species within each plot was enumerated as appropriate. Shannon-Weiner Diversity Index was used to determine the Diversity and Evenness of the species. The results revealed a diverse composition of tree species with the family Lamiaceae having the highest number of stands (n=213, 33.07%) while Rubiaceae recorded the least (n=1, 0.16%). *Gmelina arborea* had the highest abundance (n=170, 26.4%) while *Burkea africana* and *Nuclea latifolia* recorded the least abundance (n=1, 0.1%). Plot D had the highest Diversity Index (2.44) while plot C recorded the least (1.86). The highest Evenness was observed in plot A (0.47) while the least was recorded in plot C (0.34). It was then concluded that the difference in composition of species and diversity of plots may be an index of disturbances that could lead to death of some species. Hence, conservation practice is needed to preserve the tree species from further destruction and demise.
Keywords: Analysis, Composition, Diversity, Tree species, Taraba State University.

Introduction

Nigeria possesses one of the most endowed vegetations in Africa, because almost every vegetation type existing in other African countries are widely distributed in the different geopolitical zones of the country, containing about 7895 different species of plant making it one of the most richest country in the continent in terms of biodiversity (Adeyemi and Ogundipe, 2012; Adewuyi, 2012; Barau *et al*., 2015).

Vegetation as a resource provide some basic needs of life such as food, fuel, wood, land conservation, soil fertility and playing a vital role in human development. In fact, it is believed that vegetation forms the basis on which life depends and as such man cannot effectively survive without vegetation (Pelemo *et al*., 2011).

However, over the past years, the land area identified as forest with their precious plant resource have been decreasing steadily due to many anthropogenic activities that include industrial and social development which competes for the same space of land in which the forest stands. These habitats are under threat from advancing civilization and other unsustainable human activities due to poor conservation attitudes of the populace resulting in inevitable loss of biodiversity (International Union for Conservation of Nature, 2010; Alamu and Agbaje, 2011).

Every year about 6.1 million hectares of forest land is being destroyed globally, which if maintained at the present rate, could completely clear the moist forest in 170 years (Husain, 1989; Omiyele, 2001). Many developing countries like Nigeria are suffering from serious environmental degradation primarily due to the rapid growth in population which did not only brings about gross encroachment and damage to natural forest, wildlife, land, water and even air but has also brought unacceptable quality of life condition in the environment (Harvey, 1998). The high rate at which destruction of plant species occurs is aggravated by the conversion of forest lands into agricultural fields, collection of non-timber forest products (NTFPs) and indiscriminate forest fire, road construction, technological advancement, industrialization and urbanization, extraction of matured trees and collection of fuel wood. One or a combination of these actions can threaten or encourage

extinction of some aspect or entirety of plant biodiversity which in turn poses a threat to the sustainable conservation of biodiversity (Mogaka, 2002).

Nigeria loses about 5.2% of their forest annually basically which is as a result of anthropogenic activities contributing to erosion, flooding, loss of soil nutrients, desertification, poor agricultural produce, global warming, climate variability and climate change (Omiyele, 2001; Audu, 2013). Infrastructural development that includes road construction, building of houses and learning facilities has all been recognized as important ingredients exacerbating deforestation (Figure 1).

Figure 1: Clearing of trees for construction purposes (Field Sourced, 2016)

Hence, the need to assess composition and species diversity of trees in TSU main campus, Jalingo, so as to provide a baseline information for conservation purposes.

Materials and Methods

Study Area:

This study was conducted within Taraba State University (TSU) main campus, located in ATC Jalingo along the Jalingo-Sunkani road between latitude 8° 53′ 48.15″ and longitude 11° 18′ 54.34″. The University was established in 2008 with the sole aim of boosting the man power resources of the state by the state Government. Presently, the University has four operational faculties (Science, Agriculture, Education and Arts and Social Sciences), while two additional faculties of Engineering and Medicine are currently in the pipeline almost ready for operation. The university is one of the fastest growing State Universities in the country both in terms of population and infrastructural development. Currently, the University boasts of about 35,000 students across all faculties in different programs that include Degree program, Sandwich Program, Diploma program and Post-graduate program (Personal Communication, 2016).

