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A SURVEY OF PHANEROPHYTES COMMUNITIES IN THE FEDERAL UNIVERSITY GASHUA CAMPUS, YOBE STATE

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Abstract

The study assessed the composition and distribution of phanerophytes in the take-off site of Federal University Gashua which was formerly occupied by Government Science and Technical Secondary School covering a total of 48ha. The study area was divided in to four (4) sites as the researchers adopted the Point-Centred-Quarter method (PCQ). Ten (10) quadrants measuring 100 X 100m were selected as the representative of the study area with each quadrants divided into five sub-units of 20m X 20m from the right angle and the centre. Ten (10) sampling points were randomly established in each of the sub-units where importance value index (IVI) was determined. The community of the study area was established by the dominant specie designated as Azadarichta indica and Acacia spps. Two families were found to be dominant in terms of species representation in the study area and they are Meliaceae and Mimoiceae.. Azadarichta indica have the highest numerical strength. Jaccard index show similarity between site 1 and 2 and generally dissimilar to the other sites. The diverse vegetation of the study area is currently under threat as the University is carrying out constructions and work reconstruction. Thus, the study recommends among others the conservation of site 3 of Mimosaceae members due to their long term growth and difficulty of their regeneration and transplanting tolerance. This findings also suggest the need of the University to adopt a policy of 'removal of '1 and planting of 5-10 trees' by the construction Companies currently undertaking projects in the University.

Keywords: Indigenous trees, species list, frequency, densities, and cover

INTRODUCTION

The structure of any plant community is important to ecological sustainability and ecosystem resilience. It is a known fact that both humans and other animals uses plants formation and vegetation types and distributions as landmark of an area. In fact, Plants are used in recognizing and defining a community. That is why plants formations are used to compiled World map. It is also a known fact that the distribution of plants in an area is determined by climate and influenced by soil conditions. This is because differences in soil properties produced by the interaction of climate, topography and vegetation over time have a profound effect on parent material, biological system and plant communities that they support. Similarly, Plant community alongside other biotic

components and the abiotic environment make up an ecosystem in which interactions of organisms and their environmental factors take place through flow of energy and cycling of materials. The first requirement for analyzing plant communities, therefore, is to analyze the ecosystem with the list of species present, community structure and dynamics (Diamond and Case, 1985). Plants' community's studies are important for two basic reason, namely mapping and ecological purposes (Causton, 1988).

There are ongoing constructions, renovations and expansion of physical structure at the Federal University Gashu'a which attract many construction firms. This has led to uprooting of several tree species to conform to the University plans, thus the possibility of losing some important tree species in the University that would have been important to the faculties of Agriculture and Science in teaching and research. Benneh *et al.*, (1996) argued that the present environmental problem is largely a result of the interactions between people, natural resources and products of technological equipment and machines. Similarly, Pascal & Pelisser (1996) stated that information on floral composition, diversity and biomass are absolutely essential in understanding ecosystem dynamics and conservation.

Meaning of Plants' Communities

It is the scientific study of nature and development of society for human benefits. Phytosociology is otherwise known as plant sociology. It is a sub-discipline of plant community ecology and vegetation science (Edwald, 2003). It started in Europe with Swiss Botanist and ecologist by name Braun-Blanquet who lived between 1884-1980. Therefore, it is the study of floristic composition, structure, development, distribution and environmental relationships of vegetation. The systematic classification of plant communities received a special stimulus through Braun-Blanquet (1932) who developed a convincing programme by combining many initiations of his predecessors regarding the subject of phytosociology.

Various scheme of phytosociology have been proposed but the best known one in Western Europe is that proposed by Braun-Blanquet (1884-1980). It was aimed at a worldwide classification of plant communities using the presence and abundance of plant species as the basis for inventory, classification and characterizing vegetation. This scheme further defined the range of phytosociological investigations to include the following five (5) major areas:

1. The organization of the plant community i.e the investigation of the composition of plant community.
2. Synecology: the study of the dependence of plant communities upon one another and upon the environment.
3. Syngenetics: discoveries of laws of the development and decline of plant community.
4. Synchrology: the geographical distribution of plant communities.
5. Phytosociological classification: the delimitation of plant social units and the synthetic arrangements of the units.

