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Swamp Forest Use and Loss in the Niger Delta: Contextual and Underlying Issues

Nwabueze Ikenna Igu

Department of Geography and Meteorology, Nnamdi Azikiwe University, Awka, Nigeria
Email: nwabuezeigu@gmail.com

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Abstract

Forest ecosystems are vital not only for the ecosystem and biogeochemical processes, but also for the livelihood of forest dependent communities for which its continual existence is a necessity. This study explored the pattern of forest use in the hinterlands of the Niger Delta and sought to elucidate the drivers of forest loss and how the ownership and management of the forest plots influenced the changes in the forest ecosystem. Ecosystem services reduction and forest loss/degradation were found to be increasing over the years due to crude oil activities, urbanization/developments, population increase, agricultural activities and natural causes like flood. While each factor contributed to forest loss directly and indirectly, and varied from community to community, agricultural activities and population growth were responsible for most of the losses across the landscape. Even though agricultural activities were essential and thrived in the region, sustainable forest (land) uses could have reduced the associated implications of such land uses; but this was however hampered by the farming practises (shifting cultivation) across most of the communities. Lack of proper, effective and sustainable forest management structures, poor individual commitment and monitoring of forest activities were found to encourage forest loss at different spatial scales. Provision of alternative sources of livelihood and ensuring that suitable guidelines on forest abstraction and harvest are enforced across the region, are steps to promoting biodiversity conservation and resource management.

Keywords

Community Forest Management, Ecosystem Services, Forest Loss, Resilience, Sustainable Management

1. Introduction

Tropical forest ecosystems are very vital for the provision of ecosystem services, sustainability of livelihoods and global climatic processes. However, with increasing human impact, modification and consequential degradation of its biodiversity, its future

has never been more uncertain (Kareiva et al., 2007; Gardner et al., 2009). The underlying causes and proximate drivers of forest loss across the tropics are varied (Geist & Lambin, 2002) according to the patterns and processes of forest use in the different environments. Efforts to understand these patterns of loss across the tropics have been conducted at different spatial scales (De Fries et al., 2010; Asner et al., 2009; Hansen, 2013), mainly with the use of satellite remote sensors, which has enabled the estimation of forest loss across different landscapes and ecosystems. This technique has been very useful in understanding the ecology and forest dynamics of forest ecosystems, especially the swamp forest ecosystems, whose poor terrain and marshy environments have acted as constraints to their accessibility and assessment (Harvey & Hill, 2001). Hence, it has both helped to facilitate a better understanding of the ongoing processes across the Niger Delta swamp forest ecosystems (James, 2008; Onojeghuo & Blackburn, 2011), and will enable the modelling of its future scenarios.

Across the Niger Delta region, the causes of forest loss have mainly been linked or associated with crude oil exploration and pollution (Moffat & Linden, 1995; James, 2008; Onojeghuo & Blackburn, 2011), population increase (James, 2008; Mmom & Mbee, 2013), urbanization and development activities (James, 2008; Enaruvbe & Atafo, 2014; Kuenzer et al., 2014) and agricultural pressure (Enaruvbe & Atafo, 2014). While these factors of forest loss are normally viewed as the drivers of deforestation across the region as in most other tropical forest regions (Igu, 2016; Sassen et al., 2012), they are however not the main determinants underlying the spatial patterns of forest loss. A combination of institutional, economic, social factors as well as management frameworks have on the other hand contributed to the decline in forest cover through varied and inter-related ways across the region. Such information is not only vital in understanding the fundamental issues surrounding forest loss, but also useful for providing context specific and regional effective measures towards achieving an effective forest conservation and management.

To elucidate these issues, this study focuses on the associated effects of forest ownership and use across the ecosystem, the drivers and indices of forest loss, and the varied ways the peoples' attributes determined and influenced forest loss and degradation across the region.

