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Assessment of Tree Species Diversity in the University of Lagos, Akoka, Lagos

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ABSTRACT: This study was aimed at assessing and providing management options for tree species growing on Akoka Campus of University of Lagos, Southern-Western Nigeria by collecting data from four (4) randomly selected 50m x 50m plots in the study area. The assessment was carried out through extensive field survey with the inventory of all tree species, including their mean diameters at breast height (DBH), heights (H). A total of 67 woody tree species within 27 families were represented in the study area. 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 result revealed high values for tree species diversity and also provided necessary information such as tree height and diameter at breast height, which will be used in proper management and maintenance of the tree species numbered; hence, proper management and sustainability of the tree species can be achieved.

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Nigeria vegetation is one of the most endowed in Africa, as almost all the vegetation types that exists in other African countries are found widely distributed in different geopolitical zones of the country, this is favoured by the variations in climate and geographic features, which harbours about 7895 species of plant; this makes her one of the richest countries in the continent in terms of biodiversity Adeyemi and Ogundipe, 2012; Pelemo *et al*., (2011).

However, these habitats are under threat from advancing civilization and other unsustainable human activities, the attitude of the populace towards conservation is relatively poor; thereby resulting to inevitable loss of genetic resources at all levels. Ideally, conservation of biodiversity is supposed to be an intrinsic responsibility for all mankind according to IUCN, but this is far from the case, as the rate of destructive anthropogenic activities on the floras and biodiversity at large escalates daily with nearly 90% of forest in Nigeria cleared (Kabiru, 2008). In 2010 Nigeria had 9 million hectares of forest, 336,000 hectares of which were primary forest (FAO, 2010). But the continual existence of this forest is in doubt, as several authors such as Batta *et al*., 2013; Pelemo *et al*., 2011; Ladipo (2010), have lamented the rate of deforestation in the country which is estimated at 3.5% per year, translating to a loss of 350,000–400,000 ha of forest land per year and the entire Nigeria's forest land area now is about 10%, which is well below FAO's recommended national minimum of 25%. Perhaps this is threatening about 484 plant species in 112 families of 7895 plant species estimated in the country with extinction (Pelemo *et al*., 2011). Unarguably, one of the persistent problems associated with deforestation is the selective exploitation of some targeted species for economic, social and spiritual paraphernalia, and trees are mostly targeted (Alamu and Agbeja, 2011).

In Nigeria, there are about 560 species of trees (Ihenyen *et al*., 2009). However continued existence of these trees species is in jeopardy; because deforestation, logging and other various forms of unsustainable activities have drastically increased in recent times, thereby posing appreciable risk of local extinction to some species. Indeed, the tree species growing in this study area, situated in the most commercial and urbanized city of Nigeria and accommodates about 10% of the entire population of the country (Pelemo *et al*., 2011), are however not spared from the aforementioned threats. Rapid increase in population has led to the development of several infrastructural facilities so as to provide comfort to insatiable human's wants; which of course has led to direct and indirect destruction of almost all the ancestral vegetation in and within the study area and its proximate vegetation. Urbanization and other commercial activities are socioeconomic problems, and are too difficult to be controlled. Attempt to list the tree species that exist in this area has been made, but only skeletal attempt has been made so far Shonubi and Okusanya, 2007; Adekanmbi and Ogundipe (2009). This research is aimed at

enumerating and identifying different tree species in each sampling point pertaining to the study in order to provide a detailed assessment of the remnant plants species, so as to decide on adequate management options and conservation measures for sustainability.

MATERIALS AND METHODS

Study Area: The study was conducted in Akoka campus of University of Lagos, Yaba, Lagos, South-Western Nigeria (Fig. 1). The area which is largely surrounded by the scenic view of the Lagos lagoon comprises a total of 802 acres (3.25km^2) of land. It is located on longitude 3°24'E and latitude 6°30'N and on elevation of 40-90m, which makes flooding difficult.

