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Title: **Composition and Structure of Tree Species in the Main Campus of Usmanu Danfodiyo University, Sokoto, Nigeria**

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ABSTRACT

The number of anthropogenic activities on the Usmanu Danfodiyo university's main campus has increased recently. Trees are constantly being felled for the erection of different structures to accommodate the growing number of employees and students leading to the alteration of the diversity, composition and structure of the tree species within the main campus. This study was therefore carried out to investigate the current diversity, composition, and structural characteristics of the tree species within the study area. Aerial photographs were used to categorize the areas with similar tree arrangements in to clusters- Shelterbelts (SH), Avenue Trees (AT), Academic Areas (AA), and Fadama Areas (FA). Thirteen (13) sub-clusters (sampling units) were selected out of 25. Fifty percent (50%) of each of the selected sub-clusters were randomly selected for data collection. Line transects (200 m) were laid and data along every first 20 m of each transect was collected for sampling units with linear arrangement and this was repeated after every 200 m interval while for sub-clusters with scattered arrangements, variable circular plots were used. Shannon-Weiner Index (̀H) was also estimated. A total of 566 trees belonging to 15 species, 13 genera, and 10 families were identified and their diameter at breast height (DBH) were measured, recorded and analyzed using descriptive statistics. The result showed that *Azadirachta indica* was the most abundant tree species in the study area with 55.12% particularly in SH, AT and AA. The study also reveals the variations in mean DBH among tree species with *Faidherbia albida* having the highest mean DBH of 0.963 m, indicating substantial individual tree sizes. The study also revealed that while *Azadirachta indica* dominated in most clusters, *Mangifera indica* stood out in the FA. Shannon-Weiner Index (̀H) value of 1.491 was obtained. Signifying a low diversity in the study area. The highest IVI was recorded in *A. indica* 96.16% and the least was recorded in *P. guajava* 0.83%. The findings suggest intensified reforestation efforts, establishment of new plantations, and incorporation of economically beneficial plants such as Cashew (*Anacardium occidentale*) for enhanced biodiversity and economic benefits within the university community as recommendations.

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INTRODUCTION

Tropical ecosystems are among the planet's biodiversity-rich regions because they support a significant number of species from around the world (Myers et al., 2000; Baraloto et al., 2013). About 1 to 4% of the area of tropical ecosystems worldwide, and particularly the forest, is lost each year, which is a concerning rate of decline. The increased anthropogenic pressures that had resulted in agricultural expansions, an increase in the demand for fuel wood, and an increase in the human population are clearly linked to the disappearance of forest areas (Anitha et al., 2010; FAO, 2010).

Many people view biodiversity as the foundational resource upon which families, nations, and future generations will rely for access to food, medicine, and other necessities of life (Fayiah et al., 2018). The survival of people and communities is crucial for maintaining biodiversity. Despite its significance, our actions are dangerously depleting these resources. Multiple human activities, including deforestation, overgrazing, overexploitation of biological resources, urbanization, and agriculture, have resulted in the loss of several species (BSAP, 2005). Apart from the inherent moral and aesthetic values, there are many reasons why biodiversity must be conserved (NBSAP, 2017).

In many ecosystems, the diversity of tree species is an essential part of overall biodiversity because trees are ecosystem engineers who provide resources and habitat for almost all types of organisms (Huston, 1994). In order to maintain species habitat diversity, trees, an important part of vegetation, must be continuously monitored and managed (Attua and Pabi, 2013). Trees also serve as a major structural and functional foundation for tropical ecosystems, and they can act as reliable indicators of changes and stressors at the landscape scale (Aigbe et al., 2015).

In addition, the diversity of tree species is essential to the diversity of tropical ecosystems as well as forests (Evanriste et al., 2010; Tchouto et al., 2006). Because the diversity of tree species varies greatly from place to place due to variations in biogeography, habitat, and disturbance (Whitmore, 1998), it is crucial to conduct inventories in different types of ecosystems to provide quantitative information on the structure and composition of tree species.

Global species richness and diversity have been known to decline in response to land use changes (Bukar et al., 2021). Ecosystem sustainability and services like preventing soil erosion, reducing soil and nutrient loss, and maintaining hydrological cycles are all made possible by species richness (Hooper et al., 2005; Spiegelberger et al., 2006). One of the most important and important factors contributing to rapid vegetation change and the threats to biodiversity loss and extinction worldwide is land use change. According to Iwara (2012), the term "land use change" refers to how humans continuously alter the surface of the earth to satiate their insatiable hunger for life. However, since a change in land use reduces ecosystem complexity and diversity by substituting more complex agro-ecosystems for less complex natural vegetation, changes in ecosystem complexity could be measured by assessing the density and diversities of tree/shrub species (Hooper et al., 2005).

