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SOCIO-ECONOMIC IMPACTS OF TIMBER HARVESTING IN AGO'OWU FOREST RESERVE AND ITS ENVIRONS IN LOCAL GOVERNMENT AREA OF OSUN STATE, NIGERIA

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ABSTRACT

The socio-economic impacts of timber harvesting in Ago'Owu Forest Reserve and its environs were investigated. Simple random sampling technique was used to select 100 forest dwellers from 3 adjoining communities of Ago'Owu Forest Reserve. Sample was drawn in proportionate to size. A set of structured questionnaire was used to obtain data on various timber species in Ago 'Owu Forest Reserve, impacts of timber harvesting on the livelihood of forest dwellers and challenges of the timber harvesting in the Forest Reserve. Data were analyzed using descriptive statistics, chi-square and logistic regression at $\alpha_{0.05}$. The average age of the respondents was 36.7±8.9 years, mostly male (87.1%) and married (53.4%) while 34.7% and 34.7% had secondary and primary education respectively. Harvested timber species in the area were Gmelina arborea, Tectona grandis and Triplochiton scleroxylon. Results on socio-economic impacts revealed that timber harvesting has positively affected the livelihood of the respondents in terms of income generation (22.8%), rural development (20.8%), improved standard of living (19.8%), poverty alleviation (19.8%) and job opportunity (15.5%). Relationship between socio-economic characteristics and the impact of timber harvesting in Ago 'Owu Forest Reserve revealed that there was significant association among nativity ($\chi 2$ =6.75), occupation ($\chi 2$ =21.21), work experience ($\chi 2$ = 16.84) and impact on timber harvesting in Ago 'Owu Forest Reserve. Identified challenges facing timber harvesting were poor road network, high tariff, transportation of products and capital intensive nature of the harvesting process with odd-ratios of 1206.0, 81.3, 26.7 and 23.4, respectively. Timber harvesting and trade in the Forest Reserve were found to have highly impacted the livelihood of the forest dwellers positively, although still confronted by some challenges. However, government should encourage plantation establishment, review tariff, repair road network and address other problems faced by timber contractors and loggers.

Keywords: Forest Reserve, Timber harvesting, Challenges involved, Forest dwellers, Rural livelihood

INTRODUCTION

Forest is a large area dominated by trees. It constitutes one of the principal renewable natural resources of mankind. They are essential in maintaining environmental stability, provision of raw materials for wood based industries and provision of food for livelihood and employment for millions of people particularly in the rural areas (FAO, 2005).

According to Ajake and Enang (2012), over two billion people rely on forest and its resources including timbers today. All these activities directly or indirectly involve forest. Some are easy to figure out, fruits, paper and wood from trees and so on. Absorbing harmful greenhouse gases that produce climate change is another major importance of a forest as the case may be. Timber is a type of wood which has been processed into beams and planks. Basically, timber is a wood of growing trees. Any wood capable of yielding a minimum dimensional size can be termed as a timber. It is a stage in the

process of wood production. Timbers are used for structural purposes.

A forest reserve also known as natural reserve, Bio reserve, is a protected area of importance for flora, fauna or features of geological or other special interests, which is reserved and managed for conservation and to provide special opportunities for study or research.

It is very important to stress that forest provides some economic benefits, while economic benefits are usually measured in monetary terms and may include: income from employment in the sector; the value of the production of goods and services from forests; and the contribution of the sector to the national economy, energy supplies and international trade. In addition, the economic viability or sustainability of the sector can be assessed by measures such as the profitability of forest enterprises or the level of investment. The social functions of forests are often more difficult to measure and can vary considerably among countries, depending on their level of development and traditions. For example, in developed, post-industrial societies, the benefits of forests for recreation and amenity values or the maintenance of a rural way of life may be most important, while in developing countries, the area of forests available for subsistence activities or the number of people employed in the sector may be a better indication of their social value. Given the difficulties of measuring the social benefits of forests, social functions are often measured in terms of inputs rather than outputs (FAO, 2005).

