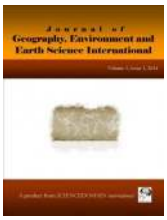

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Wetlands and Livelihood Sustainability: Qualitative Evaluation of the Impact of Oil Exploitation in Ogbia Local Government, Bayelsa State, Nigeria

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Author's contribution

This research was carried out by author EAA. He designed the study, carried out the field work, analyzed the data, interpreted the result and also wrote the manuscript. He further approved the final manuscript.

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ABSTRACT

This study investigated the impact of oil exploitation on wetland and livelihood sustainability in Ogbia Local Government Area of Bayelsa State, Nigeria. The objectives were to: carry out an expository study of the first oil well at Oloibiri; examine the vegetation and soil of the wetland; carry out an expository study of Kolo Creek as well as assessing the socio-economic and environmental impact of sand mining. Data were collected by Participatory Research Approaches which include focus group discussion, interview and field observation to elicit qualitative information on the issues involved in the wetland and livelihood sustainability. The result showed that the original mangrove forest have been replaced with secondary forest while the coastal ecosystems that was once a habitat for a diversity of flora and fauna have been lost. Kolo Creek which provided for navigation, fishing and cultural activities of the local people was taken over by water hyacinth invasion leading to the loss of fishes and other aquatic population and consequently, livelihood. The paper therefore,

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suggest the need for collaboration of all the stakeholders especially the oil companies operating in the area to ensure remediation and reclamation of the degraded wetland. All activities that degrade the wetland must be discouraged while encouraging those that promote sustainable use of resources.

Keywords: Wetland; livelihood; sustainability; environment; degradation; oil pollution.

1. INTRODUCTION

The wetland in the Niger Delta region is one of the largest wetlands and coastal marine ecosystems in Africa, known for its richness in biodiversity, oil and gas resources as well as home to some 39 million people [1]. It delivers a wide range of ecosystem services that contributes to well-being of the constituent communities. There is a complex web of interaction between the people and biodiversity. The oil and gas sector plays a critical role in ecosystem services and health systems of the wetland that provide them [2]. This incredibly well-endowed ecosystem contains one of the highest concentrations of biodiversity on the planet. It also supports abundant flora and fauna as well as containing arable terrain that can sustain a wide variety of crops, agricultural trees, and many species of freshwater fish than any ecosystem in West Africa. According to [3], oil in Nigeria has generated an estimated over US 600 billion dollar since exploration began in 1960. Despite this, majority of the Niger Delta's population lives in poverty. The United Nations Development Program (UNDP) describes the region as suffering from administrative neglect, crumbling social infrastructure and services, high unemployment, social deprivation, abject poverty, filth and squalor, and endemic conflict [4]. Majority of the people of the Niger Delta do not have access to clean and safe water. More than 60 per cent of the people in the region depend on the natural environment for their livelihood. The environmental resource base, which they use for agriculture, fishing and the collection of forest products, is their principal source of food [4]. Environmental quality and sustainability are therefore fundamental to the overall well-being, livelihood and development of the people of Niger Delta.

Oil pollution, waste dumping and gas flaring are endemic in Niger Delta. Pollution of the environment has taken place for decades and has damaged the soil, water, vegetation and air quality. Hundreds of thousands of people are affected, particularly the poor and those who rely on traditional livelihoods such as fishing and agriculture. The human right violation are enormous, underreported and have received little attention from the oil companies and the government of Nigeria. Exposure to oil or its constituent chemicals can alter the ecology of aquatic habitats and the physiology of marine organisms [5]. During water pollution by oil, some of the oil components are degraded and dispersed by evaporation, photochemical reactions, or bacterial degradation, while others are more resistant and may persist for many years, especially in the shallow water with muddy sediments. Accumulation of contaminants to hazardous levels in aquatic habitat has become a problem of increasing concern [6-8]. [9] report that despite existing and abundant natural resources, the Niger Delta region's potential for sustainable development remains unfulfilled with exacerbated environmental degradation.

