



BOTANICAL INVENTORY OF SOME COMMUNITIES IN AKPABUYO LOCAL GOVERNMENT AREA OF CROSS RIVER STATE NIGERIA

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ABSTRACT

The quest for a local floristic database and the alarming rate of species loss informed the need for a botanical inventory in seven communities in Akpabuyo Local Government Area of Cross River State. Field work was conducted between May 2011 and March 2012 with a view to obtaining information on species diversity, species abundance, species frequency and ethno botanical uses of the inventoried species. A three - 10 x 30 m modified Whittaker plot was established in each of the seven communities for vegetation data collection while the use of standard ethno-botanical questionnaires administered to local healers, carpenters, traders and market women was used in obtaining data on Indiginous plant uses. The study indicated a total of one hundred and twenty one species spread across 40 taxonomic families with a Shannon and equitability indexes of 4.65 and 0.97, respectively. Some of the plant species include *Alchornea cordifolia*, *Anthocleista vogelii*, *Anthonotha macrophylla*, *Berlina auriculata*, *Bosweillia dalzielii*, *Dalbergia melanoxylon*, *Ekerbergia senegalensis*, *Funtumia elastica*, *Klainedoxa gabunensis*, *Piptadeniastrum africanum*, and *Raphia hookeri*. Some species with hitherto poor representation in Nigeria were recorded. These are *Woodfordia uniflora*, *Englerina lecardii*, *Tarpinanthus pentagonia*, *Crateranthus talbotii*, *Rourea thomsonii*, *Santaloides afzelii*, *Cylicomorpha parviflora*, *Uvaria chamae*, *Saba comorensis* and *Strophantus senegalensis*. They accounted for about 8.27% of the total species diversity and 5.18% of the total abundance. The family Euphorbiaceae was the most diverse family with eleven species while *Caesalpinoidea*, *mimoisoidea*, and *rubiaceae* with 9 species each and *apocynaceae* and *meliaceae* with 8 members each made up the first 6 most diverse families. On the other hand, *myristicaceae*, *flacourtiaceae*, *dichapetalaceae*, and *celastraceae* were represented by one species each. The family *Mimoisoidea* was the most abundant with 167 individuals, followed by *rubiaceae* with 135 individuals. Conversely, *Bursaraceae*, *Meliantaceae* and *sapindaceae* were the families with the least individuals with 10 individuals each. Correlation analysis between species abundance and species frequency indicated a weak linear coefficient of 0.54. 39.17% of the inventoried species were shown to have ethno botanical uses, with 12.40% of the species used as roof trussers, rafters and purloins while 11.57% and 10.74% of the species are used as fruits/seeds and medicine respectively while only one species are used for such economic activities as fodders, fibers and tannins. *Canarium schweinfurthii* and *Pentaclethra macrophylla* with five uses each are the most used plants while *Allophylus africanus*, *Strombosa scheffleri*, *Beilschimidia mannii*, *Khaya senegalensis*, *Uapaca togoensis* *Oncoba spinosa*, *Morelia senegalensis* and *Melia excelsa* with one uses each are the least used plants. The inventory of alien species in this study reaffirms the need for a holistic flora study of the area.

Keywords: akpabuyo, botanical inventory, alien species, *cylicomorpha parviflora*, cross river state.

BACKGROUND

Tropical forest that contains more of the half of the global species resources is currently being challenged by increasing anthropogenic activities which leads to fragmentation (Tchatat *et al.*, 1999). These activities provoke its progressive and continuous destruction with more than 10 % of lost of the forest per year (Phil-Eze and Okoro, 2009). Rapid and frequent destruction of these primary forests and the significant modification of the landscapes have increased the decimation of many plant species resulting in the loss of some invaluable ecologic and economic species (Maley, 1996). In Nigeria, there has been a progressive and sustained increase in the number of threatened plant taxa over the years. For example, over an eleven- year period (2002-2011), the percentage of threatened higher plant species resulting from ecosystem damage was put at about 4.9% {(119 to 172) World Bank, 2010}. Major factors that cause the decline of forest species and biodiversity in Nigeria include fragmentation of habitats and populations, human over exploitation of renewable natural resources, introduction of toxic pollutants, introduction of exotic species, conversion of

wild areas to agriculture and other intensive human use and alterations in the structure and function of ecosystems and more recently, flooding. Regrettably, the extent of forest extinction with its attendant species loss is all the more disturbing when viewed from available data in different part of the country.

