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# Population Ecology of Trees of Food and Medicine in Oban Forest Reserve, Cross River State, Nigeria

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**Abstract**

One major problem militating against sustainable multiple-valued management of natural forests in Nigeria is lack of empirical data. Thus, assessment of population density of adult or mature stands and regeneration or juvenile stands of timber-tree species producing important food and medicinal items in Oban Forest Reserve, Cross River State, Nigeria was carried out using transect and quadrat sampling techniques. Results revealed that 19 tree species were encountered with *Coula edulis* having the highest population density (48 per/ha) of adult individuals, while *Cola argentea* was the only species with no adult individual stand but its regeneration were encountered. The highest regeneration population density of 113 per/ha was recorded for *Pycanthus angolensis*, while the regeneration of three species, viz; *Alstonia boonei*, *Brachystegia eurycoma* and *Rauvolfia vomitoria*, were not encountered but their adult individuals were present in the forest. All the tree species were in a rare status except *C. edulis*, *P. angolensis* and *Vitex* spp. Moreover, only *P. angolensis* had sustainable natural regeneration potential. It is concluded that a ban should be placed on the exploitation of the trees for timber to forestall their extinction from the forest, and enrichment planting should be carried out in the forest using the raised seedlings of the tree species to enhance biodiversity richness.

Key words: Rainforest, Timber trees, Food, Medicinal, Population density, Regeneration

## Introduction

A great number of tree species in the natural forests, particularly rainforest, produce in addition to timber, various non-timber products which in most cases are much more valuable than wood. The non-timber products are mostly food, medicinal items and raw materials to small and cottage industries. Forest is often erroneously viewed as a crop of merchantable timber trees rather than an interdependent high diversity ecosystem of potential multiple value (Panayotou and Ashton, 1992; Olajide *et al*., 2010). Until recently, little or no recognition was given to the non-timber products in the scheme of forest management. These products are often ignored in the reckoning of forestry contributions to the gross domestic products (Lorbaech *et al*., 2000). According to Ford Foundation (1998) and Lorbach *et al*. (2000), non-timber forest products are a particularly important part of multiple-use strategies, because they increase the range of income generating options of forest-dependent communities, while avoiding some of the ecological costs of timber cutting. Evaluating from a long-term standpoint, non-timber products from forest trees are much more valuable than their timber as the former can be harvested for many years without cutting down the trees, in contrast to timber harvesting and their harvesting activity or extraction has imperceptible perturbation on the ecosystem (Ella and Domingo, 2014; Udo, 2016).

The predominant natural forest type in Nigeria is rainforest. The Nigerian rainforest is an integral of the world tropical rainforest which has been acknowledged as the most biologically diverse ecosystem on earth (Turner, 2001; Gillespie et al., 2004 and Sukhdev, 2010). According to Mgeni (1991), with the unique diversity of plant and animal life, tropical rainforest represents biologically renewable resources of food, medicine, fibre and fuel if well managed. A considerable volume of food items in the forms of fruits seeds, nuts, leaves, twigs, bark, roots and flowers are collected from the rainforest (Ikojo *et al*., 2003). These food items greatly complement the food supply from cultivated

crops. According to Oni and Gbadamosi (1998), the dietary contribution of forest trees to improved nutritional status of mankind is further enhanced by the timing of their availability which often falls at the strategic periods of general food shortage particularly in Nigeria. The tropical rainforest is an outstanding 'natural pharmacy'. According to FAO (1985) and Spore-Dossier (2011), tropical forests provide the only medicine available to the largest proportion of the world population of which 90-95% is in the developing world, and the high concentration of different chemicals in some plants serve as raw materials for the production of modern drugs. The World Health Organization (WHO) has estimated that 80% of the population of sub-sahara Africa relies on plant based medicines for everyday healthcare needs (Bannerman, 1993).

The tropical rainforests have been widely recklessly exploited for timber, and subsequently converted to other forms of landuse aside forestry. Consequently, a considerable genetic resource has been lost, and many species are on the verge of extinction. Among the species threatened by extinction are trees that produce, in addition to timber, food and medicinal products. Unfortunately, most of these trees are not amenable to plantation environment, because of a number of silvicultural and ecological constraints, which include poor viability of seeds, endemic pests and diseases and very slow growth rate (Akinsanmi and Akindele, 2002 and Olajide *et al.,* 2010). Most of these constraints are surmounted while the trees grow in the natural forest ecosystem. It implies that the continuous availability of the food and medicinal products of these trees depends on sustainable management of the remaining areas of the tropical rainforest.

Sustainable management of a tract of natural forest like tropical rainforest would be impossible without quantitative ecological data relating to the population density of adult trees, stem-diameter distribution and regeneration density. This paper is a report of a study on stand density, and regeneration of trees that produce food and medicinal products in a rainforest reserve in Nigeria.