The inputs of the multi-national oil corporations operating in the Niger Delta are visible throughout the region. Some of the activities of oil companies have led to the disappearance of mangrove vegetation. Very little information is available about the quantity of oil that is spilled by the oil companies' offshore jetties. Indirect evidence from oil washed onto coastal shorelines and beaches in the area suggest that the pollution is significant. The oil spills in mangrove habitats permeate exposed tree trunks, accelerating the rate of decay of plant species and a consequence of their disappearance which lead to shoreline erosion. Pollution also devastates fauna and other organisms that depend on mangrove for survival [10]. This destruction will spiral down the food chain with the effect on the entire biodiversity as well as human population.

Greig et al. [11] report in their work that there was need for careful and continuing monitoring of the coastal ecosystems because of the increasing importance of fish as a source of protein for human population and the interest in

understanding the accumulation of heavy metals and polyaromatic hydrocarbons (PAHs) at the different trophic level of the food chain. Therefore, it is of paramount and utmost importance that a constant assessment and monitoring of the health of the aquatic ecosystem in the Niger Delta of Nigeria be carried out.

Consequently, this study is aimed at examining the impact of oil exploitation on wetland and livelihood sustainability in Ogbia Local Government Area (LGA) of Bayelsa State, Nigeria with the following objectives.

i. To carry out an expository study of the first oil well at Oloibiri,
ii. To examine the vegetation and soil of the wetland,
iii. To carry out an expository study of Kolo Creek, and
iv. To assess the socio-economic and environmental impact of sand mining.

1.1 Description of Niger Delta and Ogbia LGA

The areas referred to as Niger Delta in Nigeria comprise of Cross River, Akwa Ibom, Rivers, Bayelsa, Delta, Edo, Ondo, Imo and Abia States. However, this study focused on Bayelsa State with the study location at Ogbia Local Government Area. The Niger Delta is located in the southern Nigeria. It lies between latitudes 4° and 6° N and longitudes 3° and 9° E. It covers about 70,000 square kilometre with the Delta covering 20,000 square kilometre [12]. It is home to about 20 million people and 40 different ethnic groups. This floodplain makes up 7.5 per cent of Nigeria total landmass. The Niger Delta is the home of the Nigerian oil industry, with its attendant environmental hazards such as water, land, and air pollution. Ogbia is one of the eight local government areas of Bayelsa State in the Niger Delta region of Nigeria. Its headquarters is in the town of Ogbia in the south of the area and it is located at

