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**Faculty of Tropical
AgriSciences**

**The Effect of Oil Exploration on Agriculture in the Niger-Delta
Region of Nigeria.**

BACHELOR'S THESIS

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DECLARATION

I hereby declare that I have done this thesis entitled “*The Effect of Oil Exploration on Agriculture in the Niger-Delta Region of Nigeria*” independently, all texts in this thesis are original, and all sources have been quoted and acknowledged by means of complete references and according to citation rules of the FTA.

In Prague, 18th April 2024

.....

Oluwole Osunde

DEDICATION

This research is dedicated to God almighty in Heaven, my loving late parents (Mr and Mrs Osunde), my brothers (Junior & Destiny), my ever-beautiful supporting wife (Mrs Usiobaifo Eseosa Sandra), as well as my charming daughter (Eseosa Elisa Osunde). You all are my backbone and my source of strength. Thank you all for standing by me and for always praying for me and believing in me more than I could ever believe in myself, and for pushing me forward to attain greatness. Finally, this is especially dedicated to Jerry Efosa Osawaru; if not for him, I would never be here, and if I could achieve this, he too could. Someday, he will see the light of day and everything he has lost will all return back to him.

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ABSTRACT

This study on "*The Effect of Oil Exploration on Agriculture in the Niger Delta Region of Niger*" is crucial due to the region's significance in both oil production and agriculture. Understanding the impact of oil exploration on agriculture is imperative for sustainable development, as the Niger Delta serves as a major agricultural hub in Nigeria. This study aimed to determine the effect of oil exploration activities and how they have influenced agricultural productivity and livelihoods in the region. Methodologically, a qualitative research design with of various techniques, including interviews, questionnaires, field observations, and secondary data from scientific literature, was employed and a survey was conducted in 2023, with a sample size of 105 respondents comprising farmers, local communities, and stakeholders. Key findings revealed a significant negative effect of oil exploration activities on agricultural output, land degradation, pollution, and disruption of traditional farming practices. Policy recommendations include; policies on fair compensation for oil spill victims, and stringent environmental regulations for oil companies should be enforced, and diversified agricultural practices that are resilient to environmental changes, such as agroforestry and aquaculture, should be implemented. Investing in research and development of innovative technologies and sustainable farming methods tailored to the unique environmental conditions of the Niger Delta region. In summary, this research sheds light on the intricate relationship between oil exploration and agriculture, offering valuable insights for policymakers, stakeholders, and communities to foster sustainable development in the Niger Delta region.

Keywords: Agriculture, sustainability, oil, spillage, mining, exploration, Niger Delta

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Abbreviations

Sustainable Development Goal	SDG
United Nation Development Programme	UNDP
Food And Agriculture Organization	FAO
Dangote Oil Refining Company	DORC
Liquefied Natural Gas	LNG
Gross Domestic Product	GDP
Federal Ministry of Agriculture	FME
Polycyclic Aromatic Hydrocarbons	PAH
Total Petroleum Hydrocarbons	TPH

Electrical Conductivity	EC
Federal Ministry of Agriculture and Rural Development	FMARD
Local Government Area	LGA
Nigeria National Petroleum Corporation	NNPC
Niger Delta Development Commission	NDDC
United Nation Environmental Protection	UNEP
National Bureau of Statistics	NBS
National Oil Spill Compensation Rate	NOSCR
Greenhouse Gases	GHG
Potential Hydrogen	PH
Directorate of Petroleum Resources	DPR

1 INTRODUCTION

Today, the world understands the importance of environmental sustainability to the prosperity of any nation. Ensuring environmental sustainability, is one of the primary goals of the Sustainable Development Goals 2030, SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land) (Chijioko et al. 2018a). The core of Africa's economy is in agriculture. Agriculture is the primary source of income for about 70% of Africans, especially Nigerians, and about 80% of people in other African countries (Eleke et al. 2019). Nigeria's economy depended heavily on agriculture for export earnings, rural employment, and food and fibre sufficiency (Babatunde 2020). According to a UNDP (2019) report, more than 60% of people rely on the natural environment for a living. Niger Delta is the breadbasket of Nigeria, inhabited by 31 million people (Nwaichi and Osuoha 2022).

Oil exploration and extraction have persisted, culminating in environmental degradation due to the multinational companies' lack of care for the environment in the area (Eshagberi and Ofotokun 2019). As a result, the region's environment has been listed as one of the most endangered in the world (Sam et al. 2022). The Niger Delta serves as a microcosm of the larger Nigerian nation-state, which according to (the World Bank 2023), has far worse developmental outcomes than much less developed nations in Sub-Saharan Africa. The Niger Delta, on the other hand, is a good illustration of poverty amid riches. Despite widespread poverty, 90% of Nigeria's export earnings and 80% of its state revenues come from oil and gas exploitation in the region (Akpokodje and Salau 2015). Despite the enormous natural resources in the Niger Delta region, they still suffer from the “Resources Curse” (Asiegbu et al. 2024). The inhabitants of the Niger Delta rely heavily on the environment for a living, primarily through agriculture and fishing (Salami & Balogun 2015). 50% of the active workforce in the region cultivates food crops such as cassava, yam, plantain, maize, cocoyam, and vegetables (Akinde and Vitung 2020). However, the Niger Delta environment has been severely harmed because of the heavy exploitation of oil and gas resources, which has resulted in oil spills, gas leaks, gas flares, land degradation, flooding, and erosion (Ukhurebor et al. 2021).