## Materials and Methods

*Study Area*

The study was carried out in Oban Forest Reserve, Cross River State, Nigeria (Fig. 1). The forest is part of the eastern bloc of Nigerian rainforest. The forest reserve covers an area of 245.48 km$^2$. The area lies between latitudes 5° 00' and 5° 57'N and longitudes 8° 10' and 8° 55' E. The annual rainfall of the area varies between 2,500mm and 3,500mm, means minimum and maximum annual temperatures are 23°C and 30°C respectively. The average relative humidity is 85% at 12.00 hour (Offiong and Iwara, 2011). The soil is known to be formed from rocks of pre-cambrian complex especially granite, geisses and schist (Offiong and Iwara, 2011). The forest reserve has been subjected to timber harvesting or exploitation.

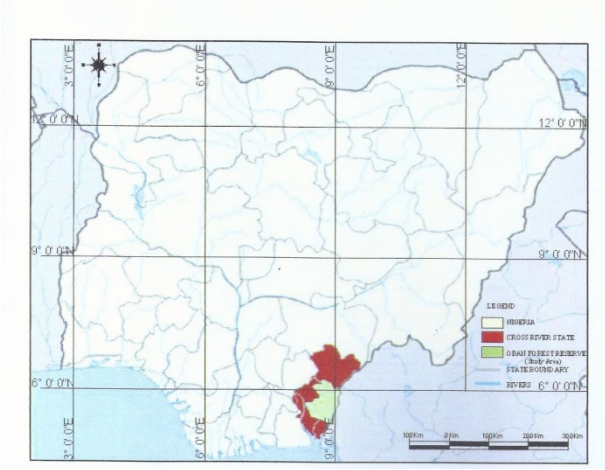


Figure 1: Map of Nigeria indicating Oban Forest Reserve in Cross River State.

*Data Collection*

One kilometer (1 km) baseline was laid 20 m away from the main access route into the forest. Thereafter, five points of 200 m apart from one another were marked along the baseline, three points were randomly selected for the laying transects. Thus three 1 km transect were perpendicularly laid to the

baseline into the forest. Mature stands (≥ 20 cm diameter at breast height) of individual tree species producing edible and medicinal items within 10 m on both sides of each transect were identified and enumerated by numbering them with indelible red paint to avoid multiple enumerations. Thus, the total sample area assessed for adult or mature trees was 60,000 $m^2$ (6 ha). In assessing regeneration or juvenile trees (< 20 cm diameter at breast height), twenty 10 m x 10 m quadrats were alternately laid on both sides of each transect and enumerated for the juvenile individuals of trees of food and medicinal products. Accordingly, a total area of 3,000 $m^2$ (0.6 ha) was assessed for juvenile trees. The data collection spanned years 2013 to 2015.

*Data Analysis*

The frequency of adult individual of a tree species was determined in order to estimate its population per hectare by dividing the total population in the sampled area by 6. The density of regeneration or juveniles of each tree species was extrapolated from the population in 0.6 ha, which was the total area enumerated for regeneration or juvenile trees.

**Results**

Nineteen (19) tree species producing various items of food and medicine were encountered, and distributed among 13 families (Table 1). The family Fabaceae was represented by the highest number of 3 species, while families Apocynaceae, Sapotaceae, Burseraceae and Annonaceae were each represented by 2 species, and all other families were each represented by 1 species (Table1). The highest population density of adult tree stands (48 per/ha) was recorded for *Coula edulis* while the only species with no adult individual was *Cola argentea* but its regeneration or juvenile stands were encountered (Table 1). The highest regeneration population density of 113 per/ha was recorded for *Pycnanthus angolensis*, while the regeneration of three species, namely, *Alstonia boonei*, *Brachystegia eurycoma* and *Rauvolfia vomitoria* were not encountered, but they had adult stands (Table 1). Accordingly, the results of adult trees' population density indicated that all the tree species were in rare state except *Coula edulis*, *Pycnanthus angolensis* and *Vitex* spp. (Table 1). The parts of the trees that are extracted for food and medicine differ from species to species, and these include fruits, seeds, nuts, barks, leaves and twigs (Table 2).