Plant community is described not by simple listing of all the species which compose it, Instead, a community is characterized by detailing with the species which most contribute to its unique structure

composition (Muleller-Dombois and Ellemberg, 1974). Characteristics species reveal a link which connects statistical structural studies and the ecological study of communities. Phytosociology has been used as a tool in studying the vegetation over long period to show stages of development and changes in physiognomy (Sharma, 1993). The knowledge of species composition in an area can be directed at protecting and preserving the plants for scientific, economic and aesthetic purposes (Oke and Isichei,1997; AbdulHameed *et al.*, 2001 and 2005; Abdullahi and Sanusi 2006; AbdulHameed and Sharma, 2008).

Thus, the aim of this study is to provide a baseline data on trees found within the take-off site of the Federal University. The objectives of this study are to determine the composition and distribution of phanerophytes within the take-off site of Federal University Gashua and identify the species similarities and differences at different site of the study area

Materials and Method.

Study Area

Federal University Gashua (FUGA) is located 2 kilometers from Gashua town in Bade local government area of Yobe State. FUGA has a total land area 2,248 hectares**.** The local government lies in the sahelian zone which is influenced by the tropical continental air mass for most parts of the year, such that the climate is of dry. The period of raining season of the area is from June to September, rainfall is scanty with a mean of 500mm annually (Geoname/yobestate 2016).); August is normally the wettest month. The mean monthly temperature is about 28^0C. The coolest months are December and January with an average temperature of 21^0C ((Geoname/yobestate 2016). Thus, maximum temperature is 40.7^0c in April. The coldest month is January with temperature of 12.8^0c and Relative humidity of the area is 27%. (Geoname/yobestate 2016). Bade local government approximately lies within Latitude 10^0 and 11^o east of Greenwich and longitude 13^0 and 12^0 north of the equator. It has a total population of 139,782 (National Population Commission, 2006).

Sample and Sampling Procedure

Point Center Quarter method (Fig. 2) was used adopting Dauda (2012). The study area was divided into four sites (site 1,2,3, and 4) where 10 quadrants measuring 100 X 100m were selected as representatives of the whole study area. Each of the quadrants was divided into five subunits (20 X 20m) from the right angles and the center. These subunits were systematically sampled for all trees. In each of the subunits (20 X 20m), 10 sampling points were randomly established and phytosociological data were recorded.

In every quarter the nearest tree to the sampling point was identified and counted and the quarter number recorded. The distance from the sampling point to the tree (Fig. 2), and the diameter at breast height were measured. Plant height was recorded by the angle of elevation.