2. Materials and Methods

2.1. Study Region

The Niger Delta region is a rich sedimentary basin located in southern Nigeria (**Figure 1**). Located in the lower reaches of the Niger River, it is found between Latitude 4˚ and 6˚ north of the Equator and Longitudes 5˚ and 7˚ east of the Greenwich. It is a generally low landscape found in the lower reaches of Rivers Niger and Benue and criss-crossed by a network of rivers and creeks that drain into the Atlantic Ocean. The region is swampy and characterized by a tropical climate with long rainy season that last nearly throughout the year. Its rainy months are mainly from March to October, and a short dry season between December and February. Its annual precipitation increases from the North of the Delta (2500 mm) to the coastal areas, where it is as much as 4000 mm. Average monthly maximum and minimum temperatures across the region

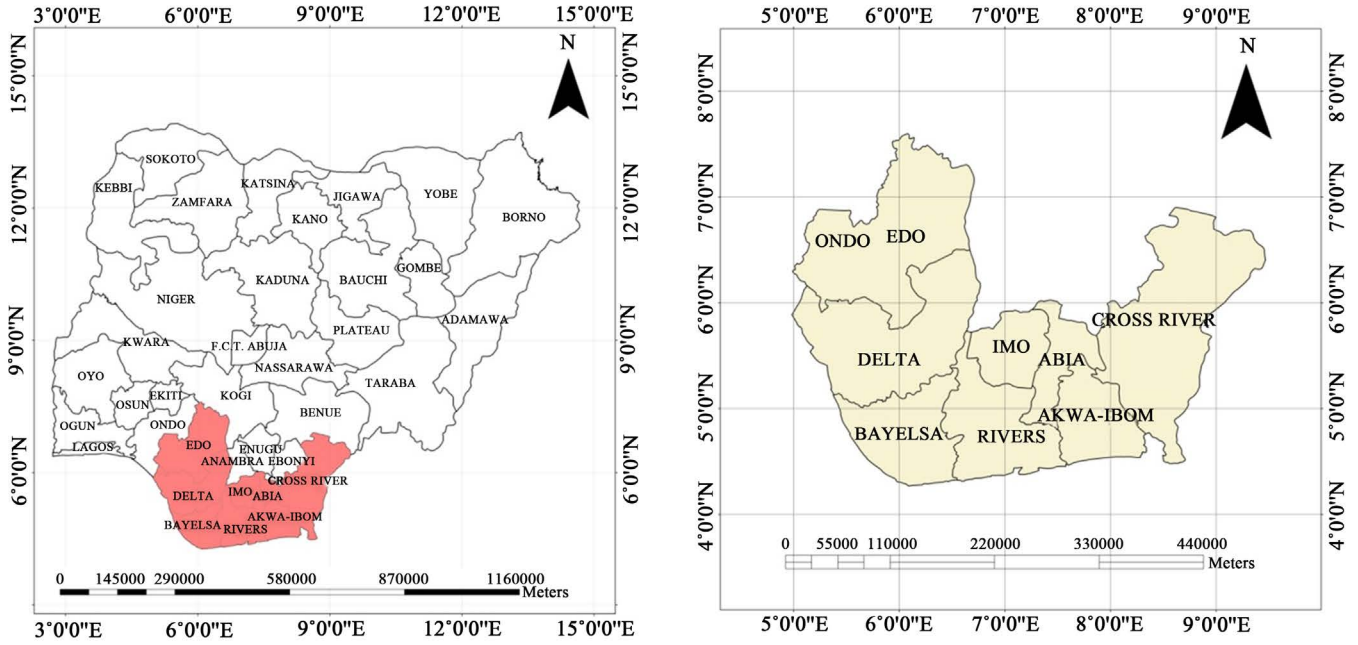

Figure 1. Map of Nigeria showing the Niger Delta region.

vary between 28˚C to 33˚C and 21˚C to 23˚C, respectively. The soils of the region are characterized by both seasonally and permanently waterlogged soils, which are broadly classified as hydromorphic (Areola, 1982). They are whitish or greyish in colour due to the reduction of oxides in the soils (as a result of their poor drainage) and are mainly of fluvial origin. They are equally characterized by a succession of thinly bedded silts and clays that are inter-bedded with sands.

