

ENVIRONMENTAL SCIENCE

THE ANTHROPOGENIC EFFECTS OF OIL EXPLORATION ON ECOLOGICAL FOREST. A PARADOX FOR AGRICULTURE AND ENVIRONMENTAL SUSTAINABILITY IN NIGER DELTA REGION, NIGERIA

Conflict of Interest

None declared.

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Abstract

It is logically acceptable in a true premise to say that there exist multiple effects in various activities taking place from the land to the environment. These effects are now spreading rapidly making human, animals, air, soil, water, plants, and planet even more vulnerable to multiple exposures. Interestingly, agriculture and environment are both interrelated and connected but only human action depicts the simultaneous cohesion which brings contradictions in them. The Nigerian soil in Niger Delta has witnessed this malady for over 50 years without remedies around the corner. Unsustainable pattern of natural resources consumption has witnessed 83% of oil spills leached into arable land and 17% in the swampy areas within one year and two months in some selected places recorded. A development which continually promote degradation of the natural ecosystem, affecting forest, agricultural production, and environmental sustainability. It has posed a threat, challenging both the present and future sustainable agricultural production, and human survival especially in this region. To support both present and future economic sustenance of the Nation at large, the natural resources exploitation requires green production activities to correct three ways adversely affecting how human beings use the environment to sustain their productive life as discussed in the methodology.

This paper cross-examines the incongruity created due to anthropogenic activities by the unwise use of the natural resources in the environment leading to disproportionate deforestation, poverty, agricultural poor yields, loss of environmental services and biodiversity. Consequently, the study objective is specifically concerned about the serious challenges facing the long-term environmental problems of oil spillages on forest and agricultural sustainability in the Niger Delta region. The study gives more insight into future sustainable planning using Multiple Exposures Multiple Effects (MEME) model analysis. It will benefit the community, public and private institutions, government agencies, policy-makers, stakeholders among others.

Keywords: Deforestation, oil production and spillage, biodiversity, oil impact on mangrove community, Toxicological effects, environmental sustainability, and MEME impact assessment.

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1 Introduction

Nigeria is known as the most populous black nation in the world, naturally endowed and located in the Western part of the African continent. Nigeria covers an area of 923,768 km² with an estimated 4,049 km of land boundaries shared with Republic Benin in the west, Cameroon and Chad in the east and Niger in the north. She has a coastal line of approximately 85 km towards the Atlantic Ocean lying between latitude 4°15' to 4°50' and longitude 5°25' to 7°37' with a land mass of about 280,000 sq/km area within the coastal region. The coast of Nigeria lies on the Gulf Guinea in the south and borders Lake Chad to the northeast. The surface area of the continental shelf

is 463,000 sq/km. The coastal areas consist of the freshwater swamp, mangrove swamp, beach ridges, sandbars, lagoons, marshes and tidal channels. Of the 923,768 sq/km, 918,768 sq/km are terrestrial lands while 13,000 sq/km are considered to be aquatic [1] (CIA World Factbook). The coastal area is humid in nature with a mean average temperature of 24-32°C and this coastal area has an average annual rainfall ranging between 1,500-4,000 mm. Nigeria is blessed with two major large rivers namely- the Benue and the Chad Rivers. There are other several rivers that channel into the Atlantic Ocean directly. Some other flowing waters flow into the Chad basin or lower Niger into the sea eventually.

Focus area of study described: The Map of Oil Producing Regions in Nigeria.



Fig. 1 –Map of Niger Delta

The Niger Delta is located on the Atlantic coast of Southern Nigeria and is the world's second largest delta with a coastline of about 450km which ends at Imo river entrance. The region is about 20,000sq/km as it is the largest wetland in Africa and among the third largest in the world. 2,370sq/km of the Niger Delta (ND) area consists of rivers, creeks, estuaries and stagnant swamps cover approximately 8600sq/km, the Delta mangrove swamp spans about 1900sq/km as the largest mangrove swamp in Africa. The ND is classified as a tropical rainforest with ecosystems comprising of diverse species of flora and fauna both aquatic and terrestrial species. The region can be classified into four ecological zones; coastal inland zone, freshwater zone, lowland rainforest zone, mangrove swamp zone and this region is considered one of the ten most important wetlands and marine ecosystems in the world. As of 1991, the National Census estimated about 25% of the entire Nigerian population lives within the Niger Delta region. The Niger Delta region has a steady growing population of approximately 30 million people as of 2005, accounting for more than 23% of Nigeria's total population.

1.1 The significance and the problem:

A diversionary attention given to oil and gas as the mainstay of Nigerian economy makes the agricultural sector irrelevant today. Every other government in succession has placed more value oil and gas production over agro-business development despite an increase in population. This has characterized the Nigerian agricultural situation since the discovery and booming of crude oil market globally. What used to be a base for revenue and external income generation now suffers numerous derogatory compositions. While the oil exploration and production continues to degrade the environment due to spillages on soil, agricultural products decline simultaneously.

Therefore, the government, as well as farmers, are facing two basic problems to solve. Firstly, to improve and intensify agricultural production. Secondly, they must minimize the anthropogenic effect of other activities affecting agriculture and the environment. The central issue is to resolve the conflicts implication of food insecurity, deepening poverty, and unplanned long-term economic sustainability which will affect social stability in the future if attention is not drawn towards agricultural production immediately. Consequences of

ravaging oil spillage are affecting both agricultural and environmentally sustainable development.