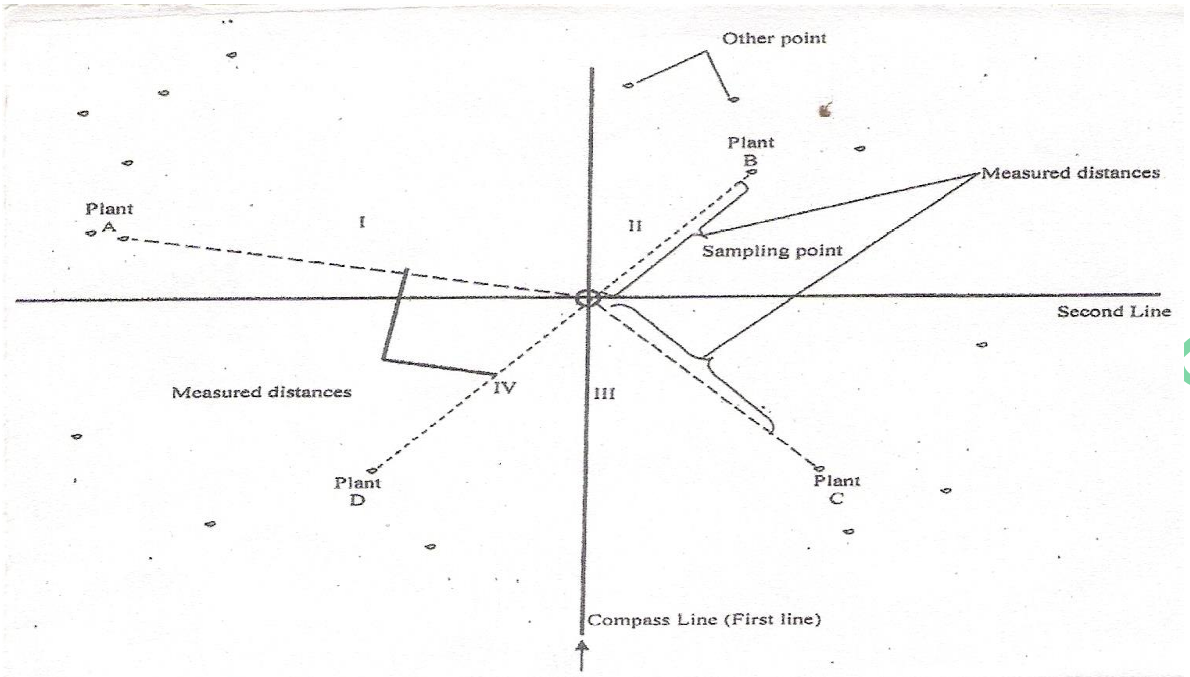

Fig. 1 Point- Center- Quarter (PCQ) method

The symbols I, II, III and IV indicate the four quarters and plants A, B, C, and D refer to those nearest to the sampling point in each quarter.

Data Collection and Analysis

The data was quantitatively analyzed for frequency, percentage and relative cover as used by Phillips, 1959. The Jaccard index of the tree species in the four different sites studied was determined. Identification of plants was made using relevant literatures and herbarium at hand. Reference texts that were consulted include those of Arbonnier (2002) and Keay *et al.*, (1964) and Bade-Hausa Dictionary of Rusell (2004).

Frequency was expressed as the number of points having the species (j_i) divided by the total number of point (k) and sum of all the frequencies was then calculated.

Frequency = $f_i = j_i/k$. Were

$\mathbf{j_i}$ = number of points with species,

k = total number of points

Frequency Percentage ($f_{i\%}$): was also determined using the fomular:

Rfi = $f / \Sigma f_i$ X 100

Cover was calculated by multiplying the total area coverage for all quadrants for each species. Coverage (C_i) is computed as the total area covered by species (A_i) multiply by density and divided by the total number of individuals in that species using:

$$\mathbf{C1} = A_i D_i / n_i$$

Relative coverage RC is the coverage value divided by the total coverage for all species using:

$$\mathbf{RC} = C_i / \Sigma C$$

Jaccard index was used to measure similarity between sites

$$\text{Jaccard index} = \frac{a}{(a+b+c)}$$

Where '**a'** = represents the total number of species where site 1 and site 2 both have a, species in common.
b, represents the total number of species present in site1 but not in site 2.
c, represents the total number of species present in site 2 but not in site 1.

RESULTS

A total of **1616** species belonging to 11 different families were recorded in this study (Table 1 below). Meliaceae was the family represented by the highest number of species. This was followed by Mimosaceae, Balanitaceae\Zygophyllaceae, Rhamnaceae, Combretaceaea, Fabaceae, Caesalpiniaceae, Arecaceae and Bombacaceae respectively. It is to be noted that Myrtaceae and Anacardiceae were the families' represented with least number of species. Site 3 had the highest individual species and *Azadarichta indica* had the highest number of 638 individuals, followed by *Acacia sieberiana* and *Acacia hockii* with 168 and 167 respectively. *Acacia nilotica* had 118 and *Balanite egyptiaca* had 102 while *Anogesus leiocarpus, Prosopis africana* and *Tamarindus indica had 70, 65 and 58* respectively. *Ziziphus mauritiana, Faidherbia albida, Hyphaene thebaica,* had less than 50 each with *Pilostigma reticulatum* having 51 and *Zizyphus-spina-christi, Adansonia digitata, Psidium guajava* and *Mangifera indica having the least members with* 27, 16, 10 and 8 individuals respectively.

Table 2 below show the mean frequency of the four sites of FUGA. *Azadirachta indica (39.48%*) was the most frequent of species; this was followed by *Acacia sieberiana* (10.39%) and *Acacia hockii* (10.33%). *Acacia nilotica* had 7.3% and *Balanite egyptiaca* had 6.39% while *Anogesus leiocarpus, Prosopis africana Tamarindus indica* and *Pilostigma reticulatum have* 4.3%, 4% 3.58% and 3.15% each. On the otherhand, *Ziziphus mauritiana, Faidherbia albida* and *Hyphaene thebaica* had less than 3% each and *Zizyphus-spina-christi, Adansonia digitata, Psidium guajava* and *Mangifera indica* had lessthan 2% each.

The number of trees per hectare in the four sites and their mean values is shown in **Tables 3 below** *Azadarichta indica* recorded remarkably high mean density value (159.0ha^{-1}). This is the highest density in the study area while *Acacia hockii* followed with (41.75ha^{-1}), *Acacia nilotica had 29.5*ha^{-1} and *Balanite egyptiaca* had 25.2ha^{-1}. The tree with the least mean density was *Mangifera indica* (2 ha^{-1}).

