Research Journal of Applied Sciences, Engineering and Technology 2(1): 28-34, 2010
ISSN: 2040-7467

Submitted Date: September 07, 2009 Accepted Date: October 03, 2009 Published Date: January 05, 2010

Mangrove Forest Depletion, Biodiversity Loss and Traditional Resources Management Practices in the Niger Delta, Nigeria

Prince C. Mmom and Samuel B. Arokoyu
Department of Geography and Environmental Management, University of Port Harcourt.
P.M.B 5323, Choba-Port Harcourt, Nigeria

Abstract: The mangrove forest of the Niger Delta is of high economic value to the local people as well as National Development generally. The mangrove forest is rich in both aquatic and terrestrial biodiversity as such a major source of rural life sustenance in the region as well as plays a vital role in ecosystems stabilization. However, unfortunately, the Mangrove forest in recent times has been subjected to the effects of a growing population, economic and social pressures manifested in the form of rapid urbanization, agricultural land expansion and industrialization. Thus, there is a steady deforestation of the mangrove forest and loss of biodiversity in the region. The mangrove forest is not under any known form of protection and or laws and strategies of biological resource conservation in Nigeria. And even in areas where they seem to exist, they have alienated the knowledge systems and practices of the local people. This paper therefore aims at examining the rate of exploitation of these mangrove resources and the traditional resource management practices of the people, as a strategy for mangrove forest resource conservation in the Niger Delta, Nigeria.Thus, using a simple random sampling technique (use of table of random digits), ten (10) communities from two states of the Niger Delta (Delta & Rivers States) were selected as samples for the study. Also, using mainly primary data generated on the field through the use of structured questionnaire and analysed in percentages, the authors found out as follows: That rural livelihood the area depends on the exploitation of the mangrove resources as such there is over exploitation and rapid loss of these resources; that the mangrove forest is not in any known form of protection; that the local people have an efficient way of protecting and conserving their resources which could be exploited to enhance mangrove resource conservation in the region. Thus, the paper recommends that policy makers and planners should enlighten the local people on the dangers of over exploitation and encourage them to strengthen these traditional resource management practices.

Key words: Traditional resource management, biological resources, biodiversity, mangrove forest, conservation, deforestation, Niger Delta

INTRODUCTION

The tropical rainforest is known to be very rich in biodiversity, in fact over 60% of the world's biodiversity are found within the tropical rainforest (FAO,1981). However, the tropical rainforest has been undergoing serious deforestation in recent times owning to population growth, change in farming systems and consumption patterns as well as poverty.

Tropical deforestation is both an economic and environmental problem. This is so because important values are lost, some perhaps irreversibly. The cost of deforestation or forest depletion could be very high. Barbier (1992) observed that in Indonesia, the foregone cost or opportunity cost of forest conversion in terms of timber rentals from conversion of primary and secondary forestland is in the order of US$ 625-750 million annually. This excludes the cost of logging damage, fire and other non-timber forest products. Tropical forest depletion destroys habitats for diversity of life forms. Also, it destabilizes the entire ecosystem function thereby exposing the area to other forms of environmental hazards as flooding and pollution.

Thus, it is a statement of fact that the mangrove forest of the Niger Delta Nigeria has witnessed serious depletion. This is primarily owing to the fact that rural livelihood in this region depend on the exploitation of the mangrove forest and its resources. The mangrove forest is utilized as a source of fuel wood, stake pole production, fish traps, boat carving, fishing, platforms as well as shoreline protection.

The growing human population and economic activities have been described (Mmom, 2007) as major factors in mangrove forest depletion. Crude oil exploration and exploitation in the region has equally contributed greatly to the loss of the mangrove forest. Bisong (2001) had earlier observed that the impact of human activities on the mangrove forest during the pre-colonial era was minimal due to the low population densities, rudimentary technology and subsistence

Corresponding Author: Prince C. Mmom, Department of Geography and Environmental Management, University of Port Harcourt. P.M.B. 5323, Choba-Port Harcourt, Nigeria

agriculture. However, the case is different today. There is presently high human population/density, commercial agricultural practices, sophisticated technology as well as industrialization. The cumulative effects of these are the depletion of the forests and biodiversity decimation, especially in the Niger Delta region.

