

*Full Length Research Paper*

## Environmental and socio-economic effects of timber harvesting in Ebonyi State, Nigeria

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This study was carried out to evaluate the socio-economic and environmental effects of timber harvesting in Ebonyi State, Nigeria. Three Local Government Areas (LGAs) were purposively selected from the timber producing areas of the state, and multi stage random sampling technique was employed to select a total of 160 respondents – composed of 50 randomly selected farmers from each of the three LGAs and 10 officials from the State Forestry Department. Primary data were used for the study. A structured questionnaire was used to collect information from the respondents. Data was subjected to statistical and econometric analysis which included percentages, frequencies and exploratory factor analysis. Environmental economic and social effects of timber harvesting observed from the study included: Silting of rivers and lakes, damaging of immature trees and non-wood forest products, loss of biodiversity, climate change/global warming, high cost of farm labour, disputes and crises over land and compensation, high cost of living, loss of forest land and increased cost of wood and timber products. Level of economic losses amounted to over 2000 trees per year from the forests excluding those harvested from free areas that were not officially on record. The study recommended that the Ministry of Agriculture/Environment and other related stakeholders should adequately sensitize the public on the long term implication of illegal logging on the environment and socio-economic well-being of the farmers in the concerned communities.

**Key words:** Environment, economic, social, effects, timber harvesting.

### INTRODUCTION

Timber harvesting is the cutting down of wood from the wild and reserved areas for both domestic and commercial purposes. It should not be confused with illegal logging, which refers to the harvest, transportation, purchase or sale of timber in violation of laws. The harvesting procedure itself may be illegal including using corrupt means to gain access to forests; extraction

without permission or from a protected area; the cutting of protected species; or the extraction of timber in excess of agreed limits. Throughout history, humans have manipulated natural resources to produce food. Although other products from the natural environment have been exploited- the rate of timber harvesting has accelerated significantly since the turn of the century. According to

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FAO (2012), the world has just less than 4 billion hectares of forest, covering about 20% of the world's land area. Surprisingly, the net forest loss remains 7.3 million hectares per year or 20,000 ha per day (Ajake and Enang, 2012). This is most serious in the tropics where over 2.5 billion people depend on the natural forest resources for variety of services (Tijani, 2007; Butler, 2012). In Central and West Africa, the tropical rainforest has been an important source of timber, as well as other valuable non-timber products (Keegan, 2011; Laird, 2008; Abayomi, 2001; Abayomi et al., 2002). Unfortunately, increased demand for timber resources and the technology adopted by man for their extraction has caused severe degradation of forest resources (Jimoh, 2001). At present, estimated timber losses in Africa (FAO, 2012) were observed to be higher than those of Latin America and the Caribbean. For instance, between 2000 and 2010, the continent lost about 5.2 million hectare of forest, accounting for about 52% of the global reduction of forest cover (FAO, 2012). To support this argument, Okonkwo et al. (2002) deduced that numerous unchecked activities including illegal logging have been taking place in the forest zones of Nigeria, ranking it second after Cameroun. Forest loss in Nigeria is put at an average of 400,000 ha per year, while afforestation has been only 32,000 ha yearly. The cumulative effect of these is that the continent has lost about 50 million hectare of forest in less than 100 years (Mmon and Mbee 2014). Furthermore, this could lead to desert encroachment, global warming, food chain depletion, destruction of soil structure, extinction of wildlife, draught and exposure of bush to burning (Rhett, 2005).

Consequently, majority of developing countries now have lower per capita income than when the decade began. According to Barbier (2005), rising poverty and unemployment have increased pressure on environmental resources as more people have been forced to rely more directly upon them. This assertion was emanates from the fact that poverty and environment are linked in a "downward spiral" approach in which poor people are forced to overuse environmental resources for their daily survival, and are further impoverished by the degradation of these resources (Cronin and Pandya, 2009; Todaro and Smith, 2009). The loss of timber resources beyond sustainable limit is a serious issue in Nigeria. The study therefore seeks to investigate the environmental, economic and social effects of timber harvesting in Ebonyi State. A proper understanding of resource-environment linkage is a good approach in developing effective public policy in retrospect to the myriads of harm that have been wittingly done to the ever-diminishing timber resources, while still observing environmental sustainability.

