

IDENTIFYING TREES FOR CLIMATE RESILIENCE AND GREEN INFRASTRUCTURE ON THE UNIVERSITY OF ABUJA CAMPUS

Umar Haniya Zainab and Abdullahi, Ibrahim Ndaginna

Faculty of Agriculture, University of Abuja, Abuja-Nigeria.

Email: ibrahim.abdullahi@uniabuja.edu.ng

DOI: <https://doi.org/10.70118/ajaas.02025050502.07>

ABSTRACT

This study assessed the tree status within the University of Abuja's main campus, located in the Southern Guinea savannah agroecological zone of Nigeria. The research aims to identify key tree species serving ornamental purposes amongst other uses, highlight their distribution, and give an inventory of perennial vegetation within the study area. The study was conducted within the university's Ring Road area due to resource constraints. Data collection involved field surveys across ten faculties, where trees were identified, counted, and ranked based on their frequency of occurrence. The Open Data Kit (ODK) mobile application was used to record tree species, propagation status, and diameter at breast height. Statistical analysis was performed using frequency distributions and percentages in Microsoft Excel 2016. Findings revealed a diverse array of ornamental tree species, with 22 identified taxa belonging to different botanical families. Prominent species included *Mangifera indica* (6.09%), *Delonix regia* (34.7%), *Terminalia mantel* (19.8%), *Ficus sycomorus* (17.4%), *Parkia biglobosa* (6.09%), and *Vitellaria paradoxa* (2.13%), among others. The distribution of these species varied across faculties, reflecting differences in landscaping productivity and ecological adaptability. The research highlights the potential of ornamental forestry in enhancing urban green spaces, improving air quality, and mitigating climate change effects within Nigeria's dryland tertiary institutions.

Keywords: Trees, landscaping, ornamentals, Nigeria

INTRODUCTION plants, and trees and shrubs. Due to their In Nigeria, the practice of cultivating woody aesthetic appeal, ornamental tree plants are plant seedlings for environmental grown for decoration rather than food or raw modernisation and urban development is materials (Mahoney, 2014). The production relatively a new concept compared to other of ornamental trees and floriculture for third-world countries. Over the last 30 landscaping is by far the most diverse sector years, its spread in the country and cities has of horticulture in Nigeria (Adetutan, 2015). been remarkable due to the social value and Given the increasing emphasis on economic potential (Adepoju *et al.*, 2016). agroecological productivity, ornamental Ornamentals encompass a wide array of forestry remains underexplored in Nigeria plants and are classified into several groups: compared to other fast-developing cutflowers, ornamental grasses, lawn or turf countries, warranting urgent attention to its grasses, potted and indoor plants, bedding potential ecological and economic

contributions.

Citizens have altered and often degraded Study Area

their environment, though it has been so gradual that its effects have not been so

drastically felt. The unabated continuous located at Airport Road, Abuja lying environmental degradation could be between Latitude 8.25° and 9.20° North of the equator and Longitude 6.45° and 7.39°

attributed to population pressure and

mismanagement of natural resources. East of Greenwich Meridian. It is situated Ornamental trees contribute to the national within the Southern Guinea Savannah economy as the industrial potential of fruits region with moderate climatic conditions of and seeds from trees in Nigeria is enormous. annual temperature between 18 and 40

While fruit trees attract greater appreciation degrees Celsius and about 1000cm

and attention from investors, industries, restaurants and food organizations with

appreciable impact on the national economy, landscape and ornamental

horticulture in Nigeria appear to be isolated The Main Campus which is within Nigeria's and relegated to the background in terms of Federal capital Territory (FCT) consists of a production and marketing of ornamental great expanse of land estimated at 11,824

plants as compared to other countries.

Hence, assessing the ornamental status of every agroecological zone is paramount.

There is a need to develop green infrastructure that enhances school

landscapes while stimulating large-scale perfect, warm and peaceful atmosphere for production of the ornamental trees. This is research, teaching and learning. The FCT

particularly vital for enhanced under climate classification features a

diversification of green entrepreneurs, tropical wet and dry climate, experiences helping to mitigate the impact of climate three weather conditions annually. The high

change and adding biodiversity net gain to

university campus landscape.

The main aim of the study is to assess the status of woody landscape with a focus on ornamental trees at the University of Abuja

Main Campus, through the botanical masses with the city receiving frequent

identification and the inventory rainfall during the rainy season from March

classification. The findings of this research to of the Jos Plateau and the zone of rising air activity will further provide the climate Tourist Information, 2013)

resilience status of socio-environmental

landscape of Nigeria institutions of higher

education. This is fundamental to the

nature-based solutions strategies for the

improvement in the climate action on Social Sciences, Faculty of Management

Sciences, Faculty of Law, I.C.T Center, and

the senate building (See plate 1).

MATERIALS AND METHODS

The University of Abuja main campus is

located at Airport Road, Abuja lying

between Latitude 8.25° and 9.20° North of

the equator and Longitude 6.45° and 7.39°

East of Greenwich Meridian. It is situated

Ornamental trees contribute to the national

economy as the industrial potential of fruits

region with moderate climatic conditions of

and seeds from trees in Nigeria is enormous.

annual temperature between 18 and 40

degrees Celsius and about 1000cm

precipitation, starting in April and ending in

October (Federal Capital Territory Gazette,

2015).

The Main Campus which is within Nigeria's

and relegated to the background in terms of Federal capital Territory (FCT) consists of a

production and marketing of ornamental great expanse of land estimated at 11,824

hectares. The topography is a sight to

behold - the hills encircling the campus in a

warm embrace, the vast expanse of lush

green plants is very pleasing to behold - creating a

perfect, warm and peaceful atmosphere for

production of the ornamental trees. This is research, teaching and learning. The FCT

particularly vital for enhanced under climate classification features a

diversification of green entrepreneurs, tropical wet and dry climate, experiences

helping to mitigate the impact of climate three weather conditions annually. The high

altitudes and undulating terrain of the FCT

act as a moderating influence on the weather

with the city receiving frequent

of the territory. Rainfall in the FCT reflects

the territory's location on the windward side

of the Jos Plateau and the zone of rising air

activity will further provide the climate Tourist Information, 2013)

act as a moderating influence on the weather

with the city receiving frequent

of the territory. Rainfall in the FCT reflects

the territory's location on the windward side

of the Jos Plateau and the zone of rising air

activity will further provide the climate Tourist Information, 2013)

university campuses in Nigeria.

