MANGROVE FOREST CONSERVATION FOR SUSTAINABLE DEVELOPMENT IN ISOKO SOUTH LOCAL GOVERNMENT AREA, DELTA STATE, NIGERIA

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Abstract
This paper report findings from a study carried out to obtain information on conservation of the forest and the environmental hazards in Isoko South Local Government Area of Delta State, Nigeria. Structured questionnaires were used to obtain information on conservation of the forest and the environmental hazards affecting the area. Data were obtained from a systematic sample of 120 residents within three clans namely: *Uzere, Aviara* and *Olomoro* in *Isoko* South LGA of Delta State, Nigeria. The data were subjected to descriptive and inferential statistics. The results showed that 97.5% of the respondents show interest in conserving the forest while 2.5% show no interest. Logistic binary regression result, revealed that two socio-economic variables, namely, occupation and educational status showed positive significant influence ($p<0.05$) on interest of the respondents in conserving the mangrove forest. Flooding, environmental pollution caused by gas flaring, oil spills from pipelines and waste materials and chemicals, increased atmospheric temperature and pest invasion are the environmental hazards affecting the study area. There is a need for a participatory forest management with conservation to achieve mangrove forest sustainability, and thereby enhancing sustainable development in the Isoko South LGA of Delta State, Nigeria.

Keywords: Conservation, environmental hazards, forest management, mitigation.

Introduction

The Nigerian mangrove forests were earlier considered to be the least disturbed of the forest zones of Nigeria (Abere and Ekeke, 2011). This is not the situation today. Fragmentation, deforestation and degradation of the mangrove ecosystem by petroleum exploration and related industrial activities and domestic uses are major concerns to the mangrove communities, environmentalists and conservationists.

The frequent occurrence of flood, coastal erosion and in recent times, adverse changes in forest based occupations of the people are clear manifestation of overexploitation of the mangrove ecosystem (Okpiliya *et al*., 2013). The invasion of the nypa palm (*Nypa fruitican*) gradually replacing mangrove has led to habitat alteration and the reduction in fish productivity. Mangrove exploitation will continue unabated as long as there is general lack of forest management plan as well as poor enforcement of regulatory and monitoring mechanisms to carry out effective mangrove regeneration and conservation

programme. The growing human population and economic activities have been described as the major factors in mangrove forest depletion (Mmom, 2007). Crude oil exploration and exploitation in the region has equally contributed greatly to the loss of the mangrove forest.

Mangrove forests provide a wide range of ecological services like protection of shorelines and riverbanks from erosion, flood regulation, violent storms and hurricanes, maintenance of biodiversity (Patrik, 1999; Mantra, 1986). They contribute to climate change mitigation and afford protection for coastal areas from tidal waves, cyclones and are the most carbon-rich forest in the tropics (Cornforth *et al.*, 2013). They support nutrient and organic-matter processing, sediment control for other inshore habitats (Giri *et al*., 2011). Wells *et al*. (2006) observed that mangroves act as carbon sinks and thereby lessen the impact of global warming.

The mangrove forest is not under any known form of protection and or laws and strategies of biological resource conservation in Nigeria (Mmom and Arokoyu, 2010). This has led to rapid decimation of the mangrove resources and biodiversity in general. In fact, most conservation efforts have ignored traditional knowledge system and practices that reflect many generations of experience in the conservation of their natural resources, thereby exposing the forest and protected areas to external influences (poaching) as well as depriving the people access to their natural resources. The resultant effect of this is the failure of the conservation strategies and depletion of the forest resources. Therefore, this study assessed the interest of the forest communities in mangrove forest conservation thereby seeking ways of encouraging participatory forest management for mangrove forest sustainability in Isoko South LGA, Nigeria.

Methodology
Study area
Isoko South LGA is one of the largest oil producing areas in Delta State of Nigeria. It is situated in the region known as Niger Delta, in the South-South Geo-political zone of Nigeria and lies between Latitude $5^o\,23^{'}$ and $5^o\,56^{'}$ North and Longitude $6^o\,13^{'}$ and $6^o\,51^{'}$ East (Figure 1). The Isoko South LGA has a total land area of 668km^2 and a population of 235,147 from the 2006 National Population Census. Clans inhabiting Isoko South include the Aviara, Emede, Olomoro, Enhwe, Erohwah, Igbide, Irri, Okpolo, Oleh, Umeh and Uzere. Isoko South LGA is a rain forest zone with a minimum and maximum temperature of 21°c and 35°C and an average mean temperature of 30°C and an annual rainfall of 1800-2000 mm. The area experiences double peak period of rainfall between June/July and September/October (Ozoro Polytechnic Meteorological Station, 2013). The Isoko South people are mostly farmers and fishermen. They practice subsistence farming. They cultivate vegetables, cassava, groundnut, yam and maize. Fishing is done using

small nets and boats. They also engaged in hunting, shrimp farming, trading, logging and fuel wood harvesting.