Nwosu (2016), highlighted the consequences of oil spills on agriculture and lamented that most of the ruined farmlands and contaminated water bodies have led to frustration and a lack of livelihoods for the farmers and fishermen in the region. Oil spills inflict significant damage to the soil due to the high retention time of oil in the soil caused by limited flow (Nduka et al. 2012).

This limits appropriate soil aeration and affects soil temperature, structure, nutrient status, and pH, ultimately destroying the crops. The negative impacts of oil extraction activities on agricultural practices have contributed to the region's abject poverty and social deprivation (Akpokodje and Salau 2015). To make matters worse, the culpable oil firms and the Nigerian government have done little to restore the deteriorated environment and alleviate people's suffering (E.Ite et al.2013). For example, Oloibiri, the village where oil was initially discovered in Nigeria, is still severely underdeveloped, with no portable water, no power, and only one outdated health centre and government institution (Etemire and Worika 2018).

Hence this study was conducted to assess the impact of these policies, with a focus on the negligence of the national policymakers on the environment and as well as look into the effects of oil exploration on agricultural activities in the Niger Delta region (SDN 2020). The country's ongoing failure to enforce environmental regulations has reduced it to a pitiful state of economic growth and infrastructure development in the region (Duru 2014). The thesis is expected to add to the current body of knowledge on environmental pollution management and aid in implementing policies that protect the environment from further harm and degradation.

2 LITERATURE REVIEW

2.1 Agriculture in Nigeria

Agricultural development is one of the most important strategies for ending poverty, increasing shared prosperity, and feeding the 9.7 billion people expected by 2050 (World Bank 2023). Agriculture is also critical to economic growth, accounting for 40% of global GDP and more than 25% of GDP in some least developed countries (World Bank 2023). Agriculture is a significant source of revenue in developing nations, employs over 80% of the labour population, and provides a means of survival for an additional 850 million rural people (DURU 2014). According to FAO (2023) report, agriculture supports nearly 2.5 billion people worldwide. The country's major employer is the agricultural sector. According to FAO (2023), agriculture has generated 40% of Nigeria's overall Gross Domestic Product. **Figure (1)** shows the top ten crops produced by households in Nigeria, as over 70% of Nigerians work in agriculture, primarily subsistence (Ifeanyieze et al. 2016). Despite its significance to the economy, Nigeria's agriculture sector still faces numerous issues that impact its productivity (Okon 2023).

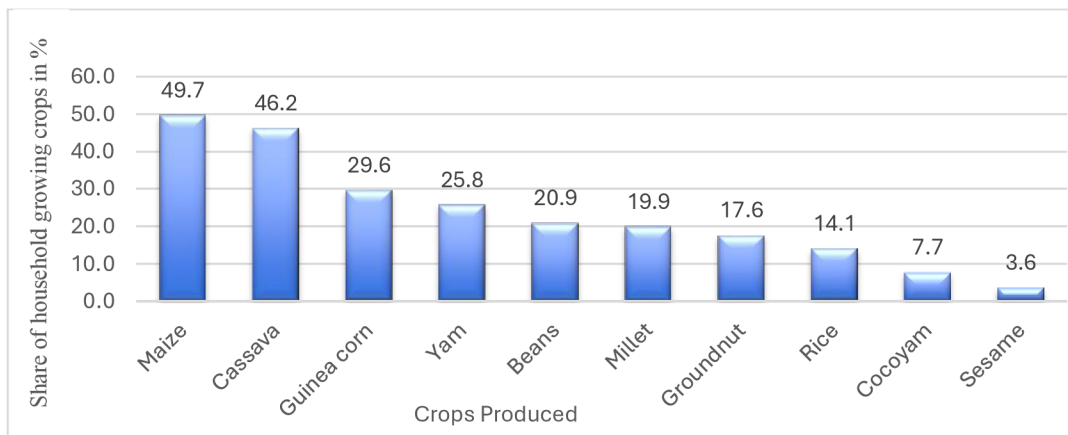


Figure.1. Ten major crops among households in Nigeria as of 2019. (Source: NBS 2019).

2.2 Niger Delta Agricultural Potential.

The Niger Delta's rich alluvial soil, combined with an array of fish and saltwater bodies, provides essential incentives for the people living there, who are primarily farmers and fishermen (Onyena and Sam, 2020).

