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# CHECKLIST OF TREE AND SHRUB SPECIES IN FORESTS ACROSS ANAMBRA STATE NIGERIA

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**ABSTRACT:** *The evaluation of tree and shrub species in forests throughout Anambra State poses a significant challenge. Despite the importance of these forests in terms of ecology and biodiversity, there is a lack of comprehensive documentation on the various tree and shrub species found in the area. The absence of precise taxonomic information impedes conservation efforts, sustainable management, and well-informed decision-making regarding forest resources. This study was carried out to delineate the species of trees and shrubs present in some forest sites in Anambra State, Nigeria. Three tropical forests were selected from different zones of the study area based on their high floristic composition. They include Unizik Conservation Forest Nnamdi Azikiwe University, Awka South (NACF), Ishigwu Forest, Umuomaku Orumba South (IFU), and Umuikwu Forest, Anam Anambra West (UFA). A field inventory of trees and shrubs flora was adopted for data collection. On each location, six plots of 10 m × 10 m each were randomly demarcated following a line transect and trees within the plots were assessed. Identification and recording of different tree and shrub species was done by considering morphological features of leaves and stem. A total of 114 species belonging to 101 genera in 38 families were recorded across the three forests. The forests contained different proportions of unique species, indicating differences in species richness. It is recommended that habitat preservation be prioritized due to the wide variety of species observed in the three forests. Measures should be implemented to avoid deforestation, illegal logging, and land-use changes that could harm these ecosystems.*

**KEYWORDS:** Forests, Taxonomy, Trees, Shrubs, Plants, Conservation, Biodiversity, Family, Tropical.

## INTRODUCTION

A measure of an area's diversity that considers the quantity and density of individual species is called diversity (Ogunleye *et al.*, 2004). The third component of biodiversity that was previously discussed is the subject of this study, which looks at the population and taxonomic abundance of tree and shrub species in three different Anambra State forest areas. Being the most diverse and abundant terrestrial ecosystem on Earth, tropical forests provide enormous benefits to humankind. Despite making up less than ten percent of the planet's land area, these forest vegetations are home to at least some of all plant, animal, and microbial species as well as over three-quarters of all higher plant biomass. Both current and future generations will be deprived of these benefits by deliberate destruction made in an effort to eliminate one or more forest products while studies are still being conducted to determine how best to use their many resources (especially the floral components) and potentials (Ojo, 2004; Cunningham *et al*., 2005).

Taxonomy and conservation complement each other; one cannot actually expect to preserve organisms that cannot be identified, and any attempts to understand the consequences of environmental change and degradation will be dangerously compromised if we cannot identify and describe the interacting units of natural ecosystems. Several contemporary reviews have highlighted the fundamental role of taxonomy in conservation, and notable high-profile science policy reports have also drawn attention to the funding and credibility gap facing taxonomic and systematic science (NRC, 1995; House of Lords, 2002; The Royal Society, 2003). Therefore, successful conservation depends on a robust and well-funded scientific base in taxonomy and systematics.

Many of these reports also highlight the lack of knowledge about Earth's species. Of the estimated total of approximately 7-15 million species, we have described approx. 1.7 million (we also lack a central inventory and don't know this number exactly). As a result, in the name of biodiversity conservation, extensive efforts have been made to catalog the entire biodiversity on Earth (Species, 2000). Comprehensive species lists, regional taxonomies and guides alone will do nothing to conserve species; On the other hand, however, it may be impossible to develop the necessary plans and mechanisms for the protection of plant species without these plants being sufficiently known and described (Rojas, 1992; Samper, 2004). Both conservation and taxonomy face serious obstacles, both in research, funding and otherwise. To address this issue, obviously relevant questions come to mind. Such questions like: what is the relationship between them? What trade-offs can be reached, where are the intersections between the two, and what type of taxonomy do we need to achieve conservation goals?

Janzen and Hallwachs (1993) call for a detailed record of the total taxonomic richness of a given area, arguing that this can make the complexity of biodiversity of wild areas “a life-enriching stimulus and a center of economic growth.” Without this understanding, wild biodiversity is but a pale green barrier to humanity's pets and a decaying sponge for human waste. Taxonomy and inventory/record keeping are essential technologies for achieving this understanding (McNeely, 2002).

The taxonomy also helps compile information for the public. For example, the millions of visitors to public exhibitions of museum collections, zoos, and botanical gardens have led to much broader public support for biodiversity, and such public information needs to be disseminated. Taxonomic information is important for addressing many important


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conservation problems, particularly across international boundaries. These include issues as wide-ranging as the spread of invasive alien plant species, the protection of migratory birds, the emergence of new diseases, the decline of amphibians and the impact of the animal trade (McNeely, 2002).

The evaluation of tree species in forests throughout Anambra State poses a significant challenge. Despite the importance of these forests in terms of ecology, there is a lack of comprehensive documentation on the various tree and shrub species found in the area. The absence of precise taxonomic information impedes conservation efforts, sustainable management, and well-informed decision-making regarding forest resources. Through the implementation of a thorough taxonomic evaluation, the primary objective of this study is to advance our comprehension of the classification of trees and shrubs within the forest ecosystems of Anambra State. In addition, it aims to support the adoption of sustainable forestry techniques and play a role in the conservation of significant tree and shrub varieties.

