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Study and Analysis of Tree Species in the Fallows of the Rainforest and Riverine Areas of Anambra State, Southeast of Nigeria

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ABSTRACT

The problem of epileptic power supply in Anambra State and in Nigeria as a whole has forced people, especially in the rural communities, to take to fuel-wood collection as an alternative source of energy. Tree inventory was carried out to analyze the tree species found in the study area and their uses. A study was conducted to analyze the availability of tree species that abound in the fallow Rainforest Area of Anambra State, South East of Nigeria. This was necessitated by the problem of epileptic power supply that forced people to continue to cut fuelwood for domestic uses as alternative energy source. Tree inventory was therefore carried out to analyze the tree species found in the study area. The population of each identified tree species was determined. The tree inventory revealed a number of tree species. These trees are used for various purposes in the state. Trees like *Garcinia kola*, *Napoleona imperialis* and *Baphia nitida* were found to be used as chewing sticks in most communities in the study area while tree species such as *Elaeis guineensis*, *Daniellia oliveri*, *Cocos nucifera*, *Albizia* spp., *Alchornea cordifolia* and *Sterculia tragacantha* are used as construction and building materials in the different study communities in Anambra State. The study revealed that most of the trees in the study area are used as fuel-wood, these include trees such as *Tetrapleura tetraptera*, *Dialium guineense*, *Psidium guajava*, *Anacardium occidentale*, *Mangifera indica*, *Prosopis africana*, *Xylopia aethiopica*, *Vitex doniana*, *Artocarpus communis*, *Nauclea latifolia* and *Parkia biglobosa*. Estimation of dominant tree species revealed that *Mangifera indica* (Mango), *Raphia* Spp. (Palm wine tree), *Pentaclethra macrophylla* (Ugba/Ukpaka), *Elaeis guineensis* (Oil palm tree), *Azadirachta indica* (Neem) and *Milicia excelsa* (Iroko) were dominant in the study area.

INTRODUCTION

Trees play a vital role in maintaining an ecological balance and improving the livelihood of the people. According to Okafor (1989a and 1990a), edible forest products generate substantial cash income for rural people, thereby contributing to their welfare and means of livelihood. The direct nutritional and dietary contributions of tree have been documented in many works (Anderson, 1989, Okafor, 1975a, 1979, 1989a; Falconer, 1990; Hoskins, 1990). It is known that the contributions of wild fruits, nuts, seeds, vegetables and other classes of edible products to the local diet in developing countries and their potential in overcoming or ameliorating prevailing food problems are enormous (Roche, 1975, Getahun, 1974 and Okigbo, 1977)). Trees help to stabilize the soil and prevent erosion. There is a disturbing increase in the rate at which trees and forests are removed in Anambra State. Knowing the dominant tree species in the state is important for successful and sustainable forest management. Survival of tree species depends on adaptation to local climates and site characteristics. Taking inventory of tree species, periodically, can be a very important management strategy of forests in the state. Knowing the trees species prevalent in different parts of the state will also help in deciding the use of an alternative species especially when a favored one is on the verge of extinction or vulnerable to pest and disease.

MATERIALS AND METHODS

Study area: The study was carried out in Anambra State, Nigeria. The study sites were located in 20 communities from four agro-ecological zones of the state. The zones were designated as A, B, C and D. The communities are: **Zone A:** Umuem, Nzam, Atani, Miata, Oroma-etiti; **Zone B:** Oba, Ojoto, Ukpor, Ihiala, Onitsha; **Zone C:** Agulu, Nanka, Awka, Umunze, Ekwuluobia; **Zone D:** Igbariam, Otuocha, Ebenebe, Anaku, Achala. Anambra state lies between longitudes $6^{0}35^{1}$E and $7^{0}21^{1}$E, and latitudes $5^{0}40^{1}$N and $6^{0}45^{1}$N.

Data Collection and Analysis: Primary data were obtained through fieldwork. This entailed observing, measuring and population count of tree species in the study sites. Field inventory of tree species was carried out while population count of the tree species was used to generate data for analysis. The basal area, relative basal area, species dominance, tree density and relative density, frequency and relative frequency, as well as Importance Value Index and Importance percentage of the dominant tree species, were determined. In the identification of the tree species, we employed the services of a field botanist with rapid

follow-up identification of the local names of the tree species through interview of the local inhabitants. The diameter at breast height (dbh) of trees was measured and recorded. Similarly, seedlings of tree species were also identified. Two rectangular plots each of 50m x 50m size were established and two 10-meter-wide transects were laid out parallel to one side. The total area of the transect was kept at $100m^2$ in each plot. The number of individuals of each species was then counted. For the measurement of tree seedlings, two 5m x 5m quadrats were laid out along with transects. The numbers of all seedlings of each species were counted.