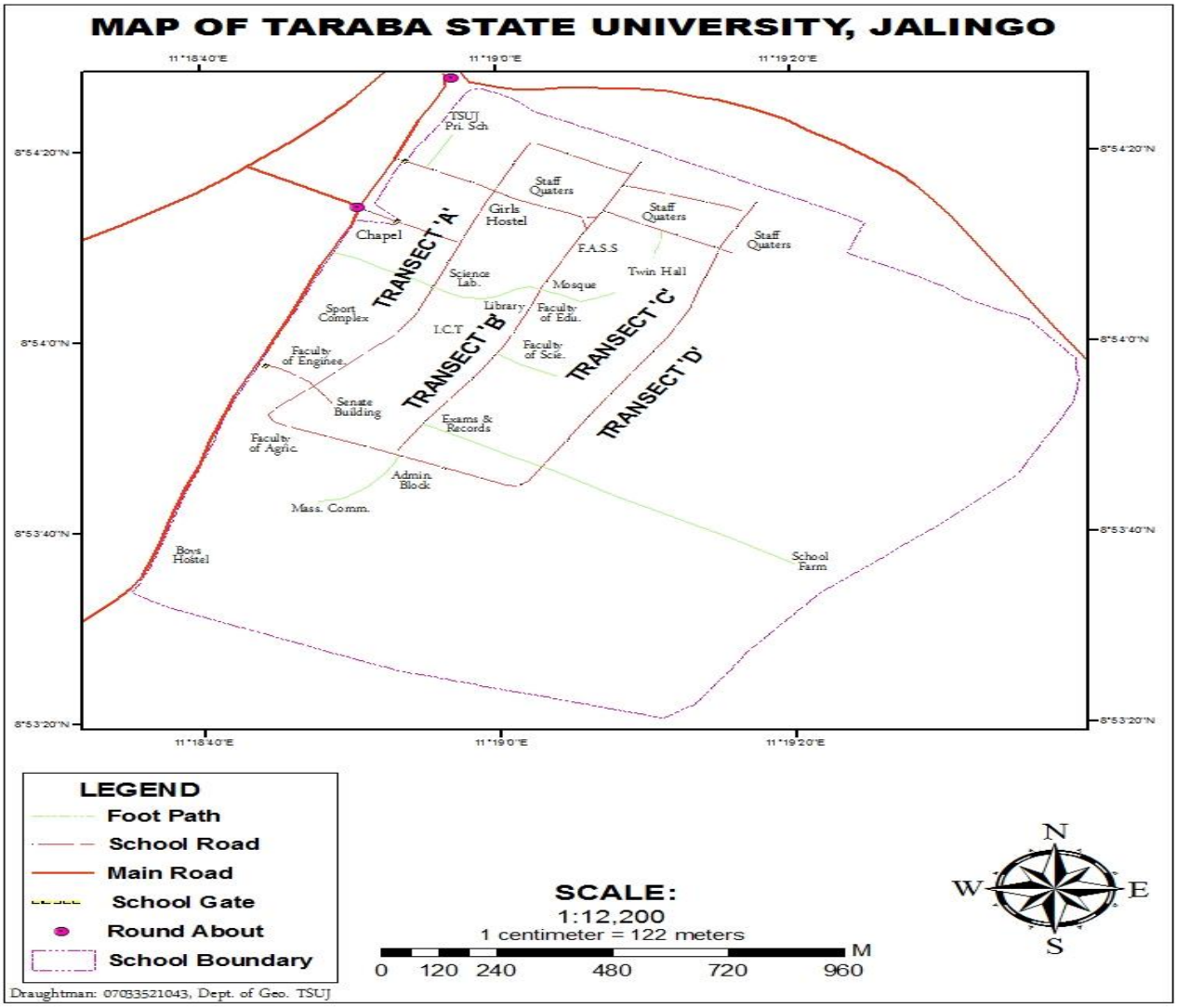

Figure 2: Map of the Study Area (Field Sourced, 2016)

Audu (2013) described the city of Jalingo within which the University is located as the administrative headquarters of Taraba State Government with climatic conditions typical of the tropics having rainy and dry seasons. The rainy season starts from May – October while the dry season commences from November – April. It has an annual mean rainfall of 1250 mm and temperature of 30°C – 40°C.