## MATERIALS AND METHODS

### Study Area

The study was carried out in Anambra state, Nigeria. It lies within the tropical rain and evergreen forest with a tropical climate that is humid all year round; although the humidity varies with the seasons. The rainy season spans from March to October and is bimodal with a two-week break of rainfall in August (August break). The mean annual rainfall in the southeast is 2000m while the average annual temperature is between $25^0$C and $28^0$C with relative humidity of about 98% during the rainy season and between 50% and 60% during dry season (ADP, 2010).

Three tropical forests were selected from different zones of the study area based on their high floristic composition:

1. Unizik Conservation Forest Nnamdi Azikiwe University, Awka South
2. Ishigwu Forest, Umuomaku Orumba South
3. Umuikwu Forest, Anam Anambra West


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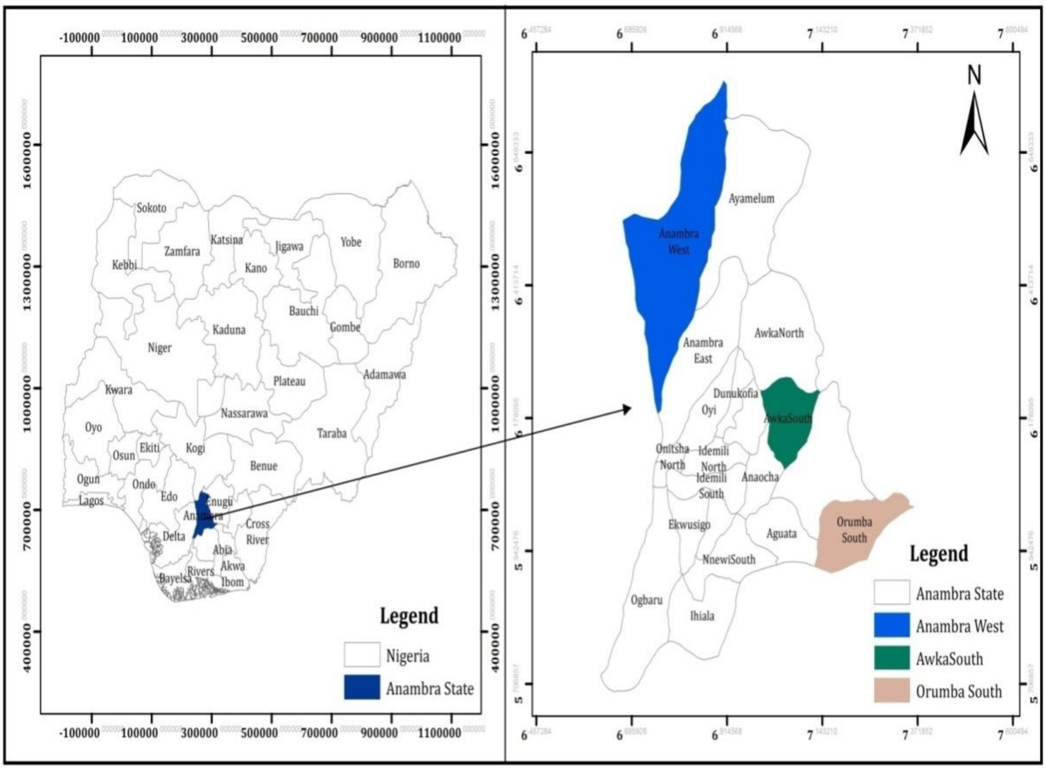


**Figure 1: Map of Nigeria Showing Anambra State and the Three Local Government Areas Where the Forest Sites Studied are Located**


**Figure 3: Aerial Map Showing the Nnamdi Azikiwe Conservation Forest Awka South LGA**

**($6^{O}15'14"N\ 7^{O}06'37"E$)**


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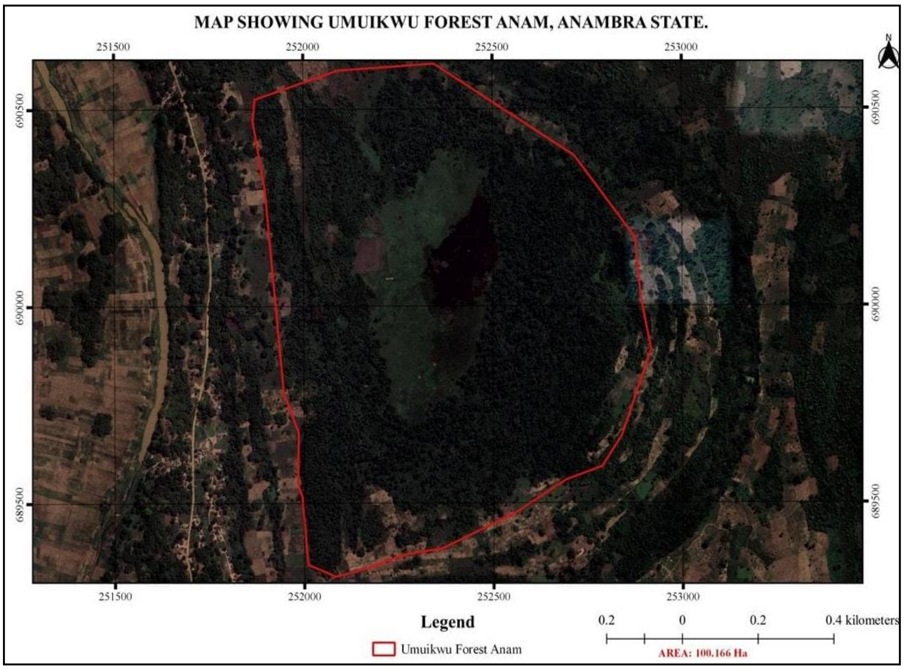


