INVENTORY OF TREE SPECIES FOUND WITHIN FEDERAL UNIVERSITY WUKARI, TARABA STATE

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Abstract: Forest inventory is a systematic process of collecting, analyzing, and interpreting data related to the composition, structure, and growth characteristics of forest ecosystems. This study documented the different tree species found within Federal University Wukari, Taraba state, addressing lack of prior data. The main objective of this study is simply identifying the tree species found within the University with a view of providing proper documentation about the relative density (RD) of such species. Using total enumeration, 536 trees (DBH >10 cm) were enumerated across academic and undeveloped areas. Data were analyzed through descriptive statistics and Pearson correlation, using excel and IBM SPSS. The results identified 38 species from 16 families, dominated by *Gmelina arborea* (14.17%), *Daniellia oliveri* (13.99%), and *Mangifera indica* (13.61%). Fabaceae was the most species-rich family (13.15%). Dominance of exotic species like *Gmelina arborea*, highlighted anthropogenic impacts, while rare species like *Maranthes polyandra* signaled conservation needs. Recommendations include, using the findings to guide reforestation efforts, prioritizing species diversity to enhance ecological resilience. Carrying out, regular tree inventories to monitor changes in species composition, growth characteristics, and overall forest health.

Keywords: Forest Inventory, Tree species, Federal University Wukari, Relative density

Introduction

Forest inventory is an important component of sustainable forest management, providing essential information on the composition, structure, and dynamics of the forest ecosystem (Husch et al., 2003). It involves the systematic collection and analysis of data on forest characteristics such as tree species, diameter, height, volume and spatial distribution (Kershaw et al., 2016). Forest inventory is a crucial tool for sustainable forest management. By assessing the resources and conditions of the forest, inventory helps to develop effective strategies for maintaining healthy and productive forest while also ensuring long term sustainability, (FAO,2020). Forest inventory is a procedure involving planning of inventory design, data collection, data analysis and reporting about forest resources of a large, forested area or country (Encyclopedia of forest science, 2004). Forest inventory are design to measure the extent, quality, composition and condition of forest resources, (Kangas et al., 2006). Forest inventory is a tool that provides the information about the size and shape of the area as well as qualitative and/or quantitative information on the growing stock within the forest ecosystem (Zerihun and Yemir, 2013). The importance of accurate reliable forest inventory data cannot be overstated, as it provides the foundation for sustainable forest management and decision making (Husch et al., 2003). By assessing the resources and conditions of the forest, inventory helps to develop effective strategies for maintaining healthy and productive forest while also ensuring long term sustainability, (FAO, 2020). Federal University Wukari is one of the nine new Universities established by the Federal Government of Nigeria in 2011. The University is located in Wukari, Taraba State, which is the second-largest city in the State after the State Capital Jalingo. Federal university wukari is blessed with diverse species of trees whose importance cannot be overemphasized. Also, the trees found in the university environment have provided both direct and indirect benefit to both staff and students of the institution. Therefore, there is need for proper inventory of the trees found within the university. The main objective of this study is to carry out inventory of the tree species found within Federal University Wukari.

Methodology

Description and Location of the Study Area

Taraba is bordered to the north by Bauchi and Gombe States, to the east by Adamawa state, to the south by Cameroon, and to the west by Benue, Nassarawa, and Plateau States and with wooded savannah in the northern region and derived Guinea savannah in the southern region of the State. The study site is the Federal University Wukari located in the north –eastern region of Wukari Taraba State between latitude 7050'37"N and longitude 9046'30''E. Geopolitically, Wukari is located in the southern region of the state on longitude 907'83''E and latitude 708'50''N. Wukari is bounded to the north-west by Benue state, to the South-east Takum local government area, and north-east by Bali, Karim Lamido and Gassol Local Government areas of Taraba State and characterized by river valley The study site Federal University Wukari occupies a total land mass of 199.25 hectares. The study site is located in the tropical savanna region of Nigeria, with a relatively flat to gently sloping topography, the study location ranges from 150 to 300 meters above sea level.