2 Methodology

Anthropogenic activities bring multiple effects on natural resources which contributes to the three ways human use the environment namely: I) As a resource bank; the environment supplies the raw materials needed to maintain life existence, and off-course social and technological structures but it brings eroding pollution ii) As a habitat; human requires more space per individual than any other species for shelter and good health but over population is a threat around the corner and iii) As sink for wastes; human beings produce more waste than other species while methods of disposing many of these wastes have not been addressed. Other pressures such as economic growth and poverty increase are factors producing greater stress on the environmental resources. This study used multiple exposures multiple effects (MEME) model (figure 4) to provide the conceptual and theoretical basis for the ecological deforestation resulting from anthropogenic actions from oil exploration indicators on the environment.

The model emphasizes more on the complex and conflicting relationship between oil mining activities in the environment and agricultural production. Both were supposed to provide/or create a better environment and sustain livelihood in the long run but in our case, the outcome of oil extraction exposes the environment to pollution and reduces other production due to pollution. Soil, water, air, forest among others are affected by these conflicting activities. The multiple exposures have led to multiple effects on different outcomes such as unsustainable environment, poor community welfare, while social growth and well-being declines alongside attributed to many different exposures. The MEME model was developed as a framework of children's environmental health indicators by Briggs D, (Briggs, 1999) for World Health Organization (WHO). We found it very informative model suitable to fix our theoretical studies on anthropogenic activities of oil production, paradoxically devaluing environment and agriculture in Niger Delta. The model provides preventive remedial and actionable options.

2.1 Oil production in Nigeria:

Nigeria has been a member of Organization of Petroleum Exporting Countries (OPEC) since 1971. It has the largest natural gas reserve in Africa, has the second largest oil reserve in Africa and is the African continent's primary oil producer. As of the 1980s oil revenue provided 90% of Nigeria's foreign exchange earnings and 85% of the government revenue, with estimated reserves extending beyond 20-30 years. Shell D'Arcy the pioneer oil company in Nigeria, which started

commercial production in 1958 with a production rate of 5100 barrels per day and a peak production of 2.44 million barrels per day over the next few years. According to NNPC through OPEC, production rates dropped to 1.5 million barrels per day from the activities of 10 international companies working in 122 fields, containing over 970 oil wells. Nigeria has four oil refineries with an estimated total refining capacity of 445,000 barrels per day.

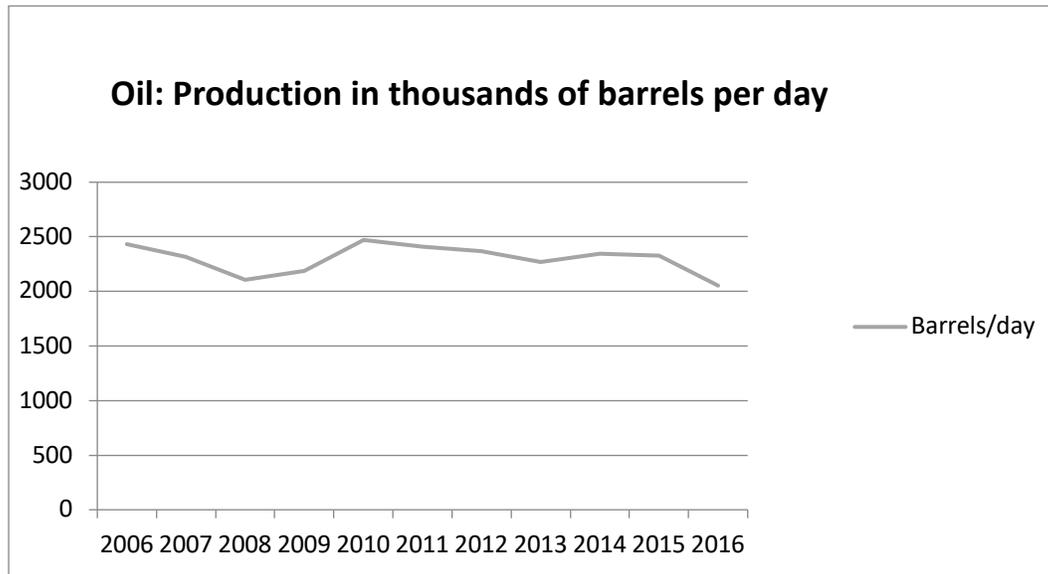


Fig. 2 –Oil production in thousands per barrels per day. Sources: EIA, 2017 [4].

The first and oldest being the Port Harcourt refinery, commissioned in 1965. It had an initial capacity of 35,000 barrels per day, which was later expanded to 60,000 barrels per day of light crude oil. The Port Harcourt refinery has the second refinery with a capacity of 150,000 barrels per day. Anifowose and Onuoha cited in their studies that the region has about 606 oil fields with 355 situated onshore; 251 situated offshore with 5,284 drilled oil wells and 7,000km of oil and gas pipelines.

2.2 Effects of Oil spills and Exploitation:

Oil exploration and exploitation has numerous adverse effects on the ecosystem and the local biodiversity. Oil exploration by seismic oil companies involves the clearing of seismic lines, dynamiting for geological excavation, which affects the aquatic environment. It causes mortality in fauna,

turbidity in the water that blockage of gills of the filter feeders in the benthic fauna, reduction of photosynthetic activity caused by the water turbidity that reduces the amount of sunlight penetration. Oil and gas pipeline has been installed covering 7,000km to enhance the distribution of crude oil products to other parts of the country. Oil has leached into soils and swamps in Niger Delta. The table below indicates that pipelines run across the rainforests and mangroves with incidences of leakage and rupture and accidental discharges.

These discharges are caused by vandalism, failure of pipeline integrity due to aging and defects in the material. Most incidences of the reported oil spillages have occurred in the mangrove swamp forest, and lands for the past one year and two months as reported by shall company and shown in the table below.

