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The impact of socioeconomic variables of fringe forest dwellers on forest resources conservation on Egbema Forest Reserve in Imo State, Nigeria

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Abstract

The study examined impact of socio-economic activities of forest dwellers on forest resource conservation in Egbema Forest Reserve, Imo State. Purposive and multistage sampling techniques were employed to obtain information from a total of 150 respondents from randomly selected villages bordering the forest reserve for the study. Data on respondents' socio-economic activities, effect of socioeconomic activities on forest conservation, forest conservation conflict and determinants of access to forest resources were obtained through structured questionnaire and interview schedule. Descriptive (Tables, frequency, likert scale) and inferential statistics (Binary logistic regression) was used to analyze data. The result shows that respondents were between 30-39 years, mostly male (57.3%), have tertiary education 44.7% and are married 54.0%. Respondents' socio-economic activities were farming (29.3%), Livestock production (8.7%), NTFPs collection (8.7%), Fuel-wood harvesting (6.7%) and logging (5.33%). Logging (1.54±0.06) had negative effect while livestock production (2.46±0.07) had positive effect on forest resources conservation using a 4- point likert scale. Serious conflict existed with theft as the lowest mean value of 2.78±0.06 and encroachment the highest (3.12±0.06). Binary logistic regression shows that location, occupation and access to NTFPs are the factors that influence respondent's access to the forest. Employment and sensitization of forest dwellers in management and on sustainable forest use is recommended by this study for effective conservation of the forest.

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Introduction

Forest is an abode to numerous flora and fauna species, which constitute biodiversity through a web of life (Vie, Hilton-Taylor and Stuart, 2009). It supports various life forms including human who dwell in settlements in and around. Human actions and the economy are linked to forests. Generally, forests impact ethics of fiscal advancement, support livelihoods, help structuring fiscal dynamism and promote continuous growth (FAO, 2010). The survival of people who dwell within forest zone hinged on the forest (Aiyeloja, Oladele and Ezeugo, 2012; Garekae, Thakadu and Lepetu, 2017). These include food, medicine, fuel wood, shelter, clothing, timber, construction materials, etc. Furthermore, the forest when managed sustainably can boost the monetary value of a region (Córdova, Wunder, Smith-Hall and Börner, 2013). Forests supply continuously elevated level of profitable benefits to stakeholders, who were the focus of initial impetus for protective statutes and policies. Forests supply other means of earnings and survival benefits which provide unofficial work privileges and houses economic values that assist in amend distress to household earnings especially in rural area (Sayer and Maginnis, 2005). Poor people have thus been able to exploit the forest for food, fuel and other marketable products which create both income and employment for the rural dwellers (Camacho, Gevana, Carandang and Camacho, 2015).

However, forests are under severe pressure leading to degradation and depletion globally (Adetula 2001; Chukwuone, Adeosun and Chukwuone, 2020). Effects of socio-economic activities on forest resources are pervasive and increasing. Effects of these activities are manifested at all ecological scales, from short-term/long-term which resulted to extirpations and exterminations of forest resources (Chukwuone et al., 2020). Socio-economic activities (hunting, grazing, logging, fire wood, bush burning, mining and others) account for loss of forest resources and forest degradation (Ohwo and Nzekwe-Ebonwu, 2021). Forests are retreating at 5.0 percent per decade as they are felled and opened to provide wood and agricultural products, cattle and bio-fuels to local, regional, national and global markets (Anon., 2010).

These actions have fast-tracked forest exploitation process to meet human need and resulted to reduction of forest biodiversity (Oldekop et al., 2020). Depletion of forest resources poses danger of soil erosion, biodiversity loss; floods, global warming and locally it could cause loss of income (Bryan, Shearman, Ash and Kirkpatrick, 2010).