According to the UNDP (2015) report, 60% of the population depends on natural, living, and non-living resources for survival. The freshwater swamps are characterised by periodic flooding that supported the growth of *Raphia* Palms (Jemimah and Ike 2015). The genus *Raphia* (Palmae / Arecaceae) contains 22 species across its distribution and is an essential multi-use resource in tropical Africa and Madagascar (Mogue-Kamga et al. 2020). *Raphia* species provide everything from food to building materials and pharmaceutical benefits; its species are important culturally in African civilisations. According to (Elum et al. 2016), maize, yam, rice, cassava, sugar cane, pineapples, and plantains are other food crops cultivated in the region. They constitute the farmers' main sources of income while the presence of a natural pool of water in some parts of the region and swamp all year round provides the basis for integrated fish farming and beekeeping (Jemimah and Ike 2015).

The chemical characteristics of the soil indicate that it is acidic; the PH values range from 4.6 to 5.3, making it appropriate for oil palm, coconut, plantain, pineapples, and sugar cane to thrive in acidic soil (Jemimah and Ike 2015). The soil is fragile, subjected to extended leaching from heavy rainfall and annual flooding cycles, high prevailing temperatures, and rapidly decomposing exposed soil organic matter (Nnaemeka 2020). It is also subjected to poor drainage and aeration, making it amenable and responsive to appropriate fertiliser application regimes and effective soil management techniques (Odafe and Titus 2013). This shows that the region has the potential to cultivate food crops and perennial tree crops (Mogie et al. 2011).

2.3 An Overview of Oil Exploration in the Niger Delta Region

Crude oil, a critical natural resource, has substantially enhanced living standards, and its advantages cannot be overstated (Eleke et al. 2019). It is the backbone of the Nigerian economy, so massive efforts have been made to explore it (Asiegbu et al. 2024). Three floated petrochemical and petroleum refineries include the Kaduna refinery, the Warri refinery, and the Port-Harcourt refineries (Nwaichi and Osuoha 2022) and the newly launched first private petrochemical and petroleum refinery, Dangote Oil Refining Company (DORC) exist to maximize the processing of oil in Nigeria. As the petroleum refining, production, and operations of crude oil in the Niger Delta region increase, so does the pollution of the water bodies and land degradation increases (Aa et al. 2022).

Nigeria is Africa's largest oil producer, has the continent's most significant natural gas reserves, and is among the world's top five liquefied natural gas (LNG) exporters (Nwaoha and Wood 2014). The region has a large hydrocarbon reserve and produces 2.4 million barrels of crude oil daily (NNPC 2015). According to the Oil & Gas Journal (OGJ), Nigeria has an estimated 37 billion barrels of proven crude oil reserves as of January 2015, ranking second in Africa to Libya (Abu et al. 2023).

The reliance on crude oil production in Nigeria is evident, as it accounts for 90% of the country's revenue, the value of this sector to the Nigerian economy cannot be overstated (Asiegbu et al. 2024). Although the Niger Delta Region, often known as the Oil Kingdom, is famous for its abundance of natural resources, the most common pollution that occurs in this region is gas flaring, oil spillage, oil theft, operational error, and non-compliance by multinational companies, in the region (Chukwuemeka et al. 2012; Obi 2021; Umar et al. 2021). Which in turn has affected the ecosystem, the water bodies, agricultural productivity, and the residents (Dung et al. 2008). Oil exploration activities in the southern part of Nigeria, which cause continuous pollution of the water, have rendered fishing and traditional farming activities of the people residing in the region unprofitable and unattractive due to degradation of waters and lands (Osuagwu et al. 2018; Aa et al. 2022). Oil is a natural asset in this region, with its exploration and exploitation projected to benefit the area (Jernelöv 2010). Unfortunately, and regrettably, the same oil has been a scourge to the Niger Delta residents (Ejiba et al. 2016).

Undeniably, the southern part of Nigeria, affectionately known as the Niger Delta region, has faced the apparent fear of gas flaring and oil spills over four decades (Elum et al. 2016). The gas flares and oil spills suffered by the residents of this region over the years have had disastrous repercussions on their livelihood, health, and the environment. According to UNDP (2015) annual report, the former natural endowment in the Niger Delta region, such as faunas, forests, water, and farmland, has been subjected to life-threatening destruction because of indiscriminate oil exploration, impoverishing the inhabitants (Little et al. 2018). The faunal zone is part of the Niger Delta region, which is also the wealthiest area of Nigeria in terms of hydrocarbon reserves and diverse natural surroundings and the world's tertiary Delta basins and extensive hydrocarbon provinces (Chidumeje et al. 2015; Chijioke et al. 2018).

2.4 Causes of Environmental Pollution in Niger Delta

2.4.1 Oil Spillage

Oil spills occur due to production operations, sabotage, and, most significantly, pipeline corrosion. Oil spills appear to be a major environmental problem in the Niger Delta region they hurt both humans and the environment (Wenibo-wei 2018). Oil spills are the most environmental damage since they affect every aspect of life, including ecological, economic, social, political, and general well-being (Aro et al. 2010). Oil spills are mostly caused by machine and equipment breakdown, sabotage, or incorrect timing in operation (Chukwuemeka et al. 2012).