In fact, the World Commission on Environment and Development (WCED) as cited by Bisong (2001) had earlier, in 1992 reported that the mangrove deforestation is one of the single greatest factor that would cause specie extinction in the region in the next fifty (50) years. Thus, it is feared that deforestation of the mangrove forest would eliminate 5-15% of species by 2020 (WRI, 1986). The resultant effect of this may be far-reaching in life sustenance.

Problem statement: Nigeria is recorded to have the third largest mangrove forest in the world, and the largest in Africa, covering an area of approximately 105,000 hectares (Anon, 1995 and Ndukwu and Edwin-Nwosu, 2007). The Niger Delta area has the largest proportion of Nigeria's mangrove forest, which is being reported to be the most exploited in the world (FAO. 1997).

Deforestation of the mangrove, which is a product of the interaction of the many environmental, economic, social and political forces in the region, is one of the environmental and economic problems of the Niger Delta. Consequent upon this deforestation is the rapid loss or decimation to biodiversity in the region. The growing awareness and concern about the rate of biodiversity loss in the tropics generally has resulted to several biodiversity conservation strategies, such as the designation of protected areas (Parks & reserves,) listing and protection of species among other legislations and regulations. Some examples of such protected areas are the:Okwangwo Rainforest Reserve in Boki area of Cross River State; Oban Group Rainforest Reserve Cross river State; Stubbs Creek Rainforest Reserve of Akwa Ibom State, to mention but a few. However, most of these protected areas contain either agricultural land or sources of livelihood to the local people.

Thus formal protection does not guarantee protection of biodiversity. More so, not all biodiversity rich or sensitive areas are under any form of protection as in the case of the mangrove forest of the Niger Delta. 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 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. In the case of the mangrove forest, there is no known form of protection thus leading to rapid decimation of these resources and biodiversity in general. Against this background, this paper aims at examining the rate of exploitation of these mangrove resources in the area, as well as assessing the efficacy of the traditional resource management practices of the people, as a strategy for mangrove forest resource conservation in the region.

MATERIALS AND METHODS

Study area: The Niger Delta is described as a unique ecological zone by virtue of its size and geophysical configuration (Mmom, 2003). It is one of the world's largest wetlands covering an area of approximately 70,000km^2. Located in the south-south geopolitical region of Nigeria. It lies between latitude 4º and 6º north of the equator and longitude 5º and 7º East of Greenwich.

Along the coast, it stretches from the Benin river in the West to Bonny river in East, while in land, it begins a few miles below Aboh at a point where river Niger bifurcates into river Nun and Forcados into the Atlantic West at the South, stretching over 160 miles (Udo, 1975 and Iyalla, 2001) (Fig. 1).

The Delta could be described as a prism that was formed by the accumulation of sedimentary deposits transported by rivers Niger and Benue. Within the flood plains, the river splits into six major tidal channels and innumerable smaller outlets. Fluvial sediments are deposited throughout the Delta with sand and silt suspension during both high and low flood regimes. The region experiences, very high annual rainfall ranging between 3000 to 4500 mm with double maxima characteristics of July and September peaks.

Although the Niger Delta can be roughly categorized into four ecological sub-zones (coastal barrier Islands, mangrove, fresh water swamp forest and the lowland rainforest), the mangrove is the largest and dominant eco-sub zone (Fig. 2).

In terms of socio-economic development, the region could be described as being a "rich region with poor people". It is blessed with abundant Crude Oil and Natural Gas, which is the main stay of Nigeria's economy. Apart from crude oil and natural gas, the mangroves offer a lot of biological resources on which the rural livelihood depend. The region is poorly drained with development difficulties. Based on its physiographic configuration, it covers five states of Nigeria (*Akwa Ibom*, *Bayelsa, Delta, Edo and Rivers states*). The Niger Delta with a population over 10 million people is one of the industrial and commercial hubs of Nigeria. It is the home of Nigeria's Oil and Gas Industries and a commercial nexus in Nigeria because of its coastal location. In fact, it is witnessing rapid economic growth and little or no development.