It is important to recognize that one of the key factors affecting vulnerability in the human-environment system is land use change. Land-use change alters the spatial distribution of various land-use types in addition to having a direct impact on the spatial extent of ecosystems through deforestation and fragmentation (Verburg et al., 2004).

According to Iwara (2012), composition refers to the floristic assemblage of plant species that define the vegetation. An in-depth knowledge of the resources presents in the ecosystem as well as the dynamic processes that occur in the forest over time is necessary for long-term management of forest ecosystems. Most people agree that long-term monitoring is a good way to record both the static characteristics of natural ecosystems and the dynamic processes taking place within those ecosystems. For a better understanding of the ecological processes that occur in a forest, monitoring plots are crucial. To track ecological processes in a changing environment, basic measures of tree diversity, forest structure, tree growth, and forest turnover are crucial parameters.

Additionally, a set of plots can address the effects of human activity, conservation, and even invasive species. The contribution of each plant species to the vegetation is referred to as species composition. It is regarded as a significant indicator of the site's ecological and management processes. According to Sankaran et al. (2005), savannas make up 60% of sub-Saharan Africa's vegetation cover and are characterized by the coexistence of woody plants and grasses. The woody component can consist of a variety of needle-like or broad-leaved, evergreen or deciduous trees and shrubs, with grasses dominating the understory and often reaching heights of more than one meter (Hutley and Setterfield, 2018). The Savannah's condition and decline are largely determined by human activities (Laube, 2007). In line with these considerations, this paper aimed to determine the diversity, composition and structure of tree species in Usmanu Danfodiyo University main campus, Sokoto.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted at the main campus of Usmanu Danfodiyo University, Sokoto. It is located within latitude 13° 6′ 30″ – 13° 8′ 30″ North and longitudes 5° 11′ 30″ – 5° 14′30″ East (Figure 1) in Wamakko local government area of Sokoto state (Zara et al., 2021). Sokoto State is located in the Sudan Savanna Zone in the extreme North-Western Part of Nigeria between longitude $3^0$7′E and 6^0E and latitude $11^0$6′N and $13^0$9′N (Mamman et al., 2000). It lies in the north of Sokoto-Rima River floodplain with land area of 697 km^2 (Eniolorunda and Jibrillah, 2020).

Vegetation and Climate

The vegetation of Sokoto is typical Sudan Savanna with intensive grass cover interspersed by a few trees and shrubs. The climate is semi-arid, characterized by low rainfall (Mamman et al., 2000), mean annual rainfall of 659 mm, relatively wide, and rapid changes in temperature and humidity. Temperature is generally high. The highest mean monthly temperature is about 40-45°C in April while the lowest mean monthly temperature occurs in December/January when the temperature could come down to 15°C (Zara et al., 2021).

Sampling Design and Procedure

This research employed a cluster and point sampling technique for tree species composition, structure, and diversity assessment. The areas within the university community with tree species were identified using aerial photographs and categorized into clusters based on similarities in arrangement, namely Shelterbelts (SH), Avenue Trees along major roads within the campus (AT), Academic Areas (AA), and Fadama Areas (FA). These clusters were further divided into smaller sub-clusters (sampling units), with shelterbelts labeled as SH1, SH2, and SH3. The Avenue Trees (AT) were also divided into six sub-clusters: AT1 connecting the Faculty of Agriculture to the Faculty of Law junction, AT2 from the new Senate building junction to VC quarters junction, AT3 from Kofar Mata to Abdullahi Fodiyo Library roundabout, AT4 from Kofar Mata to the University Jumuat Mosque, AT5 from Theatre Laboratory junction to Ahmadu Bello House (VC complex), and AT6 along the road to Stadium/Jibril Aminu Hostel. The Academic Areas were also divided into sub-clusters, with each sub-cluster representing one of each of the 12 faculties on the main campus (AA1-AA12). The Fadama Area was divided into four sub-clusters (FA1-FA4), and 50% of each sub-cluster was randomly selected and inventoried with the exception of SH cluster where 33.33% of the sub-cluster was randomly selected. In total, 13 sub-clusters (Sampling units) were randomly selected for sampling from the 25-sampling frame.

Data Collection

For areas with linear arrangements such as Shelterbelts and Avenue Trees, line transects (500 m) were laid along the belts, and tree species and their numbers encountered along every 20m were identified and recorded, and their diameter at breast height (DBH) were calculated. This process was repeated after every 250 m interval along each transects.

For areas with irregular patterns of arrangement, point sampling techniques and variable circular plots were adopted as methods for data collection.

The DBH of identified trees was computed by measuring their circumference in meters at 1.3m above ground level using a meter tape. The circumference values were then divided by the value of π to generate the DBH (Fayiah et al., 2018).