It has been observed that multinational companies perform most of the harvesting activities with little benefits reaching the local community. Now, because of their little or no effort in improving the lives of the host

communities and with the attendant impoverished environment, they are faced with the challenges of environmental degradation and resources depletion. The adverse effects of industrial timber harvesting on the forest ecosystem have been acknowledged to include loss of biodiversity, exposure of soil to erosion and harsh weather, etc. (Reading et al., 2005; Obot, 2002). Moreover, there is lack of information on the volume of timber harvesting in Nigeria, effects of timber harvesting, and the level of economic loss sustained as a result of timber harvesting. So, the rate of timber harvesting could not be compared with the regeneration potential of the natural forest and the rate of plantation establishment. This would have formed the premise on which forestry planning and development should rest, like in the developed nations that have committed substantial amount of funds to monitor growth and timber harvesting in their natural and plantation forests. Consequently, this study specifically aims to: (i) Determine, from the perception of farmers, the possible consequences (effects) of illegal harvesting of timber; (ii) Estimate the level of economic losses incurred by illegal logging, and (iii) Make recommendations based on the findings, strategies that will ensure sustainable timber utilization over time.

## METHODOLOGY

### Theoretical framework

#### *Exploratory factor analysis*

The ultimate goal of factor analysis is to explain the covariance relationships among the variables in terms of some unobservable and non-measurable random factors. A wide range of dimension or multivariate variables may exist; therefore factor analysis aims at reducing the dimensionality or multi-variate data set to an orderly structure (Ashley et al., 2006; Ledyard and Robert, 1997). Factor analysis is a technique of describing groups of highly correlated variables by a single underlying construct or factor that is responsible for the observed correlations (Ashely, 2008), and once the groups of correlated variable are identified, they are interpreted and labeled.

There are methods of factor analysis which include common and principal component analysis. As reported by Wilkinson et al. (1996), most data sets under both methods of analysis lead to similar results. Exploratory factor analysis procedure using the principal component model with iteration and varimax rotation will be employed in grouping the effects of timber harvesting into major components. Only variables with factor loading of 0.30 and above will be used in naming the factor (Ashley et al., 2006). Also variable(s) that loaded in more than one factor will not be used. High reliability of factor analysis models in social science studies has widely been explored by several authors. Ashley et al. (2006) employed factor analysis to analyze education systems of 64 countries around the world while Okorji and Chukwuone (2000) applied factor analysis to determine constraining factors to community seed project in Enugu State, Nigeria. Agwu (2000) analyzed his data on extracting cowpea technology diffusion in Northeast Savanna Zone of Nigeria using Factor analysis; Kessler (2006) applied factor analysis in determining the decisive key factors influencing farm households' soil and water conservation investments in Netherlands.



Figure 1. Map of Ebonyi State showing the study areas. Source: EB-MANR, 2011.

**The study area**

The study was carried out in Ebonyi State, Nigeria. The state lies approximately within longitudes 7° 30' and 8° 30' East of the Greenwich Meridian and latitudes 5° 40' and 6° 45' North of the Equator. It is bounded in the North by Benue State, to the West by Enugu State, to the East by Cross River State and to the South by Abia State. Ebonyi State has a total of thirteen (13) Local Government Areas (LGAs) (Ebonyi State Government, 2009). By the 2006 population census, the population of Ebonyi State was put at 2.1 million (NPC, 2006). It has a total land area of about 5,935 km<sup>2</sup>. The State is endowed with enormous mineral resources: Salt lakes at Uburu, Okposi and Oshiri; Zinc and lead deposits at Enyigba as well as Kaolin and Limestone at Ishiagu, Afikpo and Nkalagu (EB-SEEDS, 2004). Agriculture is a major occupation in Ebonyi State, with an estimated 85% of the population earning their living from one form of agriculture or another. Major food crops grown in large quantities include rice, yam, cassava, maize, cocoyam, cowpea and groundnut. cash crops such as oil palm, cashew, cocoa, rubber, etc are vigorously cultivated (Figure 1).

At present, the State has eleven officially developed forest reserves and many sacred grooves which protect her rich biodiversity. The Akanto game reserve (with an area of about 450 hectares) is a protected area where endemic wildlife species are conserved. The Ministry of Agriculture has planted over 6000; 5000 and 8000 seedlings of teak (*Tectonia grandii*) at Effium, Ovuum and Ozziza Reserves respectively; and has embarked on the forest reserve study of Federal Government of Nigeria aimed at the development of a forestry management plan (EB-MANR, 2011).