Methodlogy and data: This study was designed with emphasis on traditional resource management and conservation practices of the riverine areas of the Niger Delta. In effect, the focus was on two states of the Niger Delta with dense mangrove forest vegetation. These are

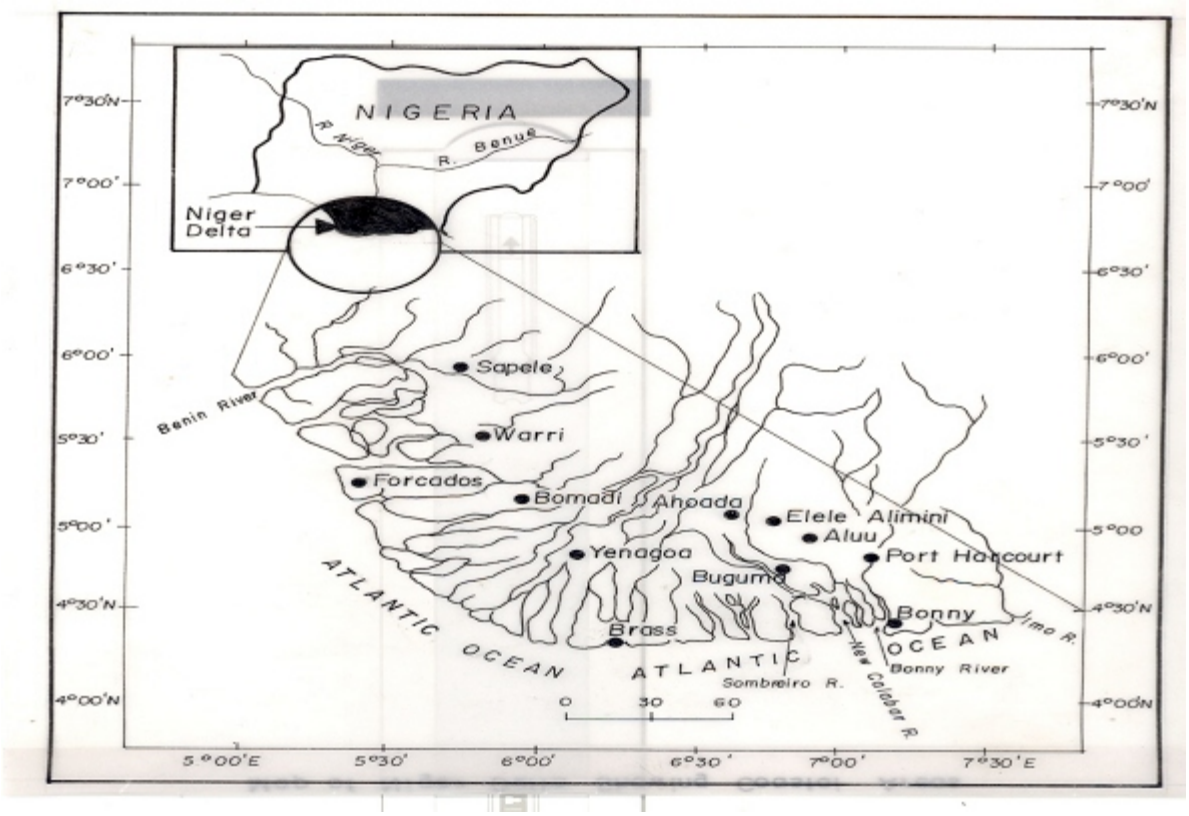

Fig. 1: Map of the Niger Delta showing the physiographic configuration

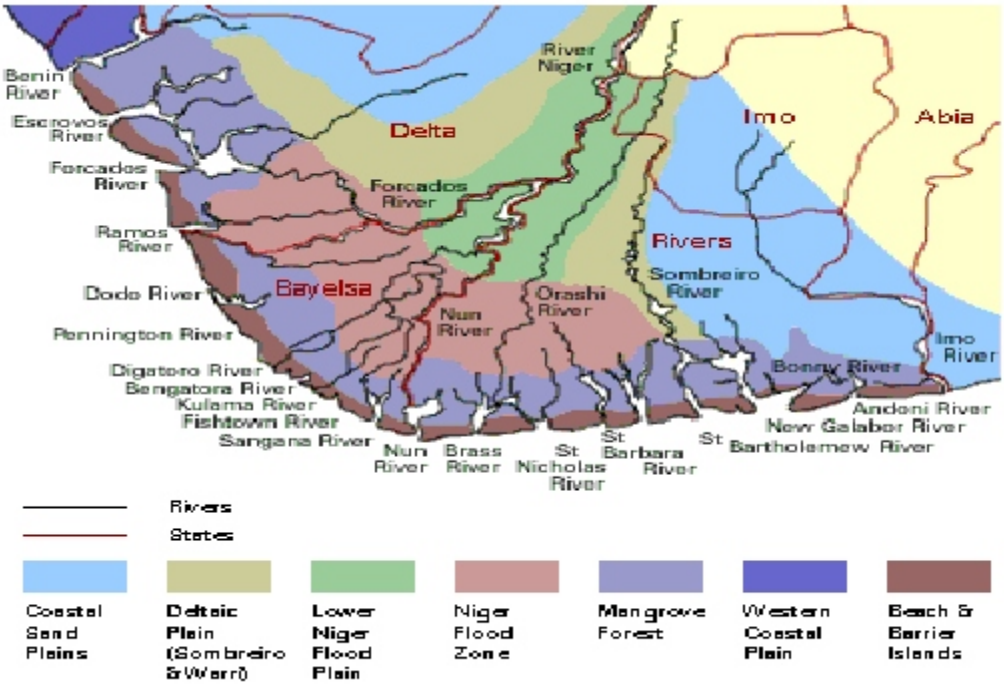

Fig. 2: Map of the Niger Delta showing the States and ecological zones (Rivers and Vegetation)

Delta and Rivers States; and five (5) riverrine communities each were selected from these states, making a total of ten (10) communities as follows: *Abalama, Ido, Okirika, Ifoko and Abuloma for Rivers State, while Koko, Patani, Okerenkoko, Otuanana and Egbokodo are from Delta States*. The authors used a simple random sampling technique to select the ten communities. Firstly, using the Yaro's formula for determining the sample size, that is

$$n = \frac{N}{\sqrt{1 + N(e)^2}}$$

= Where n=Sample size=Total Population & e=error term 1= constant

as a guide, the authors chose ten communities as a sample size from a total of thirty five (35) mangrove communities of the two states. Having done this, each of these thirty five (35) communities were coded and a table of random digits was used to draw these ten communities that are used as samples for this study.

The major data used for analysis were mainly primary data which were generated using structured, that is, close-ended questionnaire as research instrument. The questionnaire contains demographic data of respondents, that is, sex, age, educational attainment as well as occupation of the respondents. Other components of the questionnaire include: mean monthly income from mangrove exploitation, common mangrove resources exploited in the area, daily quantity and unit cost, perceived values or use of the mangrove forest, traditional management practices and their efficiency in resource conservation.