Oil spills cause colloidal suspension and lining to build on the shores of rivers, endangering aquatic life (Nwaichi et al. 2022). It permeates the soil from the shorelines, affecting the native biota and activities of living organisms (Atakpo and Ayolabi 2009). In almost 40 years of oil exploration in Nigeria, the Directorate of Petroleum Resources (DPR) documented over 6,000 oil spills (an average of 150 per year) according to (Imobighe 2011). Between 1997 and 2001, about 2097 oil spill cases were recorded, causing severe damage to agricultural resources and the coastal environment (Ekpebu and Ukpong 2013). Stringent environmental laws need to be enforced to regulate the environmental consequences of crude oil exploration and exploitation in the Niger Delta region (Nwaichi and Osuoha 2022).

2.4.2 Gas Flaring

Gas flaring is the unintentional release of undesirable gases through the burning process without sufficient precautions (Dung et al. 2008). In the Niger Delta, gas flaring mainly occurs near oil wells, which are located near residential areas and farmlands (Nichodemus 2020). Flaring is strictly prohibited by law, except for extraordinary emergency conditions or scenarios requiring the rescue of valuable properties (E. Ite and Ibok 2013). However, this is impossible in the Nigerian system due to non-compliance with the rule of law and the extent of corruption that has infiltrated the core of government and nearly every sector (Nwaichi and Osuoha 2022). One of the repercussions of gas flaring is an increase in the amount of greenhouse gases (GHG) discharged into the atmosphere (Abu et al. 2023). The GHG emissions from gas flaring and exploration in Nigeria alone exceed the amount emitted in Sub-Saharan Africa (Kingston 2011).

Gas flaring disrupts the environment's equilibrium condition, resulting in noticeable climatic changes (Bayode et al. 2011). It also impacts agricultural products by stunting crop growth (Edino et al. 2010) and causes carcinogenic effects in persons who live near oil drilling sites (Ekpoh and Obia 2010).

2.4.3 Technical or Operational Error

Figure (2) depicts spills caused by an unexpected error, that could result in an oil spill incident (for example, a bad pipeline maintenance culture) as a technical or operational error (Chukwuemeka et al. 2012). Technical or operational errors are typically caused by worn-out equipment, insufficient risk assessment, planning, and regulations, unpreparedness, human error, limited safety training, and the organisational culture influencing employee behaviour (Kashwani and Nielsen 2017). Several oil spills in the Niger Delta have been caused by operational errors (Fentiman et al 2015; E.Ite et al. 2018). Well, blowouts are frequently associated with a lack of efficient risk assessment during the construction phase, resulting in environmental damage, economic loss, loss of assets, health concerns, and human life loss (Afenyo et al. 2016). In 2008, two massive oil spills from a Shell pipeline from the Trans-Niger pipeline in the Bodo community spilled at least 560,000 barrels of oil into the community land. The oil leaks exposed the Bodo community and its littoral ecosystem to significant risk, destroying roughly 1000 ha of mangroves and all of the marine species (The Guardian 2011; Gundlach 2018; Little et al. 2018).

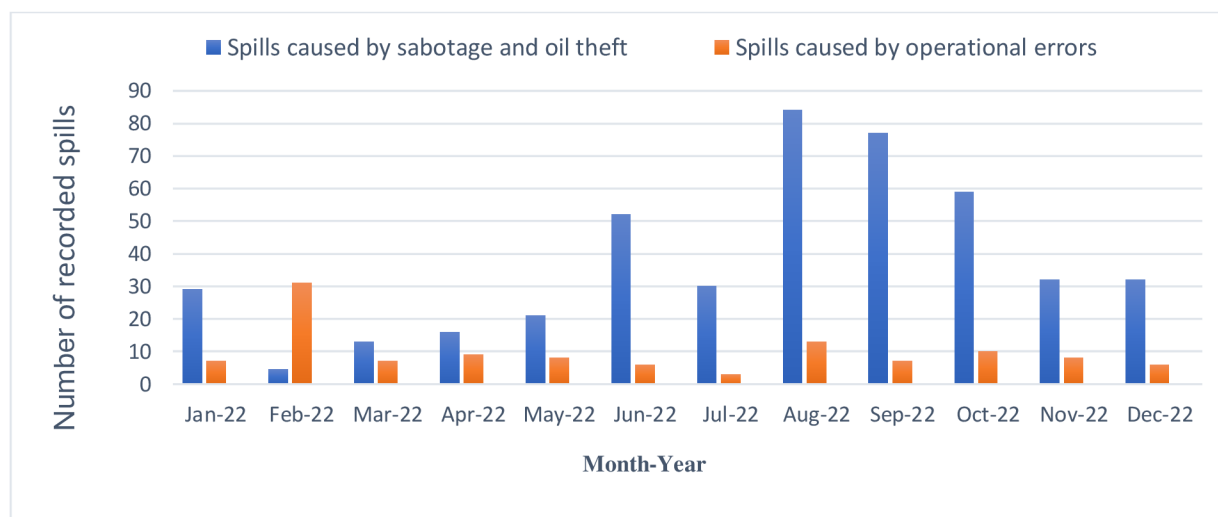


Figure 2 Number of oil spills by reported operational error 2022 Source: NOSM and NOSDRA (2022).