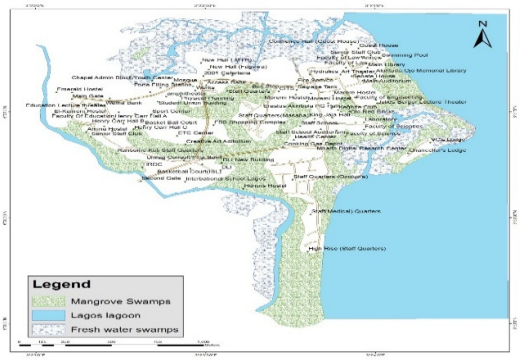

Fig 1: Map showing study area; fresh and mangrove swamp of University of Lagos

The vegetation in this area is half cleared and developed, and the remainder is represented by mangrove vegetation and most of the species have diminished in number and density (Nodza *et al*., 2014). It has an undulating terrain, half of which represents buildings, with various fresh water channels and creeks passing across at different location of this area. A large area of mangrove swamps, roughly 50%, dominates the vegetation. In the north and southeast lies the brackish lagoon water which supports a typical terrestrial habitat, and experiences less human disturbance while in the south and southwest lays the fresh water, where the soil is highly rich and supports a rich flora which is highly favoured by the climate type much disturbed by human activities. A rich lush of grasses species such as *Panicum subalbidum*, *Panicum maximum*, *Andropogon spp*, *Sporobolus spp*, *Andropogon spp*; herbaceous plants such as *Chromolaena odorata, Ipomoea aquatic, Combretum spp, Asystasia gangentica, Typha australis*, and Sedges dominated by *Kyllinga erecta, Cyperus esculentus* and *Cyperus javanicus,* amongst others, were well represented in each sampling plot.

Data Collection: A Global Position System (GPS) was used during the sampling period. The study area was divided into four sampling plots. In each of the sampling plot, trees were enumerated in a 50x50m plot, samples were collected and the tree species enumerated were identified.

The heights of the various tree species encountered were measured using Haga Altimeter and diameter at breast height (DBH) was taken using a Diameter Tape at 1.3meters above the ground level.

Haga Altimeter was used to measure the tree heights within a fixed distance to the tree by the trigonometric principle and slope in percentage. A suitable scale was selected by rotating the adjustment disk at the front of the device and a reference tape was installed at the tree to determine the distance optically. Consequently, the following measurements were taken; (i). The corresponding height scale was selected turning the adjustment disk; in this case 15m scale was used (i.e. standing at 15m away from the tree to be measured). (ii). the bottom of the tree was sighted through the Haga Altimeter and then locked (the pointer needle) for the value gotten to be recorded. The same procedure was carried out for the crown of the tree. (iii). the difference between the value obtained for the crown of the tree and that of the bottom of the tree was calculated to determine the tree height.

Diameter Tape (D-TAPE): A diameter tape (D-tape) was used to measure diameter of the trees at breast height (DBH). The DBH was measured at a fixed height of 1.3m (130 cm) above the ground level. The DBH was measured up high the tree (at 1.3m) to avoid measuring a tree's butt swell. Thus the height and diameter values were used to determine the volume of the trees.

Determination of DBH: The diameter at breast height of the trees was determined using a Diameter Tape to take the diameter of the trees at 1.3meters above ground level.

Data Analysis: The data were analysed using the Shannon-Wiener diversity index. The Shannon-Wiener Diversity Index, which accounts for species richness and how the species are distributed, is derived from the relation;

$$H' = -\sum_{i=1}^{R} \rho i \cdot In(\rho i)$$

Where: H'=Shannon-Weiner index; R=Number of species; ρi=Proportion of individuals or abundance of the i^{th} species expressed as a proportion of the total number of individuals of all species (In = log base10).

Also, the mean of the diameters at breast height (DBH) and total height of the different species of trees were taken. The analysis of the frequency of the individual families was done by plotting a chart of the

frequency of each family against the total number of families encountered in the study area.

RESULTS AND DISCUSSIONS

A total of 67 woody tree species with varying heights and diameter at breast height (all belonging to 57 genera and 26 families) were enumerated (Table 1). The number of tree species encountered in a sample survey was adopted as a surrogate for the actual species richness in this study (Adekunle *et al.,* 2013). Among 26 families identified, Fabaceae (20.89%) and Moraceae (10.45%) were the most frequent species (tables 2 and 3). Several families namely: Avicennaceae, Sapindaceae, Calophyllaceae, Casuarinaceae, Chrysophylloideae, Boraginaceae, Malvaceae, Meliaceae, Lythraceae, Lauraceae, Verbenaceae were the least frequent tree species, each occurring in only one or two belt transect.

