



## Environmental Impact Assessment of Crude Oil Exploitation on Wildlife Resources in the Niger Delta Region of Nigeria

<sup>1</sup>S. A. Abere, <sup>1</sup>V. Ojadi and <sup>2</sup>Jacinta A. Opara

<sup>1</sup>Rivers State University of Science and Technology, Port Harcourt, Nigeria

<sup>2</sup>University of Maiduguri, P.M.B 1069, Maiduguri-Nigeria

### ABSTRACT

This study was carried out to assess the environmental impact of crude oil exploitation on wild life resources in Bonny forest area of the Niger Delta region of Nigeria. The vegetation cover was sampled by laying 10m-2 quadrat at randomized interval in the study sites. Records were then taken of the plants occurring in the quadrates. Observations on the faunal life in the study sites were carried out using direct and indirect methods. The study was carried out principally during the days, but was occasionally extended to the evenings. Primate recorded the highest specie number (5) and rodentia as the highest percentage distribution (70%). Predictably, every 8% reduction in tree cover will make the expected number of animals alive to decline from 1520.10 to 220.50 until the value will become negative (-213.49). The result of the study showed there are 7 orders and 25 species of mammals in the study area. Also, the rate of mortality will increase from 0.14-1.00, and the percentage interval of tree destruction will increase from 153.65 to 249.00. By the time the exploitation of crude oil is in full scale, the balance in the ecosystem will be adversely affected with possible decline in relative abundance of wild life resources. Based on the results, the ill-effects of the exploitation, will however be grave when vegetation is destroyed beyond 70% cover.

**Keywords:** *Crude Oil, exploits, forest, environment, wildlife*

### INTRODUCTION

Nigeria is endowed with abundant mineral resources which have contributed in no small measure to the Socio-economic development. But the development of the minerals has varying degradation effects on the environment. Since much of the damage is inevitable if the minerals must be developed, both the government and the mineral industry must be involved in taking precautionary as well as remedial measures that can minimize the ill effects of the mineral development. Petroleum products are materials derived from crude oil (petroleum) as it is processed in oil refineries. Crude oil is a complex mixture of hydrocarbons from which various petroleum products are derived such as gasoline, kerosene, fuel oil, lubricating oil, wax and asphalt (Nosike and Opara, 2008; Opara, 2015; Opara, 2019). The presence of crude oil in Bonny forest area of Rivers State, Nigeria (Nosike and Opara, 2003; Enu, 1990 and Akindoyemi, 2000) will have some impacts on environment during mining. Whatever the impacts, basically because of the economic consideration, the mining of crude oil; open-cast and in-site techniques (Agagu, 1985) will not have some destructive tendencies such as vegetation removal, ecological disturbances, geological hazards like tremor, land slide, erosion and flooding due to instability of soil and rock masses, landscape degradation and radiation hazards (Akekoya, 1995). All of these will affect the balance in the ecosystem, as decline in plant and animal species due to habitat alteration and possible extinction of some species will be the grave consequences.

Wildlife is an important aspect and component of the rainforest ecosystem and is very much dependent on the natural vegetation in order to survive. Rainforest mammals (as well as other rainforest organisms) have evolved over millions of years to live in the rainforest. But progressive removal of the rainforest has however, resulted in a reduction of their geographical distribution and total numbers. Without the rainforest, the animals will become extinct (Abere and Opara, 2012).

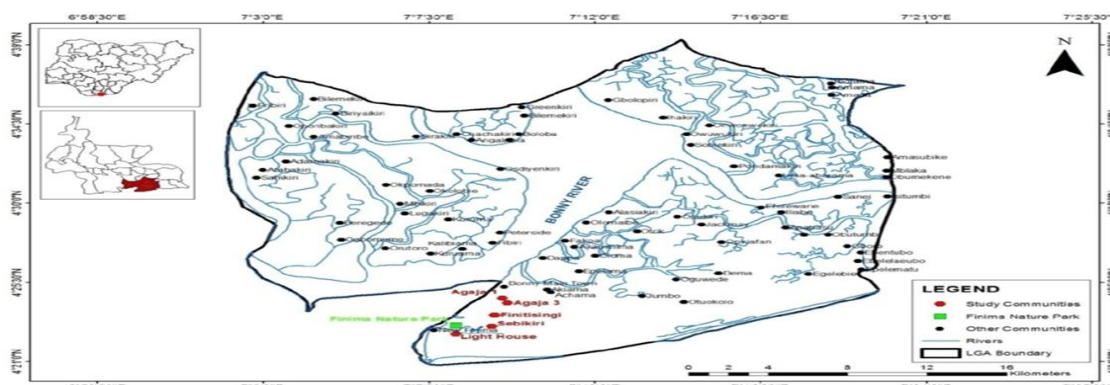
Diverse species of animals and plant all over the world are associated with the primary forest. The increasing exploitation and development of crude oil has inadvertently added to the destruction of the primary forest (habitat) caused by crude oil prospecting. With this, the variety of plant and animal species associated with the primary forest declines due to disruption, destruction fragmentation and alteration of the habitats. The disturbance in the ecological set-up caused by crude oil exploitation could lead to the extinction of wild species of plant and animal which represent an irreversible loss of unique resources (Oke and Fuwape, 1995).