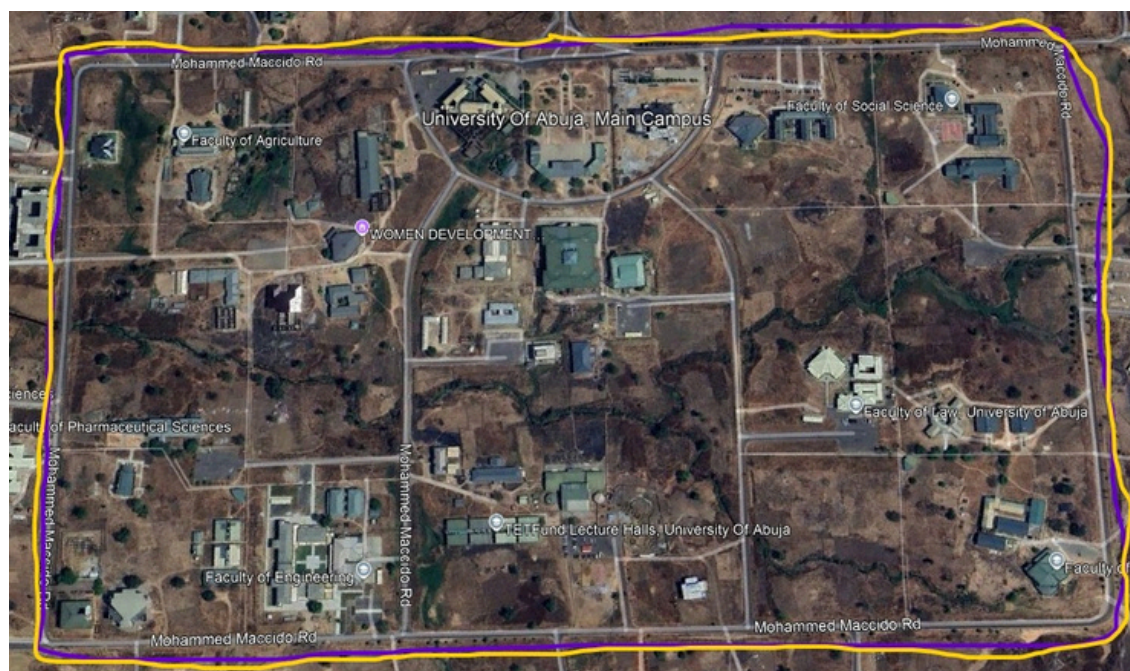


Plate 1: Aerial image of University of Abuja Main campus, Airport Road, ABUJA.
Source: Google Maps

Data Collection

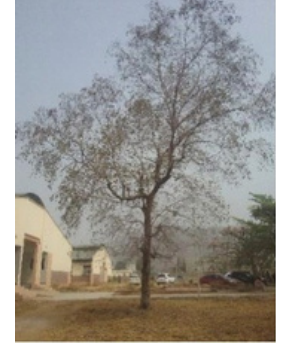
Identification and counting were carried out on each of the ten (10) faculties studied. Each of the trees were identified and counted to determine the frequency of occurrence of each tree species in each faculty. The ornamental plants were identified, captured and snapped using a digital camera, and their details were entered into a notebook. A vital part of this work was presented in the form of original-coloured photographs which were described through consultation with scientific books and tree identification app. The trees were ranked in each faculty in order of frequency from the highest occurring species to the lowest occurring species. The faculties were also ranked in according the frequency of the ornamental plants identified in each faculty.

Data Analysis

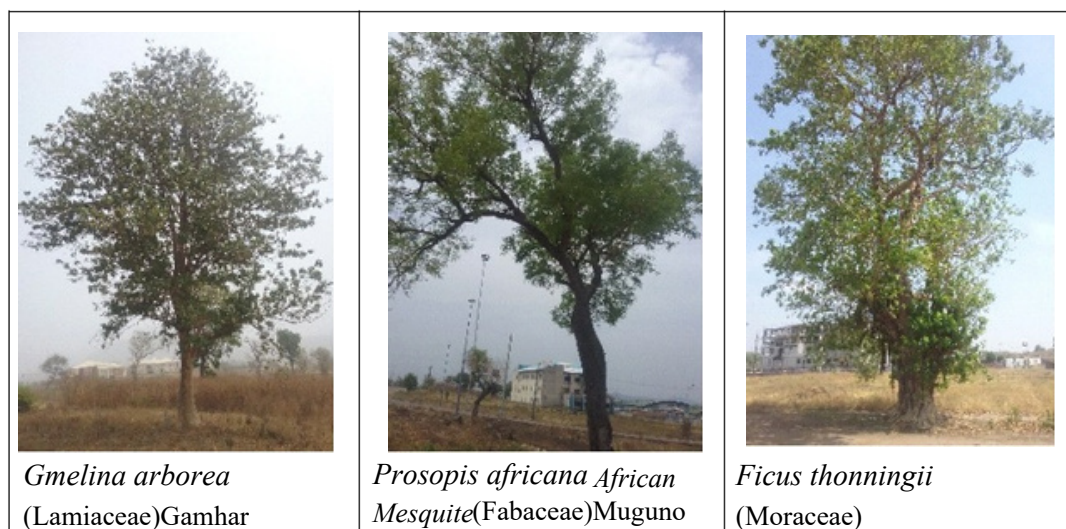
The tree data survey was collected and recorded using the Open data Kit (ODK) mobile application on a Samsung Galaxy tablet after forms for collecting data were installed on the ODK app. Data collected was analysed using percentages and frequencies via Microsoft Excel 2016 software. Data collected include tree name, tree stem diameter, tree propagation status, number of trees on each faculty landscape.

RESULTS

From the survey conducted, the following ornamental plants were identified,

 <i>Mangifera indica</i> (Anacardiaceae)Mango	 <i>Delonix regia</i> (Fabaceae)FlameTree	 <i>Terminalia mantely</i> (Combretaceae) Madagascar Almond
 <i>Syzygium cumini</i> (Myrtaceae)Java Plum	 <i>Carica papaya</i> (Annonaceae) Pawpaw	 <i>Ficus sycomorus</i> (Moraceae)
 <i>Anogiesus loecarpa</i> (Combrateceae)African birch	 <i>Saraca asoka</i> (Fabaceae) Ashoka	 <i>Ceiba bentradra</i> (Malvaceae) Kapok

 <i>Combretum molle</i> (Combrateceae) Velvet Bushwillow	 <i>Ficus benjamin</i> (Moraceae) Weeping Fig	 <i>Plume albizia</i> (Fabaceae) Paraserianthes <i>Lophantha</i>
 <i>Car yota urens</i> (Aracaceae) Jaggery Palm	 <i>Hura crepitans</i> (Euphorbiaceae) Sandbox	 <i>Parkia biglobosa</i> (Fabaceae) African Locust Bean
 <i>Daniella oliveri</i> (Fabaceae) African Copaiba	 <i>Adenthra pavonina</i> (Fabaceae) Sandal Wood	 <i>Corymbia Citriodora</i> Lemon-Scented Gum Myrtaceae