Administratively, the region encompasses the nine oil producing states across Nigeria, while it is delimited hydrologically to only comprise, Bayelsa, Delta and Rivers states. Ethnically, the region is made up of more than 40 ethnic groups that speak more than 250 dialects and characterized by a rich cultural heritage (Jike, 2004). The region is predominantly rural and composed of a populace that is mainly animist, and who that attach much importance and cultural values to the flora and fauna in their environment (Anwana et al., 2010; Adekola et al., 2015). Covering about 12% of Nigeria's total surface area, it is made up of a multi- cultural setting where 22% of Nigeria's population lives (UNDP, 2006; NPC, 2006). The Niger Delta has the most extensive mangrove and freshwater swamps in Africa (Ogon, 2006; Igu, 2013) and the third largest wetland in the world (Uluocha & Okeke, 2004). Both the forest resources and biodiversity of the region are features that contribute to the significance and importance of the area. This biodiversity importance is mainly from its vast mangrove forest ecosystem, of which three are endemic. Endemic mangrove families across the region includes the Rhizophoraceae family (red mangrove), Avicenniaceae family (white mangrove) and the Combretaceae family. These have been very useful for the provision of fuel, food, medicine, salt, timber, railway sleepers, tannins and dyes, across the region (Hamilton & Snedaker, 1984; Irikana, 2006; Igu, 2013; James et al., 2013). Freshwater swamp forests on the other hand are the region's major sources of timber and an important habitat for endangered and rare wildlife (UNDP, 2006).

2.2. Oil Resources and Social Concerns

The Niger Delta region is home to vast stores of hydrocarbons of reputable quality and the main source of Nigeria's wealth. With about 1182 exploration wells and about 400 oil and gas fields of varying capacities documented since the past fifty years (Obaje, 2009) and revenue generation of over $600 billion since the 1960's (Wurthmann, 2006), it has remained the main source of Nigeria's foreign exchange and government revenue. However, since its first commercial oil discovery in 1956, the region has steadily declined in its biodiversity potentials and suffered from "administrative neglect, crumbling social infrastructure and services, high unemployment, social deprivation, abject poverty, filth and squalor and endemic conflict" (UNDP, 2006). With about 36.4% of the inhabitants living below the poverty line (World Bank, 2003), only about 27% with access to safe drinking water, only 30% accessing electricity as at early 2000 (Ibeanu, 2002), an illiterate majority, a general lack of basic health care and employment, the region has not only been impoverished, but are a pathetic example of "resource curse". The region has been rife with aggression and violence following prolonged denials and poor human capital and regional impoverishment. Conflicts and insurgency have escalated across the region over the years, have affected the oil production adversely, shut down productions in some communities, led to the destruction of lives and property and created an endemic terror and insecurity across the region. While these have led to a drop in the oil production and consequent loss on the Nigerian economy in terms of oil revenue (Idemudia, 2009; Obi, 2011), it has not in reality improved the livelihood of the people who still depend on the forest ecosystem to meet their daily needs.

2.3. Methods

Data on the issues of forest ownership, management and use was elicited from the study communities through a household survey conducted between October 2013 and April 2014. The design of the questionnaire followed a literature review on forest use, drivers of forest loss and the ownership structure, across the region (NDES, 1997; Geist & Lambin, 2002; UNDP, 2006; James, 2008). The final draft of the questionnaire was arrived at after preliminary interviews were equally conducted during the reconnaissance survey and pilot study across the forest communities. This helped to ensure that the issues under consideration were both understood and applicable to the people.

The survey was conducted across 12 communities across the region (Delta and Bayelsa states). These communities were chosen at random across the region to capture differences in ethnicity, socio-economic backgrounds, remoteness, presence/absence of oil wells and forest uses. Due consultations with the community heads and leaders on the purpose and details of the survey were made before the selection of each of the communities. This helped to ensure that community ethics were not breached and that cooperation and openness among the community members were enhanced. To ensure that each of the communities was duly represented in the survey, they were first of all demarcated into four zones. Each of the quadrats (four zones) was then surveyed, starting from the first household and then every fourth household subsequently. This enabled the varied perceptions and status of the households in each of the communities to be captured and ensured that there were no biases in selection of the respondents.