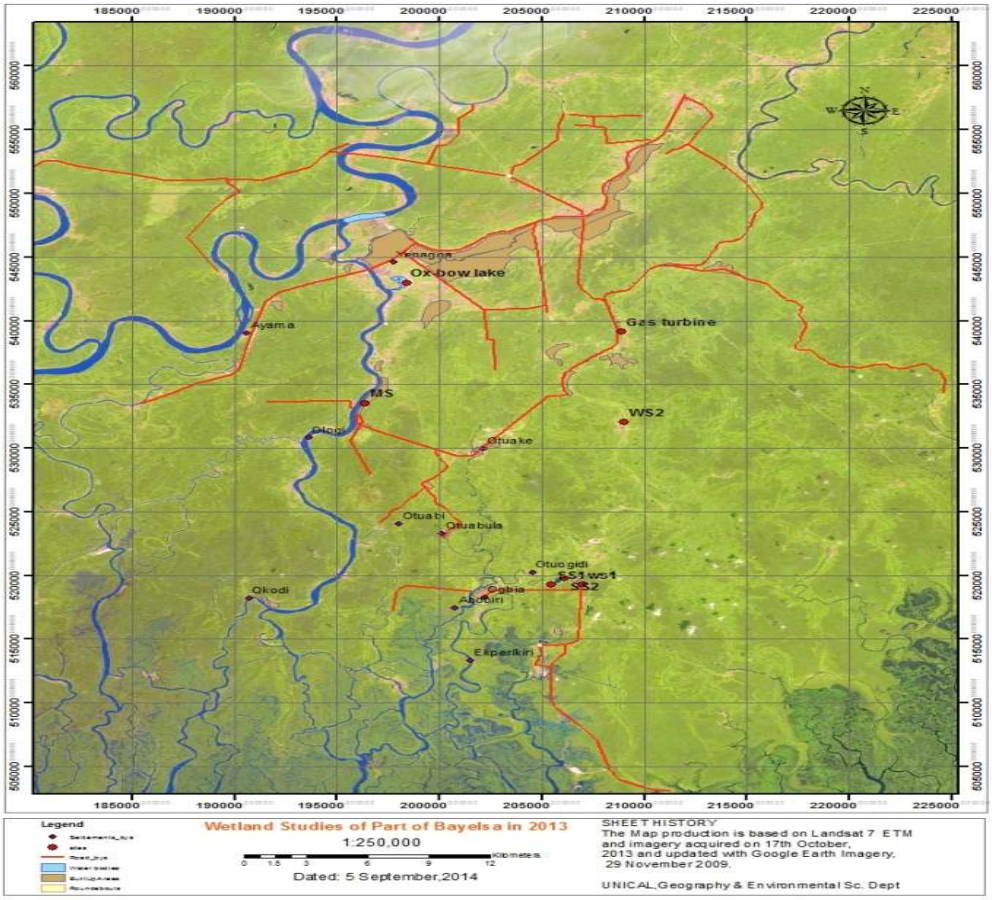

Fig. 1. Map of the study area

latitudes 4°39′ N and longitudes 6°16′ E. It has an area of 695 km² and a population of 179,926 [1]. It is the traditional home for crude oil where the first oil was discovered on Sunday 15th January, 1956 at Oloibiri.

2. METHODOLOGY

The study made use of both primary and secondary sources of data. The primary data included those obtained using Participatory Research Approach (PRA) including focus group discussion, field observation and interview to elicit qualitative information on the issue involved in the Niger Delta wetland and livelihood sustainability. Purposive sampling technique was used to include the community representatives, youth leaders, community chiefs, clan head and household leaders (both men and women) who have been living in the study area for the past 30 years. These groups constituted the study population. Interview schedule and focus group discussion was used to elicit much information as possible from the respondents on the impact of oil exploitation and other anthropogenic activities on the wetland and the people.

3. RESULTS AND DISCUSSION

The finding showed that over 70 per cent of the environmental degradation in Niger Delta was caused by oil exploration activities. Oil spills have been reported as a common event in Nigeria with 50 per cent of the spills occur due to pipeline and tanker accidents. Other causes include sabotage (20 per cent) and oil production (21 per cent) with 1 per cent of the spills being accounted for by inadequate production equipment [13].

Findings obtained through PRA showed that Oil was first discovered in Nigeria in commercial quantity by SHELDIAC Company on 15th January, 1956 at a village called ”Otuabagi” in Ogbia Local Government Area of Bayelsa State. The Oil Well was named Oloibiri because Oloibiri was the district headquarters of Ogbia Council in 1956 where the multinational oil company was located. A community leader at Otuabagi attributed the misconception in the naming of the first oil well after Oloibiri instead of Otuabagi as a deliberate attempt to create confusion in the area.

Fig. 2. Oloibiri oil well

Fig. 3. Renovated Oloibiri oil well

The discovery of oil in 1956 ended the 50 years of misery and launches Nigeria into the field of petrol state. The depth of the oil well was 12,008 feet (3,639 metre). It was tested and discharged about 5,000 barrel per day. Oloibiri oil field comprises of 22 Oil Wells, whereas Oloibiri as a community does not have any boundary with any of the oil wells. Rather, Otuabagi community owned 18 out of the 22 Oil Wells. Another community leader stated during the group discussion that SHELL exploration activities have brought an untold hardship to the community. In term of corporate social responsibility (CSR), not much has been done to the community. The first appeal to the oil company was in 1991 with the construction of secondary schools and the granting of scholarship by Shell to some selected members of the community. It is of note that the only major road at Otuabagi is the one that leads to the first oil well which according to a respondent was constructed by shell not for the community but because of access to the oil well by the multinational company.