Ranking of Trees in the Universityfigure 1 below. The faculty of arts had a The trees were ranked according to the frequency of 62 trees making up 12% of the frequency of trees observed per faculty study area. The library, Faculty of Social from the highest to the lowest. A total of 22 Sciences, Science and Veterinary Medicine tree species were identified within the had 7% each. The Faculty of Health campus ring road. The senate building Sciences and Law also had between 4-6% ranked highest with a total of 112 trees and of number of trees while the Center for 12 families which made up 22% of the Distance Learning, ETF building, Faculty ornamental trees in the entire study area. of Managemnt Sciences and Faculty of Faculty of Agriculture followed closely Engineering and the ICT Centre had less with a total 89 ornamental trees making up than 2% each of the total tree plants in the 17% of the study area as represented in study area.

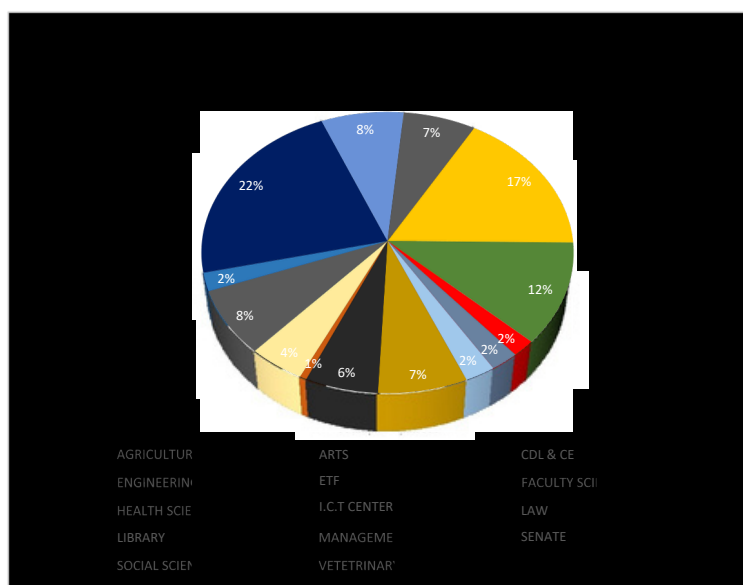


Fig 1: Ranking of the Trees in the Faculties and Units based on population

FACULTY	NOOF SPECIES PER FACULTY	NO OF FAMILY PER FACULTY/UNIT	NOOF NON- LEAFY TREES PER FACULTY	NO OF TREES ALIVE PER FACULTY	MOST FREQUENT TREES PER FACULTY	LEASTFREQUENT TREES PER FACULTY
AGRICULTURE	89	11	17	73	<i>Mangifera Indica</i> 18	<i>Saraca socia</i> 1 <i>Pakia Biglobosa</i> 1
ARTS	62	7	19	43	<i>Delonix regia</i> 17 <i>Ficus Virens</i> 2 <i>Gmelina Arborea</i> 2	<i>Piliostigma</i> 1 <i>Tabebuia Rosea</i> 1
CDL & CE	10	5	3	7	<i>Terminalia</i>	<i>Calotropis Procera</i> 1
ENGINEERING	12	6	0	12	<i>Mantaly</i> 4	<i>Mangifera Indica</i> 1
ETF	13	5	1	12	<i>Delonix regia</i> 5 <i>Terminalia Mantely</i> 9	<i>Daniellia Oliveri</i> 1 <i>Syagrus Romanzoffiana</i> 1
FACULTY SCIENCE	38	11	5	33	<i>Anogeisus Leocarpa</i> 5 <i>Saraca Asoka</i> 16	<i>Baobab Adansonia</i> 1 <i>Khaya Senegalensis</i> 1
HEALTH SCIENCES	31	4	0	31	<i>Anogeisus Leocarpa</i> 1	<i>Combretum Molle</i> 1
ICT CENTRE	3	3	1	2	<i>Terminalia</i>	<i>Ficus benjamina</i> 1
LAW	24	6	4	20	<i>Mantaly</i> 7 <i>Saraca Asoka</i>	<i>Carica Papaya</i> 1
LIBRARY MANAGEMENT SCIENCES	40	5	0	40	<i>Syzgium Cumini</i>	<i>Ficus sycomorus</i> 1
SENATE	11	4	1	1	<i>Delonix regia</i> 61	<i>Ficus Thonningii</i> 1
SOCIAL SCIENCES	118	12	47	0	<i>Syzgium Cumini</i>	<i>Prosopis africana</i> 1
VETERINARY MEDICINE	41	7	1	40	<i>Gmelina arborea</i> 1 <i>Terminalia</i>	<i>Vitellaria paradoxa</i> 1 <i>Ficus Thonningii</i> 1
	36	7	2	34	<i>Mantaly</i> 12	<i>Citrus sinensis</i> 1

Ranking of the ornamental trees by Faculty.

Trees species per each faculty were ranked according to the frequency of occurrence within the respective faculty from the highest to the lowest as reported below:

The Senate Building The results from the observation of the Senate building that *Delonix regia* had the highest frequency of 57% of the total ornamental plants in the senate building as shown in figure 2. Weeping Fig (*Ficus benjamina*) had 31%, Jaggery Palm (*Caryota urens*) had 5%, *Carica Papaya* had 4% while the least frequency Sandbox (*Hura crepitans*) with a frequency of 3%.