In Cross river state, a member of the Cross Sanaga Bioko coastal forest (Myers *et al.*, 2000) reputed to harboring over 50% of the remaining forest in Nigeria and home to over 2000 endemic flora species is facing gradual but steady decline in forest land cover across the three recognized ecobelt in the state-lowland rainforest, mangrove (fresh and salt water) and montane forest (FORMECU, 1993). Between 1978 and 1995, the area occupied by natural forests in Cross River State decreased from 52.7% to 44.8% (FORMECU, 1993). Further Assessments carried out between 1991 to 2001 and 2000 to 2008, indicated additional losses. Accurate data beyond this period regarding state scale deforestation trends are not available. However, personal communication with indigent farmers, local herbal healers and artisanal fishermen/hunters across the state suggest a measure of



general species loss as evidenced by difficulties, rarities and distances travelled in assessing otherwise common forest resources in the recent past.

This situation is not different in Akpabuyo Local Government Area of the state. In this area, the high rate of regression of the woody covering and species loss in the otherwise dominant coastal and mangrove forests can be explained essentially by the high intensity of forestry operation and farming, commercial logging, forest fires, cattle grazing, inefficient use of forest resources and poor enforcement of forest laws, policies and regulations (Barnes, 1990). The few intact forest formations still existing are found in adjoining areas of the creeks and tributaries.

Species conservation can be achieved through an integrated approach balancing *in situ* and *ex situ* conservation strategies. These methods have variously been applied in stemming species loss in different parts of the world (Cohen, 1994). The establishment of biosphere reserves, national parks, wildlife sanctuaries, gene bank, community seed bank, botanical garden and field gene bank are examples of these strategies. However, several criteria need be met in designating an area to serve as a biosphere reserve. For instance, the IUCN (International Union of Conservation of Nature) statuses of the inventoried species, presence of endemism, habitat and community structure, topography/relief, species diversity and abundance and proximity to human settlements are major criteria variables (NEST, 1991).

In the present state of knowledge, studies on flora of Akpabuyo are nonexistent in literatures. To offset this insufficiency of floristic knowledge of the area, it is essential to study the flora and the vegetation and follow the evolution of the biological diversity. The current study aims at contributing for the analysis of the floristic diversity with a view to delineating area (s) to serve as conservation corridor/buffer zone for the local government area.

Study area

Akpabuyo local government area lies between latitude 4° 5' and 5° 40' and longitude 8° 25' and 8° 32' East. It lies within the tropical rainforest vegetation belt of southern Nigeria and shares the Atlantic coastline with Bakassi to the East and the Republic of Cameroon to the West. The dominantly farming and fishing people are mainly Efik and Efut speaking with a population of 271,

395 and a land area of over 5, 000 km². The study area covers 7 communities (Ikot otu abasi, Ikot oyom eneyo, Ikot ekpo ene, Ikot edem ita, Efeta, Ikot offiiong ambi and Ifodon) with an area coverage of 6.3Km²

MATERIALS AND METHODS

Forest inventory

Standards procedures adopted by Aremu *et al.*, 2009 were adopted with slight modifications. Woody plant species were identified and enumerated along the three - 30 x 30m Whittaker transect. Plants were identified using standard keys as recommended by Akobundu and Okezie (2001) Arbonnier (2006), and Nyannanyo (2006) and were classified into economic, ethno botanical and food plant species. Botanical inventory was used to estimate woody plant frequency, diversity, evenness and richness using Shannon-Weiner functions.