Table 1: Mean Diameter at Breast Height (DBH) and Total Height of Tree Species enumerated.

S/N	Scientific Name	Local Name	DBH (cm)	Height (m)
1.	*Adansonia digitata*	Baobab tree (ose)	101	15
2.	*Albizzia lebbeck*	Eshegeshege, gbagbo	32	14
3.	*Albizia zygia*	Nyie avu, Ayin rela	48	20
4.	*Alstonia boonei*	Igi ope, Nkwu, kwakwar	44	13
5.	*Anacardium occidentale*	Cashew nut,Kaju,Kasu	28	9
6.	*Annona muricata*	Soursop, Eko oyinbo	25	8
7.	*Anthocleista djalonensis*	Ayuu,Sapo	38	12
8.	*Anthocleista vogelii*	Cabbage tree, Mpoto, Apa oro	27	15
9.	*Artocarpus communis*	Jackfruit tree	59	15
10.	*Avicennia germinans*	Black mangrove	49	12
11.	*Azadirachta indica*	Neem tree, Dongoyaro	43	8
12.	*Bauhinia monandra*	Orchid tree	47	7
13.	*Blighia sapida*	Ackee, Bread fruit	57	13
14.	*Bombax buonopozense*	Eso	62	23
15.	*Bridelia micrantha*	Coast goldleaf	41	15
16.	*Calophyllum inophyllum*	Borneo Mahogany, Alexandrian laurel	38	13
17.	*Cassia siamea*	Pheasant wood	28	7
18.	*Casuarina equisetifolia*	Coast sheoak	43	12
19.	*Ceiba pentandra*	Kapok tree, silk-cotton tree	35	24
20.	*Chrysophyllum albidum*	Agbalumo tree	30	6
21.	*Citrus sinensis*	Sweet orange, osan	39	8
22.	*Cocos nucifera*	Coconut, agbon	24	13
23.	*Cola gigantean*	Giant cola	50	26
24.	*Cola nitida*	Kola nut, Abata cola, goro cola	46	13
25.	*Cordia abyssinica*	Kababu, mukumari	42	8
26.	*Delonix regia*	Flame tree, royal Poinciana	34	9
27.	*Dialium guineensis*	Awin, icheku	44	8
28.	*Elaeis guineensis*	African oil palm	43	10
29.	*Erythrina senegalensis*	Nte/Coral tree	41	8
30.	*Eugenia malaccensis*	Malaysian apple	15	12
31.	*Ficus congoensis*	Clusterfig	41	9
32.	*Ficus exasperate*	Sycamore fig	48	16
33.	*Ficus sycomorus*	Fig tree	41	18
34.	*Ficus vallis-chaudae*		40	10
35.	*Gliricidia sepium*	Agunmaniye	47	11
36.	*Gmelina arborea*	Beechwood, gamhar	38	20
37.	*Holarrhena floribunda*	False rubber tree	33	22
38.	*Hildagardia barteri*	Okurugbedu	93	12
39.	*Hura crepitans*	Sandbox tree, jabillo, possum wood	55	12
40.	*Jacaranda mimosifolia*	Brazilian rose tree, blue trumpet tree	52	13
41.	*Khaya grandifoliola*	African mahogany	95	38
42.	*Lagerstroemia speciosa*	Pride of India, banaba	40	27
43.	*Mangifera indica*	Mango tree	44	9
44.	*Milicia excels*	Iroko, African teak	71	40
45.	*Millettia thonningii*	Teteku	36	5
46.	*Morinda lucida*	Oruwo, eze-ogu	37	8
47.	*Newbouldia laevis*	African boarder tree	32	8
48.	*Peltophorum pterocarpum*	Copperpod, golden flamboyant	43	7
49.	*Persea Americana*	Avocado tree	32	12
50.	*Phoenix reclinata*	African wild date palm	37	8
51.	*Pithecellobium dulce*	Manila Tamarind	48	12
52.	*Psidium guajava*	Guava tree	31	5
53.	*Raphia hookeri*	Raphia palm, Ogoro, ayon udin	45	7
54.	*Rauvolfia vomitoria*	Swizzle stick, Asofeyeje,	48	7
55.	*Roystonea oleracea*	Royal palm	51	11
56.	*Senna alata*	Candle bush, ringworm shrub	32	8
57.	*Senna fistula*	Alexandrian Senna	27	7
58.	*Spondias mombin*	Hog plum	35	13
59.	*Sterculia tragacantha*	Owun, Omurin	40	9
60.	*Tabebuia rosea*	Pink trumpet tree	42	10
61.	*Tectona grandis*	Indian Oak	37	12
62.	*Terminalia catappa*	Almond tree	32	11
63.	*Terminalia randii*	Spiny cluster leaf tree	19	7
64.	*Terminalia ivorensis*	Idigbo, Afara	18	6
65.	*Terminalia superba*	Afara, limba	52	17
66.	*Treculia Africana*	African breadfruit, Ukwa	43	12
67.	*Polyalthia longifolia*	Ashok tree, Indian mast tree	17	8