Table 1. Showing estimate volume of oil spills on swamps and lands

Date of report, 2017	Incidence place	Terrain	Estimated Volume (bbl)
Jan 03,2017	28" Nkpoku-Bomu Trans Niger Pipeline at Kpor.	Land	68
Jan 06,2017	6" Imo River Well 59T Flowline at Owaza	Land	2
Jan 13,2017	Agbaya Well 1 Wellhead at Ogbotobo.	Swamp	53

Date of report, 2017	Incidence place	Terrain	Estimated Volume (bbl)
Jan 15,2017	Soku Well21L Flowline at Russia	Swamp	0.6
Jan 21,2017	4" Obele-Ibaa Delivery Line at. Ibaa.	Land	4
Jan 21,2017	12" Imo River-Ogale Pipeline at Komkom	Land	21
Feb 03,2017	12" Imo River-Ogale Pipeline at Umuololo	Land	15
Feb 05,2017	24" Trans - Escravos Pipeline at Ogidigben	Swamp	4
Feb 11,2017	Imo River 1 Well 36 Flowline Igiri-Ukwu_Owaza	Land	0.5
Feb 18,2017	12" Imo River 2 – Ogale Pipeline at Odagwa	Land	88
Feb 22,2017	Imo River Well 21L Flowline	Land	0.1
Feb 23,2017	8" Mininta-Rumuekpe Bulkline at Ihuaba-Imogu-Elele-Alimini.	Land	30
Mar 03,2017	12" Imo River-Ogale Pipeline at Komkom	Land	539
Mar 08,2017	12" Imo River-Ogale Pipeline at Komkom	Land	0.8
Mar 08,2017	12" Imo River-Ogale Pipeline at Komkom	Land	3
Mar 15,2017	28" Nkpoku-Bomu Pipeline at Elimgbu	Land	4
Mar 15,2017	6" Imo River 3 Well 37L Flowline at Igiriukwu-Owaza	Land	0.8
Mar 16,2017	28" Bomu-Bonny Trans Niger Pipeline at Owokiri	Swamp	4
Mar 22,2017	4" Obele-Ibaa Delivery Line at Ibaa	Land	2
Mar 24,2017	4" Flowline RoW at Agbada	Land	1
Mar 26,2017	Bonny Oil and Gas Terminal Tank 9 Storage	Land	570
Mar 27,2017	12" Imo River-Ogale Pipeline at Uzuaku	Land	570
Mar 29,2017	6" Obigbo North-Ogale Pipeline at Ogale.	Land	977
Apr 02,2017	Bonny Oil & Gas Terminal Emulsion Tank (T1201B) at Bonny	Land	42

Date of report, 2017	Incidence place	Terrain	Estimated Volume (bbl)
Apr 03,2017	20" Otumara - Escravos Pipeline at Ugboegungun	Swamp	11
Apr 05,2017	4" Otumara Well 9T Flowline at Ugboegungun	Swamp	0.1
Apr 06,2017	12" Imo River 2 - Ogale Pipeline at Owaza	Land	2
Apr 15,2017	Afam Well27T & 25T Flowline at Ayama	Land	6
Apr 15,2017	Imo River Well 25S Flowline at Umuedeokwara	Land	2
Apr 23,2017	Benisede Well16T Wellhead at Ojobo.	Swamp	0.6
Apr 26,2017	4" Otumara Well 29L/S Flowlines at Ugboegungun.	Swamp	0.1
May 18,2017	18" Assa - Rumuekpe Pipeline at Ochia	Land	8
May 19,2017	20" Kolocreek-Rumuekpe Pipeline at Odau_Ozochi	Land	766
May 29,2017	12" Imo River - Ogale Pipeline at Uzuaku.	Land	629
May 30,2017	12" Imo River - Ogale Pipeline at Okohia-Asa	Land	22
Jun 01,2017	28" Bomu - Bonny Trans Niger Pipeline at Patrick Waterside	Swamp	97
Jun 08,2017	20" Kolocreek - Rumuekpe Pipeline at Odau	Land	1127
Jun 10,2017	20" Opukushi-Brass Creek at Tamogbene.	Swamp	0.5
Jun 10,2017	20" Opukushi-Brass Creek at Tamogbene	Swamp	71
Jun 11,2017	20" Otumara –Escravos Pipeline at Ugboegungun	Swamp	8
Jun 13,2017	8" Etelebou-Kolocreek Pipeline at Opolo	Land	38
Jun 20,2017	20" Otumara –Escravos Pipeline at Ugboegungun	Swamp	6
Jun 26,2017	Tunu Well 7T Wellhead.	Swamp	4
Jun 28,2017	12" Imo River - Ogale Pipeline ROW at Uzuaku at Umuololo.	Land	135
Jul 02, 2017	4" Adibawa Well 2S Flowline at Edagberi-Betterland	Land	11