Jaccard index

Jaccard index coefficient of similarity (**Table 4**) showed similarity between *sites* 1 and 2, 1 and 3, 1 and 4, 2 and 3, 2 and 4 as well as 3 and *4*. There was generally dissimilarity between the other *sites* among 16 different plant species enumerated in sites of the study; few species were common to the *sites*. The index ranged between 0.1 to 0.8

Discussions

This study revealed *Azadarichta indica* and *Acacia saeberina* recorded with the highest density as shown in **table 3**. From Misra's, (1968) definition of density "Density values reveal the numerically strongest plant species which depends on the luxuriance and

adaptation of the vegetation in the community". One therefore can say that *Azadarichta indica* and *Acacia saeberina* numerical presence were the result of plants' ability to thrive very well in sahel savannah habitat; Although, the sandy loam and clay nature of the soil in the habitat could also be contributory factor to this predominance. The numerical weakest tree species were *Mangifera indica*, *Psidium guajava* and *Adansonia digita* having the least density. Similarly, the tree species with higher frequency were *Azadaricda indica,* and *Acacia* species with higher population had comparatively higher frequency supportednAhn, 1970) who suggested that human interference through selective utilization and conservation of species and couple with the ecological adaptability of the tree species could strengthen the growth of some species which in turn is detrimental to others. This study also revealed the species with the highest number which were considered as the leading dominant of the community. Thus, the finding is in agreement with Arshad *et al.* (2002) who named species with highest number and responsible for naming the community as Dominant while other vegetation recorded in the area could be grouped as co-dominants, associates or rare plant species depending on the status of their importance value index (IVI).

Based on the results of this study, the panerophyte's community in Federal University, Gashua was *Azadarichda indica.* Because they are the most ecologically successful tree species. This could be attributed to their wide ecological adaptation. The co-dominant species were *Acacia spps.* The rest of the other trees having low IVI could be grouped as rare. The dominant species are those with wider amplitude and are the most successful (Chapman, 1976), the success they exhibit is linked with their ability to exploit the environment making use of a wider range of physico-chemical tolerance (Sharma, 1993). *Meliaceae* and *Mimosaceae* were found to be the dominant families representing a major portion of the four *sites* of the FUGA. This could be associated with a wider range of growth, adaptability and distribution of various members of these families in the campus. Overall, the whole study of the campus revealed 16 species in 11 families.

CONCLUSION AND RECOMMENDATIONS

The study revealed that the dominant tree families in the vegetation of Federal University, Gashua were, *Meliaceae* and *Mimosaceae,* which had the highest number of representatives. The existing plant communities in FUGA were *Azadarichta indica.* The co-dominant species were *Acacia species*. From the findings of the research, the following conclusion could be made that Federal University Gashua has reasonably diverse vegetation, the numerical strength of many species is threatened by the current construction and expansion activities.

From the findings of this study, the following recommendations are made:

1. The conservation of site 3 with *Acacia spp.* as Acacia plantation for Faculty of Agriculture The destruction of the species from the site will lead to total disappearance of the species in the campus as they take long time with some difficulty in their regeneration ability.
2. The University should adopt a policy of urging construction companies to plant 5 trees on removal of 1.
3. The University should put in **place a mechanism to monitor the felling of trees within the University.**

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TABLE 1: Names of Trees, their Similarities and their Numbers in Federal University Gashua

