

Full Length Research Paper

Sustainable timber utilization and management in Ebonyi State, Nigeria

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This study was carried out to ascertain the perception of the people on sustainable timber utilization and management 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 150 respondents. Primary data were used for the study. Structured questionnaire was used to collect information from the respondents. Statistical and econometric tools used for analysis included mean, percentages, frequencies and exploratory factor analysis. Major causes of timber exploitation and illegal logging observed from the study were: poverty and hunger; high cost of timber products; expanding agriculture; expanding population; rapid urbanization and high cost of alternative wood products. Results of multiple regression showed that the socio-economics characteristics that influenced timber exploitation were: gender, occupation, education all significant at 5% and marital status with significance level of 1%. The perception of farmers as regards strategies that could be adopted for sustainable utilization and management of timber were: use of forest-regulators in the control of timber exploitation; creating awareness on the need for environmental protection and sustainability; emphasis on agroforestry, afforestation and reforestation programme; arresting of defaulters and subsequent charging of fines; support of research on alternative source of energy. The identified constraints to effective timber management were: lack of public awareness of timber resource management; population pressure; lack of fund to tackle the problem of unsustainable use of timber; poverty and institutional problem; limited manpower to enforce environmental laws and regulation and poor value system and moral ethics. The study recommended that the law enforcement approach should be complemented with incentive based development of alternative income earning opportunities for local people involved in illegal timber harvesting.

Key words: Sustainable, timber, utilization, exploitation, management, Nigeria.

INTRODUCTION

According to Meyer and Turner (2009), societies have profoundly altered their environments in the pursuit of wealth and power; and have been punished by

environmental catastrophes (natural and man-induced). Today, world forest area has been reduced by some 20% and a large area of land converted from

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its original vegetation cover to cropping. Moreover, Putz (2011) maintained that the major causes of lumbering are increasing demand for housing and infrastructural facilities, timber export, poor agricultural practices, cutting of fuel wood for urban areas, head loading (cutting of fuel wood for sale), forest fires, logging, and overharvesting. One difficult task faced by both developed and developing countries is how to guarantee sustainable utilization of natural resources especially timber at the lowest possible environmental cost, while still ensuring both economic and social development (Klawitter, 2004). For instance, the impacts and scars from almost 130 years of logging and destruction of the Amazon forest in Brazil and Fraser Island respectively are still very evident; although, the controversy is no longer current.

Already, in parts of Latin America, Asia, Middle East, and Africa, shortage of timber resources is becoming a source of political unrest and international tension. The recent destruction of much of Africa's forest zone was more severe than if an invading army had pursued a scorched-earth policy. Yet most of the affected governments still spend far more to protect their people from invading armies than from invading desert (Babagana et al., 2012). Also, by the words of Lanky (2012), many governments have cut back efforts to protect the environment and to bring ecological considerations into development planning. Timber exploitation has caused a substantial reduction of the average size of the trees which occur and lessened the grandeur of forests. The greatest aesthetic impact in a forest is the appreciation of trees of great stature and age; but apparently, most of these have now been removed and people travel great distances just to observe the few remaining and to hold them in awe (Cronin and Amit, 2009). The traditional mode of natural resource consumptions and development as well as the current inefficient exploitation are severely threatening long term utilization of timber. The rate at which forests are destroyed in the name of furniture-making, pulp and paper production and a provision of domestic energy is alarming. Whilst countries around the world promote economic growth, at the same time, most of them have committed themselves to reduce environmental impacts and to reverse global environmental deterioration (Millenium Ecosystem Assessment (MEA), 2003).

Generally speaking, in the face of conflicting economic and environmental goals, it is often hard to reconcile new developments with environmental protection and nature conservation (Barbier, 2005). The increased demand for timber resources and the technology adopted by man for their extraction and exploitation has caused severe degradation of forest resources (Jimoh, 2001). The rate of timber destruction has accelerated significantly since the turn of the century. The loss of timber resources beyond sustainable limit is purely a serious issue in Nigeria, thus requesting for a holistic approach that dwells on building strong institutions. In essence, effective means for controlling logging do not exist in most localities in

Nigeria of which Ebonyi State is a typical case study. Laws and regulations that permit government to exercise such control, when existent, often cannot be enforced because of strong public resentment and resistance. This conflict is not within the scope of science and technology; instead, it is a question of attitudes and values heavily embodied in "frontier mentality" and "corporate greed" by free riders, with its resultant negative externalities on the natural environment (Conservation International Biodiversity (CIB), 2009).