**Sampling procedure**

The sampling techniques adopted and utilized for selecting the respondents for the study were the multi-stage sampling technique. Out of the thirteen Local Government Areas (LGAs) in the state, 3 LGAs were purposively selected from the areas where forest

reserve exists. Then, random sampling procedure was used to select 5 communities from each local government making a total of 15 communities for the study. From each sampled community, 10 farm-households were randomly selected to give a sum of 150 farmers. Also, ten (10) respondents were randomly selected from the Department of Forestry, Ebonyi State Ministry of Agriculture and Natural resources (EB-MANR, 2011). This gave a grand total of 160 respondents.

**Data collection and analysis**

Data for the study was collected from the primary source. This was done using a set of structured questions grouped in a pre-tested questionnaire. Information gathered included the perceived effects of timber harvesting on man and the environment. The questionnaire had four sections namely: Socio-economic characteristics of respondents, level of economic losses incurred as a result of timber harvesting, environmental, economic and social effects of timber harvesting constraints to effective timber management. The questionnaire was administered by the researcher with the assistance of enumerators who are familiar with the terrain and the people. In order to realize the specific objectives of the study, relevant analytical tools were employed. Principal component factor analysis model was used to realize objective (i) while descriptive statistics such as frequency and percentage were used to realize objective (ii). The principal component factor analysis model is specified as follows:

$$\begin{aligned}
 Y_1 &= a_{11} x_1 + a_{12} X_2 + \dots + a_{1n} X_n \\
 Y_2 &= a_{21} x_1 + a_{22} X_2 + \dots + a_{2n} X_n \\
 Y_n &= a_{n1} x_1 + a_{n2} X_2 + \dots + a_{nn} X_n
 \end{aligned}$$

Where:

$Y_1, Y_2, \dots, Y_n$  = Observed variable or consequences of timber harvesting;  $a_1 - a_n$  = Factor loading or correlation coefficients, and  $x_1, x_2, \dots, x_n$  = unobserved underlying factors or consequences of

**Table 1.** Varimax Distribution of environmental, economic and social effects of timber exploitation.

S/N	Resultant effect	Factor one environmental effect	Factor two social effect	Factor three economic effect
V <sub>0</sub> 1	Silting of rivers and lake	0.214	0.000	- 0.003
V <sub>0</sub> 2	High cost of farm labour	- 0.165	0.977	- 0.059
V <sub>0</sub> 3	Occurrence of disputes and crises over land and compensation	- 0.940	0.224	- 0.134
V <sub>0</sub> 4	Damaging of immature trees and non- wood forest product	0.101	- 0.003	- 0.022
V <sub>0</sub> 5	Loss of income and revenue by govt.	- 0.019	0.007	- 0.005
V <sub>0</sub> 6	Reduction in soil fertility and crop output	0.064	- 0.031	0.006
V <sub>0</sub> 7	Loss of biodiversity	0.605	- 0.011	- 0.010
V <sub>0</sub> 8	Loss of forestland	0.010	- 0.008	0.891
V <sub>0</sub> 9	Disappearance of forest cover	0.014	0.016	0.017
V <sub>0</sub> 10	Rural-urban migration	0.022	- 0.011	- 0.005
V <sub>0</sub> 11	High cost of living	- 0.143	0.103	0.974
V <sub>0</sub> 12	Increased cost of wood and timber products	0.035	- 0.007	0.912
V <sub>0</sub> 13	Climate change/global warming	0.222	- 0.014	- 0.001

Source: Field Survey, 2014.

timber harvesting.

## RESULTS AND DISCUSSION

### Environmental, economic and social effects of timber exploitation

Here, the environmental and the socio-economic effects of timber harvesting in the study area were identified. The determined effects include, but not limited to: occurrence of disputes and crises over land/compensation, damaging of immature trees and non-wood forest products, loss of income and revenue by government, loss of biodiversity, disappearance of forest cover, increased cost of wood and timber products etc. This is summarized in Table 1.