**Figure 4: Aerial Map Showing the Umuikwu Forest Anam Anambra West LGA**

**(6$^{O}$14'12"N 6$^{O}$45'50"E)**


**Figure 5: Aerial Map Showing the Ishigwu Forest Umuomaku Orumba South LGA**

**(5$^{O}$57'36"N 7$^{O}$08'52"E)**


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### Study Design

A combination of line transects and plot sampling was used in this study. To ensure proper spread and representation, a multi stage random sampling technique was used. Stage one was the selection of forest sites from each of the zones in the state (Anambra South, Anambra Central and Anambra North). Selection was based on the four cardinal points of east, west, north and south of the state; also, anthropogenic activities were put into consideration in the selection. Stage two involved the random selection of plots inside the forests selected for the study. A field inventory of trees and shrubs flora was adopted for data collection. On each location, six plots of 10 m × 10 m each were randomly demarcated following a line transect and trees within the plots were assessed.

### Collection and Identification of Plants

Identification and recording of different tree and shrub species was done by considering the morphological features of leaves and stem. Key to identification of Nigerian trees and Flora of West Tropical Africa were used for the proper identification of the trees encountered (Keay, 1953 Hutchinson & Daziel, 1963; Keay *et al.*, 1964; Gledhill, 1981; Gill, 1992). Also, samples of some of the plants encountered were collected for proper documentation in the university herbarium where they were issued voucher numbers.

## RESULT

### Checklist of Trees and Shrubs in the Three Tropical Forests across Anambra State

Table 1 shows a list of the tree and shrub species encountered in the three forest study sites in Anambra state. A total of 114 trees and shrub species spread across 38 families were recorded for the forest sites. An aggregate of 1,674 individuals belonging to 101 genera in 38 families were recorded across forests in Awka south, Orumba south and Anambra west local government areas of Anambra state. The Fabaceae family had the highest number of species with 29 species recorded. It was followed by the Annonaceae family which had 9 species; Apocynaceae and Euphorbiaceae had 7 species. They were closely followed by Malvaceae and Meliaceae which were represented by 4 species each. Anacardiaceae, Bignoniaceae, Combretaceae, Lamiaceae, Moraceae and Rutaceae were all represented by 3 species each while Bombacaceae, Burseraceae, Ebenaceae, Lecynthidaceae and Sterculiaceae all had 2 species each representing them. Other families which had only 1 species included were: Aracaceae, Boraginaceae, Cannabaceae, Capparaceae, Cecropiaceae, Chrysobalanaceae, Dichapetalaceae, Dracaenaceae, Gentianaceae, Guttiferae, Hypericaceae, Icacinaceae, Irvingiaceae, Myristaceae, Myrtaceae, Olacaceae, Pandaceae, Sapindaceae, Sapotaceae and Tiliaceae.


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**Table 1: Checklist of Trees and Shrubs in the Three Tropical Forests across Anambra State**

| S/N | BOTANICAL NAME | FAMILY | LOCAL/COMMON NAME | HABIT |
|---|---|---|---|---|
| 1. | *Anacardium occidentalis* Linn. | Anacardiaceae | Kashu, Kansun | Tree |
| 2. | *Mangifera indica* Linn. | Anacardiaceae | Mangolo | Tree |
| 3. | *Spondias mombin* Linn. | Anacardiaceae | Ijikere | Tree |
| 4. | *Annona muricata* L. | Annonaceae | Shawashopu | Tree |
| 5. | *Annona senegalesis* Pers. A. | Annonaceae | Ụbụrụọcha, Nrinnunu | Tree |
| 6. | *Annona squamosa* Linn. | Annonaceae | Sugar apple, sweet sop | Tree |
| 7. | *Cleistopholis patens* (Benth.) Engl. et Diels | Annonaceae | Ojo, Oghuru | Tree |
| 8. | *Dennettia tripetala* Bak. f. | Annonaceae | Mmimi | Tree |
| 9. | *Enantia chlorantha* Oliv. | Annonaceae | Utọ-erumeru | Tree |
| 10. | *Monodora tenuifolia* Benth. | Annonaceae | Ehuruọhia | Tree |
| 11. | *Uvaria chamae* P.Beauv. | Annonaceae | Mmimiọcha, Uda-agu | Shrub |
| 12. | *Xylopia aethiopica* (Dunal) A. Rich. | Annonaceae | Uda | Tree |
| 13. | *Funtumia elastica* (Preuss) Stapf. | Apocynaceae | Mba | Tree |
| 14. | *Alstonia boonei* De Wild. | Apocynaceae | Eghu, Egbu-ora | Tree |
| 15. | *Holarrhena floribunda* (G.Don) Dur. &Schinz | Apocynaceae | False rubber tree | Tree |
| 16. | *Picralima nitida* Stapf.Th.& H. Dur. | Apocynaceae | Osuigwe | Shrub |
| 17. | *Rauwolfia vomitoria* Afzel | Apocynaceae | Akanta | Shrub |
| 18. | *Tabernaenontana pachysiphon* Stapf. | Apocynaceae | Ivuru | Tree |
| 19. | *Voacanga Africana* Stept ex. Elliot | Apocynaceae | Pete-pete, Akete | Tree |
| 20. | *Elaeis guineensis* Jacq. | Arecaceae | Osisinkwu | Tree |
| 21. | *Kigelia africana* (Lam.) | Bignoniaceae | Ohi | Tree |
| 22. | *Newbouldia laevis* P. Beauv ex Bureau. | Bignoniaceae | Ogirisi, Ogilisi | Shrub |
| 23. | *Spathodea campanulata* P. Beauv. | Bignoniaceae | Imiewu, Utu ogbolommiri | Tree |
| 24. | *Bombax buonopozense* P. Beauv. | Bombacaceae | Akpuogiri | Tree |
| 25. | *Ceiba pentandra* (L.) Gaertn | Bombacaceae | Owuakpu | Tree |
| 26. | *Cordia millenii* Bak. | Boraginaceae | Oji nwannabe | Tree |
| 27. | *Canarium schweinfurthi* L | Burseraceae | Ube okpoko, Ube mgba | Tree |
| 28. | *Dacryodes edulis* (G.Don) H.J. Lam | Burseraceae | Ube igbo | Tree |
| 29. | *Trema orientalis* (Linn.) Blume | Cannabaceae | Indian charcoal tree | Tree |
| 30. | *Buchholzia coriacea Engl.* | Capparaceae | Oji-ogwu | Tree |
| 31. | *Myrianthus arboreus* P. Beauv. | Cecropiaceae | Ujuju | Tree |