The mangrove forest comprises of trees, shrubs, ferns and palm. Tree species such as *Rhizophora racemos*a, *Rhizophora harrisonii, Rhizophora mangle, Avicennia africana, Lagancularia racemosa* and *Conocarpus erectus* are found in the mangrove forest.
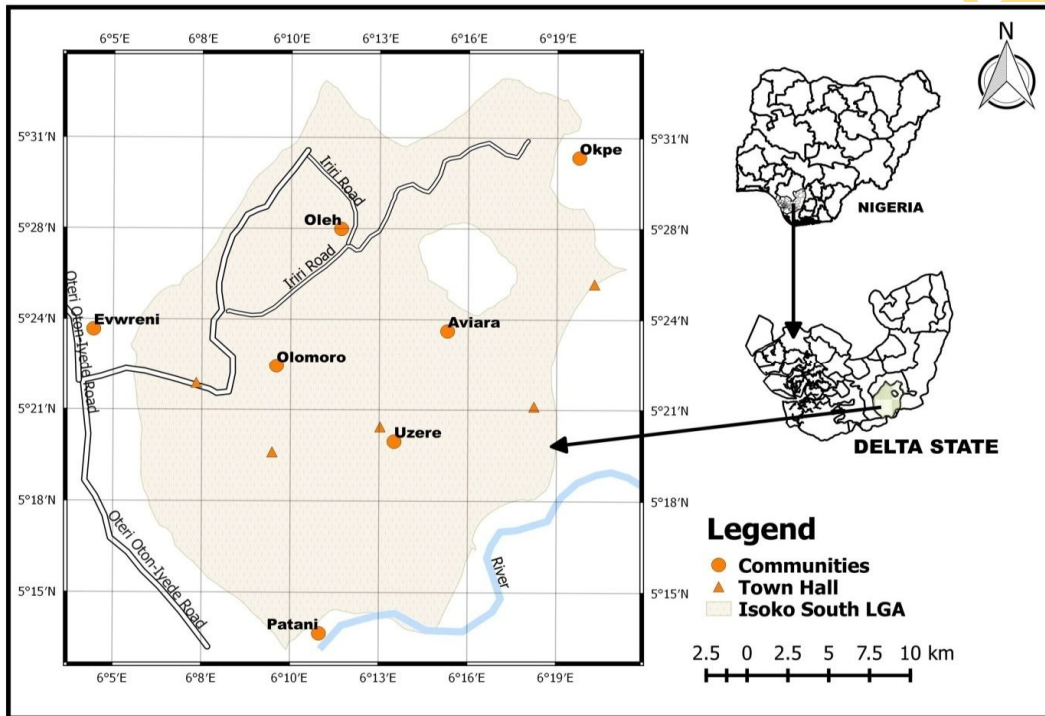

Figure 1: Map of Isoko South LGA showing Uzere, Aviara and Olomoro the study locations in Delta State, Nigeria.

Data Collection and Analysis
Data and Sampling Design
The data used in this study were obtained in 2016 through a structured questionnaire survey of 120 residents in the three selected towns namely: Uzere, Aviara and Olomoro in Isoko South Local Government in Delta State, Nigeria. The three towns were purposively selected because of the occurrence of mangrove forest, high dependence on forest resources for livelihoods endeavours and activities of oil exploration and gas flaring in the area. Structured questionnaire and interview schedule were used to obtained

information on conservation of the forest and the environmental hazards affecting the area. Forty questionnaires were administered in each of the selected town. Data on respondents' socio-economic background were also collected. The 120 questionnaires were successfully retrieved. Systematic sampling was adopted to collect the primary data. Thus, every 10th households was selected and questionnaires were administered to each of the selected 10th households. With this, 10% sampling intensity was used at household level.

Data Analysis
The data were subjected to descriptive and inferential statistics using the logistic binary regression model as expressed in equation 1 adopted by Acquah and Abunyuwah, (2011).