Degraded features of the environment include the soil, vegetation, aquatic life and land substances (Falaye and Olaniran, 1995). Following a proposal to mine crude-oil in Bonny forest area investigations were carried out to assess the current flora and fauna resources of the area, assess and predict potential impacts of crude oil extraction on wildlife resources; as well as identify alternatives with the least potential environmental impacts of the proposed crude oil mining.

**MATERIALS AND METHODS**

The vegetation cover was sampled by laying 10m-2 quadrat at randomized interval in the study sites. Records were then taken of the plants occurring in the quadrates. Observations on the faunal life in the study

soles were carried using direct and indirect methods. The study was carried out principally during the days, but was occasionally extended to the evenings. The late evening trips were expected to lead to sighting of nocturnal animals. Map of Bonny showing the study area is presented in Fig.1.



**Fig. 1:** Map of Bonny showing the Study Area

The criteria for faunal identification were based on:

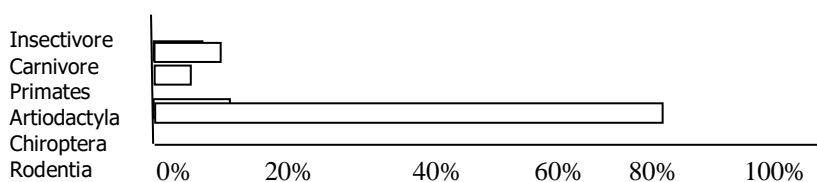
- (a) **Footprints and other signs:** A general search was made in the study sites for footprints, spoor, fecal droppings, nests, skins, hairs, animal beds, and other signs of animal presence.
- (b) **Counting of live Animals:** Some animals were occasionally sighted while traversing the census points, while faunal observations were also recorded when conducting the vegetation survey. Inventory of animals were also taken along a measure transect length of 3700 meters and also with the use of personal interviews to know the relative abundance were subjected to correlation, linear regression and life table

format for describing the mortality schedule of the population.

**RESULTS**

**Mammalian Resources**

Table 1 shows the mammalian faunal resources in Bonny forest area. The area contains 7 orders and 25 species of animals. Rodentia recorded the highest species number (10) followed by primates (5), carnivore (4), Artiodactyla (3), insectivore (1), proboscidea (1) and chiroptera (1). Figure 2 shows that Rodents that Rodentia has the highest distribution of 70% followed by primate (5%), carnivore (4), Artiodactyla (3) insectivore (1) and chiroptera (1).



**Fig. 2:** Distribution of Mammals in Bonny Forest Area

**Predicting Further Years of Crude Oil Exploitation on Animals**

Table 2 shows the number of trees per hectare and the expected percentage change in tree and animal number per hectare due to Crude Oil exploitation. The prediction line shows that, with every 8% destruction of trees due to crude oil exploitation, expected number of animals alive will decline progressively from 1514.62 to 230.20, after which it

will get to a point when it becomes negative (-119.50). The number dying at each percentage interval of the destruction (dx) will increase progressively from 163.64 to 180.00 after which it will decline to 148.89. While the number of individual alive on the average during the percentage interval of exploitation (qx) decreases progressively from 910.6 to 84.90. Figure 3 shows the projected decline in animal population due to crude oil mining.