RESULTS

A total of 40 taxonomic plant families tree species were recorded across communities inventoried including euphorbiaceae, fabaceae, rubiaceae, apocynaceae, bursaraceae and meliaceae amongst others. These represents 121 species including *Alchornea cordifolia*, *Anthocleista vogelii*, *Anthonotha macrophylla*, *Berlina auriculata*, *Boswellia dalzielii*, *Dalbergia melanoxyton*, *Ekerbergia senegalensis*, *Funtumia elastica*, *Klainedoxa gabunensis*, *Piptadeniastrum africanum*, and *Raphia hookeri*, and amongst others with all but one (*Raphia kookeri*) of the aforementioned species occurring in the 7 communities sampled. *Euphorbiaceae* family was the most represented family with 11 species. *Caesalpinoidea*, *mimoisoidea*, and *rubiaceae* were represented by 9 species each while *meliaceae* and *apocynaceae* had 8 members. On the other hand, *myristicaceae*, *flacourtiaceae*, *dichapetalaceae*, and *celastraceae* were represented by one species each. The family *Mimoisoidea* was the most abundant with 167 individuals, followed by *rubiaceae* with 135 individuals. *Bursaraceae*, *Melanthaceae* and *sapindaceae* were the families with the least individuals with 10 individuals each. *Shannon*, *dominance* and *equitability indices* were calculated for the entire study area are 4.65, 0.10 and 0.97, respectively. A 0.54 linear correlation coefficient was obtained between abundance and frequency of occurrence.

**Table-1.** Check list of plant species and uses in seven akpabuyo communities

Family	species	Frequency	Abundance
<i>Anacardiaceae</i>	<i>Ozoroa insignis</i>	3	11
<i>Annonaceae</i>	<i>Uvaria chamae</i>	2	14
	<i>Hexalobus crispiflorus</i>	2	6
	<i>Isolona campanulata</i>	3	10
<i>Apocynaceae</i>	<i>Ancylobotrys ameona</i>	4	23
	<i>Alstonia boonei</i>	3	14
	<i>Funtumia elastica</i>	7	32
	<i>Hunteria eburnean</i>	2	7
	<i>Rauwolfia vomitoria</i>	5	20
	<i>Holarrhena floribunda</i>	2	8
	<i>Saba comorensis</i>	1	5
	<i>Strophantus senegalensis</i>	3	14
<i>Arecaceae</i>	<i>Elaeis guineensis</i>	5	36
	<i>Hyphaene thebaica</i>	2	16
	<i>Raphis hookeri</i>	6	28
<i>Asclepiadiaceae</i>	<i>Calatropis procera</i>	2	12
	<i>Gymnema sylvestre</i>	1	8
<i>Balanitaceae</i>	<i>Balanite wilsoniana</i>	2	16
<i>Bombacaceae</i>	<i>Rhodognaphalon brevicuspe</i>	1	7
	<i>Ceiba pentandra</i>	2	13
<i>Bursaraceae</i>	<i>Boswellia dalzielii</i>	7	46
	<i>Canarium schweinfurthii</i>	1	4
<i>Caesalpinoidea</i>	<i>Azelia africana</i>	4	22
	<i>Berlinia auriculata</i>	7	36
	<i>Cynometra voegilii</i>	3	11
	<i>Erythrophleum suaveolens</i>	2	7
	<i>Isoberlinia doka</i>	3	13
	<i>Parkinsonia aculeata</i>	4	17
	<i>Anthonotha macrophyla</i>	7	46
	<i>Piliostigma thonningii</i>	3	15
	<i>Swartzia madagarcariensis</i>	2	20
<i>Capparaceae</i>	<i>Boscia angustifolia</i>	3	16
	<i>Crateva adansonii</i>	4	21
	<i>Ritchiea albersii</i>	1	5
<i>Caricaceae</i>	<i>Cylicomorpha parviflora</i>	2	14
<i>Cecropiaceae</i>	<i>Musanga cercropoides</i>	4	23
	<i>Myrianthus arborea</i>	2	7
<i>Celastraceae</i>	<i>Maytenus senegalensis</i>	3	18
<i>Clusiaceae</i>	<i>Allanblancki floribunda</i>	2	12
	<i>Mammea africana</i>	3	19