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|---|---|---|---|---|
| 32. | *Hannoa klaineana* Pierre & Engl. | Chrysobalanaceae | Oghulu, Awuru | Tree |
| 33. | *Terminalia catappa* L. | Combretaceae | Ukwufurut | Tree |
| 34. | *Terminalia glaucescens* (Planch. ex Benth | Combretaceae | Idigbo | Tree |
| 35. | *Terminalia superb* Engl. & Diels | Combretaceae | Edo ọcha, Ojiroko | Tree |
| 36. | *Dichapetalum barteri* Engl. | Dichapetalaceae | Akwuosa, Mgbuewu | Shrub |
| 37. | *Draecena arborea* (Wild.) Link | Dracaenaceae | Odo | Tree |
| 38. | *Diospyros suavolens* Gurke | Ebanaceae | Akpupaja | Tree |
| 39. | *Diospyros zenkeri* (Gurke) F.White | Ebenaceae | Kambiri | Shrub |
| 40. | *Alchornea cordifolia* (Schum. &Thonn.)Muell.Arg. | Euphorbiaceae | Ububo | Shrub |
| 41. | *Bridelia micrantha* (Hochst.) Baill | Euphorbiaceae | Ogaọfia, Aga ogwu | Tree |
| 42. | *Hevea brasiliensis* (Willd.) Mull.-Arg. | Euphorbiaceae | Ewe roba | Tree |
| 43. | *Hura crepitans* L. | Euphorbiaceae | Sandbox tree | Tree |
| 44. | *Macaranga barteri* Mull. Arg. | Euphorbiaceae | Ohaha-eze | Tree |
| 45. | *Ricinodendron heudelotii* (Baill.) Pierre ex Pax & K.Hoffm. | Euphorbiaceae | Okwe | Tree |
| 46. | *Tetrorchidium didymostemon* (Baill) Pax & K. Hoffm. | Euphorbiaceae | Iheni | Shrub |
| 47. | *Acacia macrostachya* Reichenb. ex Benth. | Fabaceae | Uke | Shrub |
| 48. | *Afzelia africana* Smith | Fabaceae | Akparata | Tree |
| 49. | *Afzelia bipindensis* Harms | Fabaceae | Aja | Tree |
| 50. | *Albizia ferruginea* (Guill. and Perr.) Benth. | Fabaceae | Ngu | Tree |
| 51. | *Albizia lebbeck* (L.) Benth | Fabaceae | Eshegeshege | Tree |
| 52. | *Anthonotha macrophylla* P. Beauv | Fabaceae | Ububa | Shrub |
| 53. | *Baphia pubescens* Hook. f. | Fabaceae | Abọsi-ọfia | Tree |
| 54. | *Berlinia confusa* Hoyle | Fabaceae | Ekpogoi | Tree |
| 55. | *Berlinia macrophylla* Pierre ex Pellegr | Fabaceae | Apado | Tree |
| 56. | *Brachystagia eurycoma* Harms | Fabaceae | Achi | Tree |
| 57. | *Cananga odorata* Hook. f.& Thomson | Fabaceae | Ylang-ylang | Tree |
| 58. | *Cassia sieberiana* DC. | Fabaceae | Ugbaoyibo | Tree |
| 59. | *Dalbergia latifolia* Roxb. | Fabaceae | Africa black wood | Tree |
| 60. | *Dalium guineense* Willd | Fabaceae | Icheku | Tree |
| 61. | *Daniella oliveri* (Rolfe) Hutch &Dalz. | Fabaceae | Ozaga, Agba, Inyima | Tree |


