JOURNAL OF AGRICULTURE & SOCIAL SCIENCES
ISSN Print: 1813–2235; ISSN Online: 1814–960X
07–090/SAB/2008/04–2–65–68
http://www.fspublishers.org

Full Length Article

Diversity and Population of Timber Tree Species Producing Valuable Non-Timber Products in Two Tropical Rainforests in Cross River State, Nigeria

OPEYEMI OLAJIDE[1], ENEFIOK S. UDO AND DAN O. OUT†
Department of Forestry and Wildlife, University of Uyo, Uyo, Nigeria
†*Forestry Commision, Calabar, Cross River State, Nigeria.*
[1]Corresponding author's e-mail: yemisola2000@yahoo.com

ABSTRACT

Two tropical rainforest reserves, namely Afi River and Oban West forest reserves in Cross River State, Nigeria, were assessed for the diversity and population density of timber tree species producing economically valuable non-timber products. Species similarity index of the two forest reserves was determined using Sorensen's similarity function. Totals of 12 and 11 tree species were encountered in Afi River and Oban West forest reserves respectively. Population densities of the tree species ranged from 1 to 5 ha^{-1} and 1 to 11 ha^{-1} in Afi River and Oban West forest reserves respectively. The species similarity index of the two forest reserves was 0.51, implying some similarity in their constituent tree species. However, all the species in the two forest reserves were endangered, except *Allanblackia floribunda* and *Parkia bicolor* found only in Afi River forest reserve. Therefore, there is need to conserve the tree species through participatory and sustainable multiple value management of the forests.

Key Words: Rainforest; Trees; Population density; Non-timber products; Nigeria

INTRODUCTION

The need to conserve the remaining areas of tropical rainforest cannot be overstressed. The tropical rainforest has been identified as the most biologically diverse terrestrial ecosystem on earth (Turner, 2001; Gillespie *et al.*, 2004). However, trees are often the most conspicuous plant life form in a typical tropical rainforest. According to Whitmore (1998), a typical tropical rainforest is a complex community whose framework is provided by trees of many sizes. Upon the framework of the trees and within the microclimate of the canopy of the trees, grow a range of other kinds of plants such as climbers, epiphytes, strangling plants, parasites and saprophytes. Generally, a tract of rainforest is often viewed as a crop of merchantable timber trees rather than an interdependent high diversity ecosystem of potential multiple value (Panayotou & Ashton, 1992; Ikojo *et al.*, 2005). Thus, the tropical rainforests are commonly exploited for their timber resources and until recently, Forestry Departments of governments have managed the forests virtually and exclusively for timber production over the years.

The tropical rainforest ecosystem is a cornucopia of livelihoods of millions of people from time immemorial. This is because many of the timber trees in the tropical rainforests produce a variety of highly valuable non-timber products like edible and medicinal fruits, seeds, nuts and oils. Also, a considerable number of trees produce industrial materials like latex, tannin, gum exudates, dyes and resin. The timber trees producing economically valuable non-timber products have been christened 'timber plus trees' (Muul, 1993). Evaluating from a long-term standpoint, non-timber products from those trees are 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. Ford Foundation (1998) opined that 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.

As efforts are geared towards preventing utter destruction of the tropical rainforest and ensuring the conservation of its rich biodiversity, adequate quantitative and qualitative ecological data on tree species that produce multiple products are imperative. Such data are needed for fashioning out realistic and effective conservation strategies. The required ecological data include species composition, abundance of each species, stem diameter distribution and abundance of regeneration of each species. This study therefore assessed the diversity and population density of

To cite this paper: Olajide, O., E.S. Udo and D.O. Out, 2008. Diversity and population of timber tree species producing valuable non-timber products in two tropical rainforests in cross river state. Nigeria *J. Agri. Soc. Sci.,* 4: 65–8

timber tree species that produce valuable non-timber products in two rainforests in Cross River State of Nigeria with the aim of providing the required ecological data for effective conservation of the forests.