	<i>Harungana madagariensis</i>	4	24
	<i>Diospyros zenkeri</i>	3	13
<i>Euporbiaceae</i>	<i>Alcornea cordifolia</i>	7	36
	<i>Bridelia micranta</i>	2	11
	<i>Dichostemma glaucescens</i>	1	4
	<i>Fluggea verosa</i>	2	10
	<i>Neoboutania muelleri</i>	2	6
	<i>Margaritaria discoidea</i>	3	15
	<i>Uapaca togoensis</i>	3	14
	<i>Tertrorchidium didymostemon</i>	2	10
	<i>Macaranga barteri</i>	2	9
<i>Flacourtiaceae</i>	<i>Oncoba spinosa</i>	3	12
<i>Hymenocardiaceae</i>	<i>Hymenocardia heudelotii</i>	2	9
	<i>Hymenocardia acida</i>	1	4
<i>Lamiaceae</i>	<i>Hoslundia opposita</i>	1	6
	<i>Amasonia augustifolia</i>	2	10
<i>Lauraceae</i>	<i>Beilschimidia mannii</i>	3	14
	<i>Hypodaphnis zenkeri</i>	2	10
<i>Lecythidaceae</i>	<i>Petersiathus macrocarpus</i>	1	8
	<i>Crateranthus talbotii</i>	2	13
<i>Loganiaceae</i>	<i>Anthocleista vogelii</i>	3	19
	<i>Strychnos innocua</i>	4	21
<i>Loranthaceae</i>	<i>Englerina lecardii</i>	1	7
	<i>Tarpinanthus pentagonia</i>	2	12
<i>Lythraceae</i>	<i>Lawsonia inermis</i>	1	9
	<i>Woodfordia uniflora</i>	1	10
<i>Meliaceae</i>	<i>Ekerbergia senegalensis</i>	7	27
	<i>Khaya senegalensis</i>	3	16
	<i>Cedrela odorata</i>	2	14
	<i>Entandrophragma cylindricum</i>	4	23
	<i>Carapa procera</i>	3	16
	<i>Trichilia emetica</i>	5	28
	<i>Melia excelsa</i>	7	49
	<i>Lovoa trichiloides</i>	3	20
<i>Meliantaceae</i>	<i>Bersama abyssinica</i>	3	17
<i>Mimoiisoidea</i>	<i>Acacia senegal</i>	2	11
	<i>Albizia adianthifolia</i>	5	25
	<i>Dichrostachys cinerea</i>	4	22
	<i>Cylindrodiscus gabunensis</i>	6	35
	<i>Entanda africana</i>	5	21
	<i>Parkia biglobosa</i>	3	16



	<i>Tetrapleura tetraptera</i>	4	28
	<i>Piptadeniastrum africanum</i>	7	41
	<i>Pentaclethra macrophyla</i>	3	16
<i>Monimiaceae</i>	<i>Glossocalyx brevipes</i>	2	12
	<i>Xymalos monospora</i>	3	17
<i>Moraceae</i>	<i>Antiaris toxicaria</i>	5	31
	<i>Milicia excelsa</i>	3	15
	<i>Ficus abutilifolia</i>	4	20
	<i>Trilepisium madacargariense</i>	3	13
<i>Myristicaceae</i>	<i>Pycanthus angolensis</i>	4	23
<i>Myrtaceae</i>	<i>Eugenia gilgiana</i>	3	19
	<i>Syzygium staudtii</i>	2	10
<i>Ochnaceae</i>	<i>Ochna afzelii</i>	3	16
	<i>Ouratea calantha</i>	4	24
	<i>Lophira alata</i>	1	6
<i>Olacaceae</i>	<i>Ximenia Americana</i>	3	16
	<i>Strombosa scheffleri</i>	2	21
<i>Papilionoidea</i>	<i>Pterocarpus milbraedii</i>	6	32
	<i>Dalbergia melanoxyton</i>	7	39
	<i>Lonchocarpus laxiflorus</i>	4	21
<i>Rhamnaceae</i>	<i>Ziziphus abyssinica</i>	5	23
	<i>Lasiodiscus mannii</i>	3	27
<i>Rubiaceae</i>	<i>Breonadia salicina</i>	4	24
	<i>Nauclea diderrichii</i>	4	28
	<i>Morinda lucida</i>	3	17
	<i>Tricalysia discolor</i>	4	21
	<i>Morelia senegalensis</i>	3	19
	<i>Brenania brieyi</i>	5	32
	<i>Hymenodictyon pachyantha</i>	4	21
	<i>Porterandia cladantha</i>	3	29
	<i>Rothmannia hispida</i>	6	47
<i>Sapindaceae</i>	<i>Allophylus africanus</i>	4	31
	<i>Aporrhiza nitida</i>	3	20
Total : 40 families	121 species		2180 individuals