Timber industry is slowly growing in Nigeria and in Africa. Forests and trees play an important role in the economic, environmental and social landscape of the continent. Forestry is often a key economic driver in rural areas across Africa. This can be seen through the establishment of new plantations and the resultant secondary processing and value addition industries arising from increased timber resources. Furthermore, timber provides foreign exchange as well as a considerable amount of employment. For countries with few other natural resources and low manufacturing capabilities, timber exports have become essential to their development strategies.

Therefore this paper identified various timber species harvested, determined the impacts of timber production on the livelihood of the forest dwellers as well as investigated various challenges confronting timber production in Ago'Owu Forest Reserve and its environs with a view to suggesting mitigations.

MATERIALS AND METHODS

Study area

The study was carried out in Ago'Owu Forest Reserve in Ayedaade Local Government Area of Osun State which is one of the thirty (30) Local Government Areas in Osun State. It is located between latitude $7^{O}9^{'}37.8144^{''}$N – $7^{O}14^{'}0.8376^{''}$N and longitude $4^{O}4^{'}22.728^{''}$ E – $4^{O}10^{'}6.3264^{''}$E. Ago'Owu Forest Reserve is a thick Forest zone and it consists of 32,116 hectares in the high forest area. It comprises several villages namely: Mokore, Ajegunle, Alabameta, Elewe, Alaguntan, Okodowo among others. (Figure 1 and 2).

