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Assessment of Tree Species Diversity and Abundance in Yelwa Campus, Atbu Bauchi, Nigeria

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ABSTRACT

This study examines the diversity and abundance of tree species in Yelwa campus of Abubakar Tafawa Balewa University, Bauchi, Nigeria. The campus was divided into 3 sites namely Site A, B and C where 3 plots of 100m x 100m were randomly laid in each site, making a total of nine sampling plots. Tree species were identified and direct counting method was performed in each plot. The Girth at Breast Height (GBH) of all the trees within each plot was measured and recorded. A total number of 35 different tree species from all the study sites were recorded; meanwhile, a total number of 904 individuals were sampled. Site 'B' had the highest species diversity (77.14%), followed by site 'A' (68.57%) and lastly site 'C' has minimum species diversity (54.29%). *Senna siamea* is the most dominant species, making up 21.58% of the total tree population, followed by *Khaya senegalensis* (10.40%), *Terminalia ivorensis* (8.41%), *Gmelina arborea* (6.20%), and *Anogeisus leiocarpa* (5.09%) respectively. Fifteen (15) tree families we found and Fabaceae family recorded the greatest number of individuals thus, the most abundant family. The study ultimately documented the baseline tree diversity and abundance of Yelwa University campus; therefore, one would recommend collaborative effort in conservation of trees species especially those that are least abundant like *Acacia sp, Adonsonia digitata, Borassus aethiopum, Ficus sp, Vitex doniana, Phoenix dactylifera* and *Hyphaene thebaica*.

Keywords: Abundance, Diversity, Distribution, Girth at Breast Height (GBH)

INTRODUCTION

Over the years the world has faced increased pressure on natural resources especially trees, that have undergone different levels of disturbance due to unapparelled rise in human population which have led to cutting of trees for firewood collection, charcoal production and infrastructural developments (Benneh *et al.* 1996; Omoro *et al.*, 2010*)*. This has consequences on tree species composition, diversity and abundance. Universities are regarded as champions, role models and advocates in fueling sustainable development which support coexistence between humans and biodiversity. In light of the conservation of trees to save them from declining, it is important to study the existing status of tree species diversity and abundance to provide baseline reference for assessment and guidance for their management (Suratman, 2012).

Many universities worldwide have green spaces (GS) as an integral part of their campuses because of significant benefits for ecological function and urban communities. Benefits from GS ranges from air purification, pollination and erosion control (Susilowati *et al*., 2021). In the wake of environmental crisis, with specific mention to global warming, a good quality urban forest is becoming paramount important as vegetation is key in mitigating the pangs of climate change and improvement of the quality of life (Morgenroth *et al*., 2016). Built up ecosystems or urbanized ecosystems tend to exclude a big proportion if not all-natural vegetation and as a result urbanization processes often cause vegetation loss and extinctions (Lessi *et al* 2017).

A study on diversity and spatial distribution of trees in the Federal University of São Carlos campus by Lepczyk *et al* (2017), revealed a satisfactory species diversity ($H^{'}$= 3.89). Furthermore, the study reveals low dominance of tree species with a same species individuals' aggregation, which all species with the highest abundance have an aggregated spatial distribution. Exotic species in this University were more than the native species, which a problematic situation in case of invasion by non-native species. An extensive floristic survey on tree diversity and their abundance in District Science Centre, Tirunelveli, Tamil Nadu, India was also done by Priya *et al*.,

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(2020), and reported 80 tree species in the campus. Among 80 species confined in 34 families and 68 genera, *Polyalthia longofolia* was the most dominant and frequent species. During the study several anthropogenic activities like cutting of branches, plastic bags and plastic bottle thrown around the vegetated areas exploited the tree population in the campus. These studies done elsewhere and the revelations from their findings ignited the need for the present study which acted as a pioneer research on tree composition diversity and abundance in university campuses in Abubakar Tafawa Balewa University Bauchi, Bauchi State, Nigeria.

A recent study was done to ascertain the composition, diversity, distributional pattern, and present management of woody species in the Dire Dawa University (DDU) complex in Ethiopia (Tadesse, 2023). From the 34 plots in the University Compound that were specifically chosen, several species were identified using a straight forward inventory procedure. The study identified 41 distinct species of woody plants from 24 distinct families with *Fabaceae*, *Bignoniaceae*, *Malvaceae* and *Moraceae* having more species. Overall, the findings of this study showed that the University had a significant amount of genetic diversity. It is against this background that the current study was initiated so as to understand the existing situation on the composition, diversity and abundance of woody vegetation at Yelwa University campus.