Based on the results obtained from the exploratory factor analysis with decision score of 0.3, factors that loaded from 0.3 and above were noted to be areas of significant effects, while factors that loaded below 0.3 were noted to have less significant effects and as such, were ignored. Meanwhile, factors (effects) that loaded high were categorically grouped into three factor groups. Factor one was named environmental effects; factor two was named social effects, while factor three was labeled economic effects.

Those effects that loaded high under factor one (environmental factors) were: Silting of rivers and lakes (0.214); damaging of immature trees and non-wood forest products (0.101); loss of biodiversity (0.605) and climate change/global warming (0.222). This shows that over-reliance of the rural dwellers on timber and other forest resources have resulted to a heavy decline on the ecosystem functioning of the forest. On the other hand, effects that loaded high under factor two (social effects) were: High cost of farm labour (0.977); occurrence of

disputes and crises over land/compensation (0.224); and High cost of living (0.103). It is quite evident from the result obtained that efforts made in utilizing forest resources unsustainably are self-defeating. It ends up impoverishing the people; and in most cases, hostilities arise due to unequal distribution of benefits. This agrees with Madukwe (2005), who opined that more often than known, timber exploitation, when left uncontrolled have fueled communal crises, crippling the economy. Also, effect that loaded high under factor three (economic factors) were: Loss of forest land (0.891); high cost of living (0.974) and increased cost of wood and timber products (0.912). These effects above indicated areas that significantly affected the study area in terms of their economic, social and environmental well-being.

### Assessment of economic losses arising from timber harvesting

The percentage distribution of the volumes of annual timber loss due to illegal logging is presented in Table 2. From the results obtained from the Staff of Forestry Department, Ministry of Agriculture, Ebonyi State; about 70% of the respondents agreed that over 2000 harvested trees (\$574,000) disappear from the forest in the state illegally. This trend supports the findings of Macedo et al. (2012), that most tree disappearance in tropical forests are over 2000 trees annually unreplaced. Also, 40% of the respondents admitted that the volume of harvestable timber from the three forest reserves in the study area cannot be easily quantified. About 30% of the respondents reported that the annual timber loss was about 500 to 1000 trees (\$143,000-\$287,000). From the surveys gathered from various timber experts on the market price of mature harvested trees, a base price of

**Table 2.** Percentage distribution of the volumes of annual timber loss due to illegal logging.

S/N	Item	Cost/tree(\$)	Sum of cost (\$)
1	Less than 500 trees per forest	287	-
2	500-1000 trees per forest	287	143,000-287,000
3	1500-2000 trees/forest	287	420,000-574,000
4	Over 2000 trees per forest	287	Over 574,000
5	Unquantifiable	287	Unquantified

Source: Field Survey, 2014.

\$287 was established as at the time of the study (depending on the specie and girth). This amounts to about 7% of annual budget of the State; hence, a huge loss on the economy.

## CONCLUSION AND RECOMMENDATIONS

Findings show that timber harvesting affects the environmental, economic and social well-being of the respondents in the study area. A lot of these effects are quite obvious such as increased draught, water stress, poor yield of crops arising from flooding, crisis, etc; whereas others like the much pronounced global warming and species extinction are likely to manifest in the future. Rational and efficient use of natural resources is the only means to sustain the long term availability of these resources while still improving human conditions. The great danger posed by uncontrolled/illegal logging is that it has inevitably served as a tool for sponsoring armed conflicts as was recently seen in Effium/Ngbo crisis that claimed many lives, loss of government revenue, climate change, loss of biodiversity which has often created an imbalance in ecosystem services and other related problems on the host communities. Although, farmers harvest these resources for immediate survival from poverty and hunger; but at the long run, has reinforced the scourge of hardship. Thus, there is need for a holistic approach to resource management and sustainability. Hence, the study made the following recommendations:

1. Government should ensure that all timber harvesting companies – cooperative bodies and private individuals must acquire and tender their certification and license before entering the forest. This will go a long way in abating corrupt practices by potential users and timberland owners.
2. They should also impose stiff penalties on wood companies and individuals who harvest these resources beyond agreed limits. A more feasible way to achieve this measure is by utilizing trained personnel that will help enforce these rules and subsequent arrest of parties who may display criminal behavior.
3. The ministry of agriculture and other related

stakeholders should adequately sensitize the public on the long term implications of illegal logging on the environment and socio-economic well-being of farmers in the concerned communities.

## Conflict of Interest

The authors have not declared any conflict of interest

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