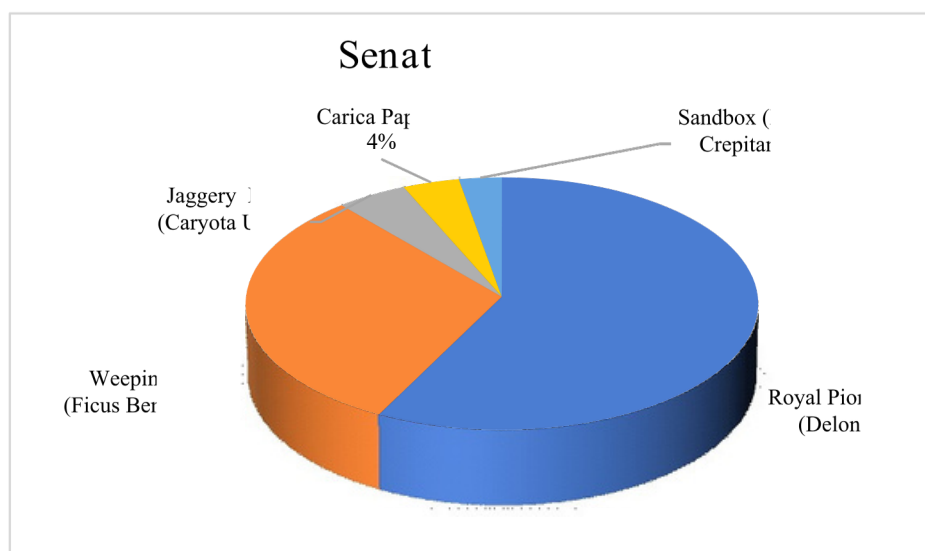


Fig. 2: Population of trees in the Senate Building

The Faculty of Veterinary Medicine As observed in Fig. 3 below the highest ranked ornamental plant in the Faculty of Veterinary Medicine is *Terminalia mantaly* with a frequency of 12 (twelve), *Anogeissus Leiocarpa* had a frequency of 6 (six), *Hura crepitans* had a frequency of 4 (four), *Parkia biglobosa* had a frequency of 3 while the least ranked ornamental plant was *Ceiba Pentandra* with a frequency of 2 (two).

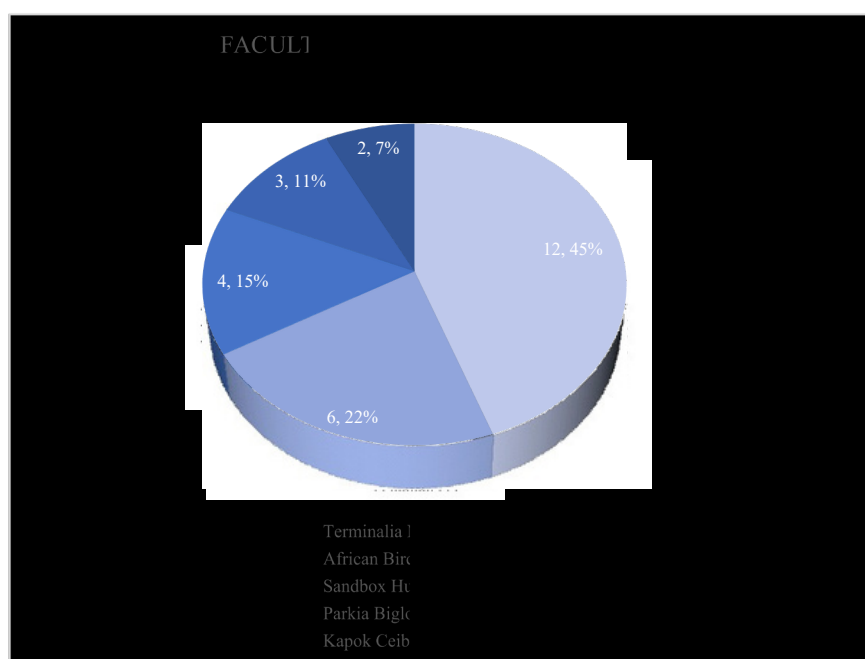


Fig. 3: Population of trees at the Faculty of Veterinary Medicine

Faculty of Agriculture Figure 4 below showed the predominant ornamental trees in Faculty of Agriculture Complex had *Mangifera indica* at the highest scaling up to 28% while the flamboyant *Delonix regia* tree had a frequency of 17. Other trees found at the faculty include *Terminalia mantaly* at 19% and *Syzygium cumini* at 14% while the least in ranking was *Carica papaya* occurred only 5 times.

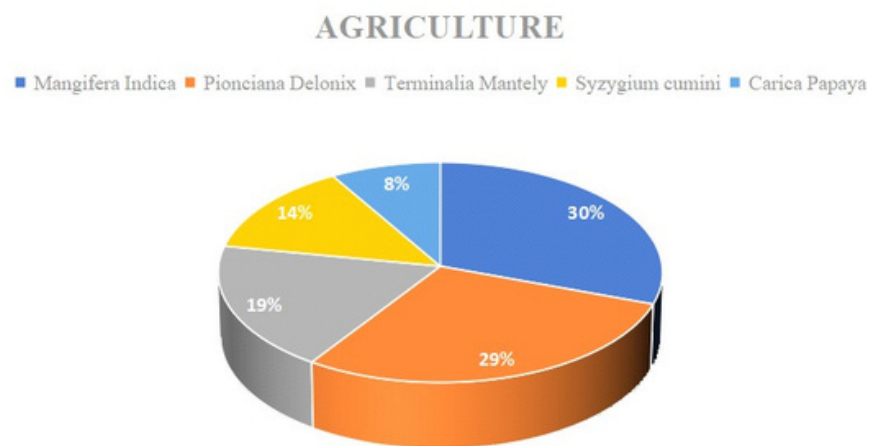


Fig. 4: Population of tree species in the Faculty of Agriculture.

Faculty of Science The results from the Faculty of Science show that the First in ranking was *Terminalia Mantely*, while the second was *Anogeissus Leiocarpa*, while the third, fourth and fifth were *Parkia biglobosa*, *Daniella Oliveri* and *Adenthra Pavonina* respectively.

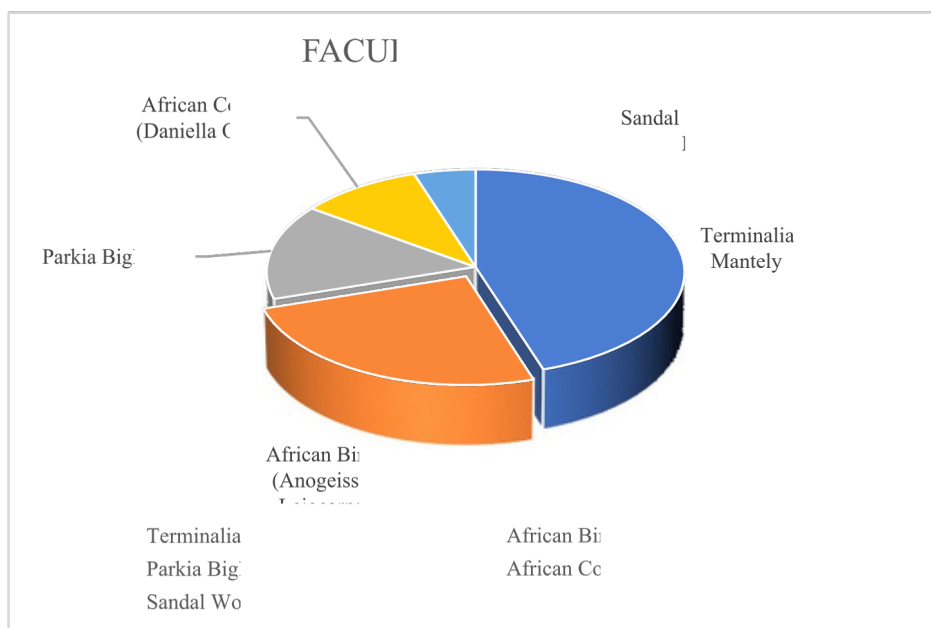


Fig. 5: Population of tree species in the Faculty of Science

The Library

Asclearlyopined in figure 6 below. *Saracaasoka* ranked first with 87%, *Terminalia mantely* ranked second with 5% while *Vitellariaparadoxa*,*Ficussycomorus* and *Carica papaya* ranked third, fourth and fifth with 3%, 3% and 2% respectively.