Oyerinde *et al* (2018), conducted an assessment of avenue tree diversity at Federal University of Technology (FUT) and Adekunle Ajasin University (AAU) in Ondo State, Nigeria. They conducted a total enumeration of all avenue trees in the two campus and the noted a rich tree species diversity of 513 tree species with 24 different species from 14 families in FUT and 22 species with 274 tree species from 13 families in AAU. They also noted that the dominant family was *Caesalpiniaceae* followed by *Mimosaceae* and *Verbenaceae* in the two campuses. Their study is one of the few studies done in Nigerian universities and they only focused on trees along avenues neglecting those that a not on avenues. Therefore, the current study was the first at Yelwa campus, Abubakar Tafawa Balewa University and it focused on the whole University campus' tree species composition, diversity and abundance. Nevertheless, the main aim of the study is to assess the tree species diversity and abundance in Yelwa Campus.

METHODOLOGY

Study area

This study was conducted at Abubakar Tafawa Balewa University Bauchi, Yelwa campus, located at latitude 100 17I North, longitude 80 49I East, at the altitude of 690.2 M above sea level in the northern guinea savannah ecological zone of Nigeria (Zaharaddeen *et al.*, 2010). The soil type is highly weathered and fragile with low activity clays. The climate is characterized by a rainy season that starts in April and ends in October, with the amount of rainfall of about 1300 mm per annum (Hassan, 2010), with the lowest mean monthly relative humidity of about 29%. The month of April is the hottest month of the year with mean minimum and maximum temperatures of 13.7°C and 30.11°C respectively (Bose *et al.,* 2014). The vegetation type is open woodland, dominated with tall grasses ranging between 1 and 3 m high in open areas and trees are up to 15 m high usually with short boles, small leaves, and isolated crowns. The vegetation is subjected to wildfire almost annually in the dry seasons; it is therefore dominated by fire-resistant species, (Obioha, 2009).

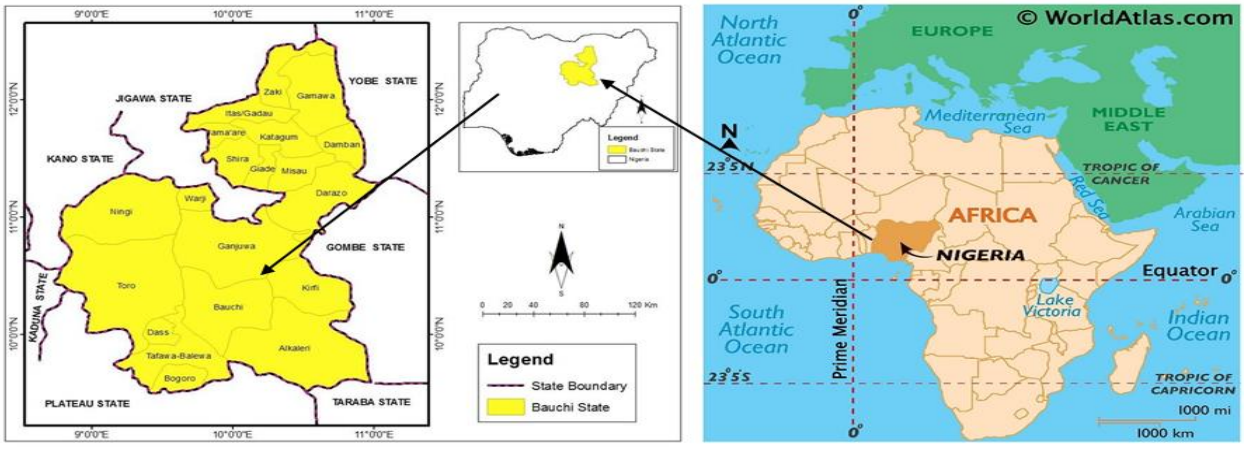

Fig 1. Map of Africa Showing the location of Nigeria. Source: WorldAtlas.

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Fig 2. Map of Nigeria Showing the location of Bauchi State (study area). Source: Administrative map of Nigeria.

Materials

In this Study, Various materials were applied to realize perfect collection and analysis of data. Measuring tape was used for determining the diameter at breast height (DBH) of trees and ranging pole for accurate measurements. Both a plant identification guide and a mobile application meant for plant identification enabled the identification of different plant species. The data concerning tree species, their frequency and others were recorded on a record sheet using a pencil and an eraser. Also, data entry and analysis were undertaken using a computer system.