The effort to convert forest has been an endless topic in earths' transformation in many societies (FAO, 2010). The transformation of forested lands by human socio-economic actions represents a great force in global environmental change and a great driver of biodiversity loss. According to Ouedraogo, Nacoulma, Hahn and Thiombiano (2014), the rate of forest resources destruction by encroachers is alarming; young and premature economic trees and other biodiversity are being destroyed on daily basis. FAO (2010) stated that up to 50.0% of forests have been lost in Nigeria during the last five decades, judging from both FAO and land-use and vegetation (LUV) data. Chukwuone et al. (2020) observed bulk loss of Nigeria forest yearly through socio-economic activities, industrial, commercial and other related activities. These losses in forest cover are majorly from population expansion and food security. If the rate is not curtailed, this will definitely lead to total destruction of forest in the state within a short period of time (FAO, 2010).

Imo State situated in Eastern part of Nigeria consists of numerous rural communities. The basic occupation of these communities is farming. However, the state is faced with environmental problems of soil erosion associated with extensive vegetation clearance (Umahi, 2011). Arising from the consequence of these practices, the need to provide in-depth information on effect of socio-economic activities on forest resources is timely. The lack of knowledge could be the reason why over exploitation of forest resource is widely observed in the state. Information generated by this study will educate farmers on the effect of socio-economic activities on forest resources and aid the government in decision/policy making toward formulating efficient forest management laws in the state.

This study examined the effect of socio-economic activities on forest resources in Imo State. Specifically, the study identified the socio-economic activities practiced, determined the effect of socio-economic activities on forest resources, identified the forest conservation conflicts arising from these socio-economic activities and examined the determinants of access to forest in Imo State, Nigeria.

Material and methods
The study was carried out in Egbema Forest Reserve in Ohaji/Egbema Local Government Area (LGA) of Imo State. Ohaji/Egbema LGA has sixteen (16) autonomous communities namely; Egbema, Umuagwo, Oloshi, Umunkwaku, Obile, Obitti, Mgbirichi, Opuoma,Assa, Awarra, Ikwerede, Umuokanne, Obiakpu, Ohaba, Obosima, Mmahu. It lies in latitude 5°29′N and 7 °2′E of the equator with an elevation of 45m above sea level. It has an area of 958.01 km² and an estimated population of 800, 904 (NBS, 2006). Socio-economic activities of farming, fishing, palm oil processing, hunting, and animal husbandry are the mainstay of the people. The vegetation is rainforest with dense and closer canopy with few plants mostly *Chromonela odorata, Tectona grandis* seedlings, *Nauclea diderichii, Gmelina arborea* etc. Other plants include *Aspila Africana* and dispersed stands of *Casuarina spp.*

A three-stage sampling procedure was employed for the study. Egbema autonomous community was purposively chosen from among the sixteen autonomous communities in Ohaji/Egbema LGA because it hosts the forest reserve (1st stage). Stage two was the selection of five villages randomly from the ten villages that make up the selected community. Thirty forest households were randomly selected from each selected villages as the 3rd stage. A total sample of 150 households was surveyed for the study.

Data collection
Data was collected from primary and secondary sources. Primary data was obtained from farmers' in the study area through a structured questionnaire and complemented with interview schedule for farmers'

who are not literate enough. Secondary data was collected from annual reports of the Imo State Ministry of Agriculture, textbooks, journals, internet and previous studies of other researchers who worked on related topics. Information on various agricultural activities carried out, forms of crisis, awareness and willingness to adopt agro-forestry practice was assessed for the study.

Data analysis
Socio-economic actions practiced were realized using descriptive statistics. The effect of socio-economic activities on forest resources and conservation conflict was analyzed on a four type likert scale (very negative=1, negative=2, positive=3, very positive=4) and (1 = strongly disagree, 2 = Disagree, 3 = strongly agree, 4 = Agree), respectively. The median score was used to rank effect of socio-economic activities on forest resources conservation.

The cut-off point was calculated by the mean of the normal values assigned to the options on the scale in (1):

$$\dot{X} = \frac{1+2+3+4}{4} = \frac{10}{4} = 2.5 \text{ ....} (1)$$

To ascertain whether a conflict is serious or not, the mean score was matched with the cut-off value of 2.5. When the mean score is greater than the cut-off value the constraint is classified as serious, if otherwise, not serious.