Basal Area = $\frac{\pi D^2}{4}$

where;
Π = 3.142
D = Diameter

Species Diversity Index

$$H' = -\sum pi.ln.(pi)$$

where;

H′ = Shannon-Weiner Index
Pi = *S/N*, *S* = equal number of individuals of one species; *N* = total number of individuals in the site
ln = Natural Logarithm

The species richness was determined using the Margalef species index

$$d = \frac{(S-1)}{lnN}$$

where;
S = Total number of species
N = Total number of individuals in site and
ln = Natural Logarithm

Relative Frequency of species (RF) =

$$\frac{Number\ of\ individual\ species}{Total\ number\ of\ individuals\ in\ the\ community} \times 100$$

Relative Abundance of species (RD) =

$$\frac{Total\ number\ of\ individuals\ of\ species\ i}{Total\ numberof\ individuals\ of\ all\ species} \times 100$$

Relative Dominance of species (RDo) =

$$\frac{Total\ Basal\ Area\ of\ species}{Total\ Basal\ Area\ of\ all\ species} \times 100$$

Important Value Index (IVI)

$$= (\frac{RF+RA+RDo}{3})$$

Data Analysis

The data collected were analyzed using SPSS and Microsoft Excel software. Basal Area and all other diversity indices were computed using the same Microsoft excel software. The results were presented in tables and charts respectively.

RESULTS

Results in Table 1 revealed fifteen (15) species of trees belonging to 13 genera and 10 families were distributed across the university main campus. Among these species, *Azadirachta indica*, *Mangifera indica*, and *Acacia nilotica* had the highest frequencies of occurrence (312, 45, and 43) and the most widely distributed species while *Delonix regia* had the least (1).

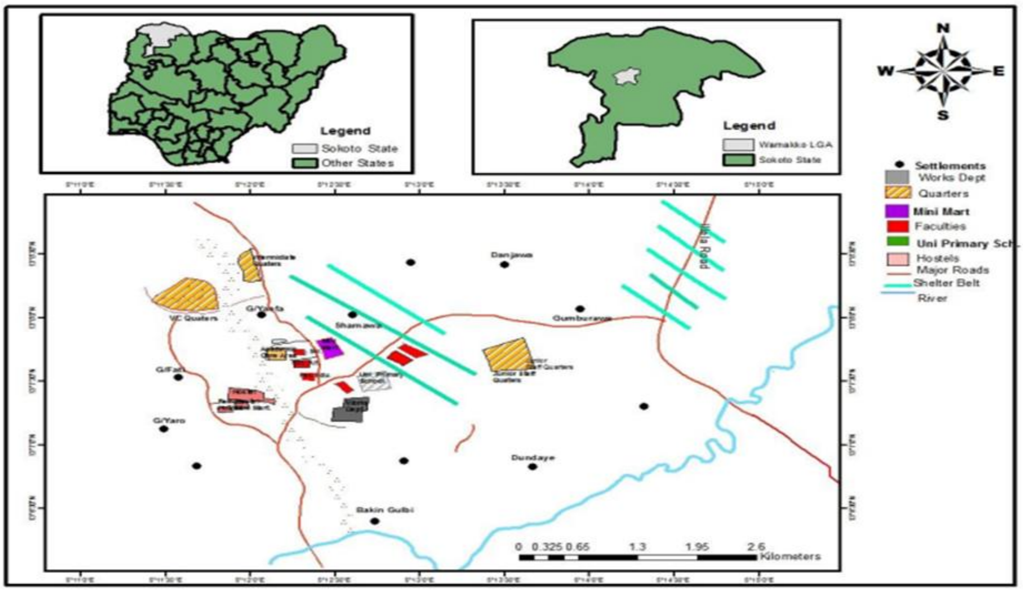

Figure1. Map of the Study Area

Table 1. Distribution of Tree Species in the Study Area

SPECIES NOMENCLATURE			CLUSTERS				TOTAL
SCIENTIFIC	FAMILY	COMMON/LOCAL	SB	AT	AA	FA	
Azadirachta indica	Meliaceae	Neem/Dogon yaro	52	152	105	0	312
Acacia nilotica	Fabaceae	Gum Arabic/Bagaruwa	0	35	8	0	43
Balanite aegyptiaca	Balanitaceae	Desert date/Aduwa	1	23	11	0	35
Eucalyptus camaldulensis	Myrtaceae	River red gum/Turare	0	1	39	0	40
Faidherbia albida	Fabaceae	Winter thorn/Gawo	1	1	3	0	5
Terminalia catappa	Combretaceae	Tropical almond	0	0	17	0	17
Terminalia mantaly	Combretaceae	Umrella tree	0	0	29	0	29
Moringa oleifera	Moringaceae	Moringa/Zogale	0	0	8	0	8
Mangifera indica	Anacardiaceae	Mango/Manguro	0	0	23	22	45
Khaya senegalensis	Meliaceae	Mahogany/Madacci	0	0	5	0	5
Psidium guajava	Myrtaceae	Guava/Gwaiba	0	0	4	0	4
Citrus limon	Rutaceae	Orange/Lemu	0	0	7	0	7
Delonix regia	Fabaceae	Flamboyant	0	0	1	0	1
Adansonia digitata	Malvaceae	Baobab/Kuka	0	0	0	6	6
Polyalthia longifolia	Annonaceae	Indian mast tree	0	0	9	0	9