MATERIALS AND METHODS

Study areas. The study was carried out in Afi River Forest Reserve and Oban West Forest Reserve, both in Cross River State of Nigeria. Afi River Forest Reserve is located between latitudes 6° 08′ and 6° 26′N and longitudes 8° 50′ and 9° 05′E. It covers a total land area of 383 km^2. Annual rainfall and average temperature in the area are about 3,500 mm and 27°C respectively (Balogun, 2003). The mean annual relative humidity is 78% at 7.00 Hr, while the soils vary from clayey-loam to loamy-clay. Oban West forest reserve is located between latitudes 4° 54′ and 5° 45′N and longitudes 8° 18′ and 8° 50′E. It covers an area of 1042 km^2 with an annual rainfall of about 4073 mm and average temperature of 25°C (Balogun, 2003). The average annual relative humidity is 80% at 7.00 Hr. The soils range from loamy-sandy to clayey-loam. The two forests have been subjected to timber exploitation over the years.

Data collection. Three 500 m line transects were laid into the core of each forest, 20 m away from the access routes. Each transect was separated by a distance of 330 m. Timber tree species within 10 m on both sides of each transect that produce valuable non-timber products were identified and enumerated by numbering them with enamel paint. Thus, the total sample area assessed in each forest equaled 3 ha.

Data processing and analysis. The frequency of a tree species in each forest was determined in order to estimate its population per hectare by dividing the total population in the sampled area by 3. The similarity index between the forests was calculated using Sorensen's similarity function expressed as:

$$SI = \frac{c \times 100}{a + b + c}$$

Where, SI = Sorensen's index.

a = number of tree species present in forest 1, but absent in forest 2.

b = number of tree species present in forest 2, but absent in forest 1.

c = number of tree species present in both forests.

RESULTS

A total of 12 tree species were encountered in Afi River Forest Reserve (Table I). Of all those species, *Brachystegia eurycoma* had the highest mean population of 5 ha^{-1}, *Allanblackia floribunda* and *Baillonella toxisperma* each had 2 ha^{-1}, while each of the remaining nine species had one tree per ha (Table I). As shown in the Table I, 11 out of the 12 timber tree species in Afi River forest reserve produce edible fruits except *Ricinodendron heudelotii*, in which the leaves are edible and not the fruits. *A. floribunda* and *B. toxisperma* produce seeds from which edible oil is obtained. On the other hand, *Garcinia kola* produces seeds that are eaten as snacks and taken as medicine. *Pentaclethra macrophylla* fruits are used as spice in soups and also have medicinal uses.

In Oban West Forest Reserve, out of 11 tree species, *A. floribunda* had the highest mean population of 11 ha^{-1}, while the lowest, one per ha, was noted each for *B. eurycoma, Chrysophyllum albidum, R. heudelotii, Tetrapleura tetraptera* and *Xylopia aethiopica* (Table II). Ten out of 11 tree species that produce important non-timber products in the Oban West Forest Reserve produce edible fruits or seeds, except *R. heudelotii* (Table II).

The Sorensen's similarity index of 51% was calculated for the two forests. The species that were found common to both forests were *A. floribunda*, *B. eurycoma*, *Irvingia gabonensis*, *Parkia bicolor*, *P. macrophylla*, *R. heudelotii*, *T. tetraptera* and *Vitex* spp.

DISCUSSION

The presence and population density of a tree species in a tract of rainforest is greatly influenced by the microclimate within the forest and the quantity of viable seeds produced by the tree concerned. For instance, a tree species that is not shade tolerant would find it difficult to regenerate in a rainforest with closed canopy. Consequently, the population density of such a tree species would be low in the forest, while the adult trees of same species would die. Generally low population densities of the tree species encountered in the forests studied may be attributed to unfavorable microclimate within the forests and the paucity of viable seeds of the trees to sustain regeneration. Christie and Armesto (2003) reported very low population densities of quite a number of economically valuable tree species occasioned by dearth of viable seeds and poor micro-sites for regeneration. Also, abundance or rarity of a timber tree species of economic value in an area of rainforest is a function of the intensity and pattern of its exploitation. Therefore, the fewer population of individual tree species observed in the study areas can be linked to overexploitation of the trees for timber. This would also cause gross inadequacy of seeds for regeneration, as a lot of mother trees must have been felled. Olajide (2004) established a positive relationship between poor population densities of some tree species and the mortality of their old mother trees. Parthasarathy and Karthikeyan (1997) reported poor population density of timber trees producing economically valuable non-timber products in a tropical evergreen forest subjected to timber exploitation in Western Ghats, India.