Another respondent stated that the community is a shadow of oil havoc with the attendant pollution of the environment. He further stressed that the only compensation paid by Shell Petroleum Development Company to the community was the one pound per square metre as agreed on in 1956 and has not been reviewed till date. The oil well has been abandoned and no longer in use today. Also, the community is not allowed to use the land because of Oil Prospecting License (OPL) issue. Before now, Oloibiri oil well has constituted an eyesore and grave danger to the community especially children but for the housing and renovation work carried out on the museum by the Ministry of Tourism in the year 2001 and a further rehabilitation work by the Federal Ministry of Culture and Tourism and National Orientation in 2013.

3.1 Impact of Oil Exploration on the Mangroves

Oil pollution poses great challenge to economic development of the Niger Delta. It is largely due to industrialization, industrial waste discharge, oil spills, gas flaring et cetera. [5] noted that mangrove forest generally provides a wide range of beneficial natural ecosystem goods and

services. Oil spills are a serious concern to the health of Nigeria's remaining mangrove ecosystems. 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 plant's breathing lenticels to perform their essential function when covered in oil with the resultant effect of suffocation. Massive die-off is a common phenomenon plaguing the mangrove regions where coastal oil exploration occurs. This was the case in Ogbia Local Government Area of Bayelsa State. Most of the original mangrove has disappeared with secondary forest growth dominating. Oil spill often occurs in the remote regions. Many of the spills persist for a long period of time without clean up. Furthermore, the clean-up are not done in a timely and effective manner even when detected. A team of experts in 2006 comprising of Nigeria Ministry of Environment, World Wide Fund (WWF), UK and the International United Commission for the Conservation of Nature (IUCN) reported that an estimated 9-13 million barrel (1.5 million tons) of oil has spilled in the Niger Delta ecosystem over the past 50 years. The financial valuation of the environmental damage was estimated to be tens of billions of dollars [14].

3.2 Impact of Oil Exploration on Local Communities

Nigeria flares more associated natural gas (AG) than any country in the world, with estimates suggesting that 3.5 billion cubic feet of AG is produced annually, out of which 2.5 billion cubic feet (about 70 per cent) is wasted through flaring. The monetary equivalent of flaring has been estimated to be US 2.5 billion dollars per year [15,5]. Another problem of flaring in the Niger Delta is the release of large amount of methane (a greenhouse gas) that contributes to global warming. Methane losses are accompanied by another major greenhouse gas escape, carbon dioxide. Gas flares can have potentially harmful effects on the health and livelihood of human communities as they release a variety of poisonous chemicals such as nitrogen dioxide, sulphur dioxide, volatile organic compounds like benzene, toluene, xylene and hydrogen sulphide as well as carcinogens like benzapyrene and dioxin. Human exposed to such substances can suffer from a variety of respiratory problems which have been reported amongst many children in the Delta but have apparently gone uninvestigated. The impact of gas flaring can be visibly seen on the dark roof tops of structures at Otuabagi and the entire Ogbia Local Government area.

3.3 Impact of Oil Exploration on Sustainable Livelihood

The study revealed that majority of the human population were predominantly fishermen, living off the rich alluvial farmland and abundant surface water web that characterize the basin. Mangrove forest acts as nursery ground for many aquatic animals. The Niger Delta is bordered by a deep belt of mangrove forests which protects vast areas of fresh water swamp in the inner Delta. The trees and roots provides rich habitat for a wide variety of fauna and flora. The Niger Delta region's brackish creek, bays and tidal pools are breeding ground for the marine life upon which many people depend for their livelihood. It has been estimated that over 60 per cent of the fish in the Gulf of Guinea breeds in the mangrove forests of Niger Delta. Regrettably, oil spillage has been found to be impacting adversely on fishery resources [16].