SB = Shelterbelts, AT = Avenue Trees, AA = Academic Areas, FA= Fadama Areas

Table 2 showed that *A. indica* had the highest Relative Frequency across the three clusters (SB96.30%, AT71.70% and AA39.71%). The results further revealed that *A. indica* had the overall total Relative Frequency (tR.F) value of 207.71% and mean Relative Frequency (mR.F) value 51.928%, respectively. This is followed by *Mangifera indica* with Relative Frequency value 78.57%, the second overall total Relative Frequency (tR.F) value of 87.03% and mean Relative Frequency (mR.F) value of 21.758%. *D. regia* was observed to have the least total Relative Frequency (tR.F) 0.37% and mean Relative Frequency (mR.F) of 0.093%.

Results in Table 3 indicate that *A. indica* had the highest Relative Abundance (55.1%) followed by *M. indica* (7.9%) and then *A. nilotica* (7.6%) while *D. regia* had the least (0.2%).

Results presented in Table 4 shows that *A. indica*, *M. indica* is the most important tree species in the study area with IVI values of 96.2% while *P. guajava* is the least important tree species with an IVI of 0.83%.

Table 2. Relative Frequencies of Tree Species in the Study Area

Species	SB	AT	AA	FA	tR.F	mR.F
Azadirachta indica	96.30	71.70	39.71	0	207.71	51.93
Acacia nilotica	0	16.51	2.94	0	19.45	4.863
Balanite aegyptiaca	1.85	10.85	4.04	0	16.74	4.185
Eucalyptus camaldulensis	0	0.47	14.34	0	14.81	3.703
Faidherbia albida	1.85	0.47	1.10	0	3.42	0.855
Terminalia catappa	0	0	6.25	0	6.25	1.563
Terminalia mantaly	0	0	10.66	0	10.66	2.665
Moringa oleifera	0	0	2.94	0	2.94	0.735
Mangifera indica	0	0	8.46	78.57	87.03	21.758
Khaya senegalensis	0	0	1.84	0	1.84	0.460
Psidium guajava	0	0	1.47	0	1.47	0.368
Citrus limon	0	0	2.57	0	2.57	0.643
Delonix regia	0	0	0.37	0	0.37	0.093
Adansonia digitata	0	0	0	21.43	21.43	5.358
Polyalthia longifolia	0	0	3.31	0	3.31	0.828

tR.F=Total Relative Frequency, M.R.F=Mean Relative Frequency

Table 3. Relative Abundance of Tree Species in the Study Area

Species	R A (%)
Azadirachta indica	55.12
Acacia nilotica	7.60
Balanite aegyptiaca	6.18
Eucalyptus camaldulensis	7.07
Faidherbia albida	0.88
Terminalia catappa	3.00

Species	R A (%)
Terminalia mantaly	5.12
Moringa oleifera	1.41
Mangifera indica	7.95
Khaya senegalensis	0.88
Psidium guajava	0.71
Citrus limon	1.24
Delonix regia	0.18
Adansonia digitata	1.06
Polyalthia longifolia	1.59

Table 4. Important Value Index (IVI) of Tree Species in the Study Area

Species	RDo	tR.F	RA	IVI
A. indica	25.660	207.71	55.12	96.163
A. nilotica	2.275	19.45	7.60	9.775
B. aegyptiaca	12.511	16.74	6.18	11.810
E. camaldulensis	6.597	14.81	7.07	9.492
F. albida	33.121	3.42	0.88	12.474
T. catappa	0.955	6.25	3.00	3.402
T. mantaly	0.910	10.66	5.12	5.563
M. oleifera	0.364	2.94	1.41	1.571
M. indica	8.053	87.03	7.95	34.344
K. senegalensis	1.638	1.84	0.88	1.453
P. guajava	0.318	1.47	0.71	0.833
C. limon	0.045	2.57	1.24	1.285
D. regia	2.593	0.37	0.18	1.048
A. digitata	3.640	21.43	1.06	8.71
P. longifolia	1.319	3.31	1.59	2.073

RDo = Relative Dominance, tR.F = total Relative Frequency, RA = Relative Abundance, IVI = Important Value Index.