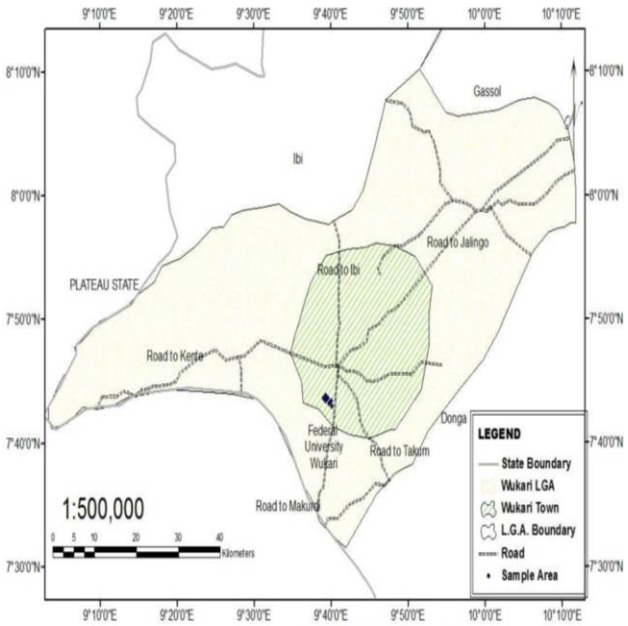

Figure 1 Map of Wukari showing the Study area. Source (Onudibia et al., 2020)

Sampling Design and Procedure

For this study, Total enumeration was carried out in some parts of the University. These parts include academic area (class rooms), administrative buildings (old buildings and new), the school farm and fallow lands. Residential areas and cultivated lands were not part of this study. Total enumeration of all trees with DBH greater than 10cm was carried out. Also, this study captured, both developed, and undeveloped areas.

Methods of Data Collection

The diameter at breast height (DBH) and total height of all individual trees within the study area with DBH greater than 20cm was identified and measured, and their growth characteristics were estimated.

Data Analysis

Data collected was entered and cleaned using the Microsoft excels software and analyzed using IBM SPSS statistical.

Relative density

The relative density of all tree species on family levels measured in Federal University Wukari was computed using the formula for relative density. The formula can be seen below.

$$RD = \frac{n}{N} * 100$$

Where;

n= number of individual tree species,

N= total number of trees and

RD= relative density.

Results and Discussion

Table 1a and 1b, shows the results of tree species measured within Federal university wukari. A total of 536 trees were identified, enumerated and measured, belonging to 38 species and 16 families, of which 258 are indigenous and 278 are exotic species. The table is, also showing frequency of occurrence and relative density at specie level as captured in Federal University Wukari, Taraba. The highest occurring species include, *Gmelina arborea* 76, *Daniellia oliveri* 75, *Mangifera indica* 73, *Azadirachta indica* 45, and *Ficus sycomorus* 36, Species such as, *Gmelina arborea* 14.17%, *Daniellia oliveri* 13.99% and *Mangifera indica* 13.61% were the most frequent species, which aligns with findings of (Onyekwelu, 2005) that certain tree species dominate due to their adaptive traits and economic importance. Also, high-frequency species like *Daniellia oliveri* and *Gmelina arborae* requires immediate management to balance timber production and biodiversity (Bettinger et al., 2017). Followed, by *Anacardium occidentale* 37, *Parkia biglobosa* 28, *Vitellaria paradoxa* 23, *Sclerocarya birrea* 20, *Vitex doniana* 19, *Terminalia mantaly* 16, *Ficus sur* 11, *Eucalyptus robusta* 10, *Prosopis africana* 11, and *Burkea africana* 9. Also, *Tectona grandis* 7, *Nauclea latifolia* 3, *Acacia nolitica* 3, *Balanites aegyptiaca* 2, *Eucalyptus camaldulensis* 3, *Eleais guineensis* 3, *Bombax costatum* 2, *Borassus flabellifer* 2, *Ceiba pentandra* 2 and *Citrus sinensis* 2. The list occurring species include, *Terminalia macroptera, Spathodea campanulata, Rosestonea regia, Phoenix dactylifera, Newbouldia laevis, Adansonia digitata, Combretum glutinisum, Grewia mollis, Kigelia african, Maranthes polyandra, Ficus reliogiosa* and *Ficus pletyplylla* with 1 frequency of occurrence each. However, the high relative density of *Gmelina arborae* (a plantation species) suggests anthropogenic influence, consistent with literature on agroforestry systems (Adejo, 2021). The presence of rare species like *Maranthes polyandra* emphasizes the need for targeted conservation, as stressed by (Burrascano et al., 2018).