Being a household survey, it was targeted at the household heads across the settlements. This comprised mainly aged individuals, community leaders and individuals that understood the norms and day to day practices in the localities. This helped to ensure that the information elicited from the survey were a true picture of what applied to the people.

The data were analysed using rankings, frequencies and variance techniques with R statistical software version 3.1.0 (http://cran.r-project.org). Normality tests were first of all conducted on the data. Kruskal Wallis rank sum test was used to show how varied the drivers of forest loss were among the communities. Mann-Whitney tests were further used to show the ownership and usage patterns of the forests across the communities. Further details regarding the percentages of each of the variables were provided using descriptive statistics methods.

3. Results

3.1. Overview of the Respondents

Most of the individuals that constituted the study had formal education (mainly primary and secondary education) and were found between less than and greater than 40 years of age (Table 1). They are divided into individuals whose full time occupation involved farming, civil service and other jobs (fishing, trading, craft making and collectors of non-timber forest products [NTFPs]) (Table 1). Though the people are divided into varying educational and occupation status, there are no wide gaps in the income levels of the populace.

3.2. Forest Ownership, Management and Loss

Forest ownership across the communities were varied ($\chi^2(U)= 3782.5$, $p < 0.05$) between individual (family or households) and community ownership of forest lands (53.9% and 46.1%, respectively). As expected, these forests were used for different purposes (Kruskal-Wallis $\chi^2 = 58.6$, $p < 0.05$, D.F. = 11; Figure 2) by the resident communities both for subsistence and for income generation. While these forests have no doubt sustained the people, its management structure has not been taken seriously by most of the people who are varied in their individual commitment to managing the forests ($\chi^2(U)= 4920$, $p < 0.05$). Managing the forest or the forest resources has on other hand remained poor following a general lack of restriction or restraint to forest use

Table 1. Socio economic characteristics.

Variable	Value
Number of respondents	243
Highest level of education	Formal education 94.2% (21.2% primary, 37% secondary, 15% diploma, 19% bachelor degree, 2% masters degree) No formal education 5.8%
Age group	16 - 40 (≤40) years 53.9% 41-above 60 (>40) years 40.1%
Full time occupation	Farming 49.4% Civil service 35.4% Others 15.2%

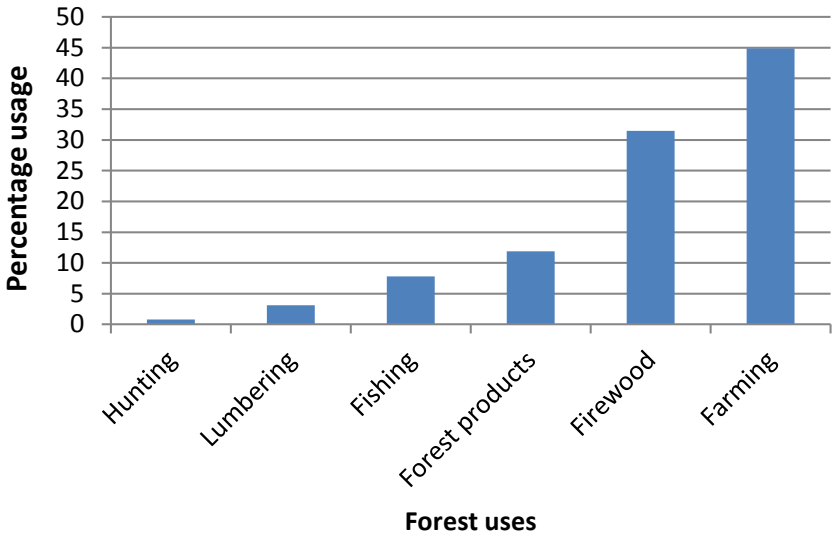

Figure 2. Forest uses across the communities.

across the communities (χ^2(U)= 4710, $p < 0.05$). Hence, forest loss and degradation has continued at different spatial scales across the forest communities. The direct and underlying causes of loss experienced across the communities are varied across the region (Kruskal-Wallis $\chi^2 = 33.72$, $p < 0.05$, D.F. = 11; **Figure 3**).