Table 5 showed that *Faidherbia albida, A. indica* and *B. aegyptiaca* had the highest mean DBH values of 0.96, 0.84, and 0.60 thereby contributing the bulk of the volume of the tree species in the surveyed area while *Citrus limon* had the least DBH value (0.03).

Table 5. Mean Diameter at Breast Height (m) of the Sampled Trees in the Study Area

Species	SB	AT	AA	FA	Total
Azadirachta indica	0.26	0.44	0.14	-	0.84
Acacia nilotica	-	0.12	0.13	-	0.25
Balanite aegyptiaca	0.17	0.21	0.22	-	0.60
Eucalyptus camaldulensis	-	0.29	0.14	-	0.43

Species	**SB**	**AT**	**AA**	**FA**	**Total**
Faidherbia albida	0.35	0.39	0.22	-	0.96
Terminalia catappa	-	-	0.16	-	0.16
Terminalia mantaly	-	-	0.16	-	0.16
Moringa oleifera	-	-	0.10	-	0.10
Mangifera indica	-	-	0.13	0.35	0.48
Khaya senegalensis	-	-	0.22	-	0.21
Psidium guajava	-	-	0.09	-	0.09
Citrus limon	-	-	0.03	-	0.03
Delonix regia	-	-	0.27	-	0.27
Adansonia digitata	-	-	-	0.32	0.32
Polyalthia longifolia	-	-	0.19	-	0.19

SB = Shelterbelts, AT = Avenue Trees, AA = Academic Areas, FA= Fadama Areas

Fig. 2 shows that *Faidherbia albida* has the highest basal area of 0.7 m^2 among the tree species followed by *A. indica* (0.6 m^2) while *Citrus limon* had the least.

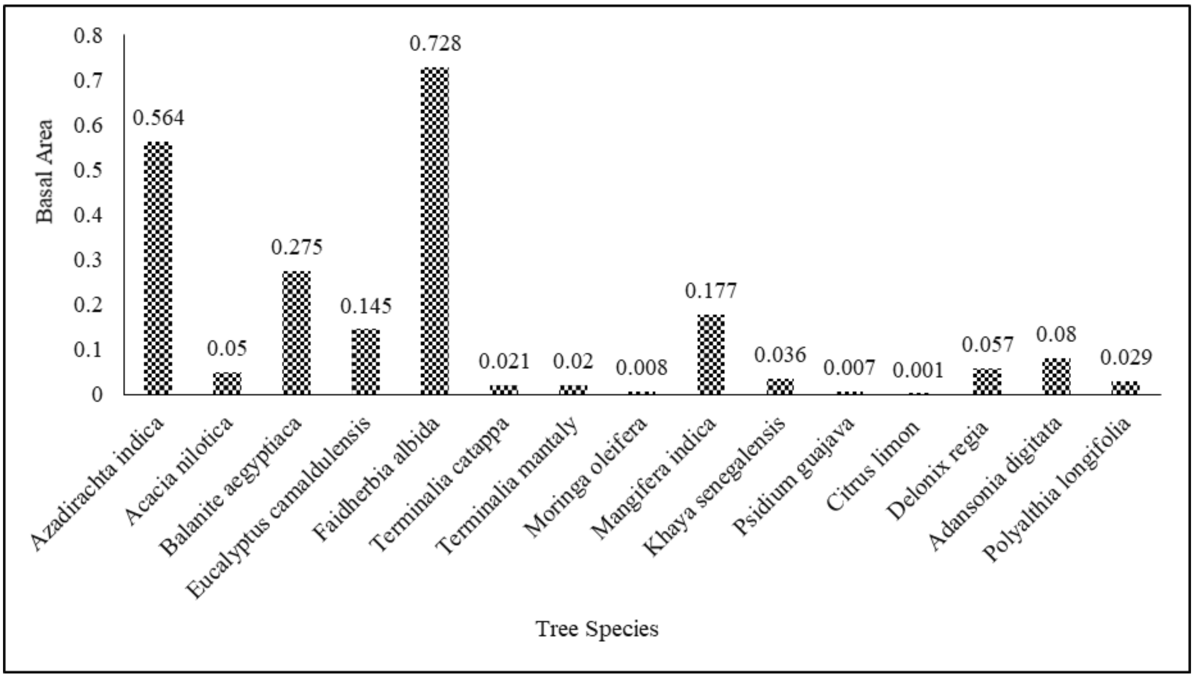

Figure 2. Variation in Basal Area among tree species

Fig. 3 shows that Academic area had the highest basal area value (3.8 m^2) while the Fadama Area had the least (0.34 m^2), thereby contributing the bulk of the volume of the tree species in the study area.