Research design

The study area was divided into three sites (site A, site B and site C). Site A starts from the school main gate to the new geology building, using the campus bank road as the boundary, it includes the whole Faculty of Science. Site B starts from the campus bank road to the end of the School Library building, it includes the whole Faculty of engineering and engineering technology. Site C starts from the end of the School Library building to the end of the campus premises, it includes the whole Faculty of environmental technology. In each site, three sample plots of equal size were laid measuring (100 x 100m) as representative of each study site, making a total of nine sampling plots. In a case where identification was not possible in the field, a photograph was taken and the tree species were later identified by a professional Botanist.

Data collection

Direct count method was employed during data collection at the selected sites. Trees of the same species at the site were written only once on a data sheet at a site, their number or distribution from the site was distinguished in the occurrence column on a data sheet. The number of occurrences of individual species was then summed up in the frequency column. The procedure was applied to all species. After species were identified they were recorded in a data sheet. Origin of trees (indigenous or exotic) was also taken note of. Diameter at breast height (DBH) of all the trees was measured above 1.3m from the ground levels. In cases where tree trunk buttresses, the DBH was taken from the point just above the buttress, and in the case of a tree that bole branches at a breast height or below, the diameter was measured separately for all the branches and averaged as one DBH. In a case where more than one tree of the same species is found in a site, their DBH was measured all and averaged as one to avoid biases.

Statistical analysis

Trees diameter at breast height (DBH) was taken by measuring the Girth at Breast Height (GBH) of particular tree, and divide by π (3.142). as described by (Husch *et al*., 2003) Mathematically as shown below:

$$DBH = \frac{\text{Girth at Breast Hight}}{3.142}$$

Basal area was calculated (Avery *et al*., 2015) by multiplying DBH^2 with 0.005454. Mathematically:

$$\text{Basal area (BA)} = 0.005454 \times DBH^2$$

Relative frequency was calculated by dividing the individual frequency by the total number of frequencies, mathematically as shown below:

$$\text{Relative frequency (RF)} = \frac{\text{Individual frequency}}{\text{Sum of all frequency}}$$

Relative density was calculated by dividing the number of individual species by the total number of species, mathematically as shown below:

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Relative density (RD) = Number of individual species X 100

Total number of individuals

Relative abundance was calculated by dividing the relative density of a species by 100, mathematically as shown below:

Relative abundance (Pi) = Relative density of a species

100

Margalef species richness index (d) was also used as a simple measure to determine species richness, according to Margalef (1958)

$d = (S-1)/\ln N$

Where S = Total number of species, N = Total number of individuals in the site, and ln = natural logarithm

According to Shannon and Wiener (1949). Shannon diversity index was also used in analyzing the data in measuring the diversity. Shannon Wiener's diversity index is mathematically represented as:

$$H = \sum_{i=1}^{S} - (P_i * \ln P_i)$$

Where H = the Shannon Wiener's diversity index.

P_i = Fraction of the entire population made up of species i.

S = Numbers of species encountered.

$\sum$ = Sum from species 1 to species S

Important value index (IVI) will then be calculated by summing relative frequency, relative density, and relative abundance to measure how dominant a species is in a given area (Wiryani *et al.*, 2018). Represented as

IVI = (RD) + (Pi) + (RF)

RESULTS

A total number of 904 trees were recorded belonging to 35 different species (Table 1). These species belong to *Fabaceae*, *Malvaceae*, *Combretaceae*, *Meliaceae*, *Arecaceae*, *Rosaceae* *Rutaceae*, *Ebenaceae*, *Myrtaceae* *Euphorbiaceae*, *Moraceae*, *Lamiaceae*, *Anacardiaceae* *Sapotaceae*, *Verbenaceae* families. The most abundant trees belong to three families; *Fabaceae*, *Anacardiaceae*, and *Combretaceae*. *Fabaceae* family has the highest number of individuals with ten (10) species and *Malvaceae* is the least with only one species (Table 1).

Table 1: List of tree species in the study area with their species code, common name and family name

S/N	Species code	Botanical names	Common name	Family name
1	ACHO	*Acacia hockii*	Shittim wood	Fabaceae
2	ACPO	*Acacia polyacantha*	White thorn	Fabaceae