Date of report, 2017	Incidence place	Terrain	Estimated Volume (bbl)
Jul 02, 2017	Adibawa Well 4 and 7 ROW at Edagberi	Swamp	0.1
Jul 07, 2017	12" Imo River - Ogale Pipeline at Komkom	Land	67
Jul 11, 2017	20" Otumara –Escravos Pipeline at Ugboegungun	Swamp	6
Jul 11, 2017	12" Oguta-Egbema Pipeline at Oguta	Land	7
Jul 15, 2017	Imo River 3 Well 22S Flowline at Igiriukwu Owaza	Land	0.9
Jul 21, 2017	28" Trans Niger Pipeline at B-Dere	Land	2
Jul 25, 2017	28" Nkpoku-Bomu Pipeline at B-Dere	Land	0.9
Jul 25, 2017	4" Tunu Well-4L Flowline at Agbidiana	Swamp	11
Jul 29, 2017	Belema Flow Station at Belema	Swamp	0.2
Aug 01, 2017	Imo River 1 Well 5S Flowline at Igiriukwu	Land	43
Aug 08, 2017	FORCADOS KTI EMULSION HEATER TREATMENT UNIT	Swamp	3
Aug 12, 2017	Adibawa North East 1 Well Head at Biseni	Swamp	1669
Aug 20, 2017	20" Otumara-Escravos pipelines at Ugboegungun	Swamp	5
Aug 30, 2017	20" Kolo Creek - Rumuekpe Pipeline at Odau	Land	797
Aug 31, 2017	28" Nkpoku - Bomu Pipeline at Rumukwurush	Land	2
Sep 12, 2017	28" Bomu-Bonny Trans Niger Pipeline at Ogbonga Forest (Oloma)	Swamp	24
Sep 22, 2017	Soku Well 22 Well Head	Swamp	6
Sep 24, 2017	01 MOV-411 Filling Valve Flange to Tank 2 at Bonny Terminals	Land	9
Sep 25, 2017	Agbaya Well 1 Wellhead at Agbayama	Swamp	8
Sep 29, 2017	16" Egbema-Assa Pipeline at Obile	Land	36
Oct 06, 2017	18" Assa-Rumuekpe Pipeline at Awara	Land	13

Date of report, 2017	Incidence place	Terrain	Estimated Volume (bbl)
Oct 24, 2017	8" Umuechem - Nkpoku pipeline at Omunwei	Land	8
Oct 26, 2017	20" Otumara - Escravos Pipeline at Ugboegungun	Swamp	4
Nov 06, 2017	Nun River Well 15 Wellhead at Onyoma	Land	26
Nov 11, 2017	28" Nkpoku-Bomu Pipeline at Norkpo	Land	103
Nov 16, 2017	20" Kolo Creek - Rumuekpe Pipeline at Odau	Land	2026
Nov 19, 2017	8" Saghara Tie-in-Saghara Manifold at Ugboegungun	Swamp	35
Nov 26, 2017	20" Kolo Creek - Rumuekpe Pipeline at Odau	Land	31
Dec 16, 2017	20" Rumuekpe-Nkpoku Pipeline at Ibaa	Land	59
Dec 18, 2017	28" Bomu-Bonny Pipline at Patrick Waterside	Land	10
Dec 18, 2017	28"Nkpoku-Bomu Pipeline at Eteo	Land	78
Dec 23, 2017	Forcados Terminal Single Point Mooring (SPM)1	Water	0.3
Dec 23, 2017	16" Egbema-Assa Pipeline at Assa	Land	6
Dec 23, 2017	20" Rumuekpe-Nkpoku Pipeline at Ibaa	Land	113
Jan 01, 2018	12" Imo River-Ogale Pipeline at Uzuaku	Land	8
Jan 05, 2018	6" Obigbo North-Ogale Pipeline at Ogale	Land	18
Jan 10, 2018	6" Seibou Bulkline -4 at Azagbene	Swamp	6
Jan 10, 2018	Agbada Well 18T Flowline at Omunike_Omunobo	Land	0.1
Jan 11, 2018	Adibawa Flow Station Perimeter Fence	Land	12
Jan 12, 2018	14"Okordia-Rumuekpe Pipeline at Ikata	Land	65
Jan 13, 2018	28" Bomu-Bonny Pipeline at Bodo West	Land	25
Jan 21, 2018	8" Nkali - Imo River 2 Pipeline at Nkali	Land	2

Date of report, 2017	Incidence place	Terrain	Estimated Volume (bbl)
Jan 22, 2018	4" Gbaran Well 12T Flowline at Onopa	Land	3
Jan 26, 2018	8" Nkali - Imo River 2 Pipeline at Odagwa	Land	28
Feb 03, 2018	Soku Well 14S Flowline at Soku	Swamp	6
Feb 14, 2018	12" Adibawa-Okordia DL RoW at Okordia	Land	470
Feb 16, 2018	8" Umuechem DL at Omusele	Land	13
Feb 20, 2018	12" Imo River-Ogale Pipeline at Komkom	Land	566
Feb 25, 2018	12" ImoR - Ogale TL RoW at Okohia	Land	2

Sources: www.shell.com.ng spill data, 2018.

In the past five decades, petroleum exploration and production activities have brought an economic boom, but not without problems. Petroleum exploration, construction of oil production units, transportation, and refining facilities, have gone hand in hand with the clearing of vegetation while waste discharge, accidental spills, and operational failures, in combination with sabotage, pipeline bunkering, and artisanal refining all contribute to a heavy load of environmental pollution with petroleum hydrocarbons. The resultant effects are substantial, causing damage to surface water, drinking water, fish and other fauna as well as other parts of the mangrove ecosystems which make up most of the rainforest environment in the Niger Delta zone.

3 Discussion and Result Analysis:

The hypothetical relationship between environmental degradation and economic development in economics is usually referred to as the environmental Kuznets’s curve. The study suggests that economic growth or development will initially lead to a deterioration in the state of the environment, and after reaching a certain level of growth, society will begin to relate well with the environment causes the overall impact of environmental degradation to reduce. But the question is how long it takes to replenish loss land if nothing concrete is happening now to secure it. The figure 3 discloses the multiple effects going on in the environment.