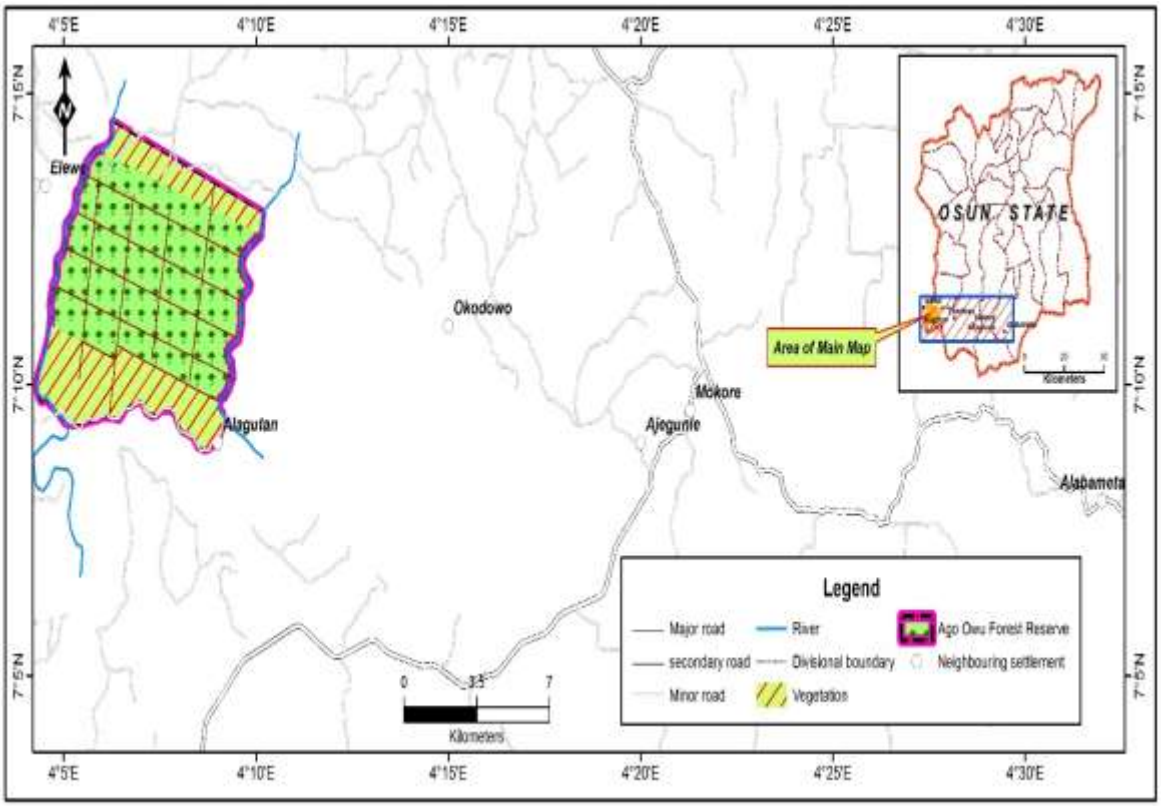

Figure 1: Map of Ago'Owu Forest Reserve Showing its Adjoining Communities

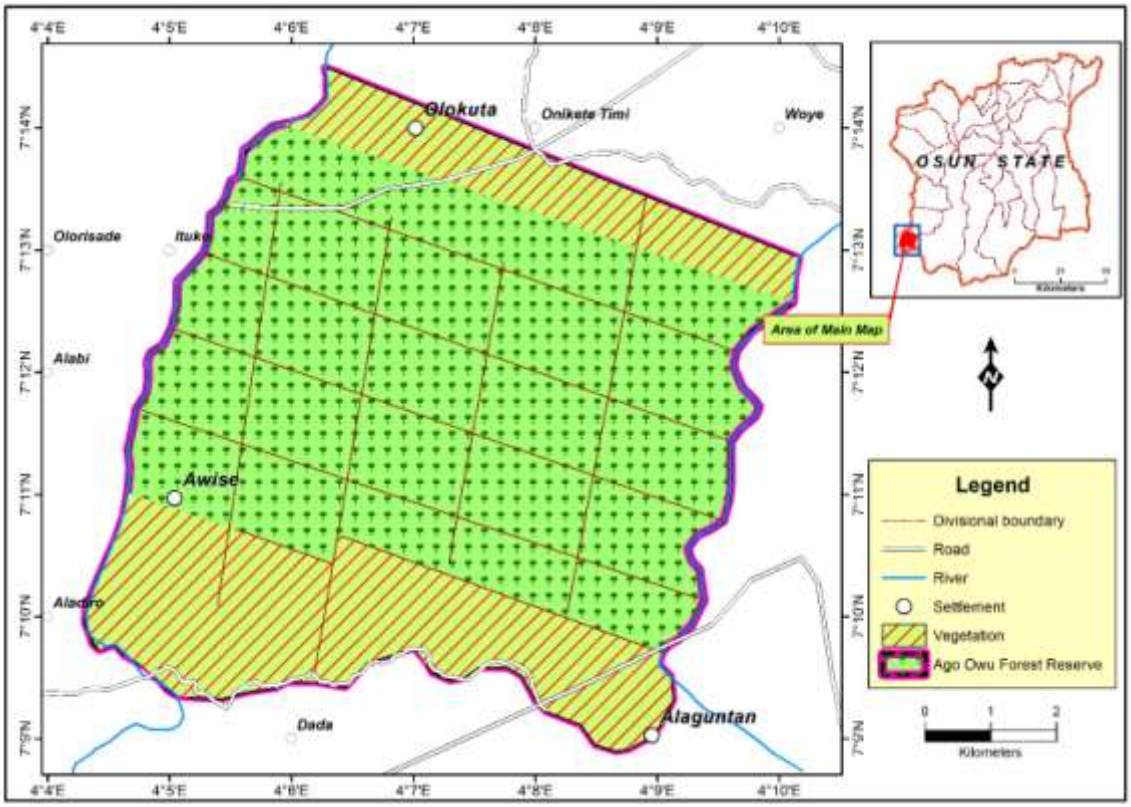

Figure 2: Map of Ago'Owu Forest Reserve in Local Government Area of Osun State, Nigeria