Sampling Procedures

The university was divided using four transects excluding the residential area. The Transect were taken based on the tarred roads that run through the school and demarcated into plots A, B, C and D, from where tree species were identified and enumerated using the methods of Nodza *et al*. (2014).

Data Analysis

Species diversity was calculated using the Shannon-Weiner (H′) diversity index as proposed by Shannon (1948), which was chosen because of its ability of providing both estimate in terms of abundance and evenness and does not favor some species over others as all species are counted according to frequencies as follows;

$$H' = -\sum pi \ln pi \quad - \quad - \quad - \quad i$$

Where i is the proportion of the plant species relative to the total number of species (pi) multiply by the natural logarithm of this proportion (ln pi) and the final product multiply by -1.

$$N = \sum n \quad - \quad - \quad - \quad ii$$

Where, n is the number of species in a community, while species evenness was assessed by the Shannon's equitability index (H'E), calculated as;

$$H'E = H'/H_{max} \quad - \quad - \quad - \quad iii$$

Where H_{max} is defined as lnS and S is species richness or total number of species

Results and Discussion

As presented in Table 1 below which shows the overall occurrence of tree species in TSU main campus, plot D had the highest number of species (22), followed by plots C, B and A with species number of 13, 10 and 9 respectively. Plot C had the highest number of stands (248) followed by plot D (208), plot B (106) while the least number of stands was recorded in plot A (82).

Table 1: Tree Species Occurrence in Taraba State University (Main Campus) ATC, Jalingo.

S/No.	Tree Species	Plots			
		A	**B**	**C**	**D**
1.	*Acacia seyal*	-	-	1	3
2.	*Adansonia digitata*	-	1	1	10
3.	*Afzelia africana*	-	-	-	5
4.	*Azadirachta indica*	8	12	62	10
5.	*Borassus aethiopum*	-	4	-	5
6.	*Burkea africana*	-	-	-	1
7.	*Cassia semen*	5	11	30	10
8.	*Citrus species*	-	-	-	6
9.	*Daniellia oliveri*	1	-	-	6
10.	*Delonix regia*	7	20	23	8
11.	*Eucalyptus camaldulensis*	10	15	35	10
12.	*Ficus species*	-	-	-	10
13.	*Gmelina arborea*	10	20	60	80
14.	*Mangifera indica*	-	-	3	7
15.	*Newbouldia laevis*	5	12	28	3
16.	*Nuclea latifolia*	-	-	1	-
17.	*Parkia biglobosa*	-	-	-	5
18.	*Piliostigma thonningii*	-	-	1	2
19.	*Prosopis africana*	-	-	-	3
20.	*Sterculia setigera*	-	-	2	10
21.	*Tamarindus indica*	-	1	1	2
22.	*Tectona grandis*	33	10	-	-
23.	*Terminalia superba*	-	-	-	2
24.	*Vitellaria paradoxa*	3	-	-	-
25.	*Ximenia Americana*	-	-	-	10
	Total	**82**	**106**	**248**	**208**