2.4.4 Oil Theft

The current spike in oil theft in Nigeria's Niger Delta region is alarming. Concerns are at an all-time high as government revenue continues to diminish because of oil thieves stealing up to 400,000 to 600,000 barrels of crude oil per day (Okoro, 2020). A more reasonable estimate of annual economic loss due to oil theft is in the neighbourhood of \$6 billion (Naanen, 2019). Oil theft considerably adds to a loss in production capacity, which in turn impacts national budget performance, encourages borrowing, raises foreign loans, and inhibits economic growth (Alohan 2013). Oil theft often comprises tampering with oil pipelines (crude oil tapping), vandalism (Sam et al. 2017), smuggling, and illicit sale (Okere 2013; Ugwuanyi 2013; Adeboboye 2013; Akpan 2013; Boris 2015), in addition to the negative consequences on the local economy (Sam et al. 2018). The process frequently results in oil spills, degrades ecosystems, reduces biodiversity, contaminates aquifers, and destroys the land and other nature-based livelihood structures on which coastal communities depend (Fentiman et al. 2015; Bello et al. 2019; Naanen 2019; Obida et al. 2021; Zhang et al. 2019). According to the NOSM report (2022), a subsidiary of the National Oil Spill Detection and Response Agency (NOSDRA) recorded about 596 publicly available oil spills during 2022, and it was caused by sabotage and oil theft, operational errors as well as company negligence and non-compliance to regulating policies as depicted in **Figure (3)** and **Table (1)** (Chukwuemeka et al. 2012).

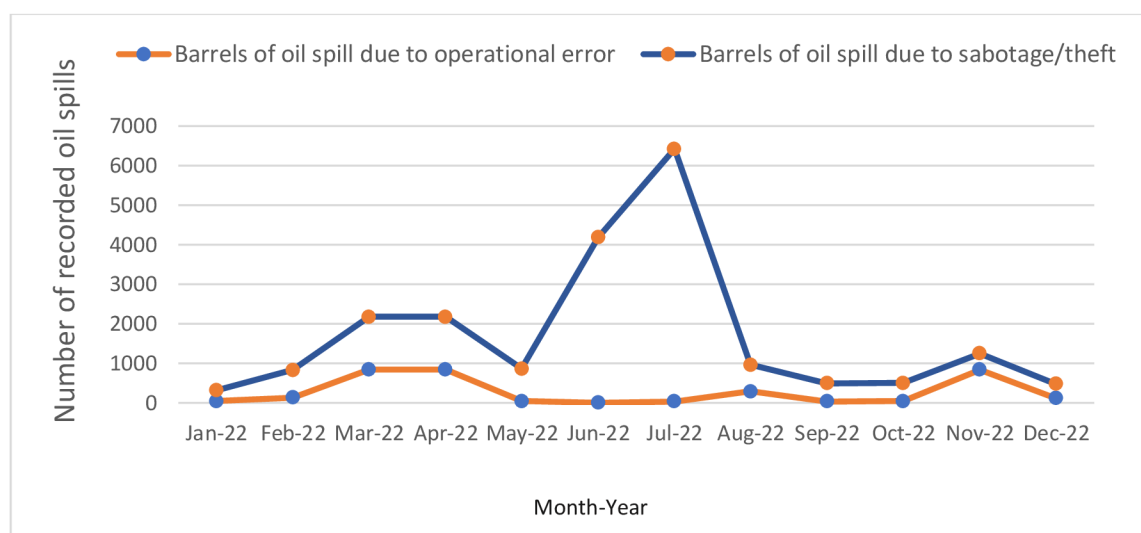


Figure 3 The volume of oil spills reported by oil theft causes 2022. Source: NOSM and NOSDRA (2022).

Table 1. Oil spills by company compliance and performance 2022

Name of Companies	Reported spills	Reported volume	No of JIV	No of Quantity
Aiteo E&P	1	3 Bbls	0% (0)	0% (0)
Belema E&P	1	20Bbls	0% (0)	0% (0)
CHEVRON	39	4Bbls	90% (35)	5% (2)
CONTINENTAL OIL AND GAS LIMITED	1	550Bbls	0% (0)	0% (0)
ERL	22	106Bbls	23% (5)	0% (0)
ESSO	1	0Bbls	0% (0)	100% (1)
Empire Energy	1	314Bbls	0% (0)	0% (0)
Eroton E&P	6	9984Bbls	17% (1)	0% (0)
FIRST	1	10Bbls	0% (0)	0% (0)
HEIRS HOLDING OIL AND GAS LIMITED	3	1Bbls	33% (1)	0% (0)
Heritage	48	1825Bbls	6% (3)	0% (0)
MPN	20	3Bbls	0% (0)	100% (20)
Midwestern	4	12Bbls	50% (2)	0% (0)
NAOC	196	3120Bbls	10% (20)	0% (0)
NDWEST	3	704Bbls	0% (0)	0% (0)
NPDC	38	698Bbls	21% (8)	0% (0)
Neconde	4	10Bbls	0% (0)	0% (0)
PPMC	1	0Bbls	0% (0)	0% (0)
PPMC (NPSC)	1	3Bbls	0% (0)	0% (0)
SEEPCO	3	119Bbls	0% (0)	0% (0)
SEPLAT	35	149Bbls	31% (11)	0% (0)
SHEBAH PRODUCTION	1	0Bbls	100% (1)	0% (0)
SPDC	160	1186Bbls	72%(115)	0% (0)
TOTAL	4	28Bbls	50% (2)	0% (0)