Sampling Techniques

Five villages (Mokore, Ajegunle, Alabameta, Alaguntan and Okodowo) were identified in the Forest area within 1-3km radius. Purposive sampling was used to select three villages among them based on their observed involvement in the subject matter (Timber harvesting activities). The sampled villages were Okodowo, Ajegunle and Mokore. A document indicating the population of the area for 2006 was obtained from the National Population Commission of Osun State and from this document a projection of the 2019 population sizes of the sampled villages were computed using the formula below:

$P_n = P_o e^{rt}$-------- (i)

Where: Pn = final population

P_o= initial population i.e 2006

e = exponential

r = growth rate (average of 3.5%)

t = Time interval (x -2006) yr(s)

Thus, Okodowo had a population of 1000, Ajegunle 200, and Mokore 800 respectively. Furthermore, sampling intensity adopted by Diaw *et al*., (2002) was used to select respondents for the study. Diaw *et al*., indicated that in a community where their population is below 500, between 500 and 1000 and above 1000, 10%, 5% and 2.5% sampling intensities respectively could serve as the representative samples for such populations. In view of the above, 40 copies of questionnaire were administered in Mokore, 40 in Ajegunle and 20 in Okodowo, respectively. Therefore, a total of 100 respondents were randomly selected for the study. In the same vein, a total of 100 copies of structured questionnaire were administered and all were retrieved (100%).

Data Analysis

Data were analyzed using descriptive and inferential statistics (Logit regression analysis and Chi- square test).

Logistic regression

The binary logistic models are useful in a situation whereby the dependent or response variable is binary in nature. This implies that they can have only two possible values. The models therefore describe the relationship between one or more continuous independent variable (s) to the binary dependent variable.

The two common binary models are the logit and probit. The logistic model is particularly preferred because of the unique information it provides. Distinct information provided by logit is the odds ratio. It is defined as the ratio of the odds of an event occurring in the group to the odds ratio of it occurring in another goup (Deeks, 1996; Davies, 1998). The logistic model of a response p between 0 and 1 is given as:

Logit (p) = log (p/1-p) = log (p) - log (1-p) ----- (ii)

The simplest form of logistic model is expressed as:

Logit (pi) = $a + bx_1 + -- + bx_{10}$ ----- (iii)

Where:

P_i = Probability of challenges facing timber harvesting in Ayedaade local government area. (Dependent variable).

X_i = Vector of predictor or independent variables a and b = regression parameters.

The independent variables are:

X_1 = dummy variable indicating whether Illegal Felling of Timber Products (IFTP) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_2 = dummy variable indicating whether Tariff to Government (TG) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_3 = dummy variable indicating whether Transportation of Products (TP) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_4 = dummy variable indicating whether Seasonal Fluctuation in Demand for Timber Products (SFDTP) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_5 = dummy variable indicating whether Availability of Desired Timber Species (ADTS) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_6 = dummy variable indicating whether Fluctuation in Market Price for Timber (FMPT) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_7 = dummy variable indicating whether Capital intensive (CI) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_8 = dummy variable indicating whether Inadequate Processing Facilities (ADF) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_9= dummy variable indicating whether Forest Laws (FL) are responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

X_{10} = dummy variable indicating whether Road Network (RN) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.

Chi-square Test Formula
This can be expressed as,

$$x^2 = \sum_{1=1}^{n} \left(\frac{(x_i - M_i)^2}{M_i} \right)$$

Where n = number of observations
X_i = observed frequency/count
M_i = expected frequency/count

RESULTS
Table 1 revealed the socio-economic characteristics of the respondents in Ago 'Owu Forest Reserve. The sex distribution of respondents in the study area showed that majority were male (87.1%) while the female respondents had a lower percentage of 12.9% and married (53.4%).The average age of the respondents was 36.7±8.9 years.