Today, forest related policy and decision making processes relating to logging at national and international levels are not clearly defined, because they demand a holistic and scientific approach to management without the ability to provide the supporting tools for the achievement of the desired objectives (Adger et al., 1995). Due to that, the existing scientific support for the decisions taken at international and national levels is merely a hypothesis and still to be tested. In closer terms, one finds that while problems and issues are well recognized, and there is some increase in community concern over sustainable use of timber in many localities around the country, in most cases, unfortunately, there is no perceived need to address the problems involved and no sense of urgency to find and implement solutions. It is against this backdrop that the study sought to ascertain sustainable timber utilization and management in Ebonyi state. Specifically, the study: (i) identified the major causes of timber exploitation and illegal logging; (ii) examined the effects of socio-economic characteristics of the respondents on timber exploitation (iii) assessed the perception of the local people as regards systematic management and improved utilization of timber and (iv) identified the major constraints to effective timber management.

MATERIALS AND METHODS

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 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 km². The State is blessed 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 industry in Ebonyi State. An estimated 85% of the population earns 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.

At present, the State has eleven (11) officially gazzetted forest reserves and many sacred grooves which protect the rich biodiversity of the State. The Akanto game reserve (with an area of

about 450 ha) is a protected area where endemic wildlife species are conserved. The Ministry of Agriculture has planted over 6000; 5000 and 8,000 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, three LGAs were purposively selected from the areas where forest reserve exists. Then, random sampling procedure was used to select five Communities from each LGA making a total of 15 communities for the study. From each sampled community, 10 households were randomly selected to give a sum of 150 respondents.

Data collection and analysis

Data for the study were collected from primary source only. This was done using a set of structured and pre-tested questionnaire. In order to realize the specific objectives of the study, relevant analytical tools were employed. Descriptive statistics such as frequency, mean and percentage were used to realize objectives (i) and (iii). Objective (ii) was achieved using multiple regression model. The principal component factor analysis model was used to realize objective (iv).

Model specification

Multiple regression model

This was employed to analyze the effects of the socioeconomic characteristics of the farmers on timber exploitation. The dependent variable here was number of timber exploited, while the socio economic attributes of the farmers will be the independent variables.

The explicit form of the model becomes:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + \dots + B_nX_n + e$$

Where

Y = Timber exploitation (measured in logs)

Bo = Intercept

B₁ – B_n = Coefficients of independent variable.

e = Stochastic disturbance/error term.

The hypothesized socioeconomic characteristics of timber exploiters include:

- X₁ = Gender (Male = 1, Female = 2)
- X₂ = Age (in Years)
- X₃ = Level of Education (years spent in school)
- X₄ = Marital Status (married =1, Not married = 2)
- X₅ = Household size (in number)
- X₆ = Occupation (farming =1, others =2)
- X₇ = Farm size (in hectares)
- X₈ = Farming Experience (years)
- X₉ = Farmers' co-operative society Participation (Member =1, Non-member =2).

Likert Scale rating technique

A four point Likert-type rating scale was used for determining the perception of the local people as regards systematic management and improvement of forest areas to ensure sustainability of timber species in the area while the scaling was regarded as; Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD) or other similar ratings with corresponding values of 4, 3, 2 and 1 respectively.

The mean score of respondents based on a 4-point rating scale was computed as;

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.50 \text{ (cut off point).}$$

Using the interval scale of 0.05, the upper cut-off point was 2.50 + 0.05 = 2.55 while the lower limit cut-off was 2.50 – 0.05 = 2.45. Based on this, any item mean score below 2.45 was taken as Strongly Disagree or Disagree as the case may be, while those items with mean values between 2.45 and 2.55 were considered as Agree or Strongly Agree as the case may be.

$$\text{Item mean score} = \frac{\sum \text{rating score} \times \text{no of respondents for the score}}{\text{Total number of respondents}}$$

Factor analysis model

Principal component factor analysis model was used in achieving objective (iv). It was stated as follows:

$$Y_1 = a_{11} X_1 + a_{12} X_2 + \dots + a_{1n} X_n$$

$$Y_2 = a_{21} X_1 + a_{22} X_2 + \dots + a_{2n} X_n$$

$$Y_m = a_{m1} X_1 + a_{m2} X_2 + \dots + a_{mn} X_n$$

Where:

Y₁, Y₂,.....Y_m = Observed variables or constraints to effective management and sustainability of timber resource in the study area.