Binary logistic regression examined determinants of access to forest and tested the formulated hypothesis below;

H_o = Forest dwellers socio-economic activities does not significantly relate with access to forest in Ohaji/Egbema LGA, Imo State

The logistics probability model is specified in (2);

$$P_i = F(Z_i) = F(\alpha + \sum_{i=1}^{n} \beta_i X_i) = \frac{1}{1+e^{-z_i}} \text{ ....} (2)$$

Where
P_i = is the probability that an individual accesses the forest given X_i.

Access to forest is = F (socio-economic characters and access to socio-economic activities)

Access to forest = F(age, sex, educational level, household, size, occupation, religion, access to logging, access to fuel wood, access to NTFP collection, access to forest recreation)

X_i = i^{th} explanatory variables
e = base of natural logarithms which is approximately equal to 2.718;
α and β_i = parameters to be estimated.

Central to usage of logistic regression is the logit transformation of P given by Z that is, to get linearity, we take the natural logarithms of odd equation (2), which results in (3)

$$Z_i = \ln\left(\frac{P_i}{1-P_i}\right) = \propto + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \quad \ldots\ldots (3)$$

Where
Z_i = indicator of individual access to forest or not
P = probability of the event's occurrence
X_i = vector of household socio-economic characteristics and socio-economic activities (access to logging, access to fuel wood, access to NTFP collection, access to forest recreation)
β_0 = constant
β_i = corresponding vectors of regression and
Ɛ = distribution term

Expansion of (3) gives (4) below;
$Z(1/0) = \beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 + \beta_{10} + \beta_{11} + \varepsilon \ldots\ldots (4)$

Where
Z = Access to forest (access to forest = 1 and no access = 0)
β_0 = Disturbance term
β_1 = Age
β_2 = Sex
β_3 = Education
β_4 = Household size
β_5 = Occupation
β_6 = Religion
β_7 = Access to logging

β_8 = Access to fuel-wood collection
β_9 = Access to NTFP collection
β_{10} = Access to forest recreation
β_{11} = off forest income

Result and discussion
The respondents were majorly between the ages 30-39 (Table 1). This implies that younger people with vigour are more involved socio-economically in the area. This finding is similar to Ohwo and Nzekwe-Ebonwu (2021) who reported that respondents were relatively middle age. A youthful and vigorous population might have serious impacts on forest resources. Positively, they can support sustainable management of forests through protection of resources from theft and unlawful harvesting.

Their undesirable impact on sustainable management is through youths' engagement in over exploitation of forest to earn a living (Garekae *et al.*, 2017). The respondents were mostly male (57.3%) and it indicates a low involvement of women in socio-economic actions as reported by Faleyimu and Akinyemi, (2014). Most respondents were married (54.0%) who engaged in socio-economic activities to sustain their families (Ohwo, 2016).

About 44.7% had tertiary education and is of great importance in sustaining the forest as information needed for sustainable forest management can be access easily as reported by Faleyimu and Akinyemi, (2014) that majority of the respondents (50.6%) had tertiary education. About 59.3% of respondent have a household size of 6-10 persons.

This stimulates various engagements in socio-economic activities for household upkeep (Ohwo and Nzekwe-Ebonwu, 2021). Most (34.0% and 18.0%) of the respondents were farmers and traders respectively because of the agrarian nature of the community (Ohwo and Nzekwe-Ebonwu, 2021).

Socio-economic actions of respondents include Farming (29.3%), NTFPs collection (8.7%), Deforestation (conversion of forest land to other uses)

(8.7%), Livestock production (8.7%), Fuel-wood harvesting (6.7%), Farming and NTFPs collection (6.0%), logging (5.3%), Grazing (4.7%), Fishing (4.0%), Hunting (3.3%), Logging and farming (2.7%), Farming and hunting (2.7%), Logging, farming and fuel-wood harvesting (2.7%), Livestock production and trading (2.0%), Logging, farming and trading (2.0%), Farming, livestock production, fuel-wood harvesting, fishing and hunting (2.0%), Farming, livestock production, fuel-wood harvesting and fishing (2.0%), Trading of forest products (1.3%), NTFPs collection and trading (1.3%) and Farming, livestock production and hunting (1.3%), Table 2.

Table 1. Socio-economic characteristics.