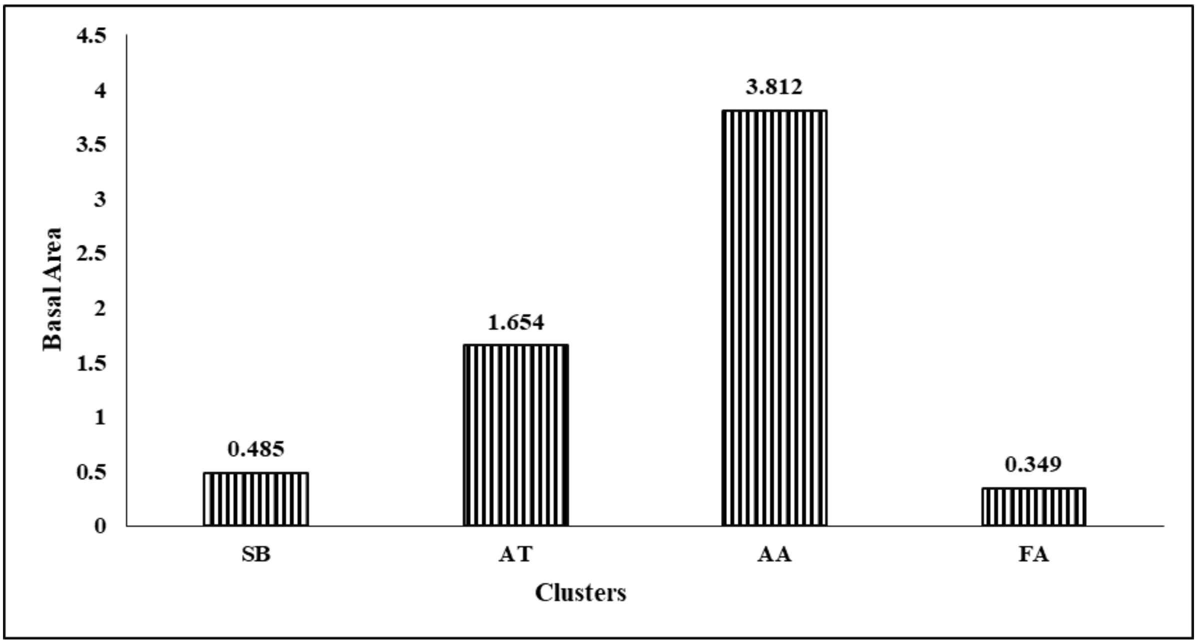

Figure 3. Basal Area Distribution in the Different Clusters

Fig. 4 revealed that AA had the highest species richness index (2.14) followed by AT (0.75) while FA had the least (0.30).