With the help of indigenous field assistants, the researchers using two hundred (200) copies of structured questionnaires, that is, 20 copies per community generated the data used to draw conclusions for this study. The generated data were collated and analyzed using simple percentages as seen below.

Analysis shows that 57% of the respondents have no formal education. 23% of them have just primary education; while 13.5% and 6% of them possess secondary and tertiary education certificates (Table 2). This finding likely explains the reason for their occupational distribution pattern (Table 1).

The occupational distribution of the respondents analysed above shows that 32% of the respondents engage in logging of the mangrove trees as well as other local craft for survival. Similarly, 29.5% of them engage in fishing and picking/harvesting of seafood (Periwinkle, Oyster, Crab, etc) as their primary occupation. The analysis also shows that 20% of them engage in trading and other forms of business; 8.5% engage in other unknown or undisclosed occupation. Finally, 5.5.% and 4.5% of them have civil service and farming

Table 1: Occupational Distribution of the Respondents by their Status

	Occupation Category	Frequency	Percentage (%)
1	Farming	9	4.5
2	Fishing/picking of seafood	59	29.5
3	Trading /Business	40	20
4	Local Craft/Logging	64	32
5	Civil Service	11	5.5
6	Others	17	8.5
Total		200	100%

Source: Authors'fieldworks, 2007

Table 2: Occupational Distribution of the Respondents by their Educational Attainment.