Logistic binary regression model specification

$$\frac{Prob\ (y_i = 1)}{prob(y_i = 0)} = \frac{P_i}{1 - P_i} = e^{(\beta_o + \beta_1 X_{1t} + \cdots \beta_k X_{kt})}$$

.... Equation (1)

For I = 1----- n
Where
Where P_i is the probability that Y takes the value 1 and then $(1-P_i)$ is the probability that Y is 0 and *e* the exponential constant.

Results and Discussion
Conservation of the Forest
The result in Table 1 shows that the 97.5% of the respondents are interested in conserving the mangrove forest and mangrove forest resources while 2.5% show no interest in conserving the mangrove forest in the study location. This is a true reflection of the mangrove forest communities' concern for mangrove conservation as observed by Abere and Ekeke, (2011). Forest stakeholders including forest communities possess an economic, cultural or political interest in, or influence over the resource (Udofia *et al.*, 2013). People have varied interest and are affected differently by the way and manner the forest is managed because they all depend, in various ways on the multiple goods and services derivable from the forest for their economic, social and cultural well-beings. People-based or participatory forest management system integrates the socio-economic and cultural needs of the people with resource conservation.

Table 1:   Interest of Respondents on Conservation of the Forest

Response	Frequency	Percentage
Interested	117	97.5
Not interested	3	2.5
Total	120	100

Socio-economic Characteristics of Respondents in the Study Area
The results in Table 2 shows the occupation of the respondents to include fishing (24.2%), farming (35.0%), trading (6.7%), fish farming (7.5%), logging (8.3%), civil servant (15.0%) and logging operation (3.3 %). The result also revealed the educational status of respondents, which include no formal education (14.2%), primary education (40.8%), secondary education (18.3%), tertiary education (24.2%) and post graduate education (2.5%) in the study area.

Table 2 Socio-Economic Characteristics of the respondents

Variables	Frequency	Percentage (%)
Gender		
Male	78	65
Female	42	35
Total	120	100
Age		
25-34	6	5
35-44	32	26.7
45-54	52	43.3
55-64	29	24.2
65 and above	1	0.8
Total	120	100
Marital status		
Single	4	3.3
Married	114	96.7
Total	120	100
Educational Status		
No formal education	17	14.2
Primary education	49	40.8
Secondary education	22	18.3
Tertiary education	29	24.2
Post graduate education	3	2.5
Total	120	100
Years of residence		

1-10	1	0.8
11-20	11	9.2
21-30	9	7.5
31-40	19	15.8
41-50	29	21.7
51-60	46	38.3
61 and above	8	6.7
Total	120	100
Household size		
1-5	10	8.3
6-10	89	74.2
11-15	21	17.5
Total	120	100
Occupation		
Fishing	29	24.2
Farming	42	35.0
Trading	8	6.7
Fish farming	9	7.5
Logging	10	8.3
Civil servant	18	15.0
Logging operation	4	3.3
Total	120	100
Income		
1000-10,000	24	20.0
10,001-20,000	35	29.2
20,0001-30,000	15	12.5
30,001-40,000	14	11.7
40,001-50,000	4	3.3
50,000 and above	28	23.3
Total	120	100

Socio-economic Determinants of Respondents' Interest in Conservation of the Mangrove Forest

Logistic binary regression model was used to determine the socio-economic variables that influence the respondents' interest in conserving the mangrove forest. This result is shown in Table 3. Of the eight variables considered, occupation and educational status have significant positive effect ($p < 0.05$) on the respondents' interest in conserving the mangrove forest in the study area. This implies that occupation contributes positively to the interest of the respondents' to conserve the mangrove forest. Most livelihood activities of the people especially farming and fishing take place within the mangrove forest and this may explain why occupation has a significant positive influence on their

interest in conserving the mangrove forest. Furthermore, educational status has a positive significant effect on respondents' interest in conserving the mangrove forest ($\rho<0.05$). This implies that educational status of respondents contributes positively to the interest of the respondents to conserve the mangrove forest. Though, most of the people in the study area have primary education they are aware of the importance of the forest and its role in mitigating environmental hazards.

Masozera, (2002) reported that agricultural income, household age, access to outside market, and household size are major determinants of forest dependency while Benefits from the buffer zone, limited access to forest resources, and   forest dependency are shown to be the significant predictors of households' attitudes towards the conservation of the Nyungwe Forest Reserve (NFR).