Table 2: Family of each tree species encountered in the study area

S/N	Scientific Name	Family
1.	*Adansonia digitata*	Bombacaceae
2.	*Albizzia lebbeck*	Fabaceae
3.	*Albizia zygia*	Fabaceae
4.	*Alstonia boonei*	Apocynaceae
5.	*Anacardium occidentale*	Anacardiaceae
6.	*Annona muricata*	Annonaceae
7.	*Anthocleista djalonensis*	Loganiaceae
8.	*Anthocleista vogelii*	Loganiaceae
9.	*Artocarpus communis*	Moraceae
10.	*Avicennia germinans*	Avicennaceae
11.	*Azadirachta indica*	Fabaceae
12.	*Bauhinia monandra*	Fabaceae
13.	*Blighia sapida*	Sapindaceae
14.	*Bombax buonopozense*	Bombacaceae
15.	*Bridelia micrantha*	Euphorbiaceae
16.	*Calophyllum inophyllum*	Calophyllaceae
17.	*Cassia siamea*	Fabaceae
18.	*Casuarina equisetifolia*	Casuarinaceae
19.	*Ceiba pentandra*	Bombacaceae
20.	*Chrysophyllum albidum*	Chrysophylloideae
21.	*Citrus sinensis*	Rubiaceae
22.	*Cocos nucifera*	Arecaceae
23.	*Cola gigantean*	Sterculiaceae
24.	*Cola nitida*	Sterculiaceae
25.	*Cordia abyssinica*	Boraginaceae
26.	*Delonix regia*	Fabaceae
27.	*Dialium guineensis*	Fabaceae
28.	*Elaeis guineensis*	Arecaceae
29.	*Erythrina senegalensis*	Fabaceae
30.	*Eugenia malaccensis*	Myrtaceae
31.	*Ficus congoensis*	Moraceae
32.	*Ficus exasperate*	Moraceae
33.	*Ficus sycomorus*	Moraceae
34.	*Ficus vallis-chaudae*	Moraceae
35.	*Gliricidia sepium*	Fabaceae
36.	*Gmelina arborea*	Anacardiaceae
37.	*Holarrhena floribunda*	Apocynaceae
38.	*Hildagardia barteri*	Malvaceae
39.	*Hura crepitans*	Euphorbiaceae
40.	*Jacaranda mimosifolia*	Bignonaceae
41.	*Khaya grandifoliola*	Meliaceae
42.	*Lagerstroemia speciosa*	Lythraceae
43.	*Mangifera indica*	Anacardiaceae
44.	*Milicia excels*	Moraceae
45.	*Millettia thonningii*	Fabaceae
46.	*Morinda lucida*	Rubiaceae
47.	*Newbouldia laevis*	Bignonaceae
48.	*Peltophorum pterocarpum*	Fabaceae
49.	*Persea Americana*	Lauraceae
50.	*Phoenix reclinata*	Arecaceae
51.	*Pithecelobium dulce*	Fabaceae
52.	*Psidium guajava*	Myrtaceae
53.	*Raphia hookeri*	Arecaceae
54.	*Rauvolfia vomitoria*	Apocynaceae
55.	*Roystonea oleraceae*	Arecaceae
56.	*Senna alata*	Fabaceae
57.	*Senna fistula*	Fabaceae
58.	*Spondias mombin*	Anacardiaceae
59.	*Sterculia tragacantha*	Sterculiaceae
60.	*Tabebuia rosea*	Bignonaceae
61.	*Tectona grandis*	Verbanaceae
62.	*Terminalia catappa*	Combretaceae
63.	*Terminalia randii*	Combretaceae
64.	*Terminalia ivorensis*	Combretaceae
65.	*Terminalia superba*	Combretaceae
66.	*Treculia Africana*	Moraceae
67.	*Polyalthia longifolia*	Annonaceae