4. Discussion

The use of the forest across the region was influenced by the variations in the demographic variables of the people (**Table 1**). While the educational status of the people are expected to influence their income flows and in effect, their dependence on the forest for different resources (Godoy & Contreras, 2001; Mamo et al., 2007), they have however not followed such trends consistently. Since many of the educated people across the region are unemployed, the expected gap in forest extraction between those with formal and higher education and those without education are not wide. Hence, though those with higher education have more environmental and sustainable management knowledge, poor government intervention (as it concerns employment), hampers their quest to practise and promote forest conservation.

Total number or the population density of persons that reside around forested landscapes affect its rate of use and capacity to provide vital resources for the wider society. While this is important in understanding the extent of pressure such forest regions may be undergoing, the population structure of such landscapes show in greater detail the variations in use and dependence that may be inherent in such environments. Hence, for the Niger Delta region whose younger age class dominate the population, such that up to 62% of its populace are under 30 years of age (Francis et al., 2011), its pattern of forest utilization is expected to follow such dynamics. Since this younger populace do not have as much knowledge as the older people in the forest resources management and its utilization (Mamo et al., 2007), they are not likely to harness the resources optimally as would the older population. Furthermore, as some of the forest users in this younger age class use the forest resources as their only sources of livelihood to either

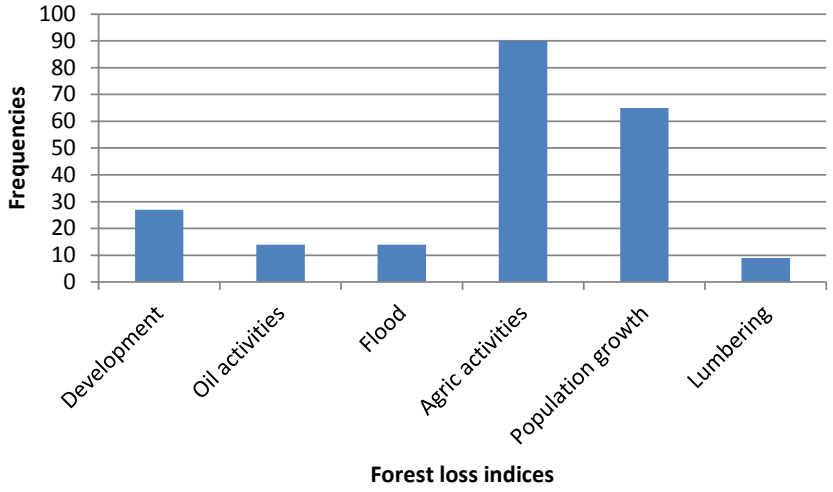

Figure 3. Direct and underlying causes of forest loss.

fend for their young families or planning to start one, they tend to harvest the forest resources more and at rates that are far below the resilience of the ecosystem.

The varied occupation of the people is not only indicators to the heterogeneity seen even in rural forest landscapes but also indices to the livelihood variabilities and commitments inherent in such systems (environment). While this could be used to understand the income levels of the populace, it invariably depicts what each person spends the bulk of his time doing (**Table 2**). Since most of the people depend on agriculture for their sources of livelihood, there is then a higher tendency for such landscapes to experience an accelerated emission of greenhouse gases as well as a higher risk of forest degradation and deforestation. With the bulk of forest reductions and losses across the tropics dominated by the associated impacts of agricultural expansion and intensification (Angelsen, 2009; Hosonuma et al., 2012), the need to develop agricultural-forest friendly initiatives and guidelines are increasingly becoming a necessity.

The causes of forest loss and reduction of ecosystem services they provide vary across different landscapes mainly as a result of human induced factors. While lumbering is seen to contribute to the loss of forest cover across the communities, it is however a multi-faceted cause-effect factor which is induced by other underlying issues such as quest for financial gain, land clearing for agricultural activities and construction purposes. Crude oil exploration activities (seismic activities and pipeline constructions), as well as the effects from oil spills and gas flares is an endemic forest and biodiversity threat in the entire Niger Delta region (Moffat & Linden, 1995; NDES, 1997; James, 2008; Zabbey et al., 2010). However, the extent to which this leads to forest cover change at landscape or community levels differ widely. While some communities in the region do not have oil wells, and so are not expected to experience forest degradation occurrences as a result of oil activities, others that have oil wells or are criss-crossed by oil pipelines have had to grapple with the degradation and losses that such occurrences have caused. With the Land Use Act (of 1978) which neutralizes the traditional rights of the people over their lands and vests authority on the Nigerian state to revoke any rights of occupancy for an overriding public interest (which includes the requirement of land for all oil activities and other connected activities) (Emuedo & Abam, 2015) in

Table 2. Frequency of forest visit according to varying occupational status.