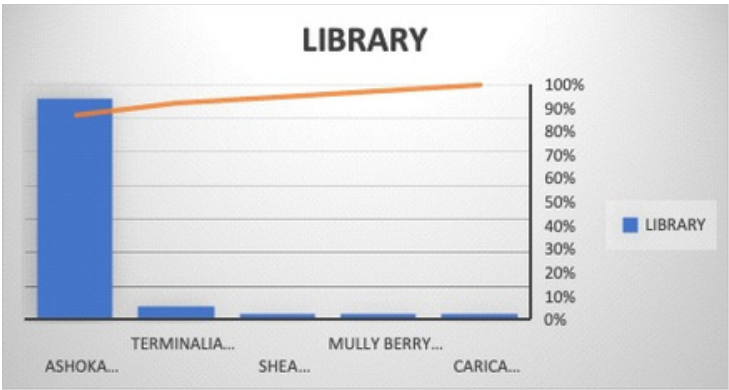


Fig. 6: Population of tree species in the library.

Faculty of Health Sciences

Theornamentalplants identified intheCollege ofHealthSciences include *Saraca asoka* at 57% occurence, *Terminalia mantel* (17%), and *Ficus sycomorus*, *Ceiba bentradra* and *Combretum molle* had 4% each. *Saraca* species dominated the college landscape, while the least in rank was also the least visible species, *Combretum molle*.

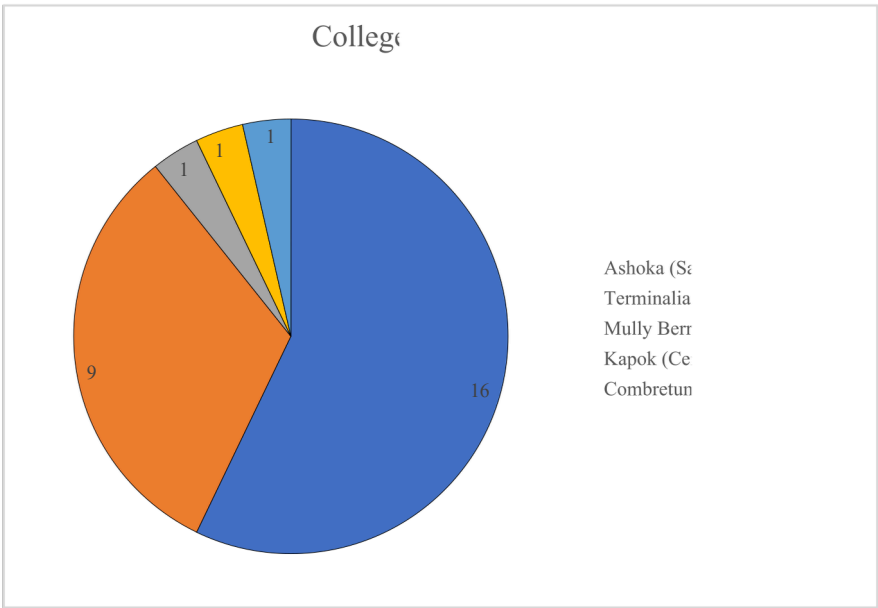


Fig. 7: Population of trees in the Faculty of Health Sciences

Faculty of Engineering

The ornamental trees identified in the faculty of engineering were *Terminalia mantaly*, *Ficus sycomorus*, *Mangifera indica*, *Anogiesus leocarpa* and *Syzyguim cumini*. As illustrated in Fig. 8 below, *Terminalia mantaly* was ranked first with a total of 4 (four) trees out of 8 trees, comprising 50% of the population. *Ficus sycomorus* was ranked second with a total frequency of 2 trees, while *Mangifera indica*, *Anogiesus leocarpa* and *Syzyguim cumini* ranked least with a frequency of 1 (one) tree each.