The low annual precipitation rate and climate of the study area may have contributed to average tree growth rates and low to medium tree basal area. The diversity index (*H'*) for the tree species was calculated to be 4.204, for all the species enumerated, and this is high, representing a diverse and equally distributed community. Thus this statistics also illustrate the great numbers of exotic plants that have become established in native habitats (Nodza *et al*., 2014).

Table 3: Frequency of each family enumerated in the study area

S/N	Family	Frequency (%)
1.	Bombacaceae	4.48
2.	Fabaceae	20.89
3.	Apocynaceae	4.48
4.	Anacardiaceae	5.97
5.	Annonaceae	2.99
6.	Loganiaceae	2.99
7.	Moraceae	10.45
8.	Avicennaceae	1.49
9.	Sapindaceae	1.49
10.	Euphorbiaceae	2.99
11.	Calophyllaceae	1.49
12.	Casuarinaceae	1.49
13.	Chrysophylloideae	1.49
14.	Rubiaceae	2.99
15.	Arecaceae	7.46
16.	Sterculiaceae	2.99
17.	Boraginaceae	1.49
18.	Myrtaceae	2.99
19.	Malvaceae	1.49
20.	Bignonaceae	4.48
21.	Meliaceae	1.49
22.	Lythraceae	1.49
23.	Lauraceae	1.49
24.	Verbenaceae	1.49
25.	Combretaceae	5.97
26.	Rutaceae	1.49

In order to measure the tree species diversity of a forest, there is need to know the total area of the forest and the area occupied by each species, this information was made available from the inventory data and the actual survey carried out (Fig. 2). The study provides a baseline for the management of protected areas in developing countries and it shows the potential of *in situ* method in conservation. Forest habitats play a central role in the functioning of the biosphere, as they are the origin of many cultivated plants and animals.

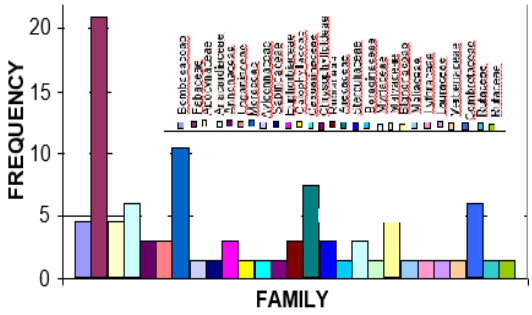

Fig 2: Families of Tree Species and the Frequency at which they occur within the Study Area

To examine the efficacy of nature reserves as a means of biodiversity conservation, ecologist can use such information from this study on rare and common tree species alike to help manage habitat as well as provide cultural resource values of these trees; the qualitative characters related with density, dominance and diversity of these trees could well act as indicators of changes and susceptibility to anthropogenic stressors among various vegetation

categories and their formations, which could be further interpreted as distinct flora habitats.

The frequency distribution of tree species suggested that most of them had low frequency as would be expected of typical species-abundance distributions. Tree structure and diversity could play an important role in climate regulation as both could influence forest biomass production and hence determine the forest' capacity for carbon storage. Findings in this study could help rationalize the need for an ecologically sound fallow period; this will ensure renewal of at least some tree species and some fauna habitat element (Kumar *et al.,* 2006).

During the survey, it was observed that some trees needed to be pruned because they posed potential risk/threat to the people and properties on the University community. Some species enumerated showed signs of decay, disease and deformity. If these species were properly managed and maintained, they would have really exhibited their aesthetic values.

Conclusion: Trees have existed within the University of Lagos campus since its establishment; afforestation has also taken place due to aesthetic values and academic purpose. Overtime, lack of proper management caused trees to overgrow, while some are dying, thereby causing potential risk to both property and life within the University community. Repairs of these damage cost a lot; in view of these, proper tree management and maintenance options should be exercised to ensure sustainability of these trees and also mitigate future hazards.

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