**Table 1:** Mammal Resources in Bonny Forest Areas

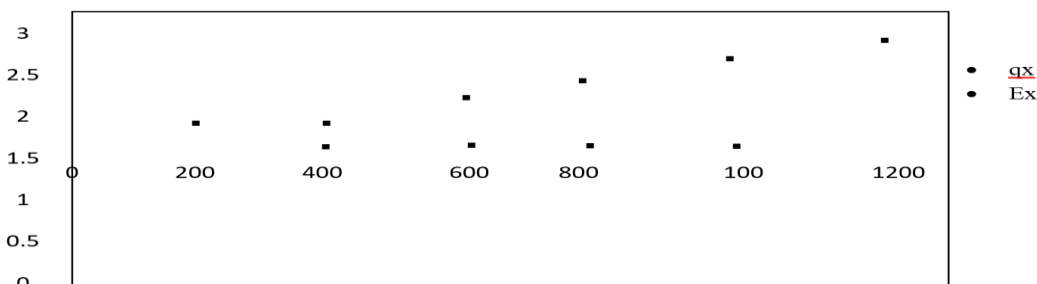
S/No	Local Names in Bonny	Common Name	Scientific Name	Order	Enumeration Method
1.	Ajao (Ema)	Flying squirrel	<i>Pteromyini</i>	Rodentia	D
2.	Okere	Orange headed tree squirrel	<i>Funisciurus anchrythrus</i>	Rodentia	A and B
3.	(Uhon)	Giant forest squirrel	<i>Protoxerus stangeri</i>	Rodentia	A and B
4.	(Orere)	Geoffroy's ground squirrel	<i>Xerus erythropus</i>	Rodentia	F, D and A
5.	Okete	Giant rat	<i>Cricetomys gambianus</i>	Rodentia	A and D
6.	Ofan	Black rat	<i>Rattus rattus</i>	Rodentia	A
7.	Ago	Stripped grass mouse	<i>Lemniscomys barbarous</i>	Rodentia	D and A
8.	Iki (Uki)	Climbing mouse	<i>Dendromys mystacalis</i>	Rodentia	A
9.	Ore-sheshe (Gelete)	Brush-tailed porcupine	<i>Artheriurus africanus</i>	Rodentia	E, D and F
10.	Oya	Cane rat	<i>Thryonomys swinderianus</i>	Rodentia	E, D and F
11.	(Eta)	African civet	<i>Viverra civetta</i>	Carnivore	D
12.	(Ogbo)	Forest genet	<i>Genetta poenisis</i>	Carnivore	E and C
13.	(Ekun)	Leopard	<i>Panther pardus</i>	Carnivore	F and D
14.	Erin	Elephant	<i>Loxodonta africana</i>	Proboscidea	D
15.	(Ehi)	Red river hog	<i>Potamochoerusporcus</i>	Artiodactyla	D
16.	Igala (Laga)	Bushbuck	<i>Tragelaphus niger</i>	Artiodactyla	F and D
17.	Kiri (Edun)	Black duiker	<i>Cephalophus niger</i>	Artiodactyla	F, C and D
18.	Asin (Ahenko)	Long-tailed musk shrew	<i>Crocidura dolichura</i>	Insectivore	D, C and G
19.	Adan	Bats	<i>Chiroptera</i>	scrotifera	A and B
20.	(Edun)	Colobus	<i>Colobus</i>	Primate	D
21.	Iki (Eki)	Potto	<i>Peridictitus potto</i>	Primate	F, and D
22.	Aaya	White nosed monkey	<i>Cercopithecus drythnrogaster</i>	Primate	A and D
23.	Ijimere	Red bellied monkey	<i>Cercopithecuserythrogaster</i>	Primate	D
24.		Mona monkey	<i>Cercopithecusmona</i>	Primate	D

Methods used for enumerating the wildlife species as coded as follows:

- A = Direct Sighting, B = Calls
- C = Footprints, D = Information from villagers
- E = dropping, F = Activity sites
- G = on sale road sides and market

**Table 2:** Animals Life Predicting Further Years of Crude Oil Exploitation Impact on Animals

% Change in Tree	nx	Ix	Dx	Qx	Ix	Ex
1110 (100%)	1514.62	195.00	163.64	0.15	910.6	2.50
1004(92%)	12500.5	823.18	184.10	0.20	700.10	1.91
884(84%)	933.20	600.00	200.00	0.30	500.84	1.30
7800(76%)	620.81	400.65	180.00	0.56	275.83	0.79
600(68%)	230.20	120.82	148.89	1.00	84.90	0.40
540(60%)	-119.50	-	-	-	-	-



**Fig. 3: Projected Decline in Animal Population due to Crude Oil Mining**

The expected decline in the number of animals per hectare as a result of crude oil mining is presented in Figure 2. It is shown that as the number of animals surviving at start and percentage interval of crude oil exploitation (Ix) and subsequent tree destruction decreases progressively from 1950.00 to 120.82, the rate of mortality (qx) increases progressively from 0.15 to 1.00, while the mean expectation of further life (ex), progressively decreases from 2.50 to 0.40.