Table 3: Parameter Estimates of the Logistic Regression of Interest in Conservation and Socio Economic Characteristics of respondents

Variables	Standard error	Wald	Degree of freedom (df)	Exp (β)
Gender	5.201	1.523	1	2.472
Age	2.029	1.131	4	0.116
Marital status	8.243	0.000	1	9.905
Educational status	1.864	1.200	4	0.010*
Years of residence	1.355	1.596	6	5.538
Household size	2.241	0.496	2	4.847
Occupation	4.705	0.001	1	0.017*
Income	-1.038	0.730	5	0.412

Significant at $p<0.05$, significant at $p<0.01$

The environmental hazards affecting the study area
The field survey revealed the following environmental hazards affecting the study area. They include: flooding, environmental pollution caused by gas flaring, oil spills from pipelines and waste materials and chemicals (from the use of fertilizer for farming) carried by flood, high atmospheric temperature and pest invasion. These environmental hazards might have influenced the choice of the forest communities in mangrove forest conservation. Delta State is currently experiencing climate change related impacts such as rising temperature, heat waves, more intense rain/wind storms, more extreme rains, including erosion and landslides, sea level rise, sea surges and coastal inundation (Okoh *et al*., 2010).

Flooding

The area is flooded yearly from July to October. The occurrence of flood in the area causes inaccessibility of homes, pollution of water bodies and harvesting of farm produce before maturity. Planting of crops is done with the going of the flood between November and December and harvesting starts with the onset of the flood from July to October. Transportation of logs and fishing activities are high within this period. Farm products are harvested before maturity at this period and the products are transported from the forest to the roadside by boats.

Mangrove forest plays vital role in regulating flood and erosion (Patrik, 1999 and Mantra, 1986). Mangrove forests provide a wide range of ecological services like protection of shorelines and riverbanks from erosion, flood regulation, violent storms and hurricanes, maintenance of biodiversity. This is why there is a need for the conservation of the mangrove forest in the area to sustain the forest for continuous provision of its ecological services.

Environmental Pollution

Gas flaring, oil spillage from pipelines and agrochemical carried by flood are the causes of environmental pollution in the area. These pollutants are threats to the mangrove forest and proper measures need to be taken to avoid death of plants and animals, pollution of water and water bodies. Nwilo and Badejo, (2005) stated that oil spills are a serious concern in regard to the health of Nigeria´s remaining mangrove forests. Leaked oil permeates the coastal waters and streams, coating the exposed, air breathing roots of the mangroves. It is difficult, if not impossible, for the plants' breathing lenticels to perform their essential functions when covered in oil; thus, in effect, they are slowly suffocated. Massive mangrove die-off is a common phenomenon plaguing the mangrove regions where coastal oil exploitation occurs.

High Atmospheric Temperature

The area experienced high atmospheric temperature due to the activities of gas flaring and high rate of deforestation. The forest is an important reservoir that helps in carbon sequestration. Recent report on global mangrove forest shows that the current rate of its degradation and disappearance has seriously threatened the fragile ecosystem and reduced its resilience to withstand climate change effect (Ajonina *et al.,* 2005).

Pests Invasion

Pest invasion may result from the occurrence of flood and high atmospheric temperature in the area. Dialoke *et al*. (2010) identified insect pests such as foliage beetles, ants, termites, thrips (*Megalurothrips usitatus*) and blister beetle (*Mylabris pustulata*), pod borers (*Helicoverpa armigera, Maruca testulalis, Etiella zinckenella*)*,* pod sucking bugs (*Anoplocnemis curvipes, Riptortus dentipes, Clavigralla tomentosicollis, Nezara*

viridula), aphids (*Aphis craccivora*), and leaf damaging weevils (*Myllocerus undecimpustulatus*) in Isoko South LGA of Delta State. Stewart and Fairfull, (2008) observed that climatic changes (e.g. changes in temperature and rainfall) can create conditions ideal for the spread of pests and diseases that can harm mangroves.

Conclusion

Based on the findings of this study, the forest communities have shown interest in the conservation of the mangrove forest. It is therefore recommended, that participatory forest management involving the Government, Forest managers, Non-governmental organisation and the forest communities be pursued to achieve mangrove forest sustainability and sustainable economic development in Isoko South LGA of Delta State, Nigeria.

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