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|---|---|---|---|---|
| 62. | *Entada abyssinia* Steud. | Fabaceae | Oyili-ugba | Tree |
| 63. | *Erythrina senegalensis* DC. | Fabaceae | Echichie | Tree |
| 64. | *Leonardoxa africana* (Baill.) Aubrev. | Fabaceae | Ant plant | Tree |
| 65. | *Leucaena leucocephala* (Lam.) de Wit | Fabaceae | Ogun bere | Tree |
| 66. | *Lonchocarpus cyanescens* (Schumach. &Thonn.) Benth. | Fabaceae | Anunu | Tree |
| 67. | *Parkia biglobosa* (Jacq.) R.Br. ex G.Don | Fabaceae | Ogiri | Tree |
| 68. | *Pentaclethra macrophylla* Benth. | Fabaceae | Ugba, Ukpaka | Tree |
| 69. | *Piliostigma thonningii* (Schumach) Milne-Redh | Fabaceae | Okpoatu, Okpachu | Tree |
| 70. | *Piptadeniastrum africanum* (Hook.f.) Brenan | Fabaceae | African greenheart | Tree |
| 71. | *Pterocarpus milbraedii* Harms. | Fabaceae | ọhaojii | Tree |
| 72. | *Pterocarpus santalinoides* L'Her. ex DC. | Fabaceae | Nturukpa, Uturukpa | Tree |
| 73. | *Pterocarpus soyauxii* Taub. | Fabaceae | ọhaọcha | Tree |
| 74. | *Tamarindus indica* L. | Fabaceae | Tamarind | Tree |
| 75. | *Tetrapleura tetraptera* (Schumach. & Thonn.) Taub. | Fabaceae | Uhiokrihio, ọshọshọ | Tree |
| 76. | *Anthocleista djalonensis* A. Chev. | Gentianaceae | Ute agu, Okpokolo, Aga okpolo | Tree |
| 77. | *Garcinia kola* Heckel. | Guttiferae | Aki ilu | Tree |
| 78. | *Harungana madagascariensis* Lam. ex Poir. | Hypericaceae | ọmasika | Tree |
| 79. | *Icacinia trichanta* Oliv. | Icacinaceae | Eriagbo, Urumbia, Ibugo | Shrub |
| 80. | *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. | Irvingiaceae | Ugiri, Ugili | Tree |
| 81. | *Gmelina arborea* Roxb. ex. Sm. | Lamiaceae | Gmelina | Tree |
| 82. | *Tectonia grandis* L.f. | Lamiaceae | Teak | Tree |
| 83. | *Vitex doniana* Sweet | Lamiaceae | Uchakoro | Tree |
| 84. | *Napoleona imperialis* (P.Beauv) | Lecythidaceae | Apọdo | Tree |
| 85. | *Napoleona vogelii* Hook. & Planch. | Lecythidaceae | Mkpodu | Shrub |
| 86. | *Adansonia digitata* Linn | Malvaceae | Ose, Igi-ose | Tree |
| 87. | *Cola cordifolia* (Cav.) R. Br. | Malvaceae | Madinka cola | Tree |
| 88. | *Cola nitida* (Vent) Schott &Endl. | Malvaceae | ọji | Tree |
| 89. | *Hildegardia barteri* (Mast.) Kosterm. | Malvaceae | Ufuku, Shishi | Tree |
| 90. | *Carapa procera* DC. | Meliaceae | Mpaoku, Nkwo | Tree |
| 91. | *Entandrophragma utile* (Dawe & Sprague) Sprague | Meliaceae | Owura, Okeong | Tree |


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|---|---|---|---|---|
| 92. | *Khaya senegalensis* (Desr.) A. Juss. | Meliaceae | Ono | Tree |
| 93. | *Trichilia dregeana* Sond. | Meliaceae | Thunder tree, Forest mahogany | Tree |
| 94. | *Trichilia lanata* A. Chev. | Meliaceae | Ogiovalo | Tree |
| 95. | *Ficus sycomorus* | Moraceae | Anwerenwa | Tree |
| 96. | *Milicia excelsa* (Welw.) CC Berg | Moraceae | Orji | Tree |
| 97. | *Musanga cecropioides* R. Br | Moraceae | Ububo/Ubebe | Tree |
| 98. | *Pycnanthus angolensis* (Welw.) Warb. | Myristicaceae | Oje, Akwa-mmili | Tree |
| 99. | *Psidium guajava* L. | Myrtaceae | Gova | Tree |
| 100. | *Heisteria parvifolia* (Sm.) | Olacaceae | Balsa | Shrub |
| 101. | *Microdesmis puberula* Hook. F. ex Planch | Pandaceae | Mkpiri, Mbugbo | Shrub |
| 102. | *Morinda lucida* Benth. | Rubiaceae | Ogere, Ezeogu, Nfia | Tree |
| 103. | *Nauclea diderrichii* (De Wild. & T. Durand) Merr. | Rubiaceae | Uvunuhu, Uburu | Tree |
| 104. | *Nauclea latifolia* Smith. | Rubiaceae | Uburuilu | Shrub |
| 105. | *Rothmannia whitfieldii* (Lindl.) Dandy | Rubiaceae | Uri | Shrub |
| 106. | *Porterandia cladantha* (K. Schum) | Rubiaceae | Ukpakonsa | Tree |
| 107. | *Citrus aurantium* Linn. | Rutaceae | Olomankirisi | Tree |
| 108. | *Fagara leprieurii* Engl | Rutaceae | Uko, Ukonta | Tree |
| 109. | *Zanthoxylum zanthoxyloides* (Lam.) Zepern. &Timler. | Rutaceae | Aga, Uko, Osisi ka ọwa | Tree |
| 110. | *Sapindus saponaria* L. | Sapindaceae | Soapberry | Tree |
| 111. | *Chrysophyllum albidum* G.Don | Sapotaceae | Udara | Tree |
| 112. | *Cola hispida* Brenan & Keay | Sterculiaceae | Oji-ogodo, Ohaka-mmuọ | Shrub |
| 113. | *Sterculia tragacantha* Lindl. | Sterculiaceae | Utoko, Uhobo | Tree |
| 114. | *Glyphae brevis* (Spreng) Monachimo | Tiliaceae | Anyachu, Anyashu, Ara anyasi | Shrub |