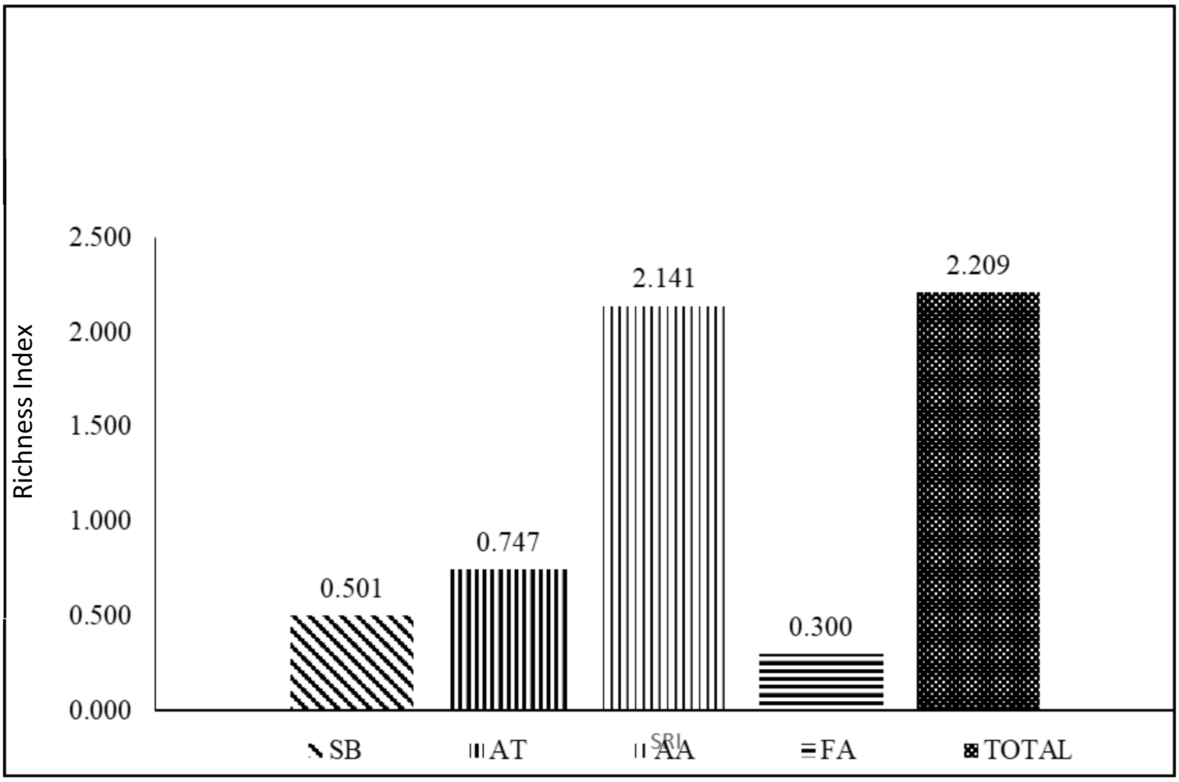

Figure 4. Showing the Species Richness Index

Results presented in Table 6 revealed very low species diversity (1.491). Neem tree (*Azadirachta indica*) was the most common species in the study area.

Table 6. Tree Species Diversity in the Study Area

Species	Frequency	Pi	Lnpi	pi*Lnpi
Azadirachta indica	312	0.551	-0.596	-0.32854
Acacia nilotica	43	0.076	-1.556	-0.11821
Balanite aegyptiaca	35	0.062	-0.666	0.04118
Eucalyptus camaldulensis	40	0.071	-2.645	-0.18693
Faidherbia albida	5	0.009	-4.711	-0.04162
Terminalia catappa	17	0.030	-3.507	-0.10533
Terminalia mantaly	29	0.051	-2.976	-0.15248
Moringa oleifera	8	0.014	-4.269	-0.06034
Mangifera indica	45	0.080	-2.526	-0.20083
Khaya senegalensis	5	0.009	-4.711	-0.04162
Psidium guajava	4	0.007	-4.962	-0.03507
Citrus limon	7	0.012	-4.423	-0.0547
Delonix regia	1	0.002	-6.215	-0.01098
Adansonia digitata	6	0.011	-4.51	-0.04781
P. longifolia	9	0.016	-4.135	-0.06575
∑	**566.00**			**-1.49139**

1.491385* = Shannon Weiner Diversity Index; NB: 0 = no diversity, 1 to 2.5 = low diversity, 2.6 to 4.5 = moderate diversity, and ≥4.6 to +∞ = high diversity.

DISCUSSION

Tree Species Composition in the main campus of Usmanu Danfodiyo University Sokoto

This study aims to provide insights and updated information on the diversity, composition, and structural characteristics of tree species in the main campus of Usmanu Danfodiyo University.

During the course of this research, a total of 566 individual trees were recorded, with 15 species belonging to 13 genera and 10 families (Table 1). The *Azadirachta* and *Acacia* families were the most dominant, with 312 and 48 individual trees recorded, respectively.

The findings indicate that *A. indica* was the most widely distributed tree species in the study area, with the highest relative frequency and relative abundance (Table 2). This could be attributed to its multi-purpose nature and the diverse ecosystem services, such as shade provision, windbreaks, green belts, and carbon sinks it provides (Shareef and Sohail, 2018; Ezzat et al., 2018), as well as its ability to adapt well to harsh environmental conditions prevalent in semi-arid regions (Bohre et al., 2016).

The results on structure and composition of tree species in this study further revealed the proportion of different tree species and their sizes, informing management decisions while helping the upcoming researchers in forestry and ecology to understand tree development and productivity in the study area. The findings also indicate the relative importance of each species in the study area, considering density, frequency and dominance. For example, results obtained on IVI helps prioritized species for conservation effort, thereby focusing on *A. indica* because of its higher IVI value. This is because IVI supports ecological impact assessments, which help in evaluating the potential effects of human activities on ecosystem. This is in tandem with Yakubu et al., (2022) who stated that tree species inventory and diversity studies help to understand the species composition and determine the information for forest conservation. By measuring species composition, researchers, conservationists, and forest managers can gain valuable insights into ecosystem functions, guiding conservation and management efforts. This is in conformity with Tahir et al., (2021) who reported that the importance value index (IVI) indicates the relative ecological significance of a tree species in a stand and also used for setting the priority/ rank of species for management and conservation practices in Ethiopia.

Structural Characteristics of Tree species in the main campus of Usmanu Danfodiyo University Sokoto

The study area is made of mostly even aged species of *A. indica* constituting the shelterbelts and avenue trees with few stands of *A. nilotica* and *B. aegyptiaca*. The academic areas are made up of patches of different species of amenity plants like the *T. catappa*, *T. mantaly*, *M. indica*, *P. longifolia.* The Fadama/farm areas are mostly composed of *M. indica* and a few of *A. digitata* species having irregular pattern of arrangement. The abundance of *M. indica* could be as a result of the economic benefits of the edible fruits.