RESULTS AND DISCUSSION

Figures 1 and 2 show the result of analysis of tree species identified in the four agro-ecological zones of the state. The result shows the number of trees and tree seedling species identified in sampled plots in different communities after population counts. An average of 31.7 tree species and 50.4 tree seedling species were identified in 20 forests in the study area while an average of 4.05 tree species and 6.2 tree seedling species were identified in adjoining farmlands in the area. This is an indication that some tree species are on the decline in the communities. The reason for this decline is as a result of deforestation which has led to decline in forest land cover.

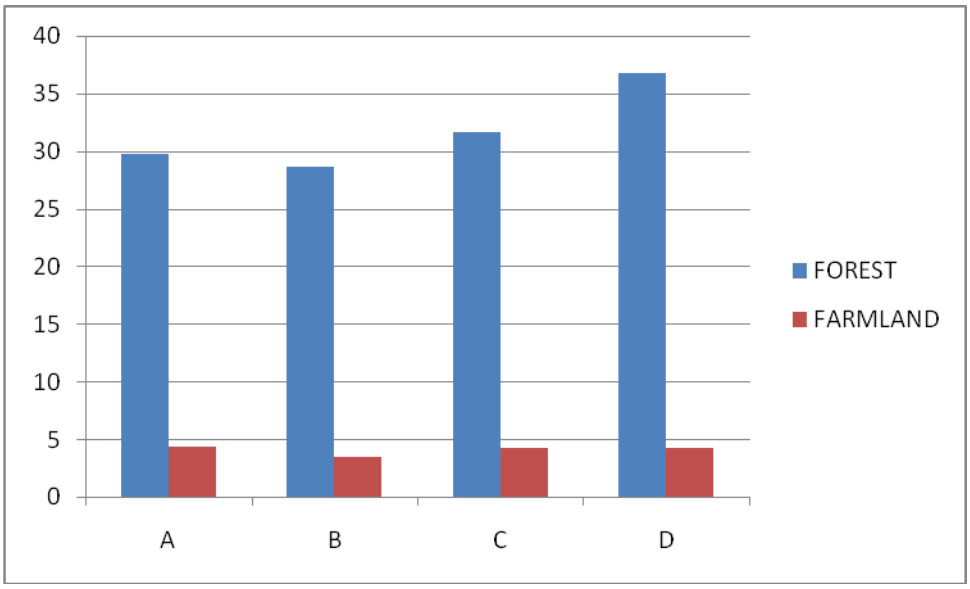

Figure 1. Number of Tree Species in Different Agroecological Zones

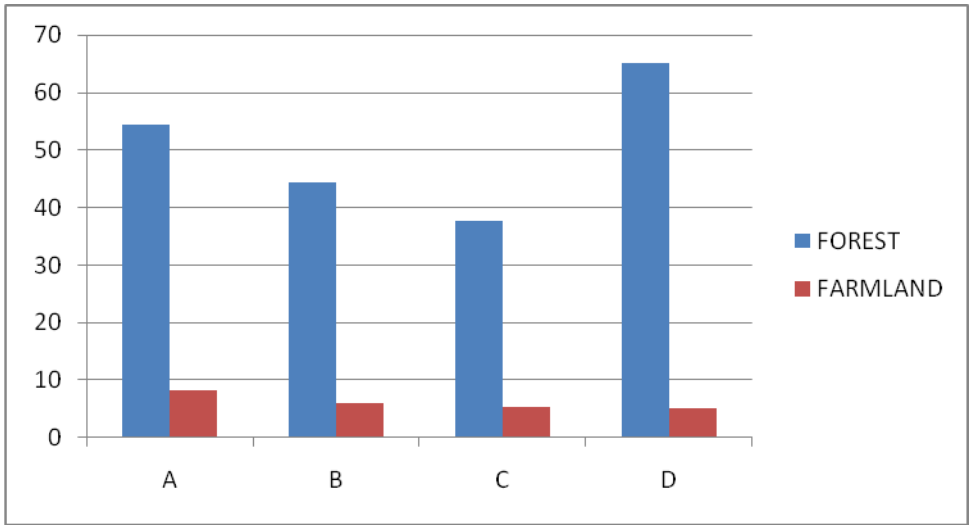

Figure 2. Number of Tree Seedling Species in Different Agroecological Zones

The study identified many of the common functions forest products serve in Anambra State to include: food (both animal and plant), medicines and dental chewing sticks, drinks (palm wine and alcohol), building materials (palm roof tiles, timber, poles, bark, liana, wattle slats etc.), fuel (fuel-wood), materials for fodder, shade, fencing, crop storage, crop stakes (e.g yam stakes), sites for traditional, religious, social and healing ceremonies etc.

Woody tree species such as *Myrianthus arboreus*, *Daniellia oliveri*, *Alchornea cordifolia*, *Pterocarpus mildbraedii*, *Afzelia bella*, *Lasianthera africana*, *Ficus* spp., *Gnetum* spp., and *Gongronema latifolium* are used as vegetables in the study area. Those used as fruits include *Carica papaya*, *Cocos nucifera*, *Anacardium occidentale*, *Psidium guajava*, *Chrysophyllum albidum*, *Mangifera indica*, *Irvingia gabonensis*, *Dacryodes edulis*, *Citrus* spp., *Dialium guineense*, *Pterocarpus soyauxii*, *Vitex doniana*, *Landolphia owariensis*, *Nauclea latifolia* and a host of others. It was observed that some of these fruits are grown in backyard or planted with other crops in small farm lots in some parts of the state. Woody species exploited for their oil include *Elaeis guineensis*, *Tetracarpidium conophorum* and *Irvingia gabonensis var. excelsa*. Species used for their nuts and seeds are *Theobroma cacao*, *Pentaclethra macrophylla*, *Cajanus cajan*, *Cola nitida*, *Cola lepidota*, *Cola acuminata*, *Garcinia kola*, *Cola gigantea*, *Anacardium occidentale*, *Irvingia gabonensis var. excelsa*, *Myrianthus arboreus*, and several others. Trees used for their medicinal properties abound in the study area and they include *Tetrapleura tetraptera*, *Irvingia gabonensis var. gabonensis*, *Kigelia africana*, *Carica papaya*, *Cajanus cajan*, *Newbouldia laevis*, *Napoleona imperialis*, and *Garcinia kola*. Trees like *Garcinia kola*, *Napoleona imperialis* and *Baphia nitida* were