This report is in agreement with the submission of a middle aged farmer in his 50's that many of the fishes they used to catch were no longer present in the river and that there has been a remarkable decrease in the number of catches. It was also mentioned that staple crops such as cocoyam and cassava could no longer grow again on their farmland. [17] reported that the economic conditions in the Niger Delta reflect that poverty was endemic in the region and that it was getting worse as a result of oil pollution of the coastal water that provided fish consumed by the local people. The impact of oil pollution in the livelihood of the communities is more evident on the women and children. This is because mangrove swamp fisheries such as hand-picking of *Tympanotonus sp* (periwinkle) and *Pachymenalia sp* are mostly done by this group in the Niger Delta.

3.4 Vegetation and Soil

Vegetation in the Niger Delta consists of exclusive mangrove forests, brackish swamp forest and rainforests. According to [18], the large expanse of mangrove forests are estimated to cover approximately 5,000 to 8,000 square kilometre of land. Mangrove remains very important to the various biodiversity and organisms that inhabit these ecosystems as well as to the indigenous human population.

Human impact from poor soil management upstream coupled with the constant oil pollution has led to the disappearance of most of the mangrove vegetation. This was evidenced by the tertiary growth arrival of forests at Otuabagi and Otuoke communities in the study area. There has been the destruction and tertiary growth (replacement of the previous and original mangrove forest. The volatile, quickly penetrating, and viscous petroleum have wiped out large areas of vegetation. Whenever spill occur close to and within the drainage basin, the hydrological force of both the river tides force spilled petroleum to move up into areas of vegetation.

Mangrove forests are included in a highly complex trophic level system. When oil affects any organism within the ecosystem, it can directly affect a host of other organisms. The communities of plants rely on nutrient cycling, clean water, sunlight and substrates. They offer habitat structure, and input of energy through photosynthesis to the organism they interact with. The effects of oil spills on vegetation are known to acidify soils, halt cellular respiration and deplete roots of vital oxygen [19].

The loss of mangrove vegetation and soil is not only degrading to plants, animals, but human as well. Mangrove vegetation has been a major source of livelihood for the indigenous people of Niger Delta especially the people of Ogbia LGA. They are also important to a variety of species vital to subsistence practices for local indigenous people who unfortunately don't see any economic benefit from petroleum exploration. Mangrove also provide essential habitat for rare and endangered species like mantee and pygm hippopotamus. The advent of oil bunkering, sabotage and militancy in the Niger Delta has further exacerbated the treat to mangrove vegetation.

3.5 Kolo Creek

Kolo Creek has been a major source of livelihood for the local people of Ogbia Local Government Area of Bayelsa State. The inhabitants depended on the creek for fishing, cultural festival and navigation through the use of canoe. It was also reported that Kolo Creek constituted a veritable means for the inhabitants' economic activities via swimming, fishing, trading, and transportation. The pollution of the creek with oil and human excrement was equally observed (Figs. 4 and 5).

The major impact of oil pollution on the creek was the depletion of the fish population and water hyacinth invasion.

3.6 Depletion of Fish Population

Fish constitutes about 40 per cent of animal protein in Nigeria with the figure generally higher for residents of the Niger Delta. The fishing industry is an essential part of the Niger Delta's sustainability because it provides the much needed protein and nutrients for the people and also employment for the local community of fishermen. However, with the higher demand for fish, fishing populations are declining faster than they are been produced. Before now, Kolo Creek provided the water for drinking, bathing, cleaning and fishing for the local communities. As the people settled along the banks of the river, marine and aquatic habitats were lost and subsequently, ecosystems have changed as a result of oil pollution and other anthropogenic activities.