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3	ADDI	*Adonsonia digitata*	Baobab	Malvaceae
4	ALLE	*Albizia lebbeck*	Lebbeck	Fabaceae
5	ANLE	*Anogeisus leiocarpa*	African birch	Combretaceae
6	AZIN	*Azadirachta indica*	Nim tree	Meliaceae
7	BOAE	*Borassus aethiopum*	African fan palm	Arecaceae
8	CISI	*Citrus sinensis*	Orange tree	Rutaceae
09	DALA	*Dalbergia latifolia*	East-Indian rosewood	Fabaceae
10	DAOL	*Daniella oliveri*	African copaiba	Fabaceae
11	DERE	*Delonix regia*	Flamboyant	Fabaceae
12	DIME	*Diospyros mespiliformis*	Jackalberry	Ebenaceae
13	EUCA	*Eucalyptus camaldulensis*	River red gum	Myrtaceae
14	EUGR	*Eucalyptus grandis*	Rose gum	Myrtaceae
15	EUKA	*Euphorbia kamerunica*	Cactus	Euphorbiaceae
16	FISP	*Ficus sp*	Fig	Moraceae
17	FISY	*Ficus sycomorus*	Sycamora	Moraceae
18	GMAR	*Gmelina arborea*	Gamhar	Lamiaceae
19	HYTH	*Hyphaene thebaica*	Doum palm	Arecaceae
20	JACU	*Jatropha curcas*	Physic nut	Euphorbiaceae
21	KHSE	*Khaya senegalensis*	African mahogany	Meliaceae
22	LAAC	*Lannea acida*	Lanea	Anacardiaceae
23	LELE	*Leocaena leucocephala*	Jumbay	Fabaceae
24	MAIN	*Mangifera indica*	Mango tree	Anacardiaceae
25	PABI	*Parinari polyandra*	Parinari	Rosaceae
26	PAPO	*Parkia biglobosa*	African locust	Fabaceae
27	PHDA	*Phoenix dactylifera*	Date palm	Arecaceae
28	PSGU	*Psidium guajava*	Guava tree	Myrtaceae
29	SCBI	*Sclerocarya birrea*	Marula	Anacardiaceae
30	SESI	*Senna siamea*	Siamese cassia	Fabaceae

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31	TAIN	*Tamarindus indica*	Termarind	Fabaceae
32	TECA	*Terminalia catappa*	Indian almond	Combretaceae
33	TEIV	*Terminalia ivorensis*	Black afara	Combretaceae
34	VIPA	*Vitellaria pardoxa*	Shea tree	Sapotaceae
35	VIDO	*Vitex doniana*	Black plum	Verbenaceae

KEY: The species code was formed from the combination of two first letters of generic and species name

Site-Based Species Diversity Results

Site 'B' has the highest species diversity, followed by site 'A' and lastly site 'C' has minimum species diversity (Table 3). *Senna siamea* has the highest occurrence in site 'A' with 130 individuals' trees, followed by *Azadirachta indica* with 103 individuals, *and Khaya senegalensis* with 58 individuals (Table 3). In site 'B' *Khaya senegalensis* and *Dalbergia latifolia* recorded the highest occurrence with 32 individuals followed by *Azadirachta indica* with 28 trees. For Site 'C' *Terminalia ivorensis* has the maximum number of occurrences with 55 individuals, followed by *Senna siamea* with 45 individuals and lastly *Parkia biglobosa* with 8 trees as shown in Table 2.

Table 2: Total count of species within the study area

S/N	**Tree species**	**Site 'A'**	**Site 'B'**	**Site 'C'**	**Total**
1	*Acacia hockii*	2	1		3
2	*Acacia polyacantha*	-	10	4	14
3	*Adonsonia digitata*	-	-	2	2
4	*Albizia lebbeck*	5	2	1	8
5	*Anogeisus leiocarpa*	22	18	6	46
6	*Azadirachta indica*	103	28	1	132
7	*Borassus aethiopum*	3	3	-	6
8	*Citrus sinensis*	2	-	-	2
9	*Dalbergia latifolia*	6	32	6	44
10	*Daniella oliveri*	3	1	1	5
11	*Delonix regia*	14	27	-	41
12	*Diospyros mespiliformis*	1	1	2	4
13	*Eucalyptus camaldulensis*	7	1	-	8
14	*Eucalyptus grandis*	2	3	-	5

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15	*Euphorbia kamerunica*	1	-	-	1
16	*Ficus sp*	-	-	1	1
17	*Ficus sycomorus*	2		1	3
18	*Gmelina arborea*	27	26	3	56
19	*Hyphaene thebaica*	10	-	-	10
20	*Jatropha curcas*	1	-	-	1
21	*Khaya senegalensis*	58	32	4	94
22	*Lannea acida*	5	3	-	8
23	*Leocaena leucocephala*	3	2	-	5
24	*Mangifera indica*	20	16	-	36
25	*Parinari polyandra*	3	-	1	4
26	*Parkia biglobosa*	5	1	8	14
27	*Phoenix dactylifera*	3	2	1	6
28	*Psidium guajava*	3	1	-	4
29	*Sclerocarya birrea*	9	10	2	21
30	*Senna siamea*	130	20	45	195
31	*Tamarindus indica*	12	4	3	19
32	*Terminalia catappa*	8	-	-	8
33	*Terminalia ivorensis*	20	1	55	76
34	*Vitellaria pardoxa*	4	12	4	20
35	*Vitex doniana*	2	-	-	2
	Grand total	**496**	**257**	**151**	**904**