The mortality rate and expected mean of further life, however, interacts to establish a maximum sustainable exploitation point of 70% tree cover, and 300 animals per hectare surviving the exploitation of crude oil. The graph of mortality rate slopes downward from left to right, thus, obeying the law of demand. While the graph of mean expectation of further life slopes upward from left to right, thus, obeying the law of supply.

## DISCUSSION

### Mammalian Resources

This study has revealed that the study area is rich in diverse species of animals as a total of 7 orders and 25 species of mammals were inventoried during the period of the study. All the animals ranging from Rodentia, Chiroptera, Artiodactyla, Primate, Carnivora, Proboscidea, and insectivora are endemic in the rainforest ecosystem. Proboscidae which was implication of this is that, the higher the mean expectation of further life, the higher the survival value of animals. With sustained exploitation of Crude Oil faunal resources that will survive successive stages and years of exploitation will continue to decline. It was observed that, as the mortality rate surge up, the mean expectation of further life will also decline. This effect means that, the higher the rate of mortality of animals due to exploitation, the lower the ability of animals to survive successive years of Crude Oil exploitation. So also will the mean expectation of further life be boosted by the survival value of the animals as will be measured by the retainance of favourable environmental conditions of habitat stability (tree cover).

The interaction between the forces of mortality rate and mean expectation of further life in any population can therefore be used as a determining factor of this maximum exploitation point of the vegetation of the study area. So, at 0.75 mortality rate and mean expectation of further life under Crude Oil exploitation, 310 animals per hectare will be alive at the maximum sustainable exploitation point. This implies that at 70% tree cover such offer protection and habitat for animals, 300 animals will survive the exploitation of Crude Oil. Further destruction of trees (habitats) beyond the 70% cover will automatically result on the population of animals.

not enumerated but was said to be in the forest area of the study site by villagers has probably wandered into the adjacent forest reserve due to habitat disruption by villagers.

The rainforest, typical of Bonny forest is rich in diversity of plant and animal species. This can however, predispose the animals to the vulnerability of local extinction. To maintain the diversity of rainforest ecosystem minimum disturbance should be caused in the forest, while large areas of wildlife habitats must be protected. Failure to do this will definitely lead to irreversible loss of habitats for wild life resources. This will then reduce the relative abundance of the animals and cause local or outright extinction of species of wild animals. This view was supported by the early works of Jeffrey (1990), Soule (1991), Saye and Wegge (1992) that the loss and fragmentation of tropical moist forest is the single greater threat to the world's wildlife resources particularly mammals.

### Prediction of Crude Oil Exploitation Effect on Animals

The mortality rate which slopes downward from left to right, thus, obeying the law of demand shows that the higher the rate of mortality, the lower the survival value of animals. The graph of mean expectation of further life slopes upward from left to right. The Because of the high density of species in the rainforest, the level of vulnerability is high. This predisposes animals to extinction. This is possible because once the natural ecosystem has been destroyed, it will take a very long time before the equilibrium in the ecosystem can be restored for it to regain its status and attain climax. This will predispose ecological components particularly wild animals to either migrate or become locally extinct, because all animals are dependent on the vegetation for food and shelter. Elucidation of these requirements will require that the animals be forced to move to the immediate environment with accommodation habitats. Tropical rainforest is known to be the most complex of all plant communities because of the huge number of species it contains which makes it to be the most vulnerable. Some anthropogenic activities that disrupt the ecosystem include solid/liquid mineral mining, the consequences of which are deforestation, destruction of wildlife habitats and wetland and deflection of natural resources (Odiere, 1999).

### Environmental Impacts

The significant environmental impacts of crude oil exploitation on animal life in Bonny forest area have been identified as follows:

1. Clearing of tall trees and woodlands will lead to irreversible forest fragmentation and degradation which will affect under storey vegetation structure, micro-climate and food

- availability. These will have pronounced effects on forest interior species of animals.
2. There will be changes in habitat structure, which could lead to outright extinction of plant irreversible loss of unique resources of unusual value vis-à-vis their potential economic applications.
  3. Water quality and quantity for wildlife could become reduced due to non-vegetated catchment as the flow pattern of rivers change when the surrounding vegetation is reduced.