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**Table 2: Common Species and Peculiar Species across the three Forests**

| S/N | SPECIES COMMON TO ALL FORESTS | SPECIES PECULIAR TO THE THREE FORESTS STUDIED | | |
|---|---|---|---|---|
| | | **NACF** | **IFU** | **UFA** |
| 1. | *Afzelia Africana* | *Afzelia bipindensis* | *Acacia macrostachya* | *Diospyros zenkeri* |
| 2. | *Alchornia cordifolia* | *Albizia lebbeck* | *Adansonia digitata* | *Hura crepitens* |
| 3. | *Anacardium occidentalis* | *Alstonia boonei* | *Annona squamosa* | *Microdesmis puberula* |
| 4. | *Annona muricata* | *Annona senegalesis* | *Berlinia macrophylla* | *Napoleona vogelii* |
| 5. | *Anthocleista djalonensis* | *Anthonotha macrophylla* | *Canarium schweinfurthi* | *Psidium guajava* |
| 6. | *Baphia pubescens* | *Berlinia confusa* | *Dennettiatripetala* | |
| 7. | *Bombax buonopozense* | *Carapa procera* | *Dichapetalum barteri* | |
| 8. | *Brachystagia eurycoma* | *Ceiba pentandra* | *Diospyros suavolens* | |
| 9. | *Bridelia micrantha* | *Citrus aurantium* | *Enantia chlorantha* | |
| 10. | *Buchholzia coriacea* | *Cola cordifolia* | *Piliostigma thonningii* | |
| 11. | *Cananga odorata* | *Cola hispida* | *Porterandia cladantha* | |
| 12. | *Chrysophyllum albidum* | *Cordia millenii* | *Sapindus saponaria* | |
| 13. | *Cleistopholis patens* | *Draecena arborea* | *Trichilia lanata* | |
| 14. | *Cola nitida* | *Entandrophragma utile* | *Xylopia aethiopica* | |
| 15. | *Dacryodes edulis* | *Ficussycomorus* | | |
| 16. | *Dalium guineense* | *Funtumia elastica* | | |
| 17. | *Dalbergia latifolia* | *Gmelina arborea* | | |
| 18. | *Daniella oliveri* | *Heisteria parvifolia* | | |
| 19. | *Elaeis guineensis* | *Holarrhena floribunda* | | |
| 20. | *Entada abyssinica* | *Khaya senegalensis* | | |
| 21. | *Erythrina senegalensis* | *Kigelia Africana* | | |
| 22. | *Garcinia kola* | *Leonardoxa africana* | | |
| 23. | *Glyphae brevis* | *Leucaena leucocephala* | | |
| 24. | *Hannoa klaineana* | *Lonchocarpus cyanescens* | | |
| 25. | *Harungana madagascariensis* | *Picralima nitida* | | |
| 26. | *Hevea brasiliensis* | *Pterocarpus mildbraedii* | | |


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|---|---|---|---|---|
| 27. | *Hildegardia barteri* | *Rothmannia whitfieldii* | | |
| 28. | *Icacina trichantha* | *Tectonia grandis* | | |
| 29. | *Irvingia gabonensis* | *Terminalia catappa* | | |
| 30. | *Macaranga barteri* | *Terminalia glaucescens* | | |
| 31. | *Mangifera indica* | | | |
| 32. | *Milicia excelsa* | | | |
| 33. | *Monodora tenuifolia* | | | |
| 34. | *Morinda lucida* | | | |
| 35. | *Musanga cecropioides* | | | |
| 36. | *Myrianthus arboreus* | | | |
| 37. | *Napoleona imperialis* | | | |
| 38. | *Nauclea diderrichii* | | | |
| 39. | *Nauclea latifolia* | | | |
| 40. | *Newbouldia laevis* | | | |
| 41. | *Parkia biglobosa* | | | |
| 42. | *Pentaclethra macrophylla* | | | |
| 43. | *Piptadeniastrum africanum* | | | |
| 44. | *Pterocarpus santalinoides* | | | |
| 45. | *Pterocarpus soyauxii* | | | |
| 46. | *Pycnanthus angolensis* | | | |
| 47. | *Rauvolfia vomitoria* | | | |
| 48. | *Ricinodendron heudelotti* | | | |
| 49. | *Spathodea campanulata* | | | |
| 50. | *Spondias mombin* | | | |
| 51. | *Sterculia tragacantha* | | | |
| 52. | *Tabernaemontana pachysiphon* | | | |
| 53. | | | | |
| 54. | *Tetrapleura tetraptera* | | | |
| 55. | *Tetrorchidium didymostemon* | | | |


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|---|---|---|---|---|
| 56. | *Trema orientalis* | | | |
| 57. | *Trichilia dregeana* | | | |
| 58. | *Uvaria chamae* | | | |
| 59. | *Vitex doniana* | | | |
| 60. | *Voacanga africana* | | | |
| 61. | *Zanthoxylum zanthoxyloides* | | | |

## DISCUSSION

Taxonomic diversity assessment carried out in three selected forests: Nnamdi Azikiwe Conservation Forest (NACF) Awka South, Ishigwu Forest Umuomaku (IFU) Orumba South and Umuikwu Forest Anam (UFA) Anambra West all in Anambra state documented an aggregate of 114 trees and shrubs belonging to 38 families with NACF having 69 species belonging to 26 families, IFU having 70 species belonging to 32 families and UFA having 49 species spread across 27 families. The differences in the number of tree and shrub species recorded in the sampled plots in each zone may be due to variations in ecological factors and other habitat conditions which had effects on tree growth, diversity and distribution (Aigbe & Omokhua, 2015).