In terms of educational status of the respondents, majority of them had secondary (37.6%) and primary education (30.7%). Information on the respondents' occupation revealed that majority of them were saw millers (34.7%) and Timber contractors (34.7%). Also, it was revealed that indigenes were more in number and recorded the highest percentage of 62.4% while non-indigenes were few (37.6%). Also, almost all the respondents have stayed beyond 5 years in the Forest Reserve.

Timber Forest Products Harvested in Ago 'Owu Forest Reserve
Table 2 showed the timber forest products obtainable in the study area with interest in authentication of its availability and frequency of harvesting. Most of the respondents (65.3%) attested to the fact that they were engaged in collection of timber products in the area, predominantly both on monthly (57.8%) and weekly basis (28.0%). The dominant timber species being collected from the area were Tectona grandis (34.8%) and Gmelina arborea (41.9%). **Socio-**

Economic Impacts of Timber Harvesting in Ago 'Owu Forest Reserve
Table 3 revealed the socio-economic impacts of timber harvesting in the study area. The study showed that timber harvesting has positively affected the livelihood of the respondents in terms of income generation (22.8%), rural development (20.8%), improved standard of living (19.8%), poverty alleviation (19.8%) and job opportunity (15.8%). Moreover, majority (87.1%) of the respondents confirmed that they are more concerned about future availability of timber products. **Uses of**

Collected Timber Products
Most of the respondents (45.6%) collect products for both local consumption and income generation (Figure 3).

Distribution of Respondents Engaging in NTFPs' Collection
Figure 4 showed that minority of the respondents (36%) relied on the Forest Reserve for NTFPs' collection.

Tab1e 1: Socio-Economic Characteristics of the respondents in Adjoining Communities of Ago 'Owu Forest Reserve

Demographic Characteristics	Frequency	Percentage (%)
Age		
21-30	26	25.7
31-40	42	42.6
41-50	28	27.7
51-60	2	2.0
61-70	2	2.0
Total	**100**	**100.0**
Gender		
Male	87	87.1
Female	13	12.9
Total	**100**	**100.0**
Marital Status		
Single	31	30.7
Married	54	53.4
Divorced	14	13.9
Widowed	1	1.0
Total	**100**	**100.0**
Educational Status		
No formal education	12	11.9
Primary	30	30.7
Secondary	38	37.6
Tertiary	20	19.0
Total	**100**	**100.0**
Occupation		
Farmers	12	11.9
Saw millers	35	34.7
Loggers	14	14.9
Timber contractors	35	34.7
Others	4	4.0
Total	**100**	**100.0**
Nativity		
Indigene	63	62.4
Non-indigene	37	37.6
Total	**100**	**100.0**
Work experience		
1-5	14	13.9
6-10	33	33.7
11-15	25	24.7
Above 16	28	27.7
Total	**100**	**100.0**
Years of residency		
5-10	20	19.8
11-15	20	19.8
16-20	29	29.7
Above 20	31	30.7
Total	**100**	**100.0**

Table 2: Timber Forest Products Collected by Adjoining Communities from Ago 'Owu Forest Reserve

Timber Products	Frequency	Percentage (%)
Do you collect timber forest products?		
Yes	66	65.3
No	34	34.7
Total	100	100.0
If yes, kindly specify timber products collected.		
Teak (*Tectona grandis*)	35	34.8
Gmelina (*Gmelina arborea*)	42	41.9
Obeche (*Triplochiton scleroxylon*)	9	9.0
Others	14	14.0
Total	100	100.0
How often do you collect timber products?		
Daily	4	3.9
Weekly	28	28.0
Monthly	58	57.8
Annually	10	9.4
Total	100	100.0