Variables	Frequency	Percentage (%)	Mean (Mode)
Age			
20-29	34	22.7	39.0
30-39	43	28.7	
40-49	39	26.0	
50-59	21	14.0	
60-69	11	7.3	
70-79	2	1.3	
Total	150	100.0	
Gender			
Male	86	57.3	Male
Female	64	42.7	
Total	150	100.0	
Marital Status			
Single	55	36.7	Married
Married	81	54.0	
Widow	11	7.3	
Separated	3	2.0	
Total	150	100.0	
Religion			
Christianity	117	78.0	Christianity
Islam	4	2.7	
Traditional	29	19.3	
Total	150	100.0	
Level of Education			
No formal education	12	8.0	Secondary
Primary	21	14.0	
Secondary	50	33.3	
Tertiary	67	44.7	
Total	150	100.0	
Household Size			
1-5	53	35.3	6.00
6-10	89	59.3	
11-15	8	5.3	
Total	150	100.0	
Occupation			
Logging	8	5.3	Farming
Farming	51	34.0	
Trading	27	18.0	
Civil servants	39	26.0	
Business/marketing	15	10.0	
Building contractor	10	6.7	
Total	150	100.0	

Source: Field Survey, 2018

Table 2. Socio-economic activities of respondents.

SN	Socio-economic Activities	Frequency	Percentage (%)
1	Farming	44	29.3
2	Deforestation(conversion of forest-land to other uses)	13	8.7
3	Livestock production	13	8.7
4	Fuel-wood harvesting	10	6.7
5	Farming and NTFPs collection	9	6.0
6	Logging	8	5.3
7	Grazing	7	4.7
8	Fishing	6	4.0
9	NTFPs collection	5	3.3
10	Hunting	5	3.3
11	Logging and farming	4	2.7
12	Farming and hunting	4	2.7
13	Logging, farming and fuel-wood harvesting	4	2.7
14	Livestock production and trading	3	2.0
15	Logging, farming and trading	3	2.0
16	Farming, livestock production, fuel-wood harvesting, fishing and hunting	3	2.0
17	Farming, livestock production, fuel-wood harvesting and fishing	3	2.0
18	NTFPs collection and trading	2	1.3
19	Trading of forest products	2	1.3
20	Farming, livestock production and hunting	2	1.3
	Total	150	100.0

Source: Field Survey, 2018

This finding affirms Aiyeloja *et al.* (2012), Ouedraogo *et al.* (2014), and Yaro, Okon, Bisong, and Ukpali (2016) who identified socio-economic activities of farming, hunting, NTFP harvesting as sources of livelihood for communities. Ullah, Noor, Abid, Mendako, Waqas, Shah and Tian (2021) reported that 82.0% of respondents in forested environment were involved in agricultural activities.

The result of the effect of socio-economic activities on forest resource conservation (Table 3) shows that logging has the highest negative effect on forest resource conservation with a mean of 1.54±0.06 and median of 1.00. Uncontrolled logging and over exploitation of timber resources leads to forest degradation thereby affecting forest resource conversation in a protected area.

Grazing had a negative effect on forest resource conservation with mean of 1.69±0.06 and median of 2. Grazing affects forest resource negatively because of activities of herdsmen who set fire on forest to allow sprout of fresh grasses for their herds. These wild fires destroy fauna, wildlife and other non-timer forest products.

Table 3. Effect of Socio-Economic Activities on Forest Resource Conservation.

Socio-economic activities	Mean	Standard error (S.E)	Median	Mode	Ranking
Logging	1.54	0.06	1.00	1	1
Grazing	1.69	0.06	2.00	2	2
Deforestation	1.75	0.07	2.00	1	3
Hunting	1.75	0.07	2.00	1	4
Fuel-wood Harvesting	1.99	0.06	2.00	2	5
NTFPs collection	2.11	0.06	2.00	2	6
Trading	2.30	0.07	2.00	3	7
Fishing	2.44	0.07	3.00	3	8
Farming	2.45	0.07	2.00	2	9
Livestock production	2.46	0.07	3.00	3	10

