

## Ecological Survey of Valuable Non-Timber Plant Resources in Two Rain forest Reserves in Southeastern, Nigeria

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### Abstract

The density and diversity of plant species producing valued non-timber products in two moist rainforests in Southeastern Nigeria were studied. The two forests are Cross-River North Forest Reserve, Cross River State and Stubbs Creek Forest Reserve, Akwa Ibom State. Twenty- three plant species with the distribution as Trees (7), Palms (1), Shrubs (6), Climber (5), and Herbs (4), were assessed in the Cross River North Forest Reserve, while twelve species with the distribution as trees (2), Palms (2), Shrubs (2), Climbers (3), and herbs (3) were assessed in the Stubbs Creek Forest Reserve. Shannon-Wiener's diversity indices result (D) in the Cross River North Forest Reserve, showed D of 2.12, 0.30, 1.50, 1.20 and 1.51 respectively for trees, palms, shrubs, herbs and climber while in the Stubbs Creek Forest Reserve D result of 0.60,0.60,0.60, 0.90 and 0.91 respectively were recorded for trees, palms, shrubs, herbs and climbers.

**KEYWORDS:** Rainforests, Non-Timber Products, Diversity-Indices, Sustainable Management

### Introduction

The tropical rainforest is the most biological diverse terrestrial ecosystem on earth (Whitmore, 1998, Turner 2001 and the Gillespie *et al* 2004). It is the predominant natural forest in Nigeria. The rainforest occupies about 10% of Nigeria landmass (Akinsanmi and Akindele, 2002). The Nigeria rainforest have extensively been degraded and mostly now in patches.

The forests have been sources of livelihood of many people from time immemorial. The rainforests have been managed exclusively over the years for timber production. In other words, the density of timber trees is often the only yardstick for determining the value of a tract of rainforest. The forest is erroneously viewed as a crop merchantable trees rather than an interdependent, high diversity ecosystem of potential multiple value (Panayotou and Ashton, 1992; Olajide, 2003). The erroneous view has culminated in gross under- valuation of the rainforest as various non-timber plant resources which in most cases are much more valuable than timber resources are ignored.

Accordingly, a considerable area of rainforest, poor in timber tree species, but often heavily stocked with diversity of valuable non- timber resources has been replaced with monoculture forests of mostly fast-growing exotic species like Gmelina (*Gmelina arborea*), Teak (*Tectona grandis*) and Eucalypts (*Eucalyptus spp.*). The monoculture stands of these trees often impair the existence of many valuable native plant species particularly the undergrowth species

(Mgeni, 1991). Among the valuable non-timber resources of rainforests are edible and medicinal fruits, seeds, leafy vegetables, twigs, nuts and bark; rattan, gum, latex, tanni and dyes.

In contrast to timber exploitation, exploitation of non- timber products causes infinitesimal or negligible perturbation in the ecosystem. Ford foundation (1998) averred that the non- timber forest products (NTFPs) are particularly important part of multiple- use strategies, because they increase the range of income generating options of forest-dependent villagers while avoiding some of the ecological costs of timber cutting. This paper, therefore, is a report of the study on diversity and densities of commercially valued non-timber plant resources in two moist rainforests in southeastern Nigeria. It is hoped that the findings would foster sustainable multiple use management of the forests.

### Study Area

The study was carried out in the Cross River North Forest Reserve, Cross-River State and Stubbs Creek Forest Reserve, Akwa Ibom State, Southeastern Nigeria

Cross River North Forest Reserve lies between latitudes 6°08<sup>l</sup> and 6°26<sup>l</sup>N and longitudes 8°50<sup>l</sup> and 9°05<sup>l</sup>E. The Forest Reserve covers a total area of 12,950 hectares. The area has an annual rainfall of about 2500mm. The mean minimum and maximum annual temperatures are 24°C and 30°C respectively. The mean annual relative humidity is about 78% while the soil is ferric lvisol underlain by basement complex.

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The Stubbs Creek Forest Reserve lies approximately between latitudes 4°32'N and 4°38'N and between longitudes 8°E and 8°20'E. It covers an area of about 15,000 hectares. The mean annual rainfall of the area is between 2400mm and 3000mm. The mean minimum and maximum temperature are 26°C and 30.5°C respectively while the mean relative humidity of the area is about 83%. The forest is growing on silt loam soil.

**Materials and Methods**

Three 1km transects were laid randomly at 20 metres away from and perpendicular to the access route into each of the two Forest Reserves. The plant species within 20 metres away from both sides of each transect which produce valuable non-timber products were enumerated. It therefore summed up to an area of 120, 000 m<sup>2</sup> (12ha) assessed in each of the two Forest Reserves. The enumerated plant species were classified into five life-forms of Trees, Palms, Shrubs, Climbers and Herbs. The data were collected during dry and rainy seasons between years 2003 and 2005.