Full time occupation	Frequency of visit					
	Yearly	Seasonally	Monthly	Weekly	Daily	Total
Farming	3	8	13	38	58	120
Civil service	1	6	15	21	9	52
Teaching	4	9	3	10	5	31
Fishing	1	0	2	3	3	9
Trading	1	0	9	5	5	20
Craft making	0	0	0	0	4	4
Collector of NTFP	0	0	0	2	2	4
Labourer	0	2	0	0	1	3

operation, most forest lands are lost. This is seen to happen in instances where forest lands (where oil wells are found) are not only confiscated, but also experience biodiversity loss and degradation. Hence, while these (oil exploration) enriches the Nigerian state, the provisioning services such locations provide are not only degraded, but are eventually lost across most of the landscapes.

Even though oil activities have impacted the forest ecosystem across the region, nonetheless, other anthropogenic activities have equally affected the forests adversely, both directly and through inter-related ways. While development activities or urbanization (which includes: roads, canals and construction activities for housing or industrial purposes) equally contributed to forest loss and reduction in the provisioning services, their impacts equally varied mainly on the basis of their proximity to urban centres. With the establishment of the Niger Delta Development Commission (which was laden with the responsibility of facilitating the rapid development of the region), most of the hinterlands started experiencing development activities (mostly in the form of roads, canals and rural electrification) for almost the first time. Such developments were beneficial to the entire region, but equally contributed to the modifications and loss of the marshy and fragile terrain that characterize the entire landscape. These dredging, landfilling, excavations and land reclamations (development activities) across the region, introduced a lot of physico-chemical changes to the ecosystem (Ohimain, 2001; Adekola & Mitchell, 2011) and exposed the biodiversity to fragmentation, physical and chemical stress and general degradation.

Even though the swampy zones of the Niger Delta experiences a yearly regime of flood, the ecosystems are not only adapted to it, but has suitable resilient capacities to cope with such occurrences. However, recent developments across the region have affected its natural coping mechanisms and altered its hydrological channels. Such events have contributed to the alteration of the region's normal flow cycle regime (which the ecosystem already has an adaptive and resilient capacities for) to more irregular-destructive patterns. Initially, the flow/flood pattern of the Niger river (which flows down to the Niger Delta) was dependent on the volume of annual rainfall across the region. However, with the completion of the Kainji dam (on the Niger river) in 1968, the flow

pattern has to a large extent been equally influenced by the opening and closing of the dam sluices (Brown & Thieme, 2005). Hence, in instances where the fluctuation in flow becomes higher than the normal capacity of the ecosystem (as seen in the year 2012), the flooding becomes so devastating that flora and fauna in the ecosystem are to a large extent destroyed, while the resilience for the ones that survived becomes affected.

Agriculture was seen as a main feature and determinant of forest decline and loss across the region. While this trend of forest loss (as a result of agricultural activities) seems to be similar with most other developing countries (Hosonuma et al., 2012), the extent to which it continues to contribute to forest loss is however a function of the population dynamics of the location. Hence, with an increasing population across the Niger Delta region (Watts, 2010), more forest lands are being converted to agricultural lands, so as to meet the needs of the teeming population. Furthermore, with high unemployment (at 8.8%) rates experienced across the region (Ukiwo, 2009), most of the people have resorted to agricultural activities and harvesting of forest products as their main sources of livelihood. Such pressures on the forest land have encouraged forest degradation and loss across the region, especially because, most of the farmers (especially plantain farmers) would prefer to (plant on virgin soils) practise shifting cultivation rather than improving the fertility of their farmlands.