	Highest Educational Qualification	Frequency	Percentage
1	Tertiary Education	12	6%
2	Secondary Education	27	13.5
3	Primary Education	47	23.5
4	No formal Education	114	57
Total		200	100%

Source: Authors' Fieldwork, 2007

Table 3: Common Mangrove Resources Exploited From the Mangrove Swamp forest

	Major resources exploited	Use Value
1.	Mangrove trees (Red and white)	Fuel wood, stake pole, fish traps, construction, boat carving, etc.
2.	Fish, crayfish and prawn	Food and income
3.	Periwinkle	Food, and income
4.	Crab, oyster, etc.	Food and income
5.	Python	Food, raw
6.	Crocodile	Food, raw material and income
	Tortoise	Food, income
8	Monkey	Food and income

Source: Authors' fieldworks,2007

consecutively as their occupation. The implication of this analysis is that over 60% of the people depend on mangrove resource exploitation for survival.

In Table 3 outlines the major biological resources exploited form the mangrove and their various use. Analysis shows that the mangrove trees possesses more use values, that is, as local fuel, stake pole, fish traps, as well for local craft and construction materials. This use value most likely accounts for its high rate of exploitation in the area, also, other aquatic organisms, which are mainly exploited, as source of food and local income (Table 3).

Analysis of Table 4 reveals that an average of 9.600 bundles of mangrove trees are logged monthly in these Ten (10) communities of the Niger Delta, with a unit cost of ₦500.00 per bundle. In terms of fish caught, an average of 3,080 baskets of fish are caught monthly from these Ten (10) communities at a unit cost of ₦3, 500 per basket. About 6,300 basket/bags of crayfish and prawn are harvested monthly at a unit cost of ₦800.00 per basket; 4,350 baskets of crab, oyster and lobsters are harvested monthly and sold at a unit cost of ₦700 per basket; while 1,230 baskets of periwinkles are harvested and sold at a unit cost of ₦1, 500 per basket.

Analysis of the mean monthly income from mangrove resource exploitation shows that at average, four hundred and eighty thousand Naira monthly is made

Table 4: Mean Daily quantity and economic value of some important biological resources of the area.

	Resources	Unit of collection	Season of collection	Monthly (x) quantity	Unit of cost
1.	Mangrove trees	Bundles	All	19,600 dles	N500.00
2.	Fish	Baskets	All	3,080	3,500
3.	Crayfish/Prawn	Basket/Bag	*	6,300	800
4.	Oyster, crab, lobsters	Basket/Bag	All	4,350	800
5.	Periwinkles	Basket/Bag	All	1,230	700
6.	Monkeys	Per head/singly	All	Not known	Not known
7.	Crocodile	"	"	"	"
8.	Tortoise	"	"	"	"

*All season, but more during the early dry season., Source: Author'fieldworks, 2007, 1$ = N160.00

Table 5: Mean monthly income from mangrove resource exploitation

	Resources	Mean monthly income
1.	Mangrove trees	₦480,000
2.	Fish, crayfish/prawn	N651,800
3.	Crab, oysters, periwinkle	N652,500
4.	Others.	NIL

Source: Authors'fieldwork, 2007

monthly from the logging of the mangrove trees as local fuel, stake pile, fish traps, boat carving, etc. Also, about one million, three Hundred seven thousand, eight hundred naira from fish, crayfish two thousand, five hundred naira from sale of crab, oyster, periwinkle, lobsters, etc (Table 5).

Table 6 analyses the responses of the people to Four (4) declarative statements about depletion of mangrove resources in the area. From the analysis, 88% of the total respondents noted that their output or productivity from the mangrove resource exploitation have to a great extent declined in recent times. Where as, 12% of them were neutral to that statement.