A₁₁ – a_{mn} = factor loading or correlation coefficients.

X₁, X₂,.....X_n = Unobserved underlying factors constraining the local people in the study area, from adopting measures in halting uncontrolled logging of timber.

RESULTS AND DISCUSSION

Causes of timber exploitation in the study area

Perception of respondents on the causes of timber exploitation

The summary of the perception of the respondents on the causes of timber exploitation was presented in Table 1.

From the result, 94 out of the 150 respondents admitted that poverty and hunger among the rural dwellers was is a very serious cause of timber exploitation. With respect to absence of forest regulations, 83 respondents perceived that it as a fairly serious cause of timber exploitation; whereas about 47 of the respondent saw it as not serious. Only very few respondents saw it as a very serious cause of timber

Table 1. Respondents' perception of causes of timber exploitation.

S/N	Causes	Responses		Frequency		Total	Item mean score	R
		Very serious VS	Serious (S)	Fairly serious (FS)	Not serious (NS)			
1	Poverty and hunger	94	38	18	0	150	3.51	VS
2	Absence of forest regulation	6	14	83	47	150	1.88	FS
3	High cost of timber products	90	43	16	1	150	3.48	VS
4	High cost of alternative wood products	13	87	14	36	150	2.60	S
5	Expanding agriculture	75	60	15	0	150	3.40	VS
6	Inadequacy of farmland	0	109	30	11	150	2.65	S
7	Illiteracy	4	84	50	12	150	2.53	S
8	Corruption	70	70	7	3	150	3.38	S
9	Expanding population	59	43	27	21	150	2.93	VS
10	Rapid urbanization	93	17	30	10	150	3.23	VS
11	Deforestation of primary forests	59	82	8	1	150	3.33	S
12	Lack of trained officials	3	12	51	84	150	1.58	NS
13	Public resentment	0	2	20	128	150	1.34	NS
14	Unstable government policies	5	0	22	123	150	1.24	NS

Source: Field Survey (2014).

exploitation. Majority (90 and 75) of the respondents agreed that high cost of timber products and expanding agriculture respectively had been very serious factors that spawned timber exploitation in the study area over the years.

Again, high cost of alternative wood products and lack of adequate education in the timber producing areas were viewed to be serious causes of uncontrolled harvesting of timber as agreed by 87 and 84 out of the 150 respondents respectively. Corruption was one of the driving forces of logging since 70 respondents agreed that it was either very serious or just a serious cause of illegal logging.

This is comparable with the findings of Global Witness (1995), using Cambodia as a case study, where it was asserted that "the role of the government in the allocation of forest to private logging companies has been rather worse in abating illegal logging. It was very corrupt and in one particular year, a minimum of US\$ 187 million of timber was smuggled out of the country and only US\$ 12 million made it into the exchequer." As many as 82 respondents agreed that it was a serious cause of illegal timber exploitation.

Lack of trained officials, public resentment, and unstable government policies recorded 84, 138 and 123 respectively who agreed that they are not serious causes of timber exploitation. In addition, 51, 20 and 27 admitted that lack of trained officials, public resentment (rebellion) and unstable government policies respectively were fairly serious causes of illegal logging of wood products in the study area. Lastly, expanding population and rapid urbanization were viewed by many 59 and 93 as very serious causes of timber exploitation.

Assessment of the effects of socio-economic characteristics of rural households on timber exploitation

A multiple regression model was used to assess the effects of socio-economic characteristics of the rural households on timber exploitation in Ebonyi State. The independent variables were Gender of Household Head (X_1), Age (X_2), level of education (X_3), marital status (X_4), family size (X_5), occupation (X_6), farm size (X_7), farming experience (X_8), co-operative membership (X_9). The result is presented in Table 2.

Gender distribution (X_1) and occupation (X_6) were found to be positive and significant at 5% level of probability. This indicates that the two variables were important determinants of timber exploitation in the study area. In other words, the males in the study area were much more involved in timber exploitation than their female counterparts. Majority of the household heads (males) only perceive it as a trade or means of complementing their source of livelihood. This is similar to the findings of Asner et al. (2003) who opined that in the midst of ever-diminishing stands of tree, the men are always at the forefront of logging large rounds of wood with no effort to replace them. Also, farmers whose major occupation was farming only were much more dependent on the forest and its products played major roles in harvesting these products even in off season.