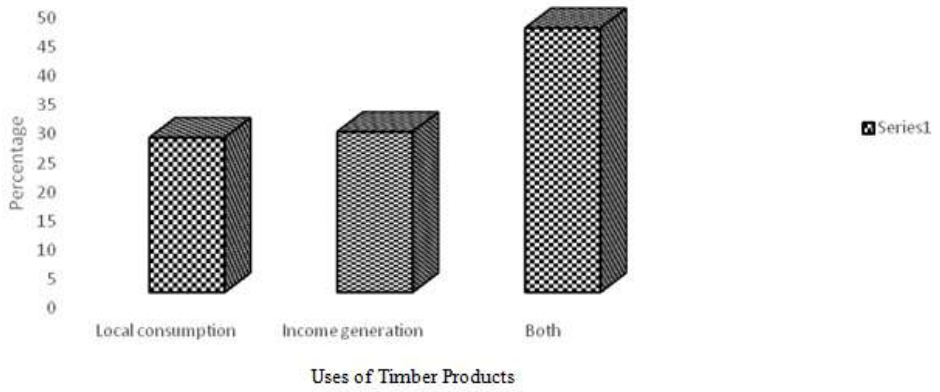

Figure 3: Uses of Collected Timber Products by Adjoining Communities of Ago 'Owu Forest Reserve

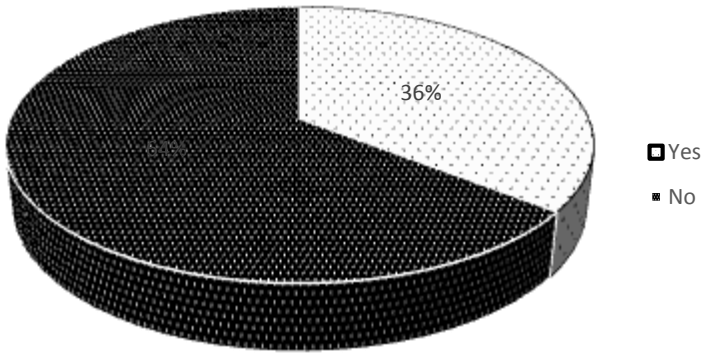

Figure 4: Distribution of respondents who are engaged in NTFPs collection.

Table 3: Socio-Economic Impacts of Timber Harvesting in Ago 'Owu Forest Reserve

Questions and Responses	Frequency	Percentage (%)
Has timber harvesting activities affected your lives?		
Yes	85	84.2
No	15	14.9
Total	**100**	**100.0**
If yes, in what way?		
Rural development	21	20.8
Job opportunity	15	15.8
Income generation	23	22.8
Improved standard of living	20	19.8
Alleviate poverty	20	19.8
Reduction in rural-urban migration	1	1.0
Total	**100**	**100.0**
Are you concerned about future availability of timber products?		
Yes	88	87.1
No	12	11.9
Total	**100**	**100.0**
If yes, what are the measures you think can be put in place for sustainable harvesting?		
Afforestation	22	22.0
Reforestation	16	I6.0
Barn against illegal logging	41	41.0
Community participation	17	17.0
Others	4	4.0
Total	**100**	**100.0**

Relationship between Socio-Economic Characteristics and the Impacts of Timber Harvesting on Rural Livelihood on Adjoining Communities of Ago 'Owu Forest Reserve

Table 4 showed the relationship between socio-economic characteristics and the impact of timber harvesting in the study area. It was clearly revealed that there was significant association between nativity ($\chi2 = 6.75$, df = 1, p =0.08), occupation ($\chi2 = 21.21$, df = 4, p =0.00), work experience ($\chi2 = 16.84$, df =3, p = 0.02) and impact on timber harvesting in the study area. While gender ($\chi2 = 0.002$, df = 1, p =0.97), age ($\chi2 = 4.68$, df = 3, p =0.18), marital status ($\chi2 = 0.739$, df = 1, p = 0.83), Education ($\chi2 = 1.57$, df = 3 p = 0.81), years of residency ($\chi2 = 4.07$ df = 3 p = 0.02) is not significant to timber trade in the study area. This is also a clear indication that these socio-economic characteristics had a huge influence on timber harvesting trade in the study area.

Table 4 Socio-Economic Characteristics versus Impacts of Timber Harvesting on Rural Livelihood on Adjoining Communities of Ago 'Owu Forest Reserve.