found to be used as chewing sticks in most communities in the study area. Such tree species as *Elaeis guineensis*, *Daniellia oliveri*, *Cocos nucifera*, *Albizia spp*., *Alchornea cordifolia*, and *Sterculia tragacantha* are used as construction and building materials in the different study communities in Anambra State. Those woody species used as timber include *Daniellia oliveri*, *Milicia excelsa*, *Xylopia aethiopica*, *Cola gigantea*, *Baphia nitida*, *Vitex doniana*, *Ceiba pentandra*, *Pterocarpus mildbraedii* and *Pterocarpus soyauxii*. Several other trees in the study area serve as fodder, and these include *Pentaclethra macrophylla*, *Ficus* spp., *Elaeis guineensis*, *Mangifera indica*, *Psidium guajava*, *Newbouldia laevis*, *Daniellia oliveri*, *Prosopis Africana*, *Milicia excelsa*, *Dacryodes edulis*, *Nauclea latifolia*, *Cajanus cajan*, *Moringa oleifera*, *Dialium guineense*, *Albizia* spp., *Irvingia gabonensis* var. *gabonensis*, *Baphia nitida*, *Acioa barteri*, *Napoleona imperialis*, *Ceiba pentandra* and *Artocarpus communis*. *Moringa oleifera* is used in some communities in the state for water purification. Almost all of the trees in the study area are used as energy sources; however, trees such as *Tetrapleura tetraptera*, *Dialium guineense*, *Psidium guajava*, *Anacardium occidentale*, *Mangifera indica*, *Prosopis africana*, *Xylopia aethiopica*, *Vitex doniana*, *Artocarpus communis*, *Nauclea latifolia*, and, *Parkia biglobosa are mostly used as* sources of fuelwood and charcoal in the study area. Most of these tree species are being threatened by deforestation as forests are cleared at an alarming rate in all the study communities. The primary purpose of cutting down trees is for agriculture, large scale construction works and for fuel-wood collection. A few forest reserves were identified in the course of this study. Notable among them are Mamu Forest Reserve in Orumba North Local Government Area, Nkisi Forest Reserve and Akpaka Forest Reserve both in Onitsha, Ukpor Forest Reserve in Nnewi South Local Government Area and the Otuocha Forest Reserve in Anambra East Local Government Area. The forest reserves in the Mamu river basin, Ajali Umeje and Akpaka reserves, Oroma Anam reserve, Uli Forest Reserve, Aguaba Forest Reserve, Osomari Forest Reserve, Achalla Forest Reserve, Apkaka and Apkaka Extension Forest Reserve, apart from providing valuable forest products also prevent sheet and gully erosion by protecting the watersheds and ensuring ecological balance. They also perform aesthetic and recreational functions, thus serving as sources of tourist attraction.