Table 2 showed the total composition of tree species in TSU main campus which comprises of twenty five (25) species spread over fifteen (15) families. *Gmelina arborea* had the highest abundance (n=170, 24.6%), this was followed by *Azadirachta indica*(n=92, 14.3%), *Eucalyptus camaldulensis* (n=70, 10.8%), *Delonix regia* (n=58, 9.0%), *Cassia semen* (n=56, 8.6%), *Newbouldia laevis* (n=48, 7.5%), *Tectona grandis* (n=43, 6.6%), *Adansonia digitata* and *Sterculeria setigera* (n=12, 1.9% each), *Ficus sp*, *Mangifera indica* and *Ximenia americana* (n=10, 1.6% each), *Borassus aethiopum* (n=9, 1.4%), *Daniellia oliveri* (n=7, 1.0%), *Citrus sp* (n=6, 0.9%), *Afzelia africana* and *Parkia biglobosa*(n=5, 0.8%), *Acacia seyal* and *Tamarindus indica*(n=4, 0.6%), *Piliostigma thonningii*, *Prosopis Africana* and *Vitellaria paradoxa* (n=3, 0.5%), *Terminalia superba* (n=2, 0.3%) and the least recorded was *Burkea Africana* and *Nuclea latifolia* (n=1, 0.2%).

Table 2: Species Abundance, Relative Density and Relative Abundance of Trees in Taraba State University (Main Campus) ATC, Jalingo.

S/No.	Tree Species	Family	Frequency	RA	Percentage Occurrence
1	*Acacia seyal*	Fabaceae	4	0.006	0.6
2.	*Adansonia digitata*	Malvaceae	12	0.019	1.9
3.	*Afzelia africana*	Fabaceae	5	0.008	0.8
4.	*Azadirachta indica*	Meliaceae	92	0.143	14.3
5.	*Borassus aethiopum*	Arecaceae	9	0.014	1.4
6.	*Burkea africana*	Fabaceae	1	0.002	0.2
7.	*Cassia semen*	Fabaceae	56	0.086	8.6
8.	*Citrus species*	Rutaceae	6	0.009	0.9
9.	*Daniellia oliveri*	Fabaceae	7	0.010	1.0
10.	*Delonix regia*	Fabaceae	58	0.090	9.0
11.	*Eucalyptus camaldulensis*	Myrtaceae	70	0.108	10.8
12.	*Ficus species*	Moraceae	10	0.016	1.6
13.	*Gmelina arborea*	Lamiaceae	170	0.264	26.4
14.	*Mangifera indica*	Anacardiaceae	10	0.016	1.6
15.	*Newbouldia laevis*	Bignoniaceae	48	0.075	7.5
16.	*Nuclea latifolia*	Rubiaceae	1	0.002	0.2
17.	*Parkia biglobosa*	Fabaceae	5	0.008	0.8
18.	*Piliostigma thonningii*	Fabaceae	3	0.005	0.5
19.	*Prosopis africana*	Fabaceae	3	0.005	0.5
20.	*Sterculia setigera*	Sterculiaceae	12	0.019	1.9
21.	*Tamarindus indica*	Fabaceae	4	0.006	0.6
22.	*Tectona grandis*	Lamiaceae	43	0.066	6.6
23.	*Terminalia superba*	Combretaceae	2	0.003	0.3
24.	*Vitellaria paradoxa*	Sapotaceae	3	0.005	0.5
25.	*Ximenia Americana*	Olacaceae	10	0.016	1.6

NB: RA = Relative Abundance

Table 3 showed the diversity characteristics of the studied site and as can be seen, plot D had the highest diversity index of 2.44 followed by plots A and B with diversity index of 2.08 each while the least diversity index was observed in plot C (1.86). In terms of evenness, plot A had the highest evenness value of 0.47 followed by plots D and B with evenness values of 0.46 and 0.45 while the least evenness value was observed in plot C with diversity value of 0.34. There were many species abundance in plot D (22; 40.74%) than they were in any of the plots. This was followed by plot C with 13 species equivalent to 24.07%, then plot B with 10 species (18.52%) and lastly plot A with 9 species (16.67%).