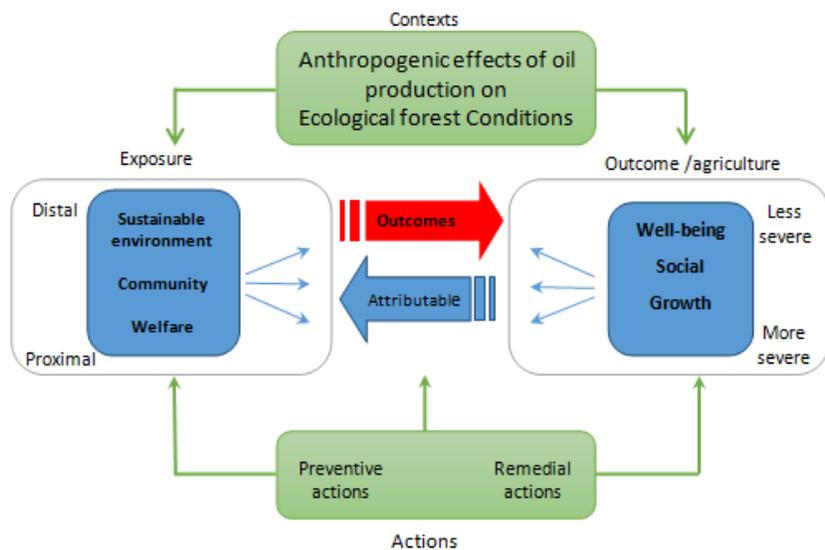


Fig. 3 –Multiple effects of exposure to ecological forest /Agriculture (Briggs, 2003).

3.1 The Oil impact on Mangrove communities:

Vegetation in the Niger River Delta (with a total land area of 7.5 million ha) consists of extensive mangrove forests, brackish swamp forests, and rainforests. The large expanses of mangrove forests are estimated to cover approximately 500,000 to 860,000 ha of land. According to FAO in 2007, mangrove surface in Nigeria is higher (nearly 1 million ha).

The Nigerian Oil Industry is located mostly in the mangrove forests. The activities of the numerous oil exploration companies have led to fragmentation, deforestation, and degradation of the mangrove forest ecosystem. Mangroves are highly sensitive to contamination with oil and industrial waste. Damage includes the acute toxic impact of chemicals and physical damage which may occur later but which persists for longer.

The mangrove ecosystems are exposed to threats of destruction arising from urban development (e.g. dredging and sand filling for swamp reclamation, urban settlements, road construction, industrial development in coastal areas, coastal resorts, etc.), coastal erosion, oil pollution, gas flaring, and subsidence of the coastal geosynclines aggravated by fluid withdrawal (oil and gas) from porous reservoirs in subsurface Niger Delta. The degradation of this ecosystem also has consequences on the competitive ecological front. In fact, we have noticed an ever stronger replacement of the mangroves by the exotic palm, *Nypa fruticans*; this has been identified by various experts as a major threat to the mangrove ecosystem and an ecological disaster deserving urgent attention.

3.2 Physical and Toxicological Effects:

Mangrove-related biological resources at risk in a spill situation can be affected in at least two principal ways: firstly, from physical effects; secondly, from the true toxicological effects of petroleum. Introduction of significant quantities of crude oil into the aquatic ecosystem will cause increases in biochemical oxygen demand, reduction in dissolved oxygen concentration, and increased temperature and pH of the water body.

Some severe effects, including tree death, can take place months or years after a spill. Damage from the actions of mechanical abrasion, trampling, or compaction during clean-up can exacerbate negative environmental impacts in the environment.

Oil pollution, apart from causing depletion of oxygen and suffocation of aquatic species, affects plants and cultivated crops in lowland areas characterized by seasonal flooding. Soil pollution may cause oxygen depletion at the rhizosphere by hydrocarbon-degrading micro-organisms. This directly affects the overall physiology of the plant by reducing plant growth.

Mangrove communities are complex and, as might be expected, the impacts of oil on the associated plants and animals vary. The available information suggests that, while oil spills undoubtedly affect animal communities, these appear to recover more quickly than the mangroves themselves. Because of this, longer-term effects are likely to be related to the death of the mangroves and loss of the habitat that supports and protects the community.

We can also see how all these causes can influence even indirectly the whole ecosystem.

- Different types of indirect effects:

- Loss of crop production capacity
- Loss of fish and shrimp production capacity
- Loss of livelihoods.
- Accelerated mineralization of Soil Organic Matter (SOM) Changes in food webs and ecosystem composition

Indirect impacts (of fossil oil production) on vegetation would include increased deposition of dust, the spread of invasive and noxious weeds, and the increased potential for wildfires. Dust settling on vegetation may alter or limit plants' abilities to photosynthesize and/or reproduce.

3.3 Biodiversity in the Delta:

The ecosystem of the area is highly diverse and supportive of numerous species of terrestrial and aquatic fauna and flora as well as human life. The Niger Delta has been declared as a key zone for the conservation of the western coast of Africa on the basis of its extraordinary biodiversity. It is estimated, that in Nigeria there are more than 46,000 plant species of which about 205 are endemic, and approximately 484 plants in 112 families are threatened with extinction as well as many animal and bird species. Another estimate is that 24 out of 274 mammals, 10 out of 831 birds and 2 out of 114 reptiles known to exist in Nigeria are endangered. The larger population of the Niger Delta survive on services provided by the ecosystem; agriculture, industry, fishing, food, drinking water, wood, shelter, medicine, employment, and aesthetics.

The Niger Delta is one of the world's largest wetlands and the largest in Africa: it encompasses over 20,000 square kilometers. It is a vast floodplain built up by the accumulation of centuries of silt washed down the Niger and Benue Rivers, composed of four main ecological zones—coastal barrier islands, mangroves, freshwater swamp forests, and lowland rainforests—whose boundaries vary according to the patterns of seasonal flooding. The mangrove forest of Nigeria is the third largest in the world and the largest in Africa; over 60 percent of this mangrove, or 6,000 square kilometers, is found in the Niger Delta. The freshwater swamp forests of the delta reach 11,700 square kilometers and are the most extensive in the west and central Africa. The Niger Delta region has the high biodiversity characteristic of extensive swamp and forest areas, with many unique species of plants and animals.