The structural characteristics of trees, such as diameter at breast height (DBH) and tree height are crucial for understanding tree biology, ecology and management. Therefore, it can be deduce that the structural characteristics of *F. albida* and *A. indica* recorded in this study inform silvicultural practices, such as pruning, thinning, and stand management.

The high mean diameter value of *F. albida* suggests that this species is well-established and mature in the main campus of the university. However, some species such as *T. catappa*, *T. mantaly*, *M. oleifera*, *P. guajava*, *C. limon*, *D. regia*, *A. digitata*, and *P. longifolia* have relatively low mean diameter values, suggesting that they are still in their early stages of growth or may not be as well-established as other species in the study area. More so, they are used as amenity plantings in administrative buildings and faculty areas. Results obtained in this study indicate that *F. albida* and *A. indica* had the highest basal area, indicating their importance in evaluating habitat quality and biodiversity, thereby supporting conservation effort in the study area. Basal data informs pruning and canopy management decisions, ensuring optimal tree growth and development.

In comparison to a study conducted by Agbelade et al., (2016) in Abuja and Minna urban and peri-urban areas, found that *A. indica* had a mean diameter value lower than the value obtained in this study. This implies that the species are still growing in those areas. Furthermore, the areas/clusters where *A. indica* had high relative abundance and frequency were found to be less structurally diverse and had lower basal area compared to where it had less relative frequency and relative abundance. This suggests a positive correlation between diversity and basal area of species (Sagar et al., 2003).

Diversity of Tree species in Usmanu Danfodiyo University Sokoto, Main Campus

The study reveals that the Usmanu Danfodiyo University main campus has low species diversity (H' = 1.4913) and a species richness Index value of 2.209. The low diversity could be attributed to recent construction activities or other land use changes (Bukar et al., 2021; Ikyaaba, 2008). Compared to a study conducted by Bukar et al., 2021, at the University of Maiduguri (H' 0.0234), the species diversity in this study is higher. However, this is still lower than what was recorded by Amonum et al., 2019 in the

College of Forestry and Fisheries University of Agriculture Makurdi, Benue State (H' = 3.21) and Oluwatosin and Jimoh (2016), who obtained a value of 3.80 for the Oban Forest Reserve, Akure, Nigeria. in the College of Forestry and Fisheries University of Agriculture Makurdi, Benue State (H' = 3.21) (Amonum et al., 2019) and Oluwatosin and Jimoh (2016), who obtained a value of 3.80 for the Oban Forest Reserve, Akure, Nigeria. The low species diversity recorded in this study can be attributed to lack of adequate tree planting awareness campaigns and careful landscape planning in this area, despite being it an academic environment.

CONCLUSION

The study identified diverse clusters on the campus, such as Shelterbelts, Avenue Trees, Academic Areas, and Fadama Areas. However, the distribution and relative abundance of tree species varied across these clusters, emphasizing the importance of considering different campus zones in tree diversity assessments. *Azadirachta indica,* commonly known as Neem, emerged as the most abundant and dominant tree species in the main campus of Usmanu Danfodiyo University particularly the shelterbelts and avenue trees and academic areas. It constituted a significant portion, accounting for 55.1% of the total recorded trees, indicating its widespread presence.

The Variations in mean diameter at breast height among species highlighted differences in sizes of tree species. *F. albida* although low in relative abundance and frequency exhibited the highest mean diameter at breast heights, indicating it ecological importance and a substantial individual tree sizes compared to other species. The calculation of tree species diversity using the Shannon-Weiner index revealed that, although the diversity of the study area is low, but *A. indica* also contributed significantly to overall diversity of the area. While *A. indica* dominated in most clusters, *M. indica (Mango)* stood out in Fadama Areas, indicating its ecological significance and adaptability in these specific zones. The findings also revealed that although efforts are being made to establish amenity plantings in various academic areas to compensate for trees being felled for structure construction, the overall species diversity of the university remains low. The university management is encouraged to consider incorporating economic plants such as cashew (*Anacardium occidentale*) into the university community as it is well adapted to semi-arid regions, improves biodiversity, and provides economic benefits.

RECOMMENDATION

Based on the research findings and conclusions, the following recommendations are made:

i. The university management should intensify efforts to reforest areas that were deforested or where trees were felled for structure construction immediately after the structures have been completed.

ii. The university management should establish new plantations in any other area within the university community to compensate for areas converted to other land uses.

iii. Proper monitoring and care should be given to existing tree stands and newly established ones.

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