Table 3: Diversity Characteristics of the Sites

S/No.	Diversity Parameters	Transect			
		A	B	C	D
1.	H′	2.08	2.08	1.86	2.44
2.	H′E	0.47	0.45	0.34	0.46
3.	S	9	10	13	22
4.	N	82	106	248	208

H′= Diversity Index; H′E= Evenness; S = Species Richness; N = Total Number of

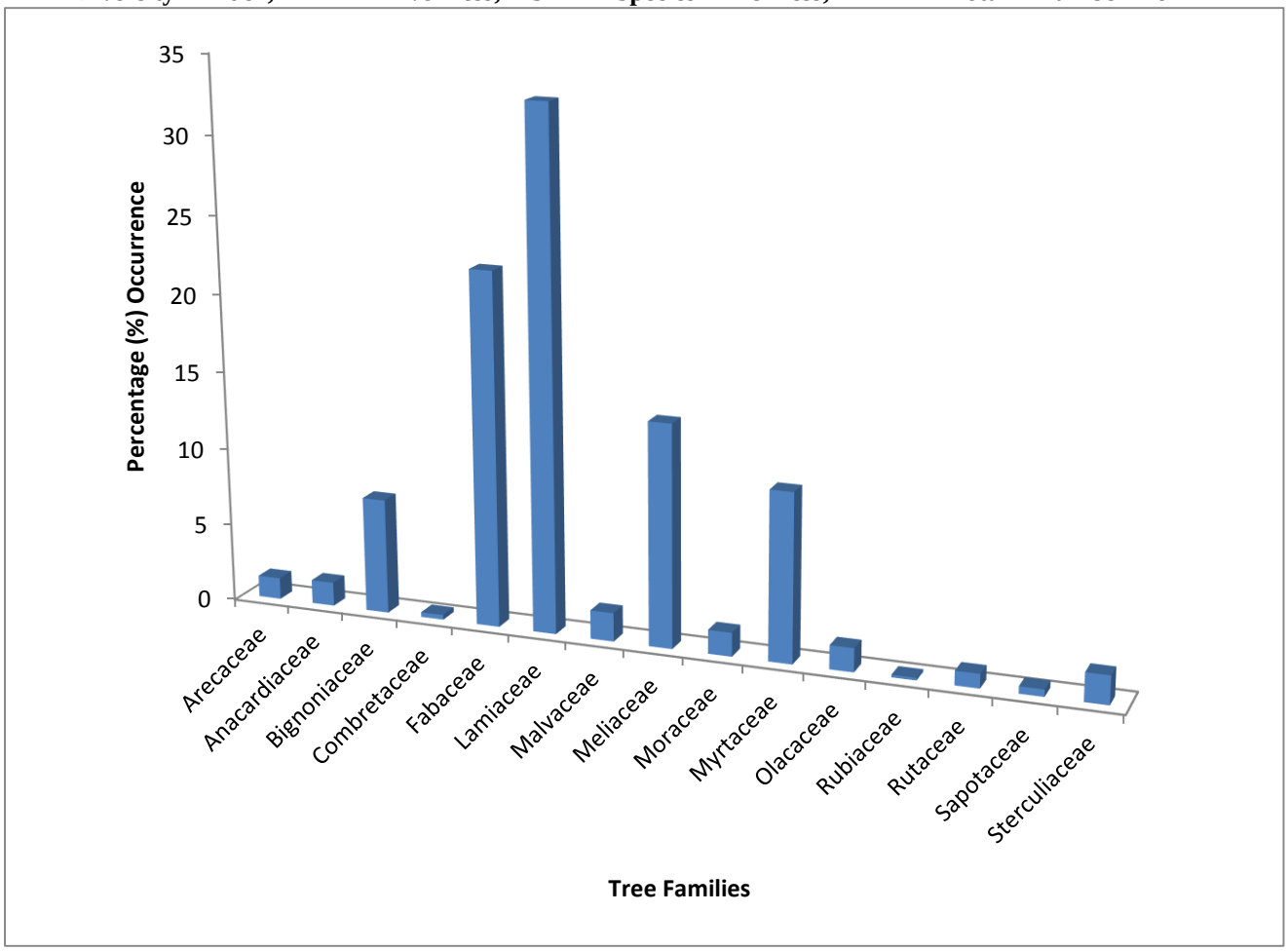

Figure 3: Species Abundance Based on Families

From the figure above, it can be seen that the family Lamiaceae had the highest species abundance of 33.07% followed by Fabaceae (22.67%), Meliaceae (14.29%), Myrtaceae (10.87%), Bignoniaceae (7.45%), Malvaceae and Sterculiaceae (1.55%), Anacardiceae, Moraceae and Olacaceae (1.55%), Arecaceae (1.40%), Rutaceae (0.93%), Sapotaceae (0.47%), Combretaceae (0.31%) while the least was recorded in Rubiaceae (0.16%).

It would not be unrealistic to opine that the surrounding of the University community had may be suffered destruction of different magnitude due to many anthropogenic activities. Trees are very important in an environment providing habitats for wildlife ranging from microorganisms to terrestrial populations, environmental balance and renewal of ecosystemic processes, and above all wraps the soil to prevent erosion.

Species richness of 25 taxa observed in the university campus might have been an underestimation of the real number during its natural state. This is because the university campus is surrounded by many buildings and populations suggesting that the original species richness that had existed was disturbed and destroyed to pave way for infrastructural development. On the other hand, it might be that some tree species in the study area were imported from some other places due to human activities. In another vein, perhaps the

disturbances due to human activities had favored seed dispersal in the area and boasted the species richness. This is in accord with Dangu (2015) who reported that the fate of seeds after predation were higher in protected areas than they are in unprotected areas.

A total of 644 tree stands was recorded in the study area with species diversity ranging from 1.86 to 2.44. Some of the species had as high as 170 individuals (*Gmelina arborea*) while others as low as a single stand (*Nucleam latifolia* and *Burkea africana*). This conspicuous difference might indeed not be unconnected to the variability and unsustainable human utilization that include felling for creation of more space and fire wood. Such elaborate