Site Based Shanon-Wierner's Diversity Index

The results from Shanon-Wierner's index diversity revealed that, site "B" has highest index value (H^1= 2.654435) followed by site "A" index value (H^1= 2.539791) and lastly is site "C" (H^1= 2.03297) as shown in the figure below:

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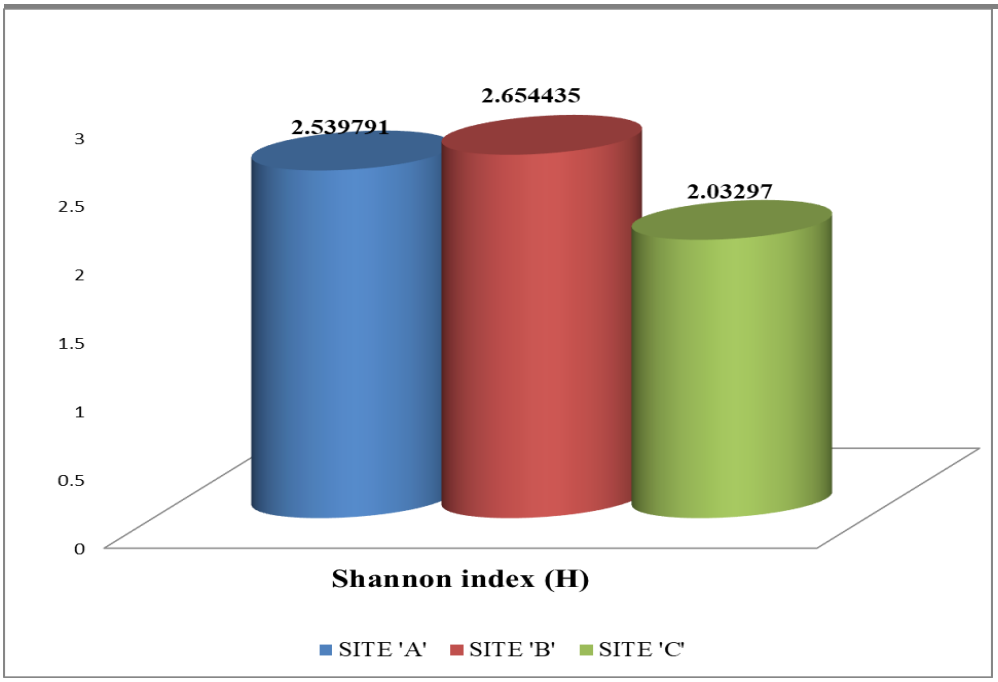

Figure 1: Diversity index across the study sites

Shanon-Wiener's Diversity Results

Results from Shanon-Wiener's diversity shows highest abundance of Fabaceae family (H^1 = 0.36544) and the least family is *Malvaceae* (H^1 = 0.0345). The rest of the results are as follows (Table 3).

Table 3: Families relative density, relative abundance and Shannon-wiener's diversity

S/N	Families	Number of tree species	RD	Pi	H
1	Anacardiaceae	18	12.5	0.125	0.25993
2	Arecaceae	9	6.25	0.0625	0.17328
3	Combretaceae	16	11.11111	0.11111	0.24413
4	Ebenaceae	3	2.08333	0.02083	0.08065
5	Euphorbiaceae	2	1.38888	0.01388	0.05939
6	Fabaceae	47	32.63888	0.32638	0.36544
7	Lamiaceae	7	4.86111	0.04861	0.14699
8	Malvaceae	1	0.69444	0.00694	0.03451
9	Meliaceae	15	10.41666	0.10416	0.2356
10	Moraceae	3	2.08333	0.02083	0.08065
11	Myrtaceae	7	4.86111	0.04861	0.14699
12	Rosaceae	2	1.38888	0.01388	0.05939

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13	Rutaceae	2	1.38888	0.01388	0.05939
14	Sapotaceae	7	4.86111	0.04861	0.14699
15	Verbenaceae	2	1.388888889	0.01388	0.05939

Keys: RD = Relative density, Pi = Relative abundance and H = Shannon diversity

Origin of the Tree Species

Trees' species varies in origin, some are indigenous while some are exotic (foreign) as shown in Table 4. The proportion of indigenous trees to exotic within the campus is almost the same, while the origin of few species was yet to be identified (unknown), as can be seen in Table 4.