2.5 Effects of Oil Exploration on Agriculture Land

2.5.1 Effects on the Soil and Land

Oil spillage is a significant contaminant of agricultural soils in the Niger Delta, affecting soil fertility, pH, moisture content, salinity, electrical conductivity (EC), soil texture and structure, heavy metal and total hydrocarbon content (Akpotor 2019; Jemimah et al. 2015). Okoro et al. (2011), evaluated the soil quality of the Orere-Oluba community in the Niger Delta and discovered a drop in pH, electrical conductivity, nitrates, and phosphate in oil-polluted soils compared to non-polluted soils. There was a considerable increase in total organic carbon and total petroleum hydrocarbons (TPH) and a rise in clay content and heavy metals in the polluted soil as shown in **Figure (4)** (Osuagwu et al. 2018; Udotong et al. 2017). The negative impacts of oil pollution are being studied in terms of soil, crop output, fishery, biodiversity, water quality, health, and the economic lives of the host communities (Eshagberi and Ofotokun 2019).



Figure 4 Soil Degradation due to Oil Spillage (site visit observation 2023)

2.5.2 Effects on Food Production

The oil spill has harmed food production in the Niger Delta (Babatunde 2020). Most crops are usually damaged when an oil spill occurs on a farm. (Ifeyanyieze et al. 2016), Investigated the impact of oil pollution on local plant species and cultivated food crops over a period of fifteen months. Young plants were more vulnerable to oil pollution than older plants, exhibiting partial

defoliation, leaf chlorosis, leaf chlorosis loss, and high levels of heavy metals (Ukhurebor et al., 2021)

2.5.3 Effects on Water Quality

According to research, most freshwater sources in the Niger Delta are poisoned by petroleum hydrocarbons (UNDP 2015). Raji and Abejide (2013) stated that drinking water from a freshwater wetland in Ogoni Community, Niger Delta, was tested for petroleum hydrocarbons. The results revealed that the water had 18 ppm of hydrocarbon, which was almost 360 times more than the threshold permitted in drinking water by the European Union (Aa et al. 2022). According to the study, 76-80% of residents in the Niger Delta's rural areas and 50-56% in the urban areas lack access to drinking water owing to oil pollution (Uzoekwe and Oghosanine 2011). The impact of treated effluent discharge from the Warri Refinery and Petrochemical Company on the Ubeji River, a key supply of water for the Ubeji Community (Nichodemus 2020). The study found that because the effluent was treated, several of the physiochemical parameters examined were within the Federal Ministry of Environment, Nigeria's limit for aquatic life but not for residential use (FME 2021). Previous research by (Aa et al. 2022; Cordes et al. 2016) demonstrated that the water from the Ubeji River was unfit for residential use and dangerous to aquatic life. Oil exploration in Ondo State's Ilaje Community has resulted in petroleum hydrocarbons' intrusion into rivers and streams (Julius et al. 2011). An estimated 68.4% of both surface and subsurface water has been contaminated, making it unsafe for drinking (Balogun et al. 2013) as depicted in **figure (5)**.



Figure 5 Oil spill in Cawthorne River in Degema LGA River State, Nigeria (site visit observation 2023).

2.5.4 Effects on Biodiversity

Biodiversity is the variance in the number of creatures found in an ecosystem (Izah 2018). This encompasses the number of distinct species, genetic variation within species, and the range of interactions among species in a community, also known as ecosystem diversity (Chidumeje et al. 2015). The Niger Delta is divided into four ecological zones: coastal inland, freshwater, lowland rainforest, and mangrove swamp. It is one of the world's most important wetlands (Kadafa and Ayuba 2012). The Niger Delta region is home to a diverse range of animals, including mammals, reptiles, birds, insects, and other invertebrates, as well as various plant species specific to the region (Onyena and Sam 2020).

The Niger Delta region is home to 60-80% of all Nigerian plant and animal species, it is an important habitat in the trans-hemisphere migration route of bird species, with over 330 different bird species identified (Little et al. 2020). Mogue et al. 2020 review that, plant species abundant in the Niger Delta include the rich mangrove forest made up of the red mangrove (*Rhizophora recemosa*), black mangrove (*Laguncularia racemosa*), and the white mangrove (*Avicennia africana*). According to Jemimah and Ike (2015), the genus *Raphia* (*Palmae / Arecaceae*) contains 22 species across its distribution and serves as a multiuse tree grown in the Niger Delta region.