The Fabaceae family was the most prevalent among the 114 trees and shrubs from 38 families that were recorded in this study. This is normal since Fabaceae trees are frequently found in large numbers in a variety of ecosystems where they significantly contribute to the social and economic well-being of the populace. Akwaji and Edu (2017) and Wakawa *et al.* (2017) discovered similar things while researching different tree species. *Parkia biglobosa, Daniella oliveri, Afzelia africana, Pentaclethra Macrophylla, Tetrapleura tetraptera, Brachystegia eurycoma*, and *Dialium guineense* are among the Fabaceae family of trees that are valued by the locals for their contribution to soil conservation and improvement, human and animal nutrition as well as their general therapeutic and commercial utility. They have mainly survived because of their significance to the rural populace. It is also possible that the presence of viable seeds in soil seed banks to support regeneration contributes to the dominance of Fabaceae tree species. The majority of Fabaceae species have hard seeds covered in glabrous coverings.

The families Annonaceae, Apocynaceae, Euphorbiaceae, Malvaceae, and Meliaceae came after the Fabaceae. Furthermore, Rutaceae, Moraceae, Combretaceae, Bignoniaceae, Anacardiaceae, and Lamiaceae also closely followed. These families' dominance might be attributed to their capacity for quick recovery in addition to their symbiotic qualities, which might have made it easy for the species to transition into ecological categories that were not available to them. This observation supports what Deka *et al*. (2012) said when they discovered that in the Takamanda Forest in Cameroon, the most well-known families were the Moraceae, Malvaceae, Annonaceae, Meliaceae, and Rubiaceae; thus, the study area explored in this study is similar to Cameroon in terms of vegetation lines and habitat features.

In addition to habitat adaptation, these families may also be dominant because of favorable environmental conditions that support pollination, dispersal, and the subsequent emergence of the species that make up these families (Pausas & Austin, 2001; Adekunle *et al*., 2004; Ojo,


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2004; Adekunle & Olagoke, 2008). Moreover, Austin *et al.* (1996) discovered that species abundance is influenced by soil characteristics, favoring the establishment of particular plant families in all types of habitats. In the forests under study, there were 114 trees and shrubs from 38 families, and the Fabaceae family had the highest species diversity. Aigbe *et al*. (2014) and Edet *et al*. (2012) made similar observations in the adjacent Afi River Forest and Wildlife Mountain Sanctuary. The dominance of the Fabaceae family goes further to confirm previous research by Adeyemi *et al*. (2013) and Aigbe and Omokhua (2015) in Cross River National Park, Oban Division and Oban Forest Reserve, which are all located on the same vegetation belt as our study area. More so, Ihenyen *et al*. (2009) reported that the Fabaceae family was the most abundant in Ehor Forest Reserve, Nigeria with eighteen species.

Adeyemi *et al.* (2015) have noted that the ability of these families to generate a large number of seeds may contribute to their dominance and encourage the establishment of these families in adapted habitats. Ige (2011) and Sanwo *et al*. (2015) stated that in the Southwestern Nigerian forests of Shasha and Onigambari, the families Malvaceae, Apocynaceae, Rubiaceae, Euphorbiaceae, and Meliaceae are dominant. With one or less than two species each, some families had much lower representation in the three forests (NACF, IFU, UFA) of our study area. The underperformance of these families may be due to competition, especially for light, as a result of canopy cover and ground flora loss from anthropogenic activities such as logging, bush burning, farming and tree reduction. Egbe *et al*. (2012) denied the occurrence of a comparable incident in Korup National Park, Cameroon, which occurred in a degraded and semi-natural forest. There is also a chance that human stress is reducing species diversity and yields in these families, as evidenced by findings from Cameroon's Korup National Park.

Our research area contains records for 114 different tree and shrub species belonging to 38 families. Based on reports from other biodiversity hotspots in the tropical rainforest biome, the study area's tree and shrub species diversity is comparable in terms of family spread. As an illustration, Lu *et al*. (2010) found that the tropical rainforests of Xishuangbanna, China, were home to 428 trees from 38 different families; in contrast, Rajkumar and Parthasarathy (2008) found that the Andaman Giant in India was home to 415 species from 32 different families.

Small *et al.* (2004) listed 422 tree species for Borneo, while Kessler *et al.* (2005) found as many as 544 species for Indonesia's natural forests. Nonetheless, compared to 347 species spread across 42 families reported by Duran *et al.* (2006) in a tropical forest in Mexico, the total number of tree species identified in this study (114 in 38 families) is lower, but higher than 92 species found in a tropical rainforest that is semi-mountainous in the Philippines by Blanc *et al.* (1999) and 81 species reported by Blanc *et al.* (2000) in a developed lowland closed canopy forest in Vietnam.