Table 4: Origin of tree species found in the study area

S/N	INDIGENOUS TREES	EXOTIC TREES	UNKNOWN ORIGIN
1	*Acacia hockii*	*Albizia lebbeck*	*Senna siamea*
2	*Acacia polyacantha*	*Azadirachta indica*	
3	*Adonsonia digitate*	*Citrus sinensis*	
4	*Anogeisus leiocarpa*	*Dalbergia latifolia*	
5	*Borassus aethiopum*	*Delonix regia*	
6	*Daniella oliveri*	*Eucalyptus camaldulensis*	
7	*Diospyros mespiliformis*	*Eucalyptus grandis*	
8	*Euphorbia kamerunica*	*Gmelina arborea*	
9	*Ficus sp*	*Jatropha curcas*	
10	*Ficus sycomorus*	*Leocaena leucocephala*	
11	*Hyphaene thebaica*	*Mangifera indica*	
12	*Khaya senegalensis*	*Parinari polyandra*	
13	*Lannea acida*	*Psidium guajava*	
14	*Parkia biglobosa*	*Terminalia catappa*	
15	*Phoenix dactylifera*		
16	*Sclerocarya birrea*		
17	*Tamarindus indica*		
18	*Terminalia ivorensis*		
19	*Vitellaria pardoxa*		

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20	*Vitex doniana*		
Total	**20 Indigenous Trees**	**14 Exotic Trees**	**1 Unknown Tree**
Grand Total = 35 Trees			

Species Abundance

In general, the study area (Yelwa campus), ***Senna siamea*** is dominant species with highest important value index (IVI), followed by *Anogeisus leiocarpa Khaya senegalensis, Terminalia ivorense,* and *Gmelina arborea* respectively (Table 5).

Table 5: Species with frequency, relative frequency, relative density, relative abundance and important value index

SPECIES	FREQ	RF	RD	Pi	IVI
Acacia hockii	3	0.003308	8.108108	0.081081	8.192497
Acacia polyacantha	14	0.015436	37.83784	0.378378	38.23165
Adonsonia digitata	2	0.002205	5.405405	0.054054	5.461665
Albizia Lebbeck	8	0.00882	21.62162	0.216216	21.84666
Anogeisus leiocarpa	46	0.145535	356.7568	3.567568	360.4699
Azadirachta indica	132	0.001103	2.702703	0.027027	2.730832
Borassus aethiopum	6	0.006615	16.21622	0.162162	16.38499
Citrus sinensis	2	0.002205	5.405405	0.054054	5.461665
Dabergia latifolia	44	0.048512	118.9189	1.189189	120.1566
Daniella oliveri	5	0.005513	13.51351	0.135135	13.65416
Delonix regia	41	0.045204	110.8108	1.108108	111.9641
Diospyros mespiliformis	4	0.00441	10.81081	0.108108	10.92333
Eucalyptus camaldulensis	8	0.00882	21.62162	0.216216	21.84666
Eucalyptus grandis	5	0.005513	13.51351	0.135135	13.65416
Euphorbia kamerunica	1	0.001103	2.702703	0.027027	2.730832
Ficus sp	1	0.001103	2.702703	0.027027	2.730832
Ficus sycomorus	3	0.003308	8.108108	0.081081	8.192497
Gmelina arborea	56	0.061742	151.3514	1.513514	152.9266
Hyphaene thebaica	10	0.011025	27.02703	0.27027	27.30832
Jatropha curcas	1	0.001103	2.702703	0.027027	2.730832
Khaya senegalensis	94	0.103638	254.0541	2.540541	256.6982
Lannea acida	8	0.00882	21.62162	0.216216	21.84666

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Leocaena leucocephala	5	0.005513	13.51351	0.135135	13.65416
Mangifera indica	36	0.039691	97.2973	0.972973	98.30996
Parinari polyandra	4	0.00441	10.81081	0.108108	10.92333
Parkia biglobosa	14	0.015436	37.83784	0.378378	38.23165
Phoenix dactylifera	6	0.006615	16.21622	0.162162	16.38499
Psidium guajava	4	0.00441	10.81081	0.108108	10.92333
Sclerocarya birrea	21	0.023153	56.75676	0.567568	57.34748
Senna siamea	195	0.214994	527.027	5.27027	532.5123
Tamarindus indica	19	0.020948	51.35135	0.513514	51.88581
Terminalia catappa	8	0.00882	21.62162	0.216216	21.84666
Terminalia ivorensis	76	0.083793	205.4054	2.054054	207.5433
Vitellaria pardoxa	20	0.022051	54.05405	0.540541	54.61665
Vitex doniana	2	0.002205	5.405405	0.054054	5.461665

KEY: FREQ = Frequency, RF= Relative frequency, RD= Relative density, Pi= Relative abundance and IVI= Important value index.