The similarity index of 51% calculated for the forests indicates that though an individual tract of rainforest consists of a heterogeneity of tree species, considerable similarity in constituent tree species between two or more rainforests at locations far apart is common. Ojo *et al.*

Table I. Timber tree species producing valuable non-timber products in Afi River forest reserve, Cross River State, Nigeria

S/No	Tree spp	Valuable Non-Timber Product	Population Density (per ha)
1.	*Allanblackia floribunda*	Edible oil from the seed	2
2.	*Baillonella toxisperma*	Edible oil from the seed	2
3.	*Brachystegia eurycoma*	Edible seed	5
4.	*Canarium schweinfurthii*	Edible fruit	1
5.	*Dacryodes edulis*	Edible fruit	1
6.	*Garcinia kola*	Edible and medicinal seed	1
7.	*Irvingia gabonensis*	Edible nut	1
8.	*Parkia bicolor*	Edible seed	1
9.	*Pentaclethra macrophylla*	Edible seed	1
10.	*Ricinodendron heudelotii*	Leafy vegetable	1
11.	*Tetrapleura tetraptera*	Spicy and medicinal fruit	1
12.	*Vitex* spp	Edible fruit	1

Table II. Timber tree species producing valuable non-timber products in Oban West forest reserve, Cross River State, Nigeria

S/No	Tree spp	Valuable Non-Timber Product	Population Density (per ha)
1.	*Allanblackia floribunda*	Edible oil from the seed	11
2.	*Brachystegia eurycoma*	Edible seed	1
3.	*Chrysophyllum albidum*	Edible fruit	1
4.	*Coula edulis*	Edible nut	3
5.	*Irvingia gabonensis*	Edible fruit (flesh and nut)	2
6.	*Parkia bicolor*	Edible seed	10
7.	*Pentaclethra macrophylla*	Edible seed	9
8.	*Ricinodendron heudelotii*	Leafy vegetable	1
9.	*Tetrapleura tetraptera*	Spicy and medicinal fruit	1
10.	*Vitex* spp	Edible fruit	2
11.	*Xylopia aethiopica*	Spicy and medicinal seed	1

(1999) reported a similarity index of 60.9% between two tracts of rainforest far apart in southwestern Nigeria.

A tree species with less than 10 individuals per hectare is regarded as a rare species (Parthasarathy & Karthikeyan, 1997; FORMECU, 1999). Accordingly, all species in Afi River Forest Reserve are rare and endangered species. Apart from *A. floribunda* and *P. bicolor*, all other tree species in Oban West Forest Reserve are endangered.

All the tree species identified and enumerated in the two forests are of economic importance to the people as they produce edible fruits and seeds on which the people depend for food and medicine. *C. albidum* fruit contains 8.8% protein, 17.1% oil, 20.9% sugar, 11% starch and other minerals of nutritional value (Okigbo, 1975). *G. kola* produces seeds that are eaten as snacks and also used for medicinal purposes because of its antibiotic potential. Moreover, a recent study by Onabu *et al.* (2006) has shown that the aqueous extract of *G. kola* may have possible biochemical significance in the treatment of some liver diseases. Because *B. toxisperma* and *A. floribunda* seeds are sources of edible oil and the fact that the species are scarce to come by, the Federal Government of Nigeria is making efforts to conserve this species by banning its felling for timber. In view of the economic, medicinal, nutritional and social importance of the fruits, seeds and leafy vegetables of these tree species, the products are sold both in rural and urban areas of the country by people who take to the trade as their means of livelihood (Alao & Popoola, 2002; Udo & Udofia, 2006).