Also, level of education (X_3) was statistically significant at 5% level of probability with a negative sign. This agrees with a priori expectation. The implication is that in most cases, level of education has negative correlation with timber exploitation. Education trains the mind and

Table 2. Socio-economic characteristics of the farmers that affected timber exploitation.

Variable	Variable name	Regression coefficient	Standard error	t-value
Y	Timber exploitation			
b ₀	Constant	4.182	1.259	3.321*
X ₁	Gender	0.004	0.120	0.037**
X ₂	Age	0.223	0.127	1.762
X ₃	Level of education	-0.051	0.040	-1.277**
X ₄	Marital status	0.082	0.131	0.623*
X ₅	Family size	0.170	0.112	1.513
X ₆	Occupation	0.062	0.064	0.970**
X ₇	Farm size	0.239	0.120	1.99
X ₈	Farming experience	0.081	0.119	0.681
X ₉	Co-operative members	-0.020	0.026	-0.790***

***, ** and * signify 10, 5 and 1% levels of significance respectively. $R^2 = 0.879 = 87.8\%$; Adjusted $R^2 = 0.889 = 88.9\%$; F – ratio = 1.620; Durbin Watson Constant (DW) = 1.281; Standard Error of Estimates (SEE) = 2.42821. Source: Field Survey (2014).

character of individuals. Farmers with lower levels of education may be harsher on natural resources, for they may have less knowledge of the environmental or socio-economic implications of illegal logging. The more enlightened farmers are the more they are apt to change and adopt innovations. Timber dealers with higher level of education have been observed to adopt the conventional harvesting (CH) approach which is more sustainable than selective harvesting (SH). Conventional harvesting uses improved technology that gives room for forest regrowth after they have been evenly harvested.

Marital status (X₄) was significant at 1% level of probability, married people have greater need for resources for family upkeep and may have greater tendency to over exploit timber. Also, co-operative membership (X₉) had a negative sign but significant at probability level of 10%. This agrees with a priori expectation. In other words, there exist a negative correlation between cooperative participation and illegal timber exploitation. Studies have found that farmers who belong to one co-operative society or the other have greater potentials of receiving novel ideals on managing natural resources from change agents as opposed to farmers who are non-members. Moreover, farmers who belong to co-operative societies easily obtain agro-related information that enhance their level of awareness of efficient farm management system that will reduce to the barest minimum, any eminent losses that are associated with environmental degradation through forest destruction.

On the other hand farm size (X₇) and farming experience (X₈) all had positive signs but not significant. Here, a priori expectations were equally met. What this means is that the size of farm and the experience derived by the farmer over time were not significant determinants of timber exploitation though they also exert some effect on timber exploitation in the study area.

Age (X₂) and family size (X₅) were also not statistically

significant, though with positive signs. Reasons may be that the age and family size of the respondents though not significant were important variables in influencing the level of timber exploitation.

Perception of the respondents on systematic management and improved utilization of timber

The perception of the respondents as regards systematic management and improved utilization of timber was explored and the results presented in Table 3.

Use of forest-regulators in the control of timber exploitation (3.40) and creating awareness on the need for environmental protection and sustainability (3.40) ranked first (Table 3) on respondents' perception on systematic management and improved utilization of timber. Emphasis on agroforestry, afforestation and reforestation programme (3.11) followed suit. Arresting of defaulters and subsequent charging of fines to (2.63) and support of research on alternative source of energy followed in that order. These are perhaps the relevant measures that would be adopted to encourage more meaningful sustainable forest management.

Adoption of improved technology in wood harvesting (1.60) scored below the acceptance point of 2.5 and was therefore regarded as not important.

Constraints to effective management of timber resources

From the outcome of the exploratory factor analysis conducted, the following variables were found to constrain sustainable timber management in Ebonyi State, Nigeria (Table 4). The factors were: lack of public awareness of timber resource management, poverty and institutional factors, poor legal framework, absence of

Table 3. Respondents' perception on systematic management and improved utilization of timber.