pressure on the trees would invariably reduce or increase their abundance in the study area. In fact, it was observed in this study that habitat conversion into residential area (urbanization), indiscriminate felling vegetation for development of several infrastructural facilities to meet human needs, and for subsistence farming were among the most important problems facing the floral community of this area.

This result conforms to the work of many researchers such as Iroko *et al.* (2009) who reported that over exploitation and utter conversion of the forest ecosystem results in the decimation of plant species. Omoro *et al.* (2010), also reported a significant difference in diversity values between indigenous forest and exotic ones in the cloud forests of eastern arc mountain hills, Kenya, because of the indiscriminate exploitation in the exotic forest occasioned by anthropogenic activities. Edet *et al*. (2012), reported that there were more tree species in Afi mountain wildlife sanctuary than the communal forest where human activities is uncontrolled. Udofia *et al*. (2014) observed that more tree composition was recorded in Ayan-Nsit sacred forest than in the adjourning community forest. Nodza *et al*. (2014) also reported that there is a decrease in the conservation status of tree species in the Akoka campus of the University of Lagos due to anthropogenic activities that include land clearing for infrastructural development and subsistent farming within the university campus. Barau *et al*. (2015) stated that in Kakulu forest of Zing the tree species abundance of the undisturbed forest fragment is higher than what was observed in the disturbed fragments.

Conclusion and Recommendation

This study revealed that *Gmelina arborea* of the family Lamiaceae had the highest number of stands (170; 26.4%) in the study area. This was followed by *Azadirachta indica* of the family Meliaceae with 92 stands (14.3%) while *Burkea africana* (Fabaceae) and *Nuclea latifolia* (Rubiaceae) had the least number of stands (1 each; 0.2%) in the study area. A total of 644 tree stands were recorded. Transect D had the highest diversity index of 2.44 while transect C had the lowest diversity index (1.86). It is recommended that many more tree species and tree stands be planted on the study site, considering the huge roles trees play in every human community.

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