Analysis of Dominant Tree Species in the Study Area

The analysis of dominant tree species in the study area revealed that the mean number of individual tree species in sampled plots is 35.61 (forest) and 12.05(farm); the standard

deviation is 14.86 (forest) and 7.871(farm). The result showed moderate variability for forest (CV=41.72) and high variability for farm (CV = 65.32). The result of analysis revealed that most of the trees in the study area are small (8cm-23cm dbh) and medium trees (23cm-38cm dbh) with a few large trees (>38cm dbh). The implication is that most of the old growth trees have been cut down in the study communities, while the small trees are no longer allowed to grow to maturity before being felled. The minimum mean DBH and standard deviation are 16.69cm and 7.30 respectively, while the maximum mean and standard deviation values for the DBH are 31.67 cm and 8.66 respectively. The trees with smaller DBH showed greater variability of 43.76 than those with bigger DBH with variability of 27.34. It was also discovered that most of the dominant trees in the study communities are economic trees. The most commonly used and highly valued tree species are found in compound farms rather than in outlying farms and fallow land areas.

The result further revealed that *Mangifera indica* (mango) had the highest number of individual trees in a sampled plot, while *Elaeis guineensis* (Oil palm) was the most dominant tree species in most study communities. *Milicia excelsa* (Iroko) was the largest plant species in the study area with diameter at breast height >62cm. The dominant trees in Zone A are *Artocarpus communis*, *Tectona grandis*, *Irvingia gabonensis* and *Milicia excelsa*, while the most dominant trees in Zone B are *Elaeis guineensis* and *Dacryodes edulis*. In Zone C, *Mangifera indica*, *Azadirachta indica*, *Gmelina arborea*, *Treculia africana* and *Pentaclethra macrophylla* dominated, while the dominant trees in Zone D are *Mangifera indica*, *Elaeis guineensis*, *Gmelina arborea*, *Raphia* Spp, and *Terminalia ivorensis*. In communities like Oroma-etiti and Onitsha, more than one species dominated. Generally speaking, trees that dominate in the state are Oil palm trees, *Gmelina arborea*, teak (*Tectona grandis*), white afara (*Terminalia ivorensis*), iroko, mahogany, obeche and bamboo. These tree species provide food beverages, stakes, fodder, fibers, medicines, building materials and fuelwood. Unfortunately, most of these trees are disappearing as a result of deforestation and if something urgent is not done to reverse the trend, most of the tree species in the state will become extinct.

Table 1: Ranking of Dominant Tree Species in the Different Agroecological Zones of the Study Area