Socio-economic characteristics	Chi- square	df	p- value
Gender	0.002	1	0.97
Age	4.86	3	0.18
Marital status	0.739	3	0.83
Nativity	6.75	1	0.08*
Education	1.57	3	0.81
Occupation	21.21	4	0.00*
Year of residency	4.07	3	0.40
Work experience	16.84	3	0.02*

**significant at p<0.05*

Challenges of Timber Harvesting Faced by Adjoining Communities of Ago' Owu Forest Reserve

However, poor Road Network (RN) had the highest odds-ratio of 1206.04 followed by high Tariff to Government (TG), Transportation of Products (TP), Capital Intensive (CI) with odds-ratio of 81.33, 26.66, and 23.37 respectively. Therefore, the challenges identified to be facing adequate timber harvesting in Ago 'Owu Forest Reserve are poor Road Network (RN), high Tariff to Government purse (TG), Transportation of Products (TP) and Capital Intensive (CI) of the harvesting process.

Table 5 Logistic Binary Nature for the Challenges Facing Timber Harvesting in Ago'Owu Forest Reserve and its Environs

Independent variables	Co-efficient	Odds-ratio
Whether the presence of (IFTP) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	0.14	1.15 ns
Whether the presence of (TG) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	2.20	81.33*
Whether the presence of (TP) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	3.28	26.66*
Whether the presence of (SFDTP) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	-0.09	0.91 ns
Whether the presence of (ADTS) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	-1.19	0.30 ns
Whether the presence of (FMPT) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve	1.57	4.81*
Whether the presence of (CI) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	3.15	23.37*
Whether the presence of (ADF) is responsible for inadequate timber harvesting in Ago 'Owu.	-1.00	0.37 ns
Whether the presence of (FL) is responsible for inadequate timber harvesting in Ago 'Owu Forest Reserve.	-4.61	0.01ns
Whether the presence of (PRN) is responsible for inadequate timber harvesting in Ago Owu Forest Reserve.	4.7	12056.04*
Model χ^2(df,10) = 14.88, Final loss = 12.36 ; p<0.05		

** = significant at p <0.05; ns = Not significant*

Dependent variable (CTP): Challenges Facing Timber harvesting in Ago 'Owu Forest Reserve (Yes = 1, No= 0)

DISCUSSION

It could be inferred from the results obtained on sex distribution of the respondents that more males than females were involved in timber harvesting in Ago 'Owu Forest Reserve. This may be traced to the fact that males are traditionally major bread winners of the family. This agrees with the findings of BMGF (2008) which stated that men are placed much higher status than women, which has access to resource rights and duties. In terms of age distribution of the respondents, it could be inferred that the respondents were young and energetic; hence this must have enabled them to actively participate in various timber forest activities, such as harvesting, hauling, processing, and sale of timber forest products to compliment output activities. Information on educational status of the respondents clearly indicated that most of the respondents did not see reason for having high level of education (Tertiary) since it is not necessarily needed by them as a major source of generating income in the rural area. Occupational data revealed active participation of the respondents in timber trade and harvesting.

The results gotten on nativity of the respondents imply that the indigenes dominated timber

harvesting in the study area. This might be due to their easy access to land and other forest resources. This is in tandem with the findings of Adejumo (2017) who reported that most of the forest dwellers in Southwest Nigeria originated from that particular locality. The study also revealed that most of the timber merchants in the study area have been in the trade for over 5 years, in other words they are highly experienced in the trade. As the case may be, it could also be inferred from the study that none of the respondents has stayed in the environment for less than a year.