Generally, the forests across the region are found in community lands, sacred groves, family lands or in reserves. The forests found on community and family lands dominate the ownership structure in the area and are equally managed by the different communities or families that own them. Even though the pattern of management differs slightly from one community to the other, their effectiveness are mostly a function of the calibre of individuals that constitute that current administration of leaders. Since there is no model or structure of management, the consistency and effectiveness of the operational management have in most cases been short lived. Conversely, forests owned and managed by individuals and families have on the other hand been affected by land tenure, the economic status of the family members, their personal interests and attitudes. While the size or numbers of forest acres owned and managed by these families are not increasing in size, they are instead being threatened by parcelization, which not only increases the number of owners, but furthermore complicates the management and existence of the landscapes (Stein et al., 2005; D'Amato et al., 2010). Hence, with rising population growth across the region, forest plots are increasingly fragmented and equally subjected to different land uses and conversions by their multiple owners.

5. Conclusion

Forest ecosystems are continually lost and degraded across many tropical ecosystems mainly due to anthropogenic influences peculiar to such environment. In a bid to utilize the resources found in the forest ecosystems, most of the landscapes have been degraded, with the effect that some of its species are lost, while the ranges of others are reduced drastically. Achieving effective management and conservation of the swamp forests in the Niger Delta as well as other tropical ecosystems have been a big challenge because very minimal attention has been given to the underlying causes of forest loss in the region. Understanding such contextual and underlying issues has become more

necessary than ever in order to suitably address such losses and provide efficient policies that could promote more environmental sustainability. This study has provided insights on these issues and recommends that suitable guidelines and monitoring of development activities, forest use and mineral exploitation be put in place, so that the swamp forests across the Niger Delta region could be protected and conserved.

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Appendix

Household survey for assessing forest use and degradation in the Niger delta

Date …….. Village ……..

Local Government Area …….. State ……..

SECTION A

FOREST ECOSYSTEM, VISIT AND PURPOSE

A1. Have you ever visited the forest in your community?

1. Yes ……. 2. No ……..

A4. What is your frequency of forest visit?

1. Yearly ……. 2. Monthly …….. 3. Weekly ……

4. Daily ……5. Others (specify) …….

A5. Why do you visit the forests? (or what are the main things you derive from the forest)

……

……

……

SECTION B

FOREST EXTENT, DISTURBANCE AND CONSERVATION

B1. Do you know what the forest was used for about 50 years ago?

1. Evil forest ……. 2. Sacred grove ……3. Farmland ……

4. Communal Oil palm bush ……..... 5. Others (specify) …….

B2. What is your view about the extent of the forest for the past 10 – 40 years?

1. Decreased …… 2. Increased …… 3. Same ……

B3. What are the causes of forest loss in your community?

……

……

……

B4. Suggest how the forests could be effectively conserved.

……

……

……

SECTION C

FOREST MANAGEMENT

C1. Who owns the forest in your community?

1. Government ……. 2. Community …….. 3. Households/families ……

4. Others (specify) …….

C2. Do you do anything in particular to care for or preserve the forest?

1. Yes …… 2. No …….

C3. Are there any restrictions to forest use in your community?

……

……

SECTION D

SOCIO DEMOGRAPHIC VARIABLES

E1. What is your highest level of education?

1. No formal education …….. 2. Primary …… 3. Secondary …… 4. Diploma/NCE ……

5. Bachelor's degree …….. 6. Master's degree …… 7. Others (specify) ……

E2. What is your age group?

1. Less than 20 (16 - 20) …… 2. 21 - 30 …….. 3. 31 - 40 ……

4. 41 - 50 …….. 5. 51 - 60 …….. 6. Above 60 ……

E3. Which of the following best describes your full time occupation? (Tick (√) only one option)

1. Farming [ ] 2. Government employee [ ] 3. Teaching [ ] 4. Fishing [ ]

5. Trading [ ] 6. Craft making [ ]

7. Collection of snails and shellfish (oysters, crabs and periwinkles) [ ]

8. Labourer (Hired) [ ] 9. Unemployed [ ] 10. Others (specify) [ ]