Species Richness

The results of the study show that, in terms of species richness index, *Senna siamea* has the highest number accounting 28.48692 (d-index) followed by *Anogeisus leiocarpa having* d-index of 19.23601. The rest of the results on species richness are shown on table (6) below:

Table 6: Species richness index, species diversity with Diameter at breast height and Basal Area

S/N	**SPECIES**	**d-index**	**H-index**	**DBH (cm)**	**BA (ft)**
1	*Acacia hockii*	0.29368	0.2037	13.68555	1.021503
2	*Acacia polyacantha*	1.908917	0.367731	7.797581	0.331616
3	*Adonsonia digitata*	0.14684	0.157717	58.24316	18.50142
4	*Albizia Lebbeck*	1.027879	0.33113	47.42202	12.26522
5	*Anogeisus leiocarpa*	19.23601	4.537532	77.65754	32.8914
6	*Azadirachta indica*	0	0.097592	59.19796	19.11299
7	*Borassus aethiopum*	0.734199	0.294999	50.28644	13.79167
8	*Citrus sinensis*	0.14684	0.157717	5.092298	0.14143
9	*Dabergia latifolia*	6.314112	0.206053	33.4182	6.090899
10	*Daniella oliveri*	0.587359	0.27047	55.69701	16.91916

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11	*Delonix regia*	5.873592	0.113752	56.33355	17.3081
12	*Diospyros mespiliformis*	0.440519	0.2405	40.73838	9.051545
13	*Eucalyptus camaldulensis*	1.027879	0.33113	39.78358	8.632226
14	*Eucalyptus grandis*	0.587359	0.27047	49.01337	13.1022
15	*Euphorbia kamerunica*	0	0.097592	21.64227	2.554586
16	*Ficus sp*	0	0.097592	53.15086	15.40763
17	*Ficus sycomorus*	0.29368	0.2037	60.15277	19.73451
18	*Gmelina arborea*	8.076189	0.627251	69.06429	26.0149
19	*Hyphaene thebaica*	1.321558	0.353603	50.28644	13.79167
20	*Jatropha curcas*	0	0.097592	35.64609	6.930089
21	*Khaya senegalensis*	13.6561	2.368741	87.683	41.93204
22	*Lannea acida*	1.027879	0.33113	50.28644	13.79167
23	*Leocaena leucocephala*	0.587359	0.27047	73.83832	29.73574
24	*Mangifera indica*	5.139393	0.026658	61.42584	20.57867
25	*Parinari polyandra*	0.440519	0.2405	46.46722	11.77629
26	*Parkia biglobosa*	1.908917	0.367731	81.1585	35.92387
27	*Phoenix dactylifera*	0.734199	0.294999	31.19032	5.305849
28	*Psidium guajava*	0.440519	0.2405	21.96053	2.630274
29	*Sclerocarya birrea*	2.936796	0.321468	47.58116	12.34767
30	*Senna siamea*	28.48692	8.75962	23.55188	3.025284
31	*Tamarindus indica*	2.643117	0.342246	84.02292	38.50442
32	*Terminalia catappa*	1.027879	0.33113	24.82495	3.361182
33	*Terminalia ivorensis*	11.01299	-1.47854	23.23361	2.944072
34	*Vitellaria pardoxa*	2.789956	0.332533	47.74029	12.43041
35	*Vitex doniana*	0.14684	0.157717	61.33036	20.51475

KEY: d-index = Margalef species richness, H-index = Shannon-Weiner's diversity index, DBH = Diameter at breast height and BA = Basal Area

DISCUSSION

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The current study revealed that Fabaceae family was dominant in Abubakara Tafawa Balewa University Yelwa Campus. Based on the study on Diversity and Distribution of Nigerian Legumes (Fabaceae) by Abubakar *et al*., (2021), the Northern region of Nigeria is dominated with Fabaceae (43%) more than any other region. The university under study lies in the northern region of Nigeria hence the abundance of Fabaceae family. Similarly, the findings of our research concurred with the findings of Yilangai *et al*., (2023), Diversity, abundance, and conservation status of woody species in a West African dry forest, which reveals that the Fabaceae family was among the dominant families in the area, highlighting its prevalence in the region's flora (and unsurprisingly, ATBU is situated in the same region). These findings also aligned with the study conducted by Ogunyebi *et al*. (2018), in University of Lagos**;** Assessment of tree species diversity, in which the result revealed that; the family Fabaceae had the highest frequency (14 species) representing 20.59% of total species enumerated in all the plots followed by Moraceae which consists of 7 species (10.29%).