### CONCLUSION AND RECOMMENDATIONS

The potential dangers during all phases of crude oil extraction operations are considerable. A combination of some or all the possible hazards could result into serious reductions of both flora and fauna resources. In order to mitigate the impacts arising from the exploitation of crude oil on wild animals, the following amelioration measures will be undertaken by the prospective proponent to make the project less environmentally damaging.

1. In the event that re-injection method is adopted in any crude oil project the prospecting company will ensure non-exploitation of watershed catchments no matter the richness of the watershed in crude oil.
2. Bush clearing and stripping will be carried out gradually and over a certain period of time (in

4. There will be decline in the relative abundance of wildlife occasioned by forest fragmentation as animals either die or migrate to suitable habitats, thus causing loss of species diversity.
5. Hazardous sludge deposited on the land from drilling and sweeping of crude oil wells and water with soil could trap some land animals, while it combines with oil pollution can taint the woods of animals, making them to lose their insulating and water proofing effects.

term of years) so that wildlife that may inhabit the proposed project site will have the opportunity to move to unaffected areas which are amply available in the contiguous lowland rainforest of Bonny and Andoni. This will have minimal effects on the area.

3. Bush clearing regime of 10% or less per year will be maintained, to buffer the breeding densities of mammals and other wildlife.
4. Before proceeding to new areas for crude oil exploration activities, there should be immediate reforestation of exposed land before the exploitation of other areas.
5. Critical breeding habitats will as much as possible be identified and restored and rehabilitated to the highest possible level of biodiversity and productivity.

### REFERENCES

- Abere, S.A. and Opara, J. A.(2012). Deforestation and Sustainable Development in the tropics; causes and effects. *Journal of Education and Social Research*. Vol. 2(4), p.109.
- Agagu, O.K. (1985). A Geological Guide to Bituminous Sediments in South Western Nigeria. *Unpublished Report*, Department of Geology, University of Ibadan, Nigeria.
- Akindoyeni, O. (2000). Irele, the Ripe Home of Bitumen. *The Radiant Magazine*, Vol 1:42
- Enu, E.I. (1990). Nature and Occurrence of Tar Sands in Nigeria; Occurrence, Utilization and Economics of Nigerian Tar Sand/Ogun State University, Ago-Iwoye. Pp 11–16.
- Falaye, A. E. and Olaniran, T.S. (1995).The Degradation of the Aquatic Resources: Effects of Crude Oil and Petrochemical Industry. In: T. A. Afolayan *et. al.* (eds.). *Proceedings (UNESCO-MAB) Regional Workshop on Impact of Human Activities and Livestock Grazing in West African Sub-Region*, Akure 23-26 July, Pp. 244-249.
- Jeffrey, A.M. (1990). *The Loss of Biological Diversity: World Guide to Environmental Issues and Organisations*. Peter, B. (ed). Longman G. P., U. K. pub. Pp 79–92.
- Nosike, A.N and Opara, J.A. (2003).*Environmental health in the Niger delta. Perspectives on human ecology and sustainable development in the 21<sup>st</sup> Century*. Port Harcourt: Centre for Environment and Community Development
- Nosike, A. N and Opara, J.A (2008).*Essays on the Niger Delta*. Granada: Afro Euro Centre for Development Studies.
- Odiete, W.O. (1999). *Environmental Physiology of Animals and Pollution*. Diversified Resources Ltd. Pub. 255 pp.
- Oke, D.O. and Fuwape, J. A. (1995). Environmental impact of indiscriminate logging in Ondo State. In *proceedings of Man and Biosphere training workshop*. Akure. 257-260.
- Opara, J. A(2015).*Science, Environment and Globalization*. New Delhi: Renu Publishers
- Opara, J.A.(2019).*Health, Environment and Sustainable Development*. Maiduguri: University of Maiduguri Press
- Saye, T.A. and Wegge, P.(1992). Biological Conservation Issues in Forest Management. The IUCN Conservation Programme. *Proc. of workshop Held at the IUCN General Assembly*. Perth, Australia. Nov/Dec. 1990 pp 1–224.
- Soule, M.E.(1991).The Current State of Biological Diversity. In *Biodiversity*, E. O. Wilson and F. M. Peter (eds.). *Washington DC Natural Academy Press*. Pp 3–18.