A decline in fish availability have resulted in the poor nutritional status of the people especially children who require adequate intake of protein for development. The people of the Niger Delta are today living in poor health conditions and in a polluted environment because of economic deprivation arising from oil exploitation. According to [15], an urgent need exist to implement mechanism to protect life and health of the regions' inhabitants and its ecological systems from further deterioration and degradation.

3.7 Water Hyacinth Invasion

Water hyacinth is an invasive species that was introduced into Africa as an ornamental plant and which thrives in polluted environments. Water hyacinth has the ability to completely clog the waterways in which it grows making it nearly impossible to navigate fishing boats. In recent years, it has found its way into the River Niger, choking out both sunlight and oxygen to marine organisms. Kolo Creek has almost been completely taken over by water hyacinth as shown in Fig. 5. Navigation has been hampered as the water body has been covered. When water hyacinth makes its way into an ecosystem, it competes with the native plants for sunlight, diminishing energy resources within the marine environment. With the loss of energy, some population will not be able to survive, or their numbers may drop beyond a point of no return, thereby creating a threatened environment. In

addition to the loss of energy, water hyacinth also takes up and depletes the water of oxygen which is essential to the livelihood of aquatic [20].

A local resident stated that "*Abiola grass*" (a local name for water hyacinth) has destroyed their economic activities. Recreation and cultural activities are no longer taking place in the community. "Infestation by ""Abiola *grass*"" is high during the dry season and that it does not have any economic value even when removed by farmers" he concluded. There was a contrast in his submission as another respondent; a farmer said he uses *Abiola grass* for compost and that crop yield fare better than when no compost was used.

3.8 The First Gas Turbine

The Kolo Creek/Nun River Gas Turbine Power Station at Imiringi in Ogbia Local Government area was built in 1985 and commissioned in 1988 by the then Chief of General Staff, Vice-Admiral Augustus Aikhomu. It was built for the purpose of rural electrification of the immediate communities. The Station Manager reported that the turbine, called SK31 is a Russian turbine which was test run in 2012 at 80 per cent completion (Fig. 6).

He further stated that the gas turbine was almost abandoned at the moment because it is yet to be completed and most of the equipment was getting deteriorated. Power supply to the host community was from Port Harcourt power station. The first gas turbine station presents a classic case of government abandoned project arising from lack of continuity of government programs as a result of politics and systemic corruption.

It is pertinent to mention here that the major raw material for the gas turbine power station is gas, which is in abundance in the Niger Delta region. Nigeria flares more natural gas associated with oil extraction than any other country. With an estimated 3.5 billion cubic feet of associated gas produced annually, 2.5 billion cubic feet (about 70 per cent) is flared. Flaring is done by the oil companies because it is costly to separate commercially viable associated gas from the oil. Oil companies operating in Nigeria also harvest natural gas for commercial purposes, but prefer to extract it from deposits where it is found in isolation as non-associated gas. Thus, associated gas is burned off in order to reduce cost.

Fig. 4. Oil pollution of Kolo creek

Fig. 5. Feacal pollution on Kolo creek

Fig. 6. The first gas turbine

Gas flaring is generally discouraged as it releases toxic components into the atmosphere and contributes to global warming. In Western Europe, 99 per cent of the associated gas is

used or re-injected into the ground. Gas flaring in Nigeria began simultaneously with oil extraction in the 1960s by Shell-BP. The international communities, the Nigerian government and the oil corporations have been in accord that gas flaring needs to be curtailed. Efforts to do so however have been limited even though flaring has been declared illegal in 1984 under Section 3 of the "Associated Gas Re-injection Act of Nigeria", over 75 per cent is still being flared [21].