Table 1: Population density of trees of food and medicine in Oban Forest Reserve, Cross River State, Nigeria

| Tree species | Family | Population density of adult tree stands (per/ha) | Population density of regeneration (per/ha) |
|---|---|---|---|
| *Allanblackia floribundia* | Guttiferae | 1 | 10 |
| *Alstonia boonei* | Apocynaceae | 1 | - |
| *Baillonella toxisperma* | Sapotaceae | 1 | 8 |
| *Brachystegia eurycoma* | Fabaceae | 5 | - |
| *Canarium schwinfurthii* | Burseraceae | 1 | 5 |
| *Cola argentea* | Sterculiaceae | - | 5 |
| *Coula edulis* | Olacaceae | 48* | 65 |
| *Dacryodes edulis* | Burseraceae | 1 | 5 |
| *Dialium guineense* | Fabaceae | 1 | 22 |
| *Enantia chlorantha* | Annonaceae | 5 | 48 |
| *Gambeya albida* (formerly *Chrysophyllum albidum*) | Sapotaceae | 1 | 30 |
| *Irvingia gabonensis* | Irvingiaceae | 9 | 32 |
| *Pentaclethra macrophylla* | Fabaceae | 2 | 43 |
| *Poga oleosa* | Anisophylleaceae | 1 | 20 |
| *Pycnanthus angolensis* | Myristicaceae | 20* | 113** |
| *Rauvolfia vomitoria* | Apocynaceae | 1 | - |
| *Treculia africana* | Moraceae | 1 | 23 |
| *Vitex spp.* | Verbenaceae | 12* | 60 |
| Xylopia aethiopica | Annonaceae | 4 | 35 |

*Not-Rare

**Sustainable natural regeneration potential

Table 2: Food and medicinal products of trees of food and medicine in Oban Forest Reserve, Cross River State, Nigeria

| Trees Species | Tree Part Used | Uses |
|---|---|---|
| *Allanblackia floribundia* | Seeds | Food (oil) |
| *Alstonia boonei* | Leaves, bark | Medicine |
| *Baillonela toxisperma* | Seeds | Stomach ailment; rheumatics pains |
| *Brachystegia eurycoma* | Seeds | Food (soup condiment) |
| *Canarium schwinfurthii* | Fruit | Food (snacks) |
| *Cola argentea* | Fruit mesocarp | Snacks |
| *Coula edulis* | Seed (nuts) | Snacks |
| *Dacryodes edulis* | Fruit mesocarp | Food (fat/oil) |
| *Dialium guineense* | Fruit mesocarp | Snacks |
| *Enantia chlorantha* | Bark | Medicine (malaria; jaundice) |
| *Gambeya albida* (formerly *Chrysophyllum albidum*) | Fruit mesocarp | Beverage |
| *Irvingia gabonensis* | Fruit mesocarp; seeds | Beverage; soup condiment |
| *Pentaclethra macrophylla* | Seeds | Snacks (delicacy) |
| *Poga oleosa* | Seeds | Food (oil) |
| *Pycnanthus angolensis* | Leaves | Medicine (tooth ache) |
| *Rauvolfia vomitoria* | Leaves | Medicine (sedative and tranquliser; ringworm) |
| *Treculia africana* | Seeds | Food (snacks) |
| *Vitex spp.* | Fruit | Food (snacks) |
| *Xylopia aethiopica* | Fruit & seeds | Spice; medicine (Rheumatic and boil pains) |

**Discussion**

According to Parthasarathy and Karthikeyan (1997) and Olajide *et al.* (2015) a tree species with less than 10 individuals per hectare is considered as a rare species. Accordingly, the results on adult trees' population density indicated that all the tree species were in rare state except *Coula edulis*, *Pycnanthus angolensis* and *Vitex* spp (Table 1). Moreover, the results of this study also indicated that only *Pycnanthus angolensis* has sustainable natural regeneration potential. According to Nwoboshi (1982), Dike (1992) and Akpan-Ebe (2005), any tree species in the tropical rainforest with less than one hundred (100) regeneration population per/ha is deemed to have unsustainable natural regeneration potential, because it had been observed that an average of 10 out of 100 regeneration survived and grew up to mature trees. The low population density of most of the tree species reported in this study is similar to the findings of previous workers on population density and regeneration potentials of timber tree species producing economically valuable non-timber products in some areas of rainforest (Ganesan and Davidar, 2003; Olajide *et al.,* 2010 and 2015). The fewer population of individual tree species observed in the study forest may be linked to their over-exploitation for timber. This might have also caused gross inadequacy of seeds for regeneration, as a lot of mother trees (seed producing trees) have been felled for timber, and seeds produced by the few available mother trees are frequently collected as food and medicinal items. Agyeman (2013) reported poor population density of many timber trees (including tree producing edible and medicinal fruits and seeds) in a rainforest subjected to timber exploitation in Ghana.

**Conclusion and Recommendation**

The very low population density and unsustainable natural regeneration potentials of most of the tree species require a ban on the exploitation of the trees for timber to forestall their extinction from the forest reserve. Also, enrichment planting operation should be carried out by planting the raised seedlings of the tree species in the forest reserve to boost their stocking, and largely enhance biodiversity richness of the forest.

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