CONCLUSION

Since these tree species are important for timber and non-timber forest products, it is necessary to ensure the sustainability. In order to prevent their extinction, the government should out-law their exploitation for timber from the forest estates. People living in adjoining villages to the forests should be incorporated into the conservation program, which would prevent the exploitation of these tree species for timber and ensure sustainable production of their valuable non-timber products.

REFERENCES

Alao, J.S. and L. Popoola, 2002. Valuation and marketing of *Garcinia kola* (Linn) in Osun and Kwara State, Nigeria. *Nigerian J. Fores.,* 32: 1–10

Balogun, O.Y., 2003. *Senior Secondary School Atlas,* 2nd edition, p: 19. Longman Publishers, Lagos

Christie, D.A. and J.J. Armesto, 2003. Regeneration at micro site and tree species co-existence in temperate rainforest of Chilue Island, Chile. *J. Ecol.,* 91: 776–84

Ford Foundation, 1998. *Forestry for Sustainable Rural Development,* p: 58. A Review of Ford Foundation Supported Community Forestry Program in Asia, Ford Foundation, New York

FORMECU, 1999. *Forest Resources Study, Nigeria, Revised National Report,* Vol. 2, p: 224. Prepared for FORMECU by Beak and Geomatics International

Gillespie, T.W., J. Brock and C.W. Wright, 2004. Prospects for quantifying structure, floristic composition and species richness of tropical forest. *Int. J. Remote Sens.,* 25: 70–7

Ikojo, H.A., O. Olajide and I.J. Uwadinma, 2005. Effects of soil media and watering regimes on the growth of *Brachyategia eurycoma* (Harms) Seedlings. *J. Sust. Agric. Env.,* 7: 93–8

Muul, I., 1993. *Tropical Forests, Integrated Conservation Strategies and Concept of Critical Mass*. Man Biosphere (MAB) Digest No. 15, UNESCO, France

Ojo, L.O., A.O. Adeola, J.A. Okojie, S.O. Bada and P.O. Adegbola, 1999. Status of a strict nature reserve in Akure Forest Reserve. *J. Trop. Forest Resou.,* 15: 1–9

Okigbo, B.N., 1975. Neglected plants of horticultural and nutritional importance in traditional farming systems of Tropical Africa. *Acta Hort.,* 53: 131

Olajide, O., 2004. Growth performance of trees in Akure Forest Reserve, Ondo State, Nigeria. *Un-published Ph.D. Thesis*, University of Ibadan, Ibadan, Nigeria

Onabu, C., E.O. Anosike and G.O. Ibeh, 2006. Effect of aqueous extract of *Garcinia kola* on some liver enzymes of rats with carbon tetrachloride induced liver damage. *Global J. Pure Appl. Sci.,* 12: 343–6

Panayotou, T. and P.S. Ashton, 1992. *Not by Timber Alone: Economics and Ecology for Sustainable Tropical Forests*. Island Press Washington, D.C. Ad Coveln, California, U.S.A

Parthasarathy, N. and R. Karthikeyan, 1997. Biodiversity and population density of wood species in a tropical evergreen forest in Courtallum reserve forest, Western Gharts, India. *Trop. Ecol.,* 38: 297–306

Turner, I.M., 2001. *The Ecology of Trees in the Tropical Rainforest*, p: 298. Cambridge University Press, Cambridge, U.K

Udo, E.S. and S.I. Udofia, 2006 Marketing of *Chrysophyllum alidum* (Linn) fruits within the produce market in Uyo, Akwa Ibom State of Nigeria. *Global J. Pure Appl. Sci.,* 12: 307–13

Whitmore, T.C., 1998. *An Introduction to Tropical Rainforests*. Oxford University Press, Oxford, U.K

(Received 16 May 2007; Accepted 14 December 2007)