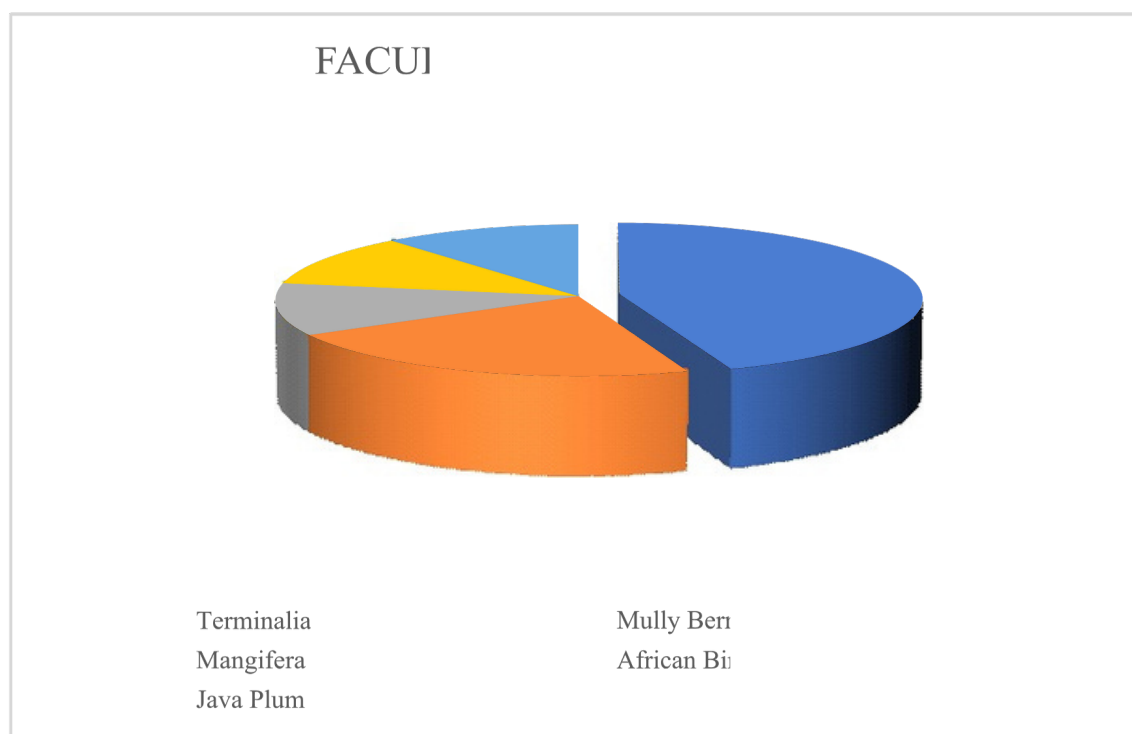


Fig.8: Population of trees at the Faculty of Engineering

Faculty of Social Sciences Fig. 9 showed the population of trees recorded from the Faculty of Social Sciences. The graph indicated that *Syzyguim cumini* ranked the first by occurring 25 times, *Corymbia citriodora* ranked second with a frequency of 5 while *Parkia biglobosa*, *Vitellaria paradoxa* and *Gmelina arborea* ranked third, fourth and fifth respectively with a frequency of 2(two), 1(one) and 1(one) respectively.

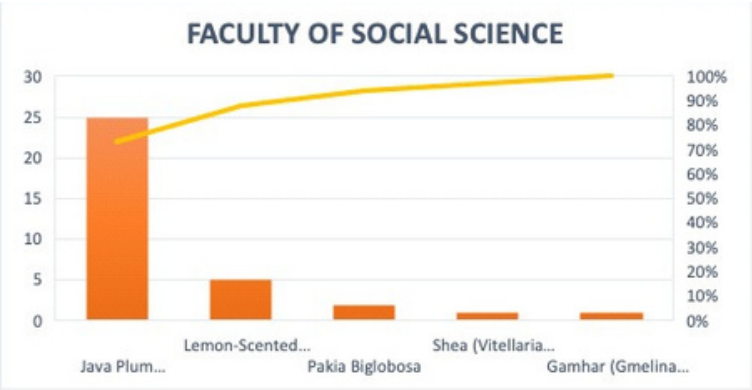


Fig.9: Population of trees at the Faculty of Social Sciences

Faculty of Law The Faculty of Law complex had trees as indicated in Fig. 10 below showed *Terminalia mantaly* and *Delonix regia* occurred at 45% each, ranking as the highest in frequency. Other trees are *Prosopis africana* ranked second and *Carica papaya* ranked third. There is only one *Parkia biglobosa* tree available in the complex, making it the least in occurrence.

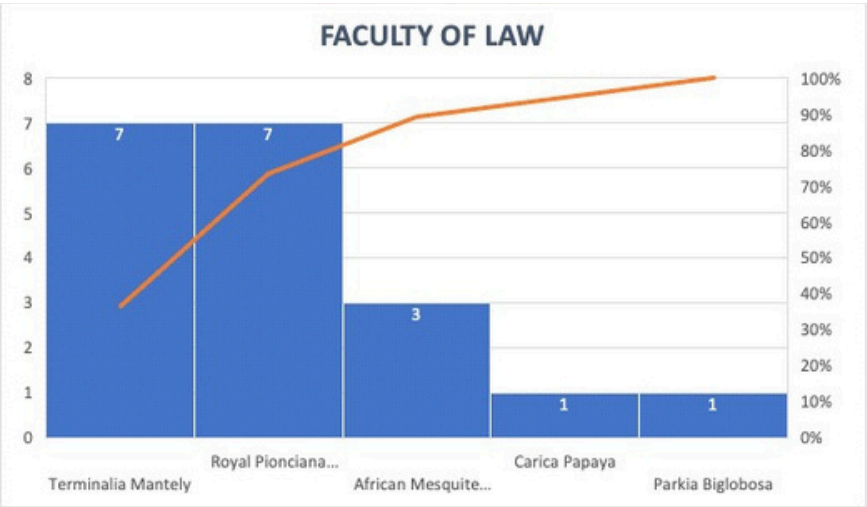


Fig. 10: Population of trees in the Faculty of Law

Faculty of Arts The details of the finding from the Faculty of Arts are in Fig. 11 below. *Delonix regia*, *Syzygium cumini*, *Terminalia mantely*, *Daniellia oliveri* and *Combretum molle* were the ornamental plants identified and recorded. The first in rank is the *Delonix regia* with 17 trees planted, the second in rank was the *Syzygium cumini* with a frequency of 12. the species, *Terminalia mantely* came third in ranking at frequency of 7 while fourth and fifth were the *Daniella oliveri* and *Combretum molle*. with frequencies of 4 and 2, respectively.

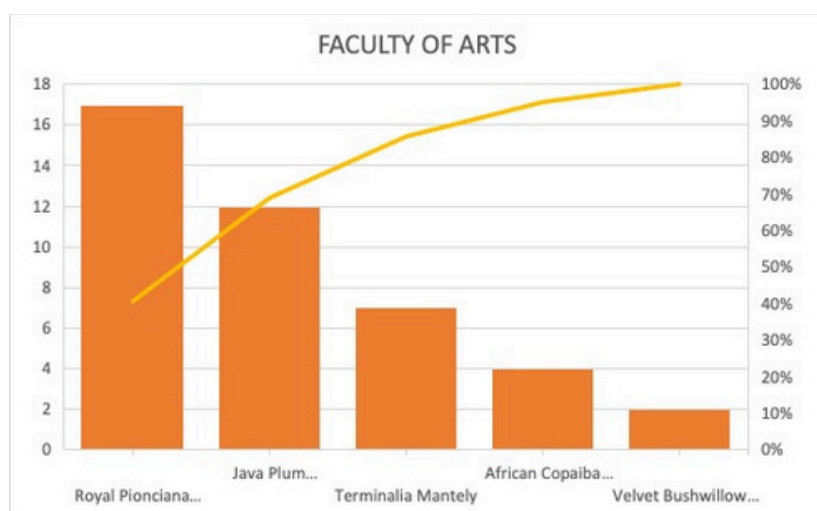


Fig 4.11: Population of trees in the Faculty of Arts

Faculty of Management Sciences and the ICT centre

As illustrated in Fig. 12 below, the ornamental trees identified were *Syzygium cumini*, *Terminalia mantely*, *Delonix regia* and *Ficusthonningii*. The highest ranking with a frequency of 7 was *Syzygium Cumini*. The ornamental species identified in the ICT Centre were *Ficus benjamina*, *Anogeissus leiocarpa* and *Plumealbizia*.