Also, in terms of over exploitation as a strong reason for this decline, 55% accepted that this is to great extent; 31.5% of them were neutral in this regard, while 8.5% of them said this is to no extent. That the conversion of the mangrove forest into some other uses as well as industrial activities having negative influence on the abundance of these resources; 93.5% of them affirmed that this is to a great extent; 4.5% neutral, while 2% noted that it is to no extent.

More so, 89% of them noted that to a great extent, mangrove forest and its resources have been significantly depleted in recent times, wile 11% were neutral. Similarly, the analysis affirms that the people are aware of the rapid depletion of the mangrove resources.

Analysis of traditional conservation/management practices in the area show that designation of certain parts of the mangrove swamp as sacred grove is a very effective way of conserving the mangrove forest and its resources. 90% of the respondents affirmed to this and only 8% noted that it is to an extent, while 2% noted that it was ineffective. Analysis of responses concerning the practice of sacred animals and fish show similarity as 86% of them affirmed that this practice is very effective and 11% noted that it was to certain extent and 3% neutral. It is worthy of note that in these communities certain animals are branded sacred and people revered them (Table 7).

Also, in terms of the practice of community preserved forest, opinion varied; 38% affirmed that this strategy is effective to a certain extent; 29%, noted that was very effective, while 27% said it is ineffective, with 6% neutral. In effect, the strategy or practice is not very efficacious.

The table also revels that 68% of the respondents see restriction of access and community legislations against the use or harvest of certain plants and animals at certain time period as being very effective and 23% noted that it has not been effective; whereas, 8% said it is to a certain extent and 1% in effective.

Aforestation as a traditional practice has not been effective as 94% alluded to this fact and only 8.5% noted that it is effective and 6% neutral.

RESULTS

The study found out that the mangrove forest is rich in biological resources that are heavy income earners to the people as well as source of food. The paper found out that most of the people from the study area depend mainly on the extraction and sale of these mangrove resources for their livelihood. The predominant occupations of the people include logging of the mangrove trees, fishing and picking of seafood. Thus, their over dependence on these mangrove resources for survival would have serious implication for the sustainability of these resources. In fact, the mangrove resources are seriously depleted in the region. The use of the mangrove trees as local fuel wood has significantly led to its depletion.

This finding corroborates with the earlier findings of Hunn, *et al.* (2003) and (Mmom (2007) that the depletion of the mangrove forest is basically as a result of over-dependence of rural livelihood on their traditional resources.

From the study, it was discovered that the local people are aware that the mangrove resources are rapidly being depleted. Thus, there is high level of awareness among the people about the rate of depletion of these resources. The study equally discovered that the mangrove swamp is rapidly being converted to other land uses due to the level of development and industrialization. Thus, this constitutes a great threat to the mangrove resources.

Table 6: Analysis of the Level of awareness of the rate of depletion of the mangrove resources

		To a great extent (%)	Neutral (%)	To no extent (%)
1	Your productivity (output) has significantly declined in recent times	176 (88)	2.4(12)	-
2.	Over exploitation of these resources is a strong reason for this decline	110 (55)	63(31.5)	17(8.5)
3.	Mangrove forest conversion into some other uses, as well as industrial activities has negatively affected the abundance of these resources.	187(93.5)	9(4.5)	4(3)
4.	Mangrove forest and its resources have been significantly depleted in recent times.	178(89)	22(11)	-

Source: Authors'fieldwork,2007

Table 7: Traditional Management/Conservation practices and their level of efficacy

		Very (%)effective	To certain extent (%)	Not effective (%)	Neutral (%)
1.	Sacred forest/groves	180 (90)	16(8)	4(2)	-
2.	Sacred animals/fish	172(86)	22(11)	-	6(3)
3.	Selective harvest	55(27.5)	10(5)	131(65.5)	4(2)
4.	Community Preserved forest	58(29)	76(38)	54(37)	12(6)
5.	Periodic Restriction/Laws	136(68)	16(8)	46(23)	2(1)
6.	A forestation	17(8.5)	-	18(94)	12(6)