Plant diversity index 4.65; Dominance 0.01; equitability index 0.97; correlation coefficient 0.54

Useful Plant Species: Useful plant species in the area were classified broadly into twenty uses cutting across timber uses and non-timber products, including frames, chewing sticks, trussers, gum and adhesives, fodder, spices, wattles, medicinal and thickeners amongst

others. A total of 44 plant species representing 37.19% of the recorded species were classified as useful including *Alstonia boonei*, *Canarium schweinfurthii*, *Mammea africana* and *Oncoba spinosa* amongst others (Table-2).

**Table-2.** Indigenous uses of the inventoried plant species of Akpabuyo.

Species	Fuelwood	Charcoal	Medicinal	Fruits and Seeds	Nuts	Vegetables	Spices, Flavoring and Thickeners	Chewing sticks	Sweeteners	Fodder	Gums & Adhesives	Fibers	Beverages & Drinks	Tannin	Sundry products	Wrapping leaves	Fence	Poles	Green Manure & Soil Reclamation shade from sun	Roof Trusses (Roof Rafters & Purlins)
<i>Hexalobus crispiflorus</i>					x															
<i>Ancylobotrys ameona</i>				x							x									
<i>Alstonia boonei</i>			X																	X
<i>Funtumia elastica</i>											X									
<i>Rauvolfia vomitoria</i>			x																	
<i>Strophantus senegalensis</i>					x															
<i>Elaeis guineensis</i>				X	X								x		X					
<i>Raphis hookeri</i>													x							
<i>Canarium schweinfurthii</i>	X	X		X				X												X
<i>Azelia africana</i>	x	x																		
<i>Anthonotha macrophyla</i>	x		x																	
<i>Musanga cercropoides</i>																		x		X
<i>Myrianthus arborea</i>						x														
<i>Allanblancki floribunda</i>				X																
<i>Mammea africana</i>				X																
<i>Harungana madagariensis</i>			X																	
<i>Anogeissus leiocarpa</i>	x							x												
<i>Diospyros preusii</i>																				x
<i>Alcornea cordifolia</i>			X																	
<i>Bridelia micranta</i>			X														X			
<i>Uapaca togoensis</i>				X																
<i>Oncoba spinosa</i>				X																
<i>Beilschimidia mannii</i>							X													
<i>Khaya senegalensis</i>																				x
<i>Carapa procera</i>				X					X									x		
<i>Melia excelsa</i>																		x		
<i>Albizia adianthifolia</i>	X														X				X	
<i>Cylindiscus</i>			X						x											X



Iwara *et al.*, 2012; Offiong *et al.*, 2012; Olajide and Udofia, 2008 and Oyebo *et al.*, 2010). Regrettably, the primary interest of these studies are the effects of deforestation, monetary values of the forest (Timber and non timber products), and/or the prevailing land use systems. Very few that tended to quantify the floristic resources in terms of abundance and frequency are held either as propriety rights of exploration (solid minerals and oil) industries operating within their spatial area of interest or as Biodiversity component part reports of impact assessments required by law in Nigeria (Lameed and Ayodele, 2008).

Diversity indices: Shannon wiener index, equitability index and dominance index were the ecological indices used in the study. A Shannon index of 4.65 represents an exceptional rich flora and with a percentage probability of 0.97 in recording any of the inventoried species, the area surpasses the richness of most reserves. For example, Aremu 2009 estimated the diversity indices of Gele - gele forest reserve as 3.85 (Shannon wiener), 0.85 (equitability) and 73 (species diversity) species over a 20Km study area while Edet *et al.*, 2012 quantified the diversity indices of Afi Mountain Reserve as 4.35 (Shannon), 35 families and 102 species over a 15km study site.