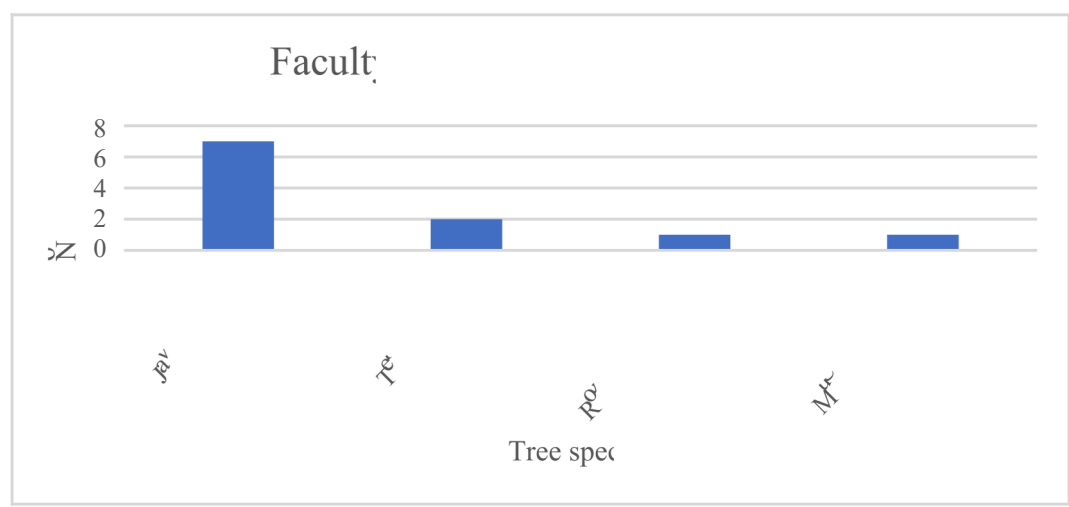


Fig.12: Population of trees in the Faculty of Management Sciences

DISCUSSION

(2014) who reported that the Meliaceae In the study area, the following tree species family dominated the villages and were more common: *Delonix regia*, communities, respectively. Meanwhile, *Mangifera indica*, *Terminalia mantel*, *Ficus* Onyekwelu et al. (2008) reported that the *sycomorus*, *Gmelina arborea*, *Daniella* dominant tree families in Nigerian habitats *oliveri*, *Parkia biglobosa*, and *Vitellaria* Euphorbiaceae, Sterculiaceae, Meliaceae, *paradoxa*. The mean number of tree bole Mimosoideae, and Apocynaceae. Foresters size ranged from 176 cm to 18 cm across all frequently utilize inventory as a metric to faculties (Table 2). *Delonix regia* and evaluate the percentage of prominent *Mangifera indica* were the most abundant species across different vegetation, individual species, with 67 and 61 trees per including modified landscapes such as hectare, representing over 50% of the campuses. Prioritizing tree species for overall population of trees/hectare. (Table conservation or management actions is 2). According to Alamu and Agbeja (2011), frequently implemented to allow trees to tree species per hectare are becoming serve purposes beyond ornaments and endangered as the climate vulnerability nutrition. Hence, the tree species in the increases in urban areas. As seen in this university community support balancing study, native tropical tree species with the ecosystem and greenery of the ornamental potentials are vulnerable and surroundings. threatened by extinction as they are at the highest risk (FORMECU, 1999). The results also align with the findings of Aigbe and Omokhua (2015), which indicate that the family composition of tree species on the campus reveals that Fabaceae, Leguminosae, and Moraceae have the most tree species, as shown in Table 1. These findings contradicted those of Aigbe

CONCLUSION The ornamental trees were clearly found to be pleasing to human eye and were deliberately used to aestheticize the school environment. The ornamental plants were found to have other purposes other than beautification, which is the main purpose,

like landscaping and relaxation spots etc. This study has shown that trees are very important plant species that improves the aesthetic value of the university and could be used more to beautify home, offices and the general environment. Based on the results of this study, further research is required to improve on the following:

- i. The untapped landscaping potential which could benefit the university community aesthetically.
- ii. The act of landscaping using horticultural trees should be encouraged for youths and graduates to see the business as a lucrative green business and solution to climate crisis on our campus.
- iii. Faculty offices and campus streets need to be landscaped even more using ornamental trees to improve the microclimate of the campus and

provide aesthetic value.

- iv. Grants and Loans should be made available to farmers and gardeners to boost ornamental horticulture business around the Abuja axis.

This research underscores the necessity of integrating ornamental forestry into Nigeria's urban planning and afforestation programs. Future studies should expand the scope to other agroecological zones, incorporating advanced geospatial analysis further to evaluate tree distribution patterns and their ecological impact. Strengthening policies on ornamental forestry management will contribute to sustainable environmental development and climate resilience.

REFERENCES

- CFA, Sadiq Y, Gabriel OA, Abdulkadir UZ, Ezzeldin AM. (2005). J Ethnopharmacol; 101: 27.
- Abegunde, A.A., Omisore, E.O., Oluodo, O.F & Olaleye, D. (2019) Commercial horticultural practice *Bizimana, Veterinary Practice in Africa* spatial effects in German Leguminosae African Journal of Cooperation, ISBN 3-88085-502-4, 4(10), 1064-1072.
- Adeduntan, S.A. (2015). Contribution of some ornamental plants to the socio-economic development of urban household in Akure metropolis. African Journal of Agricultural Research, 10(4):264- 268.
- Adepoju, S. O.; Owonubi, A.; C. Nwadike. (2016) Economics of Ornamental Plant Seedlings in Jos Metropolis of Plateau State. In: Adepoju, S. O and P. B. Okuneye (Eds), Technology and Agricultural Development in Carey, R.O.; Hochmuth, G.J.; Martinez, C.J.; Boyer, T.H.; Nair, V.D.; Duke, 20th M.D.; Annual National Conference of J.L.; Tropical Management Association of review Niger forest fertilization management in Jos Plateau State, 18th-21st September, 1995, 322-323.
- Ajayi, W.O. (2004) Phytochemical and antibacterial properties of *P. biglobosa* and *P. bicolor* leaf Cobley L.S & Steele W.M. 2016. An Introduction to the *B. Brum.* Res; 5:125-130.
- Almitoye, H.A., Idowu, O.O., Olufolaji, A.O., Adebayo, A.G., Olatunji, Dick C. W., Bermingham E., Lemes M. R. & M.T., Aina, O.O. and Shokalu, A.O. (2021) Prospects and challenges of floriculture business in Nigeria. European Journal of Social Sciences, 9(3), 348-355.
- Amey Shirokara, Anjum Gahlauth, Anil K. Chhillarb (2013) Quantitative Analysis of *asoca* Chemical investigation of the stem bark of *Parkia clappertoniana* Keay. *Journal of China Science* 14(2) 199-202.
- Banwo (2014) The antimicrobial activity of the stem bark of *Parkia Duvall*, C. S., (2011). *Ceiba pentandra* (L.) clappertoniana Keay family Leguminosae against selected microorganisms. *Nig J Pharm Res*; 3(1): 16-22.
- Berg C C and Corner E J H 2005 Moraceae: Ficeae. Flora Malesiana Series I Vol. 17 Part 2. P 702
- Nsekuye (1994). *Traditional*
- Burrows, J.N., van Huijsduijnen, R.H., Mohrle, J.J., Oeuvray, C., Wells, T.N., (2013). Designing the next generation of medicines for malaria control and eradication. *Malar. J.* 12, 187.
- Buta, E.; Cantor, M.; Singureanu, V.; Husti, A.; Hort, D.; Buta, M. (2013) Ornamental plants used for improvement of living, working and studying spaces microclimate. *ProEnviron. Promediu*, 6, 562–565.
- Gribel R. (2017) Extreme long-distance dispersal of the lowland tropical rainforest tree *Ceiba pentandra* L. (Malvaceae) in Africa and the Neotropics. *Mol. Ecol.* 16, 3039–49