3.4 Multiple effects on agricultural sustainability

As at today, Nigeria is confronted with multiple developmental challenges ranging from large imports of food products such as wheat, rice, fish, tomato paste, sugar, textile and even beverages as well as green technology for packaging of food products. The effects could not be cushioned from the oil proceeds where the nation's survival has depended on for over 55 years as a major source of external and internal revenue generation. However, the need to diversify the mono-cultural economy by going back to the initial agricultural sectorial development perhaps is the key not only to economic stability but for food security. Especially now that three digit oil price tendencies is a lingering expectation which may not see the light of the day.

Over the years, oil exploration, exploitation, and production activities have instead of contributing to the social development and social well-being of the citizens, it is continuously affecting the environment negatively. Soil degradation causes poor yields of agricultural products, the

presence of oil spillage on water reduces aquatic life, portable water, fishing, farming system and aqua-tourism, while gas flaring pollutes the air which affects man and his environs. Massive agitations become the order of the day while sustainable development suffers on the other hand. Poor leadership structure, stakeholder’s management, as well as will-power to implement policies are main issues that are yet to be resolved (Okpara et al, 2017). The endless multiple effects are that after 50 years, explored resources have not been able to transit to a better life, social project, infrastructure, good

health care system, human development or poverty reduction. What we have achieved rather is to sit on gold, oil, manganese, uranium, edible land and other resources while an average citizen cannot afford three square meal per day.

Paradoxically, in Niger Delta, exploration of natural resources from the land is in a continuous conflict with the agricultural production and environmental sustainability due to poor replenishing mechanisms thereby affecting sustainable development planning to succeed.

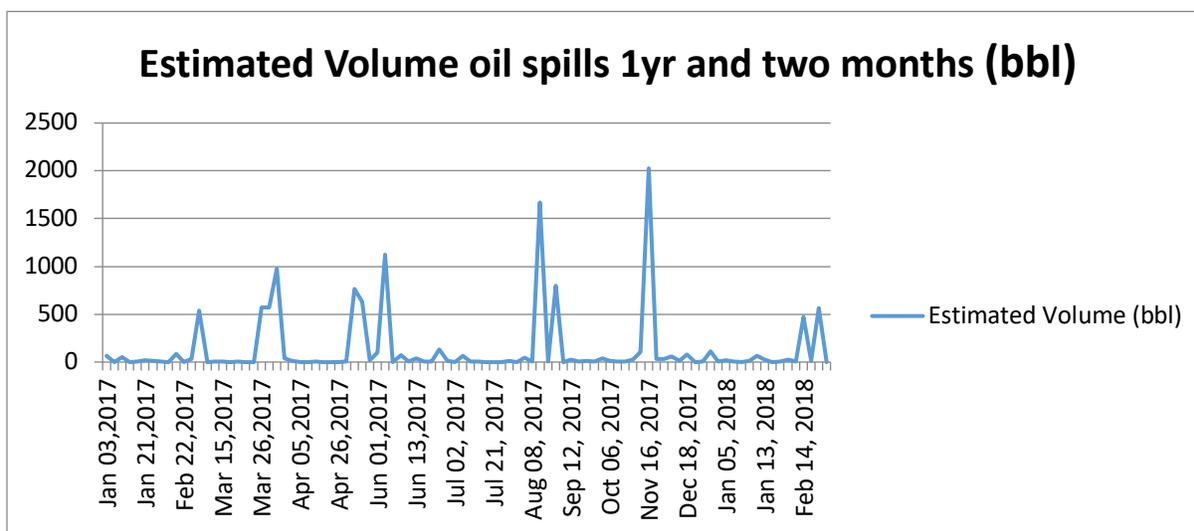


Fig. 4 – Volume of oil spilled within 1 year and two months
Sources: Spill data, www.shell.com.ng.

Agriculture served as the mainstay of the Nigerian economy before the discovery of crude oil (the black gold) in commercial quantity in 1958 at Olobirin in Rivers State today. The sector between 1960 to 1969 contributed 57 percent of the Gross Domestic Product (GDP) and 64.5 percent of export earning was accrued from the sector according to Collins (Collins, 2017). Ironically, the oil sector that replaced agro-business has neither sustained contributions to food security nor improved the environment and soil where agricultural activities take place. The graph in figure 4 above showed that above 2000 barrels of oil spilled into the terrestrial environment in November 06 & 26 of 2017. It supports the 87% lost to farmers thereby encouraging idle minds and unemployment. Even though, economic diversification to agriculture is gaining weight due to the recent fall in crude oil prices, the interest of the stakeholders in the oil industry is still high. However, food security is triggering panic to the global world population with Nigeria included. Conversations around the world suggest that agricultural sector needs massive investment to increase production that will solve food challenges facing the mankind.

3.5 Social growth and well-being

Societal growth is a way of alleviating poverty which can be achieved through supporting systems geared towards the sustainable well-being of people and the environment. One of the ways is to incorporate developmental functions such as financing agro-business projects. The Nigerian CBN Governor Godwin Emefiele said: “Agric- financing is the way forward

for the economy in Nigeria”. Perhaps the reason CBN developmental role is recently collaborating with the Federal Government of Nigeria and the Federal Ministry of Agriculture and Rural Development (FMARD) in establishing the Commercial Agriculture Credit Scheme for promoting commercial agricultural enterprises.