Table 1a: Tree Species, Families, Frequency of Occurrence and Relative Density.

S/N	Tree Species	Frequency	Families	RD (%)
1	*Acacia nolotica*	3	Fabaceae	0.55
2	*Adansonia digitata*	1	Bombacaceae	0.18
3	*Anacardium occidentale*	37	Anacardiaceae	6.90
4	*Azadirachta indica*	45	Meliaceae	8.39
5	*Balanites aegyptiaca*	2	Balanitaceae	0.37
6	*Bombax costatum*	2	Malvaceae	0.37
7	*Borassus flabellifer*	2	Aracaceae	0.37
8	*Burkea Africana*	9	Fabaceae	1.67
90	*Ceiba pentandra*	2	Malvaceae	0.37
10	*Citrus sinensis*	2	Rutaceae	0.37
11	*Combretum glutinisum*	1	Combretaceae	0.18
12	*Daniellia oliveri*	75	Fabacaea	13.99

Table 1b: Tree Species, Families, Frequency of Occurrence and Relative Density.

S/N	Tree Species	Frequency	Families	RD (%)
13	*Elaeis guineensis*	3	Arecaceae	0.55
14	*Eucalyptus camaldulensis*	3	Myrtaceae	0.55
15	*Eucalyptus robusta*	10	Myrtaceae	1.86
16	*Ficus pletyphylla*	1	Moraceae	0.18
17	*Ficus reliogiosa*	1	Moraceae	0.18
18	*Ficus sur*	11	Moraceae	2.05
19	*Ficus sycomorus*	36	Moraceae	6.71
20	*Gmelina arborae*	76	Verbenaceae	14.17
21	*Kigelia Africana*	1	Bignoniaceae	0.18
22	*Lannea discolor*	6	Anacardiaceae	1.11
23	*Mangifera indica*	73	Anacardiaceae	13.61
24	*Maranthes polyandra*	1	Chyrsobalanaceae	0.18
25	*Nauclea latifolia*	3	Rubiaceae	0.55
26	*Newbouldia laevis*	1	Bignoniaceae	0.18
27	*Grewia mollis*	1	Malvaceae	0.18
28	*Parkia biglobosa*	28	Fabaceae	5.22
29	*Phoenix dactylifera*	1	Arecaceae	0.18
30	*Prosopis Africana*	11	Fabaceae	2.05
31	*Roystonea regia*	1	Arecaceae	0.18
32	*Sclerocarya birrea*	20	Anacardiaceae	3.73
33	*Spathodea campanulate*	1	Bignoniaceae	0.18
34	*Tectona grandis*	7	Verbanaceae	1.30
35	*Terminalia macroptera*	1	Combretaceae	0.18
36	*Terminalia mantaly*	16	Combretaceae	2.98
37	*Vitellaria paradoxa*	23	Sapotaceae	4.29
38	*Vitex doniana*	19	Verbenaceae	3.54

Table 2 shows the result of relative density of each family of tree species found within Federal University Wukari, Taraba state. Of all the families of tree species encountered, the family Fabaceae emerged as the family with the highest number of tree species (5 spp) with RD of (13.153%), indicating the most species-rich family in the area. Followed by Anacardiaceae (4 spp) with RD (10.256%), Arecaceae (4 spp) with RD (10.256) and Moraceae (4 spp) with RD (10.256). However, Maliaceae, Sapotaceae, Rubiaceae, Balanitaceae, Rutaceae, Chrysobalanaceae, and Bombacaceae with (1 spp) having the lowest RD of (2.632%) each, which shows lower density. The occurrence of Fabaceae as the most dominant tree family in Federal university wukari agrees with studies in tropical ecosystems where nitrogen-fixing species thrive (Adebayo et al., 2022). Families with the higher number of species measured trees are, Fabaceae 5, Anacardiaceae 4, Arecaceae 4, Moraceae 4, followed by Verbenaceae 3, Bignoniaceae 3, Combretaceae 3, Malvaceae 3, Myrtaceae 2, and the families with the least recorded species are Maliaceae 1, Sapotaceae 1, Rubiaceae 1, Balanitaceae 1, Rutaceae 1, Chrysobalanaceae 1, and Bombacaceae 1. This result agrees with the findings of Kangas et al., (2006); Zerihun and Yemir, (2013) who emphasizes that forest inventory is a fundamental tool for sustainable forest management, providing data on species composition, frequency, and growth characteristics and recorded 38 tree species across 16 families, confirming the importance of inventory in assessing forest structure. The finding also agrees with previous studies that stresses the dominance of certain families, such as Fabaceae, Moraceae, and Verbenaceae, in tropical forests (Malik, 2014).