Economic uses: As could be seen in Table-2, fifteen species are used as roof trussers, rafters and purlins which represented 12.40% of the total species recorded. Other indigenous uses with higher species number include fruits and seeds (11.57%) and medicine (10.74%). On the other hand, indigenous activities where only one plant species is used are fodders, fibers, tannin and leaf wrapping. Consequently, *Canarium schweinfurthii* and *Pentaclethra macrophylla* with five uses each are the most used plant species. *Allophylus africanus*, *Strombosia scheffleri*, *Beilschimidia mannii*, *Khaya senegalensis*, *Uapaca togoensis*, *Oncoba spinosa*, *Morelia senegalensis* and *Melia excelsa* are some examples of species with one uses only.

The percentage of plant species (37.19%) used by the people is comparatively lower than that recorded by most studies. For example, analysis of the studies of Gill (1992), Odugbemi (2006), Edeoga (2005) and Okoli (2007) indicated that 82.4% of the inventoried species are used for various medicinal purposes across Nigeria. Some exceptions in addition to previously un recorded species include *Brenana brevii*, *Tricalysia discolor*, *Hypodaphnis zenkeri* and *Rhodognaphalon brevicuspe*. Two species *Mammea africana* and *Apporrhiza nitida* with medicinal values in this study were not recorded in Gill (1992) and Odugbemi (2008) as possessing medical properties. Analysis of Ogunkunle and Oladele (2004), Abdulrahman *et al.*, (2006), Ihenyen *et al.*, (2009), Kayode and Ogunwole (2011), and Oldfield (1998) on timber species in Nigeria showed that 59.5% of the inventoried species are used as timber species in Nigeria as against 12.40% recorded in this study. Some of the species with timber value unknown to the people of

Akpabuyo include *Dalbergia sissoo*, *Azelia Africa*, *Albizia zygia*, *Funtumia elastica* *Rauvolfia vomitoria*, *Ceiba pentandra*, *Allanblancki floribunda*, *Anthonotha macrophylla*, *Entandrophragma cylindricum*, *Nauclea diderrichii*.

CONCLUSIONS

The inventory of alien species in some communities in Akpabuyo is a call for concerted efforts towards a holistic botanical inventory. The establishment of a local floristic database is imperative to fill obvious gaps in vegetation studies.

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REFERENCES

- Abdulrahman A. A., Fajemiroye O. J. and Oladele F. A. 2006. Ethnobotanical Study of Economic Trees: Uses of Trees as Timbers and Fuelwoods in Ilori Emirate of Kwara State, Nigeria. *Ethnobotanical Leaflets*. 10: 113-120.
- Aremu O.T., F.E. Osayimwen and G.U. Emelue. 2007. Estimate of biodiversity indices of macro flora and fauna resources of gele-gele forest reserve, Edo State, Nigeria. *Res. J. Agric. Biol. Sci.* 5: 660-667.
- Barnes R.F.W. 1990. Deforestation trends in tropical Africa. *Afr. J. Ecol.* 28: 161-173.
- Borokini T.I. 2011. Invasive alien plant species in Nigeria and their effects on biodiversity conservation. *Tropical Conservation Science*. 4(1): 103-110.
- Cleaver K, Munasinghe M., Dyson M., Egli N., Peucker A. and Wenceleus F. 1992. Conservation of west and central African rainforests (Eds) The International Bank for Reconstruction and Development Washington D.C. p. 337.
- Cohen D.M. 1994. *Opisthoproctidae*. In: *Fishes of the North-Eastern Atlantic and the Mediterranean*, Whitehead. P.J.P., M.L. Bauchot, J.C. Hureau, J. Nielsen and E. Tortonese (Eds.). Vol. 1. UNESCO, Paris, France. pp. 395-398.
- Edet D.I., Ijeomah, H.M. and Augustine U. Ogogo A.U. 2012. Preliminary assessment of tree species diversity in Afi Mountain Wildlife Sanctuary, Southern Nigeria. *Agriculture and Biology Journal of North America*. 3(12): 486-492.
- Eni D.D., Iwara A.I. and Offiong R.A. 2011. Analysis of soil-vegetation interrelationships in a south-southern secondary forest of Nigeria. *International Journal of Forestry Research*. 2012: 1-8.