Gas is often flare close to the local communities, and also lack adequate fencing or protection for villagers who may risk working near heat of the flare. Some of the local people claimed that flaring causes acid rain which corrodes their homes and local structures, many of which have zinc-based roofing. Some affluent and wealthy ones result to the use of asbestos-based materials which is a stronger repellant of acid rain deterioration. According to [22], asbestos exposure increase the risk of lung cancer, pleural and peritoneal mesothelioma, and asbestosis. Also, flaring creates noise pollution and community may have to live with permanent light. When gas is flared, the combustion is often incomplete and hence oil droplets fall on waterways, crops, houses and people.

3.9 Sand Mining and Its Socio-economic Implication and Environmental Impact

Otuogiri, another community in Ogbia Local Government Area is a floodplain settlement with linear structures that are closely-knitted. Sand mining activities are carried out in the community and have impacted heavily on the socio-economic life of the people. The community head, an elderly man in his mid-seventies gave graphic and historical details of the origin of sand mining in the community. According to him, the community was so much covered with sand from the river that transverse the community and that it almost submerged with sand between 1968 and 2000. The presence of the river was a nightmare and a menace to the people of Otuogiri as navigation was almost impossible with no economic activities. The problem was further compounded as a result of lack of access road in the community.

However, respite came their way when Oakman, a dredging company came and started dredging in 2010 as a result of abundance of sand. This marked the beginning of fortune to the community as many other dredging firms came in for commercial activities (Fig. 7). Consequently, socio-economic activities grew in leap and bound with the local residents making a living from the dredging activities.

Also, more structures are springing up with markets, shops, restaurants and night clubs and other economic activities all receiving a boost. A boat transport operator hinted that his business has been made easy and more viable because of the dredging activities. However, fishermen can

Fig. 7. Sand mining at Otuogiri

no longer fish because the fish's population has decreased just as the community has also prohibited fishing on the river. The environmental impacts of sand mining on the community are many and varied. An immediate noticeable impact is that of noise pollution arising from the dredging equipment that littered the waterways. Also, animals have disappeared from the nearby mangrove forests because of noise pollution. According to the community head, dredging is only allowed at 100 metre offshore and disallowed between the month of September and November because of risk of flood. The indigenous knowledge system of the community is that any dredged sand during this period stands the risk of being wash back into the river by the flood. An interesting impact of the sand mining activity is that the community no longer experience flood. In fact, they were not affected by the 2012 flood that ravaged all the entire coastline of Nigeria. Another problem is that of water hyacinth which according to a site operator prevent dredging as well as impedes navigation.

The Otuogiri traditional ruler, during an interview session affirmed all the various findings in the entire communities and villages in Ogbia Local Government Area of the state. This shows cultural homogeneity among the communities. He further corroborated the negative impact of oil exploration in the Niger Delta which has impacted negatively on the environment and the socio-economic activities of the people. Notable agricultural crops such as cocoyam and cassava have almost disappeared as well as a decline in fishing and navigation activities. He also reported massive unemployment among the inhabitants which have made them to resort to various crimes such as armed robbery, militancy and oil bunkering. He further stated that farming activities was the major occupation of the people before oil exploration. He admitted that the people have an indigenous knowledge on sustainability.

4. CONCLUSION AND RECOMMENDATION

This study provides a qualitative analysis of the on-site assessment of the Niger Delta wetland of Nigeria with Ogbia LGA in focus. Oil exploration and development occurred in Nigeria without a comprehensive master plan to protect its natural resource. Many of the oil facilities and operations are located within sensitive habitats of fish, mangroves and rainforest. These habitats have been severely damaged by oil and gas operations, thereby contributing to biodiversity loss, misery and poverty. The impact of multinational oil companies has been chronic and cumulative and has become a source of environmental stress to result in a severely impaired coastal ecosystem and compromised livelihoods and health of the people.

Sustainability of mangrove forests and coastal ecosystems depends on collaboration by all stakeholders including governments, multinational oil companies and the communities (local residents). There must be introduction of adjustments to operational procedures by the multinational oil companies operating in the area. Corporate social responsibility (CSR) and environmental stewardship should be required of the multinational oil companies with effective and efficient enforcement of environmental laws by government regulatory agencies saddled with such responsibilities. The 2012 UNEP Report on Ogoni should be implemented in order to pay adequate compensation to the injustices done to the environment and the people without further delay.