Table 2: Families Number of Species Measured and Relative Density

Families	No. of Species Measured	RD (%)
Fabaceae	5	13.15
Anacardiaceae	4	10.52
Bombacaceae	1	2.63
Meliaceae	1	2.63
Balanitaceae	1	2.63
Malvaceae	3	7.89
Arecaceae	4	10.52
Rutaceae	1	2.63
Combretaceae	3	7.89
Myrtaceae	2	5.26
Moraceae	4	10.52
Verbenaceae	3	7.89
Bignoniaceae	3	7.89
Chrysobalanaceae	1	2.63
Rubiaceae	1	2.63
Sapotaceae	1	2.63
TOTAL	38	99.94

Figure 1 visualizes the RD percentages, the tallest bar, showing Fabaceae, followed by families clustered around 10.5% and smaller bars for less diverse families. Fabaceae has the highest RD (13.158%, 5 spp), indicating it is the most

species-rich family in the area. Anacardiaceae, Arecaceae, and Moraceae each have 4 species (10.526% RD), reflecting moderate dominance. Families like Bombacaceae, Meliaceae, and Chrysobalanaceae have only 1 species each (2.632% RD), suggesting lower diversity. Fabaceae's prevalence could be from ecological advantages (e.g., nitrogen-fixing ability, adaptation to local soil and climate) or human activities (e.g., afforestation programs systems). This agrees with, (Adejo, 2021). Dominant families like Fabaceae may require targeted conservation efforts due to their ecological significance.

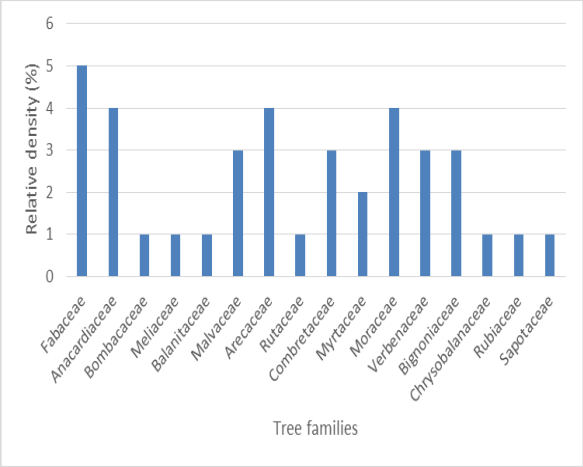

Figure 2: Graph of relative density of tree families in Federal University Wukari

Conclusion

Forest inventory serves as a critical tool for sustainable forest management, enabling effective planning, conservation, and utilization of forest resources. Accurate forest inventory data is essential for assessing biodiversity, estimating timber volume, and monitoring changes in forest conditions over time. The importance of forest inventory cannot be overstated as it provides a foundation for informed decision-making in forest management, ensuring the sustainability of forest resources. It also helps identify endangered species, track forest degradation, and guide afforestation and reforestation initiatives.

This study reveal that Federal University Wukari hosts a diverse range of tree species, with a total of 536 trees enumerated, belonging to 38 species and 16 families. The study provides information on the tree species, there relative density and growth characteristics within Federal University Wukari. Fabaceae was the most dominated family, having 5 different tree species of which *Daniellia oliveri* was the most dominant tree species found within the University.

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