Source: Author'fieldwork, 2007

The study equally identified many traditional resource conservation practices and analysed their level of efficacy. From the analysis, the study found out that each of these traditional practices had their level of efficacy. However, it is a common and effective practice in these areas for certain portion of the mangrove and its animals and fishes being designated as sacred. To this end, there is natural restriction of access to these plants, animals and fishes. It is prohibited for any body to extract any resource from these groves. Through this practice, such species of animals and fishes increase in abundance and are conserved. However, the problem with this is that the preserved area is usually small in size. Wokoma (2006) in his study of traditional resource management practices in the tropical rainforests belt had also noted that the problem with the use of the sacred groves as conservation strategy is its limited scope

Selective harvest was also identified as a traditional practice in which case, people harvest only matured fish, animal or trees. However, greed has reduced the efficacy of this technique. Also, in some communities, apart from the sacred groves, the community preserves certain forests. To that end, no body logs in thee forests and defaulters are sanctioned.

Apart from the aforementioned practices, periodic or seasonal restriction on the harvest of these mangrove resources is practiced. In some communities, picking of periwinkle and other seafood are restricted and prohibited at certain period or days in the week. In most communities, people are restricted from logging premature mangrove trees and strict sanctions varying from payment of fines, seizure of property, punishment by the gods, to ex-communication are melted on defaulters.

CONCLUSION

On the premise of the findings of this study, the authors conclude that the use of traditional conservation practices is still a better conservation/resource management option. The people see themselves as stakeholders in their resources as such endeavour to protect them. When conservation efforts are imposed on the people, they feel excluded and have no sense of stewardship. It is easier for the defaulters to be handled in traditional practices than in formal conservation approach. In fact, conservation approach as forest reserve is usually alien to the people and they feel the practice is for the benefit of the government rather than theirs.

The traditional resource management practices should be encouraged as way of conserving the ecological resources of the region. The people may see formal protection as a threat to their right of access to their resources. They should rather be enlightened and encouraged to strengthen these practices for sustainable development of the Niger Delta.

REFERENCES

Anon, 1995. Defining an Environmental Strategy for the Niger Delta. Industry and Energy Operation Division, West Central African Department.

Barbier, E.B., 1992. Sustainable Forest Utilisation. In: Economics for the Wilds. T.M. Swanson and E.B. Barbier, (Ed.). London. Earthscan

Bisong, F.E., 2001. Natural Resource Use and Conservation Systems for Sustainable Rural Development. Calabar, (Ed). Baaj International.

FAO, 1981. Tropical Forest Resources Assessment Project. In: The Framework for the Global Environmental Monitoring (GEMS). Forest Resources of the Tropical Africa, Part 1 Regional Synthesis, Rome, pp: 108.

FAO, 1997. Management and Utilization of the Mangroves in Asia and the Pacific. FAO. Rome, pp: 319.

Hunn, S.E., E. Johnson, N.P. Russell and F.T. Thornton, 2003. Traditional Environmental Knowledge Conservation and the Management of Wilderness & Parks. The Wenner-Gren Foundation for Anthropological Research. Vol: 44.

Iyalla, T.M., 2001. Environmental and hydrogeological mapping; a requirement for the niger delta development planning. Technical Paper presented at the Nigerian Society of Engineers' Techincal Session, 12th April, Port Harcourt.

Mmom, P.C., 2003. The Niger Delta: A spatial Perspective to its Development. Port Harcourt. Zelon Enterprises.

Mmom, P.C., 2007. Impact of Human Density and Economic Activities on the Mangrove forest of the Niger Delta, Nigeria. Paper presented at the Annual Conference of the International Association for Impact Assessment, held in Seoul South Korea. 1-9th June.

Ndukwu, B.C. and N.L. Edwin-Wosu, 2007. Changes in Specie Diversity due to dredged spoils in the Mangrove Forest of the Niger Delta, Nigeria.

Udo, R.K., 1975. Geographical Regions of Nigeria. Ibadan, Heinemann.

Wokoma, N.O., 2006. Traditional Resource Management Practices for Biodiversity Conservation. Unpublished B.Sc. Research Project, University of Port Harcourt.

WRI, 1986. World Resources. Basic Books, New York.