S/N	Item	VI	I	FI	NI	Total score	Remarks
i	Adoption of improved technology in harvesting of timber	0.94	0.37	0.42	0	1.60	5 th
ii	Use of forest regulators/guards in the control of timber exploitation	2.2	0.8	0.4	0	3.40	1 st
iii	Arresting of defaulters and subsequent charging of fines	1.70	0.84	0.47	0.2	2.63	3 rd
iv	Creating awareness on the need for environmental protection/sustainability	2.40	0.9	0.1	0	3.40	1 st
v	Emphasis on agroforestry, afforestation and reforestation programme.	2.88	0.320	0.1	0	3.11	2 nd
vi	Support of research on alternative source of energy	0.7	0.75	0.86	0.14	2.45	4 th

VI = Very important; I = Important; F = Fairly important; NI= Not important. Source: Field Survey (2014).

Table 4. Varimax distribution of respondents' constraints to effective timber management in the strong area.

S/N	Constraint Variables	Socio-economic factor	Economic/Managerial factor	Cultural factor	Community
V ₀ 1	Lack of Public awareness of timber resource management	0.6926	- 0.168	- 0.178	0.540
V ₀ 2	Poverty and institutional factor	0.002	0.458	- 0.098	0.219
V ₀ 3	Poor legal framework	- 0.105	0.049	- 0.213	0.059
V ₀ 4	Absence of alternative source of energy	- 0.048	- 0.049	0.015	0.005
V ₀ 5	Population pressure	0.400	0.053	0.088	0.251
V ₀ 6	Lack of forest governance	- 0.043	0.028	0.159	0.028
V ₀ 7	Limitation of manpower to enforce environmental laws and regulation	0.172	0.946	0.086	0.932
V ₀ 8	Lack of fund to tackle the problems of unsustainable use of timber	0.711	0.190	0.035	0.543
V ₀ 9	Financial and social pressure	0.261	0.178	- 0.096	0.109
V ₀ 10	Poor value system and moral ethics	0.270	- 0.417	0.899	1.055
	Eigenvalue	1.33	1.38	0.95	3.741

Source: Field Survey (2014).

alternative source of energy for heating, population pressure, weak forest sector governance, limitation of manpower to enforce environmental laws and regulations, financial and social pressure, poor value system and moral ethics.

The decision rule for the result of the Principal Component Factor Analysis (PCFA) in Table 4 is 0.3 This is to say that any factor loading of a variable less than 0.3 is ignored and cannot be considered as a relevant factor that has constrained the sustainable utilization and management of timber products in the study area; whereas those that loaded high (from 0.3 and above) were chosen as relevant factors that have significantly constrained the management of forest resources (timber) in Ebonyi State.

Meanwhile, these constraint variables have been generally grouped into three component factors as; socio-economic factor, managerial factor and cultural factor. Variables that loaded high under socio-economic factors were: lack of public awareness of timber resource management (0.629); population pressure (0.400) and lack of fund to tackle the problem of unsustainable use of timber (0.711). Variables that loaded high under managerial/economic factors were: poverty and

institutional problem (0.458) and limitation of manpower to enforce environmental laws and regulation (0.946). Poor value system and moral ethics (0.899) was the only factor that loaded high under cultural factor. From the foregoing, one can deduce that among the factors that loaded high, limitation of manpower to enforce environmental laws and regulation (0.946) appeared to be the most significant variables that strongly constrained relevant efforts to ensure sustainable exploitation of timber in the study area.

CONCLUSION AND RECOMMENDATIONS

From the study the following conclusions were drawn:

- i) Use of forest-regulators; creation of awareness on the need for environmental protection and sustainability; emphasis on agroforestry, afforestation and reforestation programme; arresting of defaulters and subsequent charging of fines; support of research on alternative source of energy are strategies that could be adopted for sustainable timber utilization and management.
- ii) Constraints to effective timber management were: lack

of public awareness of timber resource management; population pressure; lack of fund to tackle the problem of unsustainable use of timber; poverty and institutional problem; limitation of manpower to enforce environmental laws and regulation and poor value system and moral ethics.

The study therefore recommended that the relevant stakeholders like the Ministry of Agriculture should adequately sensitize the public on long term implication of illegal logging. Also, the strict law enforcement approach should be complemented with a soft law enforcement approach that provides incentives for developing alternative income earning opportunities for local people involved in illegal timber harvesting. Moreover, government and concerned stakeholders should be aware that efficient management is assured if people who are directly dependent on forest resource are involved in the management. The combination of a participatory approach and effective management allows for transparency and accountability in implementing governance rules and regulations.

Conflict of Interest

The authors have not declared any conflict of interests.

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