				SITES				
	SPECIES	**FAMILY**	**HAUSA NAME**	**1**	**2**	**3**	**4**	**TOTAL**
1	*Acacia hockii*	Mimosace-ae	*Bakin-'kaya*	2	2	155	8	**167**
2	*Acacia nilotica*	Mimosace-ae	*bagaruwa*	9	18	72	19	**1I8**
3	*Acacia sieberiana*	Mimosace-ae	*Farar kaya*	17	18	99	34	**168**
4	*Adansonia digitata*	Bombacace-ae	*Kuka*	2	-	5	9	**16**
5	*Anogeissus leiocarpus*	Combretace-aea	*Marke*	8	5	28	29	**70**
6	*Azadirachta indica*	Meliaceae	*Maina*	205	387	39	7	**638**
7	*Balanites aegyptiaca*	Balanitaceae\ Zygophyllaceae	*Aduwa*	11	2	34	55	**102**
8	*Faidherbia albida/Acacia albida*	Mimosace-ae	*Gawo*	16	8	11	7	**42**
9	*Hyphaene thebaica*	Arecaceae	*Goruba*	8	6	13	5	**32**
10	*Mangifera indica*	Anacardice-ae	*Mangoro*	2	6	-	-	**8**
11	*Pilostigma reticulatum*	Caesalpinia-ceae	*Kalgo*	8	5	29	9	**51**
12	*Prosopis africana*	Mimosace-ae	*'Kirya*	14	12	22	17	**65**
13	*Psidium guajava*	Myrtaceae	*Gwaiba*	6	1	-	3	**10**
14	*Tamarindus indica*	Fabaceae	*Tsamiya*	19	9	13	17	**58**
15	*Ziziphus-spina-christi*	Rhamnaceae	*Kurna*	-	2	14	11	**27**
16	*Ziziphus mauritiana*	Rhamnaceae	*Magarya*	2	6	17	19	**44**
	Source: Field Survey, 2015	**TOTAL**		**329**	**487**	**551**	**249**	**1616**

TABLE 2: Number of trees in the four sites Delineated and their Frequencies in Federal University Gashua Campus

		SITES				
S/N	***NAME OF SPECIES***	1	2	3	4	**FREQUE-NCY %**
1	*Acacia hockii*	2	2	155	8	10.33
2	*Acacia nilotica*	9	18	72	19	7.30
3	*Acacia sieberiana*	17	18	99	34	10.39
4	*Adansonia digitata*	2	-	5	9	0.9
5	*Anogesus leiocarpus*	8	5	28	29	4.33
6	*Azadirachta indica*	205	387	39	7	39.48
7	*Balanite egyptiaca*	11	2	34	55	6.31
8	*Faidherbia albida/Acacia albida*	16	8	11	7	2.6
9	*Hyphaene thebaica*	8	6	13	5	1.9
10	*Mangifera indica*	2	6	-	-	0.4
11	*Piliostigma reticulum*	8	5	29	9	3.15
12	*Prosopis africana*	14	12	22	17	4.0
13	*Psidium guajava*	6	1	-	3	0.62
14	*Tamarindus indica*	19	9	13	17	3.58
15	*Ziziphus spina christi*	-	2	14	11	1.67
16	*Ziziphus mauritiana*	2	6	17	19	2.72
	TOTAL 329	**487**	**551**	**249**		

Source: Field Survey, 2015

TABLE 3: Number of Trees per Hectare in Federal University Gashua Campus

		SITES				
S/N	***NAME OF SPECIES***	1	2	3	4	**MEAN**
1	*Acacia hockii*	2	2	155	8	41.75
2	*Acacia nilotica*	9	18	72	19	29.5
3	*Acacia sieberiana*	17	18	99	34	17
4	*Adansonia digitata*	2	-	5	9	5.3
5	*Anogesus leiocarpus*	8	5	28	29	17.5
6	*Azadirachta indica*	205	387	39	7	159
7	*Balanite egyptiaca*	11	2	34	55	25.2
8	*Faidherbia albida/Acacia albida*	16	8	11	7	10.5
9	*Hyphaene thebaica*	8	6	13	5	8
10	*Mangifera indica*	2	6	-	-	2
11	*Piliostigma reticulum*	8	5	29	9	12.8
12	*Prosopis africana*	14	12	22	17	16.3
13	*Psidium guajava*	6	1	-	3	3.3
14	*Tamarindus indica*	19	9	13	17	14.5
15	*Ziziphus spina christi*	-	2	14	11	9
16	*Ziziphus mauritiana*	2	6	17	19	11

Source: Field survey, 2015

Table 4: Jaccard Index of Similarity between the sites

Sites	**A**	**B**	**C**	**N**	**Jaccard index**
Site 1 and 2	10	3	-	12	0.8
Site 1 and 3	10	3	3	16	0.6
Site 1 and 4	12	1	3	16	0.8
Site 2 and 3	7	3	6	16	0.2
Site 2 and 4	9	1	6	16	0.6
Site 3 and 4	13	-	2	15	0.1

Where:

A: represents the total species common to both *sites*

B: represents the total numbers of species present in first mentioned site (one *site)* but absent in *other site*

C: represents the total number of species absent in comparing site (first mentioned site) *but* present in the second mentioned site.

N: represents total number of species.