N.B.: Very negative=1, negative=2, positive=3, very positive=4

Source: Field Survey, 2018

Deforestation and hunting both had a mean of 1.75±0.07 and median of 2.0, respectively. Deforestation reduces land area available for forest growth and development. During hunting, fire sometime is used. The uncontrolled use of fire lead to its spread and untold destruction is done to plant, microorganism and wildlife. Fuel-wood harvesting had a negative effect on forest resource conservation with mean of 1.99±0.06 and median of 2.0 (Table 3). Over exploitation of forest trees for fuel-wood reduces forest canopy and affects wildlife habitat. NTFPs harvesting also has a negative effect on forest resource conservation with mean value of 2.11±0.06 and median of 2. When there is excessive collection/harvesting of NTFPs such as harvesting of roots and bark of forest trees for medicinal purposes or other uses, this starve forest of necessary characteristics that makes up a forest. Farming also has a negative effect on forest resource conservation with mean equal 2.45±0.07 and median of 2. This will affect forest resources conservation to burning and soil cover loss.

Livestock production and fishing both have positive effect on forest conservation with mean of 2.46±0.07 and median of 3 and 2.4± 0.07 and median of 3 respectively. During grazing, fecal droppings of cattle acts as organic manure to forest soil hence increase forest soil fertility. Furthermore, cattle serve as agent of dispersal thus allows the growth seeds of various herbs thus enriching forest biodiversity. Trading shows both negative and positive effect on forest resource conservation with mean 2.30±0.07 and median of 3 (Table 3). Trading can affect the forest resource conservation when trees are felled, wildlife hunted and NTFPs collected and sold for income generation. However, when conscious efforts are made to replace the harvested forest resources or controlled hunting is done, the effect will not be much on conservation.

The above findings collaborates with Anon (2010), Bryan *et al.* (2010), Kissinger, Herold and de Sy (2012), Oduntan, Soaga, Akinyemi and Ojo (2012), Rahmat, Premono, Ulya, Waluyo, Sumadi, Azwar and Kurniawan, Ullah *et al.* (2021) and Ngwembe, Minja, Tegeje and Mkonda (2022). Anon (2010) found that forests are retreating via logging and clearing to supply wood products and bio-fuels. Bryan *et al.* (2010) found that the depletion of forest resources poses threats such as soil erosion, loss of biodiversity, floods, global warming and locally it could cause a loss of income. Kissinger *et al.* (2012) and Oduntan *et al.* (2012) reported deforestation occurrence from increased economic activities characterized by population growth, accelerated urbanization trends, agricultural practices and other forms of natural resource exploitation.

Rahmat *et al.* (2019) reported that grazing of livestock aids the preservation of forest ecosystem while Ullah *et al.* (2021) and Ohwo and Nzekwe-Ebonwu (2021) listed agriculture, livestock, harvesting of forest products and off farm activities as the socioeconomic engagement of respondents. Ngwembe *et al.* (2022) reported forest cover loss and climate change as challenges affecting forest conservation.

The result of forest conservation conflicts due to socio-economic actions shows respondents strongly agree to conflict from socio-economic activities on forest conservation as the mean was above the cut off (2.5). Theft was the lowest mean value of 2.78±0.06 and median of 3.00. Forest theft violates forest laws and creates conflict at two levels- the government level and community level (community and logger, Government and community and government and logger). Deforestation had a mean of 2.79±0.03. Forest-lands are converted for housing due to urbanization, road constructions, agricultural lands expansion, and causes conflicts between the converter and forester. Sometime, when Government converts forest land to other uses, it causes conflicts between the governments and community.

Unlawful NTFPs harvesting and operating without license had mean value of 2.82±0.06 and 2.89±0.07 respectively. Operating without license creates economic sabotage and causes conflicts between the operator and government. Arson had a mean of 2.89±0.07. Wild fire mostly caused by herdsmen and farmers through bush burning destroys forest and create conflicts between government and community, farmers and community and farmers and other forest users. Bribes and violence, and timber smuggling had mean of 2.93±0.06 and 2.97±0.06 respectively. Poaching had a mean of 3.00±0.06 (Table 4). Poaching, the illegal hunting or capturing of wild animals in the forest reserve leads to decrease in wild animal population. This violates forest laws and causes conflicts between the government and poacher, poacher and the community and the government and community.