2.5.5 Effects on Public Health

Heavy metals, aromatic hydrocarbons, and other hazardous pollutants found in oil spills harm the health of people living in the Niger Delta (Little et al. 2018). Heavy metals and trace elements present in oil spills, such as chromium and barium, have been associated with disorders such as stomach distress and ulcers, kidney and liver damage, high blood pressure, and cancers (Egbe and Thompson 2010). Sulphur dioxide and nitrogen dioxide are produced by burning spilled oil and gas flaring, which react with water in the air to form acid rain (Tawari and Abowei 2012). Some communities may suffer from digestive disorders, skin rashes, and respiratory difficulties since they rely on rainwater for domestic usage (UNDP 2015). Infertility may be caused by crude oil pollution, and inhaling gaseous pollutants from petroleum hydrocarbon combustion may cause respiratory and lung illnesses such as asthma and bronchitis (Nichodemus 2020). According to (UNDP 2015), benzene, a carcinogenic chemical, was found in air samples from the Ogoni community in the Niger Delta in quantities ranging from 0.155 to 48.2 gm-3.

According to Ordinioha and Brisibe (2013), carcinogens such as benzene and polycyclic aromatic hydrocarbons (PAH) were found in the surface water and soil of the oil-impacted communities. The presence of these carcinogens may be responsible for the more extraordinary occurrence of certain types of cancers in Port Harcourt, a city in the Niger Delta, compared to Ibadan, a city outside the Niger Delta (Obi 2021).

2.5.6 Effects on Income and Economy

In 1997, oil revenue accounted for 88% of the Federal Government's foreign exchange earnings, while in 2000, it accounted for 83.5% of overall gross revenue (Kadafa and Ayuba 2012). Oil wealth spurred tremendous infrastructure development in many Nigerian capital cities, including Lagos and Abuja, with flyovers, dual carriageways, and skyscrapers visible everywhere (Eugene et al. 2022; FAO 2016). Meanwhile, the communities that generate this revenue are impoverished and hungry, with no access to electricity, adequate roads, potable water, health care, or proper education (Amnesty International 2009; FAO 2023; Okon 2023). The Niger Delta's residents are traditionally farmers, hunters, and fishermen, but due to oil contamination, the region has resulted in forest degradation, loss of fertile soil, and decreased fish population (Kadafa, 2012). As a result of this, hunters, farmers, and fishers have lost money (E.Ite et al 2013). According to Oyebamiji and Mba (2013), investigated the consequences of oil spillage on poverty and hunger in the Niger Delta and discovered a high degree of youth unemployment, an increase in poverty rates, and hunger. More than 60% of Niger Delta residents rely on the natural environment for a living, hence environmental quality and sustainability are critical to their general well-being and growth (Asiegbu et al. 2024; Eugene et al. 2022). Oil spills primarily harm people experiencing poverty and those who rely on traditional livelihoods such as fishing and agriculture (Jernelöv 2010). The output of crops in crude oil-contaminated farms (15.98tons) was lower than in non-polluted farms (18.75tons), and agricultural income achieved per farm was lower in crude oil-polluted farms (\$324.20) than in unpolluted farms (\$365.84) (FAO 2023).

The oil spill has a negative impact on tourism and recreational activities in the Niger Delta, recreational activities such as swimming, boating, and diving are prohibited when beaches and other waterfronts are polluted (Béné et al. 2011; Uzoekwe et al. 2011). Hotel and restaurant owners, photographers, and other service providers lose money (Egbe and Thompson 2010).

With no land to farm and water to fish, the people are forced to look for non-existent jobs, thereby keeping them in a perpetual state of poverty (Béné et al. 2011; Okon 2023).

2.6 Environmental Effects

Oil spills harm the environment and devastate the ecosystem (Onyena and Sam 2020). When oil spills or other circumstances pollute the environment, the chemical composition of the environment, as well as the amount of petroleum exposed to species, are both critical elements in determining how populations react to released hydrocarbons (E. Ite et al. 2013). Specific biological and chemical characteristics, particularly the habitat and depth of the species, render certain lifeforms more susceptible to hydrocarbon exposure than others (Duru 2014). The oil spill reduces oxygen levels in both the terrestrial and aquatic habitats, reducing the amount of oxygen available to living species and ultimately resulting in their mortality as shown in **Figure (6)** (Aa et al. 2022; Onyenekwe et al. 2023). The extinction of these species reduces their population size, which affects the food chain (Béné and Friend 2011).



Figure 6. A reckoning of the oil spill in Niger Delta causing vegetation damage in Degema LGA River State, Nigeria (site visit observation 2023).

2.7 Agriculture in a Polluted Environment

The leading cause of losses in cassava output in the Niger Delta's oil spill-affected villages is oil spills, with a 41% decline in production in 2013 (Ahmadu et al. 2013). Agriculture has been an essential element of the culture and sustaining power of the rural population in Nigeria's oil-producing areas (Egbe and Thompson 2010).