In the Sakponba Forest Reserve in Nigeria, Omorogbe (2004) discovered that the Fabaceae family possessed the greatest diversity, consisting of fourteen different species of trees. Additional investigators like Aigbe *et al*. (2014), Wakawa *et al.* (2017), Aigbe and Omokhua (2017) as well as Amonum *et al*. (2016) have noted similar findings, reporting that the Fabaceae family is the dominant family in the following areas: the Northeastern Sahelian Ecosystem, Afi River Forest, Oban Forest Reserve in Cross River State, Nigeria, and Nengi Forest Reserve in Benue State, Nigeria. The families Annonaceae, Apocynaceae, Euphorbiaceae, Rubiaceae, Malvaceae and Meliaceae came after the Fabaceae family in this study. The prevalence of these families in the research area could be attributed to their ability to thrive in the specific soil conditions of the region. According to Ojo (2004), the Euphorbiaceae, Annonaceae,


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Apocynaceae, and Meliaceae families make up 86% of the tree population in the Abeku axis of the Omo Forest Reserve in Ondo State, Nigeria. The abundance of species within these families may be a result of their effective seed dispersal methods, which include blasting mechanisms and wind dispersal. Ogunleye *et al*. (2004) revealed that surface wind dispersal promoted the dominance of the Fabaceae, Annonaceae, Apocynaceae, and Meliaceae families in Olokemeji Forest Reserve, Nigeria. Soladoye *et al.* (2005) also mentioned the significance of dispersal media in the establishment of Fabaceae, Sapotaceae, Phyllanthaceae, and Euphorbiaceae species on Olabisi Onabanjo University's permanent property.

Adekunle *et al*. (2013) noted that the three main families in a strict conservation area in Southwest Nigeria were the Meliaceae, Moraceae, and Sterculiaceae. However, the findings of our investigation supports earlier research by Adekunle (2006) and Adekunle *et al*. (2010) who found that these families' tree species dominated the tropical rainforest ecosystem in Southwest and Southeast Nigeria. Similar studies observed that in some Southeast Asian tropical rainforests, the families Meliaceae, Euphorbiaceae, and Moraceae were the most numerous (Kanzaki *et al*., 2004; Kessler *et al.*, 2005; Rajkumar & Parthasarathy, 2008; Lu *et al*., 2010). Additionally, the families Anacardiaceae, Moraceae, Rutaceae, Bignoniaceae, Combretaceae, and Lamiaceae were well-represented in the current study. Given the current ecological conditions in the ecosystem, these families' presence in the study area suggested that they were highly adaptable. The lowest representation in our study area was found in the families: Arecaceae, Boraginaceae, Cannabaceae, Capparaceae, Cecropiaceae, Chrysobalanaceae, Dichapetalaceae, Dracaenaceae, Gentianaceae, Guttiferae, Hypericaceae, Icacinaceae, Irvingiaceae, Myristicaceae, Myrtaceae, Olacaceae, Pandaceae, Sapindaceae, Sapotaceae and Tiliaceae. Due to scarification or variations in temperature or light, the seeds may have a dormant period that they must overcome, which could account for the low accumulation of tree species seen in these families. These environmental factors may have an effect on species richness, according to Pausas and Austin (2001). Additional anthropogenic factors, nutrient distribution, shadow light passing through tree canopy, and drying of the forest floor's soil flora are some of the other limiting factors (Egbe *et al*., 2012). During the classification and taxonomic identification, we noticed a large variety of tree and shrub species in the study areas.

It is interesting to note that, of the 69, 70, and 49 forest trees and shrub species that were identified from the three forest sites in Anambra State, our study only found 23, 9, and 4 of these species to be peculiar to the NACF, IFU, and UFA, respectively. Variations in climatic factors, such as rainfall (precipitation), temperature, topography, and soil (edaphic factors), may be the cause of these tree species' restriction to particular zones within our study area. It has been suggested that variations in precipitation play a major role in determining the variety of plants that would germinate and individuals that would flourish upon reintroduction into an ecological zone (Aregheore, 2009). When climatic factors surpass a species' capacity for ecophysiological resilience, they also play a significant role in determining its distribution since they directly impact biological processes and plant synthetic processes (Rowe, 2009). Hills, altitude, and other topographical characteristics can affect the edaphic conditions and community climate, which can have varying effects on plant arrangement (Zhang *et al.*, 2006; Zhang *et al*., 2016). In addition to affecting the structure and distribution of forest flora, the relative distance from a water source can also alter the amount of water that is available for growth (Sarvade *et al*., 2016; Asanok *et al*., 2017).


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## CONCLUSION

Different forests contained different proportions of unique species, indicating differences in species' richness. It is recommended that habitat preservation be prioritized due to the wide variety of species observed in the three forests. Measures should be implemented to avoid deforestation, illegal logging, and land-use changes that could harm these ecosystems. Designating the forest areas as protected reserves or national parks is suggested to create biodiversity hotspots and safe havens for rare or threatened species. Also, the local communities should be encouraged to participate in and support conservation initiatives. Inform people of the value of these forests and promote sustainable behaviors that strike a balance between preserving the environment and meeting human needs. More so, it is necessary to identify any endangered or vulnerable tree and shrub species in the study areas. Create specific conservation plans for these species, including habitat restoration and regular monitoring. Additionally, identify, monitor, and manage invasive plant species that may pose a threat to native biodiversity, and take action to prevent their spread. Furthermore, identify keystone species that have a significant ecological impact and prioritize their protection since they are vital for ecosystem stability.

## CONFLICT OF INTEREST

Authors have declared that there are no conflicts of interest.

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