The findings of the current study were consistent with findings of Bukar *et al.,* (2021), which stated that *Azadirachta indica* and *Eucalyptus camaldulensis* are the most abundant species, with *Faidherbia albida* (a member of the Fabaceae family) having the highest basal area in University of Maiduguri Campus. This indicates a notable presence of Fabaceae species, though not necessarily dominant. Furthermore, the findings of this study were consistent to those of Bello *et al*., (2021), which identifies 552 taxa within the Fabaceae family in Nigeria, encompassing 540 species across 155 genera and six subfamilies. Notably, 36 of these taxa are new records for the country, highlighting previously undocumented species.

It was shown that in site "A", *Senna siame*a was the predominant species than any other species. It is important to note that the site is a residential building and the plant has ornamental value, medicinal uses and some environmental benefits (Ogunkunle & Ladejobi, 2006; Bello *et al*., 2021). This could be the reason for the abundance of this tree species in this site as residents of this place could be keeping it to accrue the benefits that the tree offers. Research conducted by Ogunniran *et al*., (2024), reveals that *Senna siamea* leaves possess significant nutritional and phytochemical properties, including antioxidant and antimicrobial activities. These attributes enhance its utility in local communities, further promoting its cultivation.

Meanwhile, Site "B" *Khaya senegalensis* and *Dalbergia latifolia* dominated. These two species are considerably sensitive to climatic and soil conditions of a place, therefore their abundance in this area might be due to a favourable local climate and soil conditions of the area (da Silva *et al*., 2023). *Terminalia ivorensi* dominated site "C" a species that usually act as one of the pioneer tree species in disturbed areas (Whole Earth Education, 2020). Given this background the abundance this species might be a result of its colonizing capabilities of disturbed or open areas, where no trees are growing or where trees have been removed, such as Yelwa campus.

The proportion of indigenous trees to exotic within the campus is almost the same, while the origin of few species was yet to be identified (one unknown). This scenario might require attention because according to research conducted by Escobedo *et al*., (2011); Guerrero-Leiva *et al*., (2016) and in Santiago, the ecosystem services provided by native tree species with evergreen foliage are multiple, temporarily persistent, and highly demanded. Therefore, the abundance of exotic species in Yelwa campus ATBU might destabilise the proportion of ecosystem services offered by indigenous species despite the provision of ecological services that might be offered by exotic species. In Addition, there is invasive potentiality by the exotic species in case they become invasive, spreading rapidly and causing significant ecological and economic damage. The dominance of exotic species can lead to a decline in native biodiversity, affecting the ecological integrity and cultural heritage of the area, (Guerrero-Leiva *et al*., 2016).

CONCLUSION AND RECOMMENDATION

The diversity and abundance of tree species in Abubakar Tafawa Balewa University, Yelwa campus have been documented. The area is blessed with vegetation resources that either directly or indirectly give contribution or support life of people. The study has shined little light on many tree species within the study area and this increased understanding of tree diversity within the campus. This study provides a reference baseline for monitoring changes in diversity and abundance of tree species which is of vital importance to the ecology of green spaces of Abubakar Tafawa Balewa University.

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These diverse flora species provide invaluable environmental and economic services and thus, are of great importance. Conservative measures should be put in place to checkmate their disappearance as well as promote the cultivation of more trees. Trees species that have medicinal value (such as *Senna* spp) should be put into intensive research to explore their potentials. Awareness and orientation should be given towards sustainable uses of trees as well as the negative effects of unlawful felling of trees to enable us to appreciate the plants in the University campus.

Government and non-governmental organizations should come together in collaboration with the university campus to mount a program on the sustenance and conservation of both the exotic and indigenous trees like *Acacia sp, Adonsonia digitata, Borassus aethiopum, Ficus sp, Vitex doniana, Phoenix dactylifera, Hyphaene thebaica,* etc. that are on the verge of extinction in the study area. Duplication of similar studies in different parts of Nigeria is highly recommended to understand green spaces in institutions of high learning, so as the transfer of managerial knowledge among Nigerian institutions in order to achieve sustainable development that consider conservation of trees.

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