The mean population density per hectare of each species was determined from its population in the 12 ha area assessed. Species diversity indices (D) were determined with Shannon –Wiener information function (Bhandari, 2003). The function is of the form:

$$D = \sum_{i=1}^S \left( \frac{n_i}{N} \right) \log_2 \left( \frac{N}{n_i} \right)$$

Where,

D = Shannon – Wiener index of species diversity

n<sub>i</sub> = density of the species i

N = total density of all the species

S = total number of species involved.

**Results**

Twenty three (23) plant species were identified and enumerated in the Cross River North Forest Reserve. The tree life-form had the highest representations of 7 species. This was followed by shrub (6), climbers (5) herb (4) and palm (1). The population of individual plant species varied (Table 1). In the tree category, *Pentacletra macrophylla* had the highest population of 222 per hectare, while *Petersia africanum*, *tetrapleura tetraptera* and

*Dacryodes edulis* had the least of 3 frequencies apiece per hectare. *Lasienthra africana* had the highest population of 164 per hectare in the shrub category, while *Lecanodiscus cupaloides* had the least of 3 per hectare.

Palm was represented by only *Elacis guineensis* with a population of 39 per hectare. In the climber life form, *Ancistrophyllum secundiflorum* had the highest population of 122 per/ha, while *Dioscorea bubifera* had the least of 7 per/ha. *Thaumatococcus danielli* had the highest population of 3025 per/ha in the herb category while *Gongronema latifolium* had the least of 67 per/ha. The population of each of the species enumerated in the Cross River North Forest Reserve and the non-timber products derived from them are contained in Table 1.

In the Stubbs Creek Forest Reserve, 12 plant species were enumerated. Tree was represented by 2 species, shrub (2 species), climber (3 species) and herb (3 species). In tree category, *Mitragyna ciliata* had the highest population of 11 per/ha, while *Tetrapleura tetraptera* had the least of 7 per/ha. Under palm, *Raphia spp.* had the highest population density of 333 per/ha, while *Elaeis guineensis* had 8 per/ha. *Lasienthra africana* had the highest population density of 375per/ha in shrub category while *Randia spp* had the least of 28 per/ha. Under herb, *Thaumatococcus danielli* had the highest population of 308 per/ha followed by *Piper guineensis* (3 per/ha). *Calamus deeratus* was assessed to have the highest population density of 2325 per/ha in the climber category, and followed by *Ancistrophyllum secundiflorum* with the population of 2028 per/ha and *Gnetum africana* had the least of 33 per/ha. The population density of each of the plant species encountered in Stubbs Creek Forest Reserve and their non-timber products are contained in Table 2. Diversity indices (D) of 2.12, 0.30, 1.50, 1.20 and 1.51 were calculated respectively for trees, palms, shrubs, herbs and climber in the Cross River North Forest Reserve. In the case of the Stubbs Creek Forest Reserve, 0.60, 0.60, 0.60, 0.90 and 0.91 are the diversity indices calculated respectively for tress, palms shrubs, herb and climbers.

## Discussion

The tropical rainforest resources are not homogenous but differ in species composition and structure (Turner, 2001 Gillespie *et al* 2004). There are also differences within, between and among tropical rainforest resources in different locations.

However, the existence of a plant species in a forest ecosystem is a function of the prevailing microclimates in the forest. Different microsites with varying microclimates are often created in forest consequence of natural and artificial perturbations. Different microsites provide niches for different plant species or group of plant species. The variation in the population densities of the plant species enumerated can probably be influenced by different sizes of niches in the forests. Distribution of tree regeneration and tree species' coexistence have been found to be influenced by different microsites in temperate and tropical rainforests (Dalling and Hubbell, 20-02; Christie and Armesto 2003). The existence or non-existence of a plant species is dependent on a number of factors. The effects of the factors vary from one species to another. However, a sufficient availability of viable seeds, appropriate climate and edaphic conditions for seed germination and establishment of the plant are indispensable for the existence of any plant species (Richards, 1996). Also, the population of individual plant species may be influenced by the varying exploitation intensities.

The generally higher diversity indices calculated for all the groups of plants in Cross

River North Forest Reserve when compared with Stubbs Creek Forest Reserve may be due to the greater degree of degradation to which the latter had suffered.