- FORMECU. 1993. Forestry II Programme. The Federal Ministry of Environment, Nigeria.
- FORMECU. 1999. Forestry II Programme. The Federal Ministry of Environment, Nigeria.
- Gill L.S. 1992. Ethnomedical uses of plants. UNIBEN press, Benin city. p. 6.
- Ihenyem J., Okoegwale E. E. and Mensah J. K. 2009. Composition of Tree Species in Ehor Forest Reserve, Edo State, Nigeria. *Nature and Science*. 7(8): 8-18.
- Iwara A.I., Offiong R.A., Njah G.N., Atu J.E. and Ogundele F.O. 2012. The effect of land-use change on the structure and floristic pattern of vegetation in Ugep, Nigeria. *Sacha journal of environmental studies*. 2(1): 101-113.
- Kayode F. and Ogunwole S.O 2011. A Quantitative Analysis of Some Nigerian Wood Species as Local Material in Printmaking Technology. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)* 2(2): 139-143.
- Keay R.W.J. 1989. *Trees of Nigeria*, Clarendon Press, Oxford.
- Lameed G.A. and Ayodele A.E. 2008. Environmental Impact Assessment of Cement Factory Production on Biodiversity: A Case Study of UNICEM, Calabar Nigeria. *World Journal of Biological Research*. 001: 1-7
- Maley J. 1996. The African rain forest-main characteristics of changes in vegetation and climate from the upper cretaceous to the quaternary. *R. Soc. Edinburgh Proc. Sect. B: Biol. Sci.* 104: 31-74.
- Myers N., R.A. Mittermeier C.G. Mittermeier G.A.B. da Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*. 403: 853-882.
- Nambu D.M. 2001. Botanical inventory of the Banyang-Mbo wildlife sanctuary, south west province, Cameroon. *The wildlife conservation society*. p. 62.
- NEST. 1991. *Nigeria's Threatened Environment: A National Profile*. Nigerian Environmental Study and Action Team, Lagos.
- Nyananyo B.L. 2006. *Plants from the Niger Delta*. Onyoma Research Publications, Port Harcourt and Rivers State. p. 403.
- Odugbemi T. 2008. *A textbook of medicinal plants from Nigeria*. University of Lagos press, Yaba, Lagos. p. 617.
- Ogunkunle A.T.J. and Oladele F.A. 2004. Ethno botanical study of fuel wood and timber wood consumption and replenishment in Ogbomosho, Oyo state Nigeria. *Environmental monitoring and assessment*. 91: 223-236.
- Offiong R.A., Iwara A.I., Njah G.N. and Atu J.E. 2012. Effects of industrial activities on the structure and floristic pattern of vegetation within the Calabar port authority, south-southern Nigeria. *Journal of Geography and Geology*. 4(1): 1-9.
- Olajide, O. and Udofia S.I 2008. Ecological Survey of Valuable Non-Timber Plant Resources in Two Rain forest Reserves in Southeastern, Nigeria. *Ethiopian Journal of Environmental Studies and Management* 1(1) 1-5
- Oldfield, S. 1988. *Rare tropical timbers*. International union of conservation of nature and natural resources, Gland, Switzerland and Cambridge, UK. p. 48.
- Oyebo, M., Bisong, F. and Morakinyo, T. 2010. A Preliminary Assessment of the Context for REDD in Nigeria. An informative document of the Federal Ministry of Environment, the Cross River State's Forestry Commission and UNDP. p. 367.
- Phil-Eze, P.O. and I.C. Okoro, 2009. Sustainable biodiversity conservation in the Niger Delta: A practical approach to conservation site selection. *Biodivers. Conservy*. 18: 1247-1257.
- Shell Petroleum Development Company. 2004. *Environmental Impact Assessment of the 20" x 37 km Kolo Creek - Rumuekpe Trunkline Replacement Project*. p. 208.
- Shell Petroleum Development Company, 2008. *Environmental Impact Assessment of the Oben Gas Plant*. p. 223.
- Tchatat, M.O., Ndoye and R. Nasi, 1999. Forest products other than timber (NTFPs) place in the sustainable management of rainforests of Central Africa. FORAFRI project. p. 88.
- Zabbey, N. 2004. Impacts of extractive industries on the biodiversity of the Niger delta region, Nigeria. paper presented at a 3-day national workshop on coastal and marine biodiversity management holding in pyramid hotel, Calabar, cross-river state. 7-9 September, 2004
- World bank 2010. *World development indicators*. World Bank publications. Washington D.C. p. 422.