- Musa M. Abarshi. Science World
Journal Vol. 16(No 3) 2021
www.scienceworldjournal.org
ISSN: 1597-6343

- X 1339-Induced Hyperlipidemic Rats. *Res J Pharm Biol Chem Sci*; 4(1):576.
- Komolafe K, Olaleye MT, Fasan TI, Elekofehinti OO, Saliu JA, Odetola AA, Akinloye O, Egunjobi C, Adekunle WA, Akindahun AG. (2016) Possible lipid-lowering and antihyperlipidaemic effect of fermented extract of *Pegibba nigra* (Lecyptaceae) in alloxan-induced diabetic rats. *Clin Exp Pharmacol Physiol* 33:808-812.
- Induced Hyperlipidemic Rats. *Res J Pharm Biol Chem Sci*; 4(1):576.
- Kovats, R.S., Hajat, S. (2018) Heat stress and public health: A critical review. Olaniyan, A.A. (2017) Biological system: Soil and Human Health paper presented during the 35th Annual conference of Horticultural Society of Nigeria (HORTSON) held at Kabba College of Agriculture, Kogi State, Nigeria from October 3rd to November 2nd, 2017.
- Lawal T, Giddu M, Kog Estate Nig Ba Agri (2014). *October 3rd to November 2nd, 2017*. pentandra (L.) Gaertn. and Cordia sebestena Linn. on selected rapidly growing mycobacteria, African Journal of Microbiology Orwa C, Mutua A, Kindt R, Jamnadass R, Anthony S. (2019) Agroforestry Database:a tree reference and selection guide version 4.0.
- Research, Vol.8(24), pp 2387-2392.
- Lemmens RHMJ, Soerianegara I, Wong WC (eds.). 2015. Plant Resources of South-east Asia. No 5(2). Timber Pandey G, Vignana D (2004). Varanasi Chetkhanoba Krishi Sadak Adarsh, Reprint; 663-671.
- Backhuys Publishers, Leiden.
- Mann, A.; Yahaya, Y.; Banso, A.; Ajayi, G. Perrone, S.; Grossman, J.; Liebman, A.; Sooksakulchai W, et al. (2018) Nitrogen fixation and productivity of winter annual legume cover crops in Upper Midwest organic cropping systems. *Nutr. Cycl. Agroecosyst* 117:61-76.
- "Agroecology of *Vicia cracca* against some microorganisms associated with infectious wounds". *Academic Journals*.
- Mathew N., Anitha M. G., Bala T., Raharimalala V. Y., (2015). Contribution à l'étude des effets de la incorporation de *Sesuvium portulacastrum* en alimentation de poulets de chair, Mémoire d'Ingénieur Agronome Ecole Supérieure des Sciences Agronomiques, Université d'Antananarivo.
- of Saraca indica, Nyctanthes arbor-tristis, and Clitoria ternatea extracts against three mosquito vector species , *Parasitol Res*. 104:1017²1025
- Nelson, I.U.; Udo, E.S.; D.E. Jacob. (2018) Sabiiti EN, Cobbina J. (2012). *Parkia bigloba* as a multipurpose tree legume in West Africa. The International Tree Crops Journal 7: 43-49.
- Ibom State, Nigeria. Eurasian Journal of Forest Science, 5 (2), 35- 43.
- Ntui V.O, Uyoh E.A, Urua I.S, Ogbu U, Sagrawat H. Pharmacological potential of Okpako E.C. (2012) Regeneration *Eugenia jambolana*: A review.

- Pharmacogn Mag.* 2006;2(6):96-105.
- Saka JDK, Rapp I, Akinnifesi FK, Ndolo V, Spennemann, D.H.R. (2018a). Canary Island Date Palm (*Phoenix canariensis*) in the Australian media until World War II. *Palms & Cycads* 14(4), 16-27
- Shuaibu, M. N.; Pandey, K.; Wuyep, P. A.; Yanagi, T.; Hirayama, K.; Ichinose, Tybirk K. (2021) Exploiting the potential of indigenous agroforestry: *Inesna Rionia biglobosa* of Food and Agriculture Technology, Sahel Africa. *Agrofo Syst*; 61-62(1-3): 207-220
- Shuaibu, M. N.; Pandey, K.; Wuyep, P. A.; Yanagi, T.; Hirayama, K.; Ichinose, Tybirk K. (2021) Planting trees in Sahel - *Adansonia digitata*, *Kassia* and *Lawesson, J.* (eds.) *Dryland degradation: Causes and consequences*, pp 22-28. Aarhus University Press, Aarh.
- Shuaibu, M. N.; Wuyep, P. A.; Yanagi, T.; Vogt K. 2015. A field guide to the identification, propagation and use of common trees and shrubs of dryland Sudan. SOS Sahel International (UK)
- Sina S, Traoré SA. (2022) *Parkia biglobosa* (Jacq.) R.Br. ex G.Don. In: Oyen, L.P.A. and Lemmens, R.H.M.J. (Editors). PROTA (Plant Resources of Tropical Africa /Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands.
- Singh, S., & Kumar, S. N. 2014. A review: introduction to genus *Delonix*. *World J Pharm Pharm Sci*, 3(6):2042-55
- Wang, C.; Wang, Z.H.; Yang, J. (2018) Cooling effect of urban trees on the built environment of contiguous United States. *Earth's Future*, 6, 1066–1081