Communities	Species	BA m^2	RBA	S D %	F	RF	T D	RD	IVI	IP %	RANK
Zone A											
Umuem	*Milicia excelsa*	3.02	0.19	0.22	16	0.01	0.06	0.009	0.204	6.82	1
Nzam	*Artocarpus communis*	0.53	0.03	0.60	37	0.06	0.37	0.061	0.154	5.15	3
Atani	*Irvingia gabonensis*	0.91	0.06	0.56	32	0.05	0.32	0.052	0.158	5.28	2
Mmiata	*Tectona grandis*	0.91	0.06	0.39	12	0.02	0.02	0.003	0.079	2.64	4
Oroma-Etiti	-	0.57	0.04	0.45	-	0.00	0.00	0.000	0.035	1.17	5
Total		5.94	0.38	2.22	97	0.14	0.77	0.125	0.63	21.06	
Zone B											
Oba	*Elaeis guineensis*	0.66	0.04	0.89	52	0.08	0.52	0.085	0.207	6.92	1
Ojoto	*Dacryodes edulis*	0.42	0.03	0.36	22	0.04	0.22	0.036	0.102	3.41	4
Ukpor	*Elaeis guinensis*	0.62	0.04	0.60	38	0.06	0.38	0.062	0.16	5.35	3
Ihiala	*Elaeis guinensis*	0.62	0.04	0.72	41	0.07	0.41	0.067	0.175	5.85	2
Onitsha	-	0.55	0.03	0.45	-	0.00	0.00	0.000	0.034	1.14	5
Total		2.87	0.18	3.02	153	0.25	1.53	0.25	0.678	22.67	
Zone C											
Agulu	*Treculia africana*	0.62	0.04	0.54	38	0.06	0.38	0.062	0.16	5.35	3
Nanka	*Gmelina arborea*	0.71	0.04	0.29	17	0.03	0.17	0.028	0.101	3.38	5
Awka	*Mangifera indica*	1.19	0.07	0.46	27	0.04	0.27	0.044	0.157	5.25	4
Umunze	*P. macrophylla*	0.80	0.05	0.68	48	0.08	0.48	0.079	0.208	6.95	1
Ekwulobia	*Azadirachta indica*	0.76	0.05	0.63	49	0.08	0.49	0.080	0.206	6.89	2
Total		4.08	0.25	2.6	179	0.29	1.79	0.293	0.832	27.82	
Zone D											
Igbariam	*Mangifera indica*	1.08	0.07	0.94	59	0.09	0.59	0.097	0.253	8.46	1
Otuocha	*Raphia* Spp.	0.62	0.04	0.92	57	0.09	0.57	0.093	0.22	7.39	2
Ebenebe	*Gmelina arborea*	0.76	0.05	0.37	21	0.03	0.21	0.034	0.11	3.68	4
Anaku	*Terminalia ivorensis*	0.49	0.03	0.29	14	0.02	0.14	0.023	0.07	2.44	5
Achala	*Elaeis guineensis*	0.49	0.03	0.89	51	0.08	0.51	0.084	0.194	6.49	3
Total		3.44	0.22	3.41	202	0.31	2.02	0.331	0.847	28.46	
Grand Total		16.31	1.07	11.25	621	1.00	6.11	1.00	3.00	100	20

Author's Computation from Field Survey, 2011

KEY: BA = Basal Area, RBA = Relative Basal Area, SD = Species Dominance, TD = Tree Density, RD = Relative Density, F= Frequency, RF = Relative Frequency, I VI = Importance Value Index, IP = Importance Percentage.

CONCLUSION

Trees are important and serve many useful purposes. They help to ensure ecosystem stability, provide food, shelter and medicine for man and habitat for animals. Trees help to reduce CO_2

concentration in the atmosphere and as such help reduce global warming. The indiscriminate felling of trees for various purposes including as a source of energy is alarming and a cause for serious concern. The erratic power supply and high cost of kerosene and cooking gas have led many people, especially the poor, to resort to the use of wood as alternative energy source. This has contributed to erosion and soil degradation in the state. There is an increasing loss of biodiversity and extinction of useful tree species in the state due to the use or sell of trees or derived charcoal for fuel and other purposes. Due to concerns for global warming arising from use of fossil fuels, and the loss of important tree species of economic and social values, there is need to explore other renewable and alternative energy sources such as solar energy, wind energy, hydroelectric power generation and biogas from waste generation. Furthermore, the following recommendations are suggested to help reduce deforestation and cutting down of trees in the state:

1. There is need to develop rapidly growing species of trees such as gmelina, mahogany and neem. These trees can be harvested after five to eight years and easily replanted.
2. People should be educated and awareness created on the immediate and future impact of felling trees in the state.
3. Since poverty bolsters deforestation and the resulting biodiversity loss, efforts should be made to satisfy the basic survival needs of the people. This can be done through poverty alleviation programs and interventions.
4. Both the state and local government should formulate and implement policies that enhance conservation of trees. The government should also prohibit indiscriminate tree cutting and encourage tree planting campaigns in communities, schools and colleges.

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