The indigenous knowledge system of the locals should be encouraged and integrated with the scientific knowledge system using bottom-top approach. All the polluted soils and vegetation should be reclaimed. All acts that enhance sustainable use of resource should be promoted by all the stakeholders including the local residents, while those that degrade the environment should be discouraged. People must be made to understand that the soul of the environment is the soul of man and that the survival of the environment is the survival of man.

CONSENT

It is not applicable.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. NPC. Report of the Niger Delta technical committee. Nigerian Population Commission 2006 Census. 2008;102.
2. Nwilo PC, Badejo OT. Impacts and management of oil spill in Nigeria coastal environment. A paper presented at the international conference on the Nigeria State, the oil industry and the Niger Delta at the department of political science, Niger-Delta University, Bayelsa State, Nigeria; 2008.
3. Wurthmann G. Ways of using the African oil boom for sustainable development. African Development Bank, economic research working paper series, No. 84; 2006.
4. UNDP. Niger Delta human development report. United Nations Development Program; 2006.
5. Nwilo PC, Badejo OT. Oil spill problems and management in the Niger Delta. International oil spill conference, Miami, Florida, USA; 2005.
6. Idodo-Umeh G. Pollution assessment of Olomoro water bodies using physical, chemical and biological Indices. Ph. D thesis, University of Benin, Benin City; 2002.
7. Adeyemo OK. Consequences of pollution and degradation of Nigerian aquatic environment on fisheries resources. Environmentalist. 2003;23(4):297-306.
8. Adeyemo OK. Habitat assessment for seasonal variation of river pollution in Ibadan, Nigeria. In a geographic information systems interface. Veterinaria Italiana. 2008;44(2):361-371.
9. Moffat D, Olof L. Perception and reality: Assessing priorities for development in Niger Delta. Ambio. 1995;24(7):527-538.
10. Molles MC. Ecology concepts and applications. 3rd Edition. McGraw-Hill Companies Inc. 2005;93-94.
11. Greig RA, Wenzloff DR, Mckenzit CL, Merill AS, Zdanowicez VS. Trace metals in sea scallops *Pacepedent megalonicus* from Eastern United State. Bull Environ. Contam. Toxicol. 1978;19:326-334.
12. Spalding M, Blasco F, Field C. World mangrove atlas. The International Society for Mangrove Ecosystems, Okinawa, Japan. 1997;178.
13. Nwilo PC, Badejo OT. Impact of oil spills along the Nigerian coast. The Association for Environmental Health and Sciences; 2001.
14. Federal Ministry of Environment. Niger Delta natural resource damage assessment and restoration project. 2006;13.
15. World Bank. Defining an environmental strategy for the Niger Delta; 1995.
16. Akpofure EA, Efere ML, Ayawei P. The adverse effects of crude oil spills in the Niger Delta. Uroboh Historical Society; 2000.
17. Aworawo D. The impact of environmental degradation on the rural economy of the Niger Delta. In Osuntokun Akinjide, environmental problems of the Niger Delta. Friedrich Ebert Foundation; 2000.
18. Nwilo PC, Badejo OT. Impacts and management of oil spill pollution along the Nigerian coastal areas. International Federation of Surveyors; 2007.
19. Adelana SO, Adeosun TA, Adesina AO, Ojuroye MO. Environmental pollution and remediation: Challenges and management of oil spillage in the Nigerian coastal areas. American Journal of Scientific and Industrial Research. 2011;2(6):834-845.
20. Friends of the Earth. Media briefing: Gas flaring in Nigeria. Friends of the Earth; 2004.
21. World Bank. Gas flaring in Nigeria. Friends of the Earth Report; 2004.
22. Bronwen M. The price of oil. Human Right Watch; 1999.

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