The results obtained on timber forest products harvested in Ago 'Owu Forest Reserve agrees with the report of Adekunle and Adekayode (2011) which reported that prominent exotic species that have been established in Nigerian rainforest ecosystem include *Tectona grandis*, *Gmelina arborea*, *Eucalyptus spp*, *Ciderella odorata* and *Pinus spp*. While the indigenous ones include *Nauclea diderichii*, *Triplochiton scleroxylon*, *Terminalia ivorensis* and *Terminalia superba*. High level of disappearance of indigenous timber species is noticed in Ago 'Owu Forest Reserve as most of the respondents indicated that they collect Teak and Gmelina which are exotic species.

As the results on products' consumption depicted that respondents collect products for both local consumption and income generation, it becomes necessary to mention that it is quite reasonable to convert debarked wood, tree branches to fire wood and other uses after log extraction. Fire wood can be consumed locally as well as serving as revenue generation source. Local bakeries rely on fire wood for the smooth running of the industries. Hence, aside from earning income from the sale and conversion of logs, high revenue can also be generated from the sale of fire wood. In the same vein it is essential in Nigeria that value should be added to timber products so that this country would not be like Liberia. Lomax (2008) reported that the timber industry in Liberia is still based overwhelmingly on the export of logs. He added that the country has found itself in this unfortunate position because it lacks the capacity to add value to its products which invariably deprives it of value-added benefits.

Since it is evident from the results obtained on reliability of the respondents on Ago 'Owu Forest Reserve for NTFPs that minority of them rely on it for its collection, it is very likely to trace this to the fact that the respondents concentrated better on collection of timber products than the non-timber forest products believing that quick cash can be made from it. Nevertheless, the managers of the reserve still have to be conscious of the fact that the extraction of these products should be regulated because if not, it could cause a lot of damages in the forest estate and even in the entire ecosystem at large. Reference can be made to the report of IITO (2002) which stated that in many countries the management of NTFPs is ad hoc, and little is known about its sustainability.

This study upholds the positive impacts of timber harvesting on the livelihood of the dwellers in Ago 'Owu Forest Reserve, therefore this agrees with the finding of Adejumo (2016) which observed that forest dwellers in reserve areas depend on forest products and encourages afforestation so as to sustain produce. Also, imposition of logging barn against illegal logging and afforestation were mentioned as the measures in which sustainable production can be attained.

In considering the results obtained on logit regression, there was sufficient evidence that the estimated coefficients for the factors were not zero. This implies that the regression parameters in the model were statistically significant. In other words, the higher the value of odd-ratios, the more likelihood these factors (challenges) affect adequate timber harvesting in Ago'Owu forest reserve and its environs. Hence, it clearly indicated the variable (s) i.e factors that mostly influence adequate timber harvesting in Ago'Owu and its environs. The implication was corroborated by Deeks (1996); Bland and Altman (2000) that the logistic model provides information on the consequences of one variable on the other. Therefore, the reoccurrence of these factors poses serious challenges to achieving adequate timber harvesting in Ago 'Owu.

CONCLUSION

The timber species in Ago 'Owu Forest Resrve*Gmelina arborea* and *Tectona grandis*, while few indigenous species like *Triplochiton scleroxylon* (Obeche) and others were found to be available in small proportion. Nevertheless, Timber harvesting and trade in Ago Owu Forest Reserve were found to have highly impacted the livelihood of the forest dwellers such that their income propensity is improved, standard of living is also improved, poverty alleviated and there was job creation. The study also revealed the challenges facing timber harvesting in the area to be poor road network, high tariff placed by the government on timber products, transportation of products and capital intensive of the harvesting processes.

Recommendations

Therefore, it is necessary for the government to encourage establishment of more forest plantations of both the exotic and indigenous timber species in Ago 'Owu, Ayedaade Local Government Area of Osun State so as to meet the economic demand of timber products. It is also important for the government to create awareness on how forest products could be managed sustainably to the benefits of the dwellers and economy at large. Furthermore, government should also implement strategies by which various identified challenges such as high cost of tariff, inadequate processing facilities, poor road network and other transportation problems faced timber contractors and loggers can be reduced in Ago 'Owu Forest Reserve.

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