Devi and Behera (2003) calculated higher diversity indices for the trees, shrubs, lianas and herbs in a relatively undisturbed natural forest as against lower indices in a disturbed natural forest in India. Nath *et al* (2005) reported higher population of undergrowth species as compared with tree species in a disturbed tropical rainforest in Northeast India. A species with less than ten individuals per hectare is considered as a rare and endangered species (Parthasarathy and Karthikeyan, 1997). Accordingly, *Dacryodes edulis*, *Diospyros Spp*; *Parkia bicolor*, *Petersia africanum*, *Tetrapleura tetraptera*, *Heinsia crinata*, *Lacaenodiscus cupaloides*, *Rinorea gracilipes* and *Dioscorea bubifera* can be deemed rare species in the Cross River North Forest Reserve, while same can be said of *Tetrapleura tetraptera*, *Elaeis guineensis*, *Gongronema latifolium* and *Piper guineensis* in the Stubbs Creek Forest Reserve.

## Conclusion

This study has revealed the abundance of ecologically valuable non-timber forest plants in the study area. Sustainable management of forest reserves requires holistic approach in which both timber and non-timber forest plants are managed in accordance with their ecological attributes. The present only timber management objective need to be reviewed to incorporate multiple value management strategies.

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**Table 1: Valuable Non-Timber Plant Species and Products in the Cross River North Forest Reserve, Southeastern Nigeria**

Scientific Name	Population Density (Per/ha)	Non-Timber Products
<b>TREE</b>		
<i>Brachystegia eurycoma</i>	28	Grounded seed used as soup thickening
<i>Dacryodes edulis</i>	3	Edible fruit
<i>Diospyrous spp</i>	8	Medicinal bark
<i>Parkia bicolor</i>	6	Edible seeds
<i>Pentaclethra macrophylla</i>	222	Edible seeds
<i>Petersia africanum</i>	3	Medicinal leaves
<i>Tetrapleura tetraptera</i>	3	Spicy and medicinal fruit
<b>PALM</b>		
<i>Elaeis guineensis</i>	39	Edible oil from seed's mesocarp and nuts: wine from sap, broom from midrib of leaflets
<b>SHRUB</b>		
<i>Carpolobia hitea</i>	36	Sticks for shepherding cattle; chewing stick and medicinal bark.
<i>Heinsia crinata</i>	6	Edible leafy vegetable.
<i>Lasienthera africana</i>	164	Medicinal and edible leafy vegetable
<i>Lecanodiscus cupaloides</i>	3	Edible fruit
<i>Randia spp</i>	25	Chewing sticks
<i>Rinorea gracilipes</i>	7	Chewing sticks
<b>HERB</b>		
<i>Afromomum sceptrum</i>	253	Edible fruit and pulp; medicinal rhizome
<i>Gongronema latifolium</i>	57	Leafy vegetable; edible and medicinal raw leaves.
<i>Piper guineensis</i>	67	Edible and medicinal leafy vegetable and seeds;
<i>Thaumatococcus danielli</i>	3025	Leaves for rapping food
<b>CLIMBER</b>		
<i>Ancistrophyllem secundiflorum</i>	128	Cane for furniture making, leaves as roofing materials
<i>Calamus deeratus</i>	61	Cane for furniture making leaves as roofing materials
<i>Combretum albidum</i>	25	Sponge from the pulp
<i>Dioscorea bubifera</i>	6	Medicinal tuber
<i>Gnetum africanum</i>	33	Leafy vegetable

**Table 2: Valuable Non-Timber Plant Species and Products in the Stubbs Creek Forest Reserve, Southeastern Nigerian.**

Scientific Name	Population Density (Per/ha)	Non-Timber Product
<b>TREE</b>		
Mitragyna ciliata	11	Leaves are used for kolanut preservation
Tetrapleura tetraptera	7	Spicy and medicinal fruit.
<b>PALM</b>		
Elaeis guineensis	8	Edible oil from seed's mesocarp and nuts, wine from sap; broom from midrib of leaflets
Raphia spp	333	Wine from sap; leaf's midrib for furniture making. Leaflets for roofing and midribs of leaflets as broom
<b>SHRUB</b>		
Lasianthera africana	375	Medicinal and edible vegetable
Randia spp	28	Chewing stick
<b>HERB</b>		
Gongronema latifolium	3	Leafy vegetable ; edible and medicinal raw leaves
Piper guineensis	6	Edible leaf vegetable and seeds, leaves and seed are medicinal
Thaumatococcus danielli	308	Leaves for rapping food
<b>CLIMBER</b>		
Ancistrophyllum secundiflorum	2028	Cane for furniture making and leaves roofing materials
Calamus deeratus	2325	Cane for furniture making; leaves as roofing materials
Gnetum africanum	33	Leafy vegetable