This might inject a new hope if it is sustainable but it will not be complete if incentive across the segments oil producing regions which is in bad shape today are not in the value chain. A well-priced loan can add to the profitability of the sector which would otherwise be considered as a loss before now. Though, with the recent amendment of the Commercial Agriculture Credit Scheme (CACS) by the Central Bank of Nigeria, young entrepreneurs keying into agriculture will begin to benefit from their scrambling agro-businesses, leveraging on financing schemes available. With a maximum loan pegged intake for any project at NGN 2 billion inclusive of all charges, this sector appears to be promising but on the detriment of those who cannot farm due to oil spillages on their lands.

The challenging moment of the Nigerian agricultural economy, will not enhance national food security, through food supply if effective agro- product prices are not being promoted to lower food inflation and stabilize the cost of living to a reasonable extent. If the three-year bond raised by the Debt Management Office (DMO) from the proceeds of NGN 200 billion is not being used to finance CACS program appropriately, our conditions will worsen in the near future.

3.6 Community and welfare:

The life of an average farmer in the community suffers multiple effects without welfare programs. What would be achieved to allocate scarce forex to rice importers who trade in an exchange with foreign currency not contributing to GDP growth when a vast amount of paddy rice of comparable quality produced by poor communities and hardworking local farmers across the rice belts of Nigeria are wasted? Local farmers are falling deeper into poverty sacrificing efforts which the Nation export as jobs and income to rice producing countries abroad. It is interesting to note that, Indonesia and Malaysia combine, who came to Nigeria to take palm fruits a few decades ago, today exports over 90 percent of global palm oil demand while Nigeria, the one-time world's largest producer is now an importer of nearly 600,000 Metric Tonnes of the same product according to CBN Boss in 2017. This shows that something went wrong alongside with unsustainable planning. And it has negatively affected community welfare. To cushion these effects on the economy, there is a need to set appropriate mechanisms to protect the locals' farmers from losing jobs and incomes by supporting them with credit facilities and subsidies. As reported by Collins (Collins, 2017) Agriculture still remains the largest employer of labor in Nigeria and its contributing close to 24.2 percent of the national GDP. Reviving this sector is significant as it will ensure that we maintain a sustainable production, foods security as well as providing successful export to attract more foreign or external revenue.

3.7 Environmental Sustainability – a Global Perspective

The United Nations has emphasized the need for environmental sustainability in recent times. This has usually been accepted by all world leaders and countries and leading development institutions. The Millennium Development Goals

(MDGs) which had the target year of 2015 had environmental sustainability as one out eight goals. The new goals of the United Nations which is referred to as the Sustainable Development Goals (SDGs) launched in 2015 further breaks the goal on environmental sustainability into parts such as climate action(goal 13), Life below water (goal 14), and Life on Land (goal 15). Has our own environment fare well in the in the pursuit of sustainable development? Table 2 details oil spills within 1 year and two months as recorded by shell Petroleum Company of Nigeria, 2018.

Table 2. Showing quantity of oil spills on land, swamp and water within 1 year & two month.

Terrain	Estimated Volume (bbl)
Land	10334.1
Swamp	2043.2
Water	0.3

Sources: generated by author.

According to the United Nations Development Program (UNDP), the world is experiencing an unprecedented level of land degradation with a historical rate of loss in an arable land of about 30 to 35 times. This is a threat to our forests and the people that depend on them for their livelihoods. It is believed that about 1.6 billion people (including 70 million indigenous people) depend on the forest for their livelihood. Desertification which is a by-product of deforestation causes about 12 million hectares of arable land is lost which could have been used to grow about 20 million tons of grain. UNDP (UNDP, 2006).

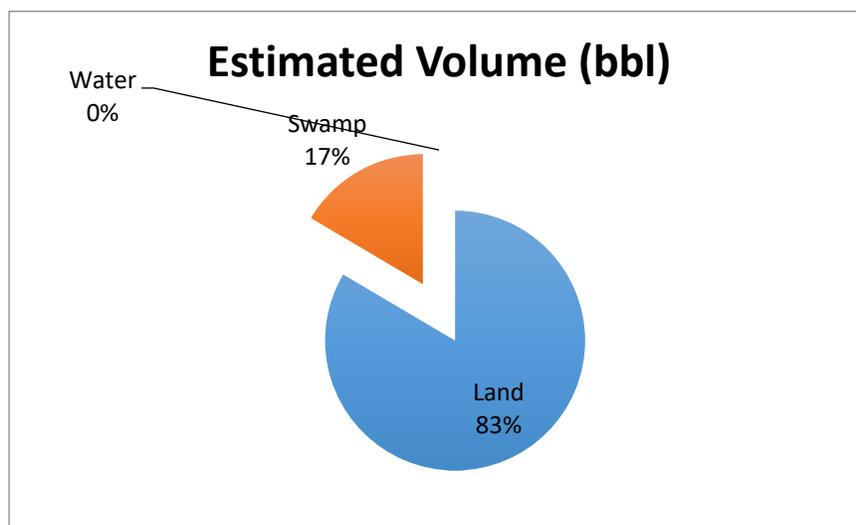


Fig. 5 – Estimated volume of oil per (bbl.) spilled onto land and swamp within 1 year & two months.

Sources: Generated by author 2018.

The targets set in order to meet the sustainable development goals include the promotion of sustainable management of

forests, to a halt and promote afforestation and reforestation globally by the year 2020 will not to be close to actualization

if measures are not place to ensure compliance. In the figure 5 above, 83% of land, and 17% of swampy areas were affected. These are expected to impact on climate change and contribute most especially in reducing farmable lands as well as loss of habitat to biodiversity. The UN agenda commits all stakeholders to work together to achieving the goals. UNDP (UNDP GOAL 15, 2012).