Unlawful allocation of forest land with mean of 3.07±0.053 by community leaders to individuals either from the community or foreigners, has led to conflict in such forest communities. Encroachment had a mean 3.12±0.06. Crossing of forest boundaries by individuals without the permission of forest managers is illegal. The above observation corroborates reports of Oldekop *et al.* (2020) that deforestation leads to conflict. Ngwembe *et al.* (2022) observed poaching as source of conflict in forest based community.

Table 4. Forest Conservation Conflicts Arising from Socio-Economic Activities.

Socio-economic activities	Mean	Standard error (S.E)	Median	Mode	Ranking
Theft	2.78	0.06	3.00	3	1
Deforestation	2.79	0.08	3.00	3	2
Unlawful NTFPs harvesting	2.82	0.06	3.00	3	3
Operate without licence	2.87	0.07	3.00	3	4
Arson	2.89	0.07	3.00	3	5
Bribes or violence	2.93	0.06	3.00	3	6
Timber smuggling	2.97	0.06	3.00	3	7
Poaching	3.00	0.06	3.00	3	8
Unlawful allocation of forest land	3.07	0.05	3.00	3	9
Encroachment	3.12	0.06	3.00	3	10

N.B.: Strongly disagree=1, disagree=2, strongly agree=3, agree=4

Source: Field survey, 2018

The Binary logistic regression output shows that the socio-economic factors of respondents influence their access to forest, hence affect conservation (Table 5). Location, occupation and access to NTFPs are the factors that influence respondent's access to forest. Location of forest dwellers and occupation are significant determinant of access to forest at 5.0% while access to NTFPs was significant at 1.0%. The farther away the respondents from forest, the less access they have to forest corroborating (Chukwuone *et al.*, 2020).

Increase in number of employed individual significantly influenced access to forest and conservation (Lepetu and Oladele, 2009). When individuals in forest community are employed to

protect the forest, conservation goals are best achieved. Chukwuone *et al.* (2020) recorded occupation to significantly influenced traditional practices in management and forest conservation.

Table 5. Logistics Regression for Determinants of Access to Forest.

Forest access	β coefficient	S.E	Wald	Degree of Freedom	Level of Significance	Exp (B)
Constant	13.88	69616.29	0.00	1	1.00	1066473.43
Location	6.21	3.17	3.99	5	0.05*	496.04
Age	0.07	0.08	0.83	28	0.36	1.07
Sex	-3.69	2.63		2		0.03
Marital Status	-11.21	24503.17	0.29	4	0.96	1.00
Religion	-1.82	1.75	1.08	3	0.58	6.15
Level of Education	27.09	40193.07	2.60	6	0.76	83304.93
Household Size	-17.69	40193.00	5.25	15	0.97	36.52
Occupation	7.40	3.18	5.43	5	0.02*	1635.34
Access to Logging	-0.93	47073.11	3.43	2	0.06	0.40
Access to NTFPs	-6.97	2.47	7.97	2	0.01**	0.00
Access to recreation	-2.72	2.25	1.47	2	0.23	0.07
Access to hunting	-4.52	2.52	3.22	10	0.07	0.01
Income	0.00	0.00	2.05	5	0.15	1.00
Distance to Forest (km)	-0.03	0.25	0.02	16	0.89	0.91

Source: Field survey 2018

*Significant at 5.0%, ** Significant at 1.0%

Conclusion and recommendations

Socio economic activities of forest dwellers negatively impact on forest resources conservation. Forest plays a major role in daily living of forest dwellers. Farming, hunting, logging, NTFPs collection and various traditional practices are done in forest. Conservation, the outright preservation of forest from man's activities impinges on the above socio-economic activities of rural dwellers. Consequently, conflict in form of theft, arson, forceful conversion of forest land to other uses and timber smuggling were evident. However, location, occupation and access to NTFPs influences respondents access to the forest, hence conservation. Employment and sensitization of forest dwellers in management and on sustainable use of forest is recommended by this study for effective forest conservation.

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