4 Conclusion and recommendations

4.1 Sustainable methods to control Deforestation

The preventive and remedial actions against the problems associated with deforestation and environmental degradation have got the attention of researchers from different backgrounds and they have come up with some ideas on how deforestation and environmental degradation can be controlled. One of such studies is by Chethan (Chethan, 2012). In their study on "Sustainable Forest Management Techniques," they propose the use of wireless sensor networks (WSNs) for the monitoring of trees in the forest. These will not only monitor but will provide alerts in the case of detection of any rare events by consuming ultra-low power. In their prototype, they include two sensors, mercury, and temperature sensor, which are expected to detect fire and illegal logging of ecological forest respectively. A major challenge to this is that the sensors rely on batteries and would require a recharge at some point in time. They, however, propose a solar and RF energy harvesting technique to support the system and increase the lifetime of the WSN. Envisaging some future challenges, they propose a more robust system that will cater for falls alarms and auto healing of the sensor nodes in case of failure. The Government in developing countries like Nigeria where these simple technologies lack presence as at today should work hard to improve their situation.

4.2 Management system

Chakravarty et-al (Chakravarty et al., 2012) proposed a forest management system based on the community which is founded on strong institutions and political goodwill. They also suggest that the welfare of cultivators in forest areas should be considered in all methods designed to reduce deforestation. They equally suggest that it would be difficult to propose general solutions for deforestation as conditions may vary from region to region; however, they identify effective implementation strategies, development of management plans and monitoring as factors that should be considered. Concrete steps must be taken to ensure reforestation, which is another sustainable way of management for the future benefits.

4.3 Economic improvement for poverty reduction

To provide reasonable solutions in controlling deforestation, adequate consideration should be given to economic improvement. Others include reduction of population growth and an increase in per capita incomes, reduction in the emissions level from deforestation, increasing the area of forest reserves for timber production, encouraging the use of substitutes with respect to forest products, promote sustainable management and strengthen policies as well as governmental and non-governmental institutions.

4.4 Proactive solution

Many of the existing solutions to these problems rely on commitments. It is a well-known fact how damaging oil can be to the natural environment. It is also well known how difficult it can be to clean up oil after spills or contamination. The process and capital intensive it could be removing an oil spill or contamination from the soil as well as different techniques

involve removing oil from water using a water solution of bio-surfactant. Depending on the situation, the soil can either be treated on the same location or removed and treated if it's in sensitive areas like Delta creeks. All these affect the agricultural sustainable production and farming system in the environment. Therefore, commitment on the part of the pollutants who must ensure immediate proactive actions over leakages and replacement of warm out equipment as a remedial or preventive measure should not be negotiated.

What is New? If post crisis growth does not exceed, reach or solve pre-crisis level, then we are slightly dormant in the field of prosperity. Given the regularity production pattern, actual growth will not differ because it depends on the export prices and changes in the economy. As observed, declining rate of oil prices can no longer guarantee current sustainability of food security and other developmental projects. Hence, resolving the conflicts discussed above is now not later.

References

- Briggs, D. (1999). Environmental health framework and Methodologies. WHO, Geneva.
- Briggs, D. (2003) Indicators; Making a difference; Indicators to Improve Children's Environmental Health, WHO, Geneva.
- Chakravarty, S., Ghosh, S. K., Suresh, C. P., Dey, A. N., & Shukla, G. (2012). Deforestation: causes, effects and control strategies. In *Global perspectives on sustainable forest management*. InTech.
- Collins, N. (2017). Making agriculture the main stay of economic growth in Nigeria. Vanguard Newspapers, September, 16, 2017. Accessed 17/03/2018.
- Collins, N. (2017). Making agriculture the main stay of economic growth in Nigeria. Vanguard Newspapers, September, 16, 2017. Accessed 17/03/2018.
- Cuaresma, J. C., Danylo, O., Fritz, S., McCallum, I., Obersteiner, M., See, L., & Walsh, B. (2017). Economic development and forest cover: evidence from satellite data. *Scientific reports*, 7, 40678. DOI:10.1038/srep40678
- Okpara, D.A., Kurbatova A. I., Kapralova D.O. (2017). Energy situation in Nigeria and its influence on sustainable development drive, Global scientific Conference, Management and economics in Manufacturing Zvolen, Slovakia, P337. ISBN 978-80-228-2993-9.
- Ekundayo, E.O., Emede T.O, Osayande D.I. (2001). Effects of crude oil spillage on growth and yield of maize (zea mays L) in soils of Midwestern Nigeria. *Plant foods Human Nutrition* 56(4); 313-24.
- CIA World Fact book (2018). <https://www.cia.gov/library/publications/the-world-factbook> accessed 19/3/2018.
- Chethan K.P., Jayaraman Srinivasan, Kumar Kriti and Kaki Sivaji (2012). Sustainable Forest Management Techniques. InTech.
- Mmom, P. C., & Arokoyu, S. B. (2010). Mangrove forest depletion, biodiversity loss and traditional resources management practices in the Niger Delta, Nigeria. *Research Journal of Applied Sciences Engineering and Technology*, 2(1), 28-34.
- Niger Delta Quarterly Conflict Trends: July – September (2016), Published December 12, 2016 by Partners for Peace, Fund for Peace, PIND, FFP Publication 501 01 1612.

UNDP (2006). Niger Delta Human Development Report, 229

UNDP GOAL 15: LIFE ON LAND,
<http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-15-life-on-land/targets/> Date accessed: 21.03.2018