However, since the commercial discovery of crude oil, the Niger Delta has been suffering from the harmful environmental repercussions of oil production activities (Julius et al. 2011). As a result, the existing pandemic of hardship and rural underdevelopment has persisted (Adekola and Igwe 2013). With the discovery of new oil wells, states endure changes in their natural environment because of pollution caused by spillage during exploitation activities. Oil spills have become a major threat to the environment and a major threat to economic development because they cause land degradation, air and water pollution, and the destruction of most crops, as well as the infertility of large areas of land and the death of fish and other seafood (Ekpebu and Ukpong 2013).

The degradation of traditional fishing grounds has decimated aquatic life, worsening hunger and poverty in fishing communities, and people groan amid harsh environmental and economic conditions (Béné and Friend 2011). As a result, when safety or comfort is endangered, they tend to get restless (Okon 2023). Farmers in the oil-rich region have lost their lands. They are consequently forced to emigrate to other communities in search of better livelihoods, exerting additional pressures on natural resources in such areas (Iheke 2019). The blame for oil-producing company's wantons and continuous destruction of the ecosystem has been placed on the Federal Government's lack of political will (Aa et al. 2022; Nwaichi et al. 2022).

2.8 Pollution and Contamination of Water Bodies

The Niger Delta region is one of Africa's most extensive marshes and one of the world's top ten most important wetlands in maritime environments (Chidumeje 2015). Contamination from oil spills has contributed significantly to the change of the area into a bleak wasteland (Chidumeje et al. 2015). Oil spills harm the ecosystem by destroying flora, mangrove forests (Figure 3), food/cash crops, fishing grounds/marine life, lowering soil nutritional value, fragmenting land, and, in rare circumstances, setting fire to communities, forcing internal relocation (Babatunde 2020; Béné et al. 2011; Onyena et al. 2020). Indeed, the region has become so polluted that it now has poisonous waters, depleted biodiversity, and forest damage (UNDP 2015). When oil spills on farmland or is carried into the shoreline by flooding, the soil cannot absorb water, depriving plants of oxygen (Ukhurebor et al. 2021). It might have a detrimental effect on the soil's nutrients and richness, which would cause the land to deteriorate and reduce agricultural yield (Joseph 2015) as depicted in **Figure (7)**.



Figure 7. Hydrocarbon pollution on surface water and vegetation in Ogu/Bolo LGA River State, Nigeria (site visit observation 2023)

2.9 National Policies and Laws Governing Oil Exploration and Agriculture

In response to the environmental menace in Nigeria, the federal government of Nigeria enacted legal instruments and environmentally friendly policies such as the 1991 guidelines and standards for environmental pollution and control law, the National Oil Spill Detection and Response Agency (NOSDRA), the National Enforcement Standard and Regulation Enforcement Agency Act (NESREA), and the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria and Standard for Petroleum Industry in Nigeria (EGASPIN), Federal Environmental Protection Agency Act Cap 131 LFN 1990/ 1992, and other laws were enacted to address this issues and despite the existence of these policies, the region continues to suffer from the aforementioned issues (Albert et al 2018; Odey 2023; Adi 2023).

2.10 Federal Environmental Protection Agency (FEPA) Act 1990/1992

Nigeria's most important environmental law is the Federal Environment Protection Act (FEPA). The Act outlined methods for natural resource, agricultural, and industrial actions to limit ecosystem damage (Albert et al. 2018). The agency also provides environmental standards, rules, specifications, and criteria for preserving land, water bodies, and air, which could be critical for the protection of the people's welfare, safety, and health from environmental devastation and

degradation (Odey 2023). FEPA was also obligated to create limits and standards for water quality, hazardous material control, effluent limitation, ozone protection, and noise control, all of which are aimed at reducing Nigeria's climate change issues (Olaniyan 2015). The federal government's mandate for environmental protection is straightforward and profoundly evident, however, there still needs to be a significant gap in enforcement and compliance, which has raised many questions. Citizens in Nigeria believe that irresponsible oil and gas production and exploitation cause over 90% of ecological degradation in the region, leading them to think that there are no guidelines guiding the production and exploration of petroleum products in the country (Albert et al. 2018).

2.11 National Enforcement Standard and Regulation Enforcement Agency Act (NESREA)

The NESREA was founded in 2007 to replace the former FEPA. The agency was tasked with providing proper biodiversity conservation, ecosystem protection, and sustainable development of the country's natural resources (NESREA Amended Act 2018). The agency's responsibilities also include communication and cooperation with appropriate stakeholders on matters concerning the execution of environmental policies, guidelines, rules, and standards (NESREA 2018). Furthermore, Section 7 of the NESREA Act states that the agency has the authority to (a) impose compliance with environmental standards, policies, guidelines, and laws and (b) implement compliance with provisions of environmental conventions, protocols, international agreements, and treaties—including ozone depletion, hazardous waste, chemicals, forestry, wildlife, climate change, and other environmental agreements that may arise in the future. Even with all of these tools in place, environmental degradation and contamination remain significant, highlighting a lack of compliance by the relevant entities (Albert et al. 2018).

2.12 Environmental Guidelines and Standards for Petroleum Industry in Nigeria (EGASPIN)

Numerous rules or legislation are in place in Nigeria to safeguard the environment (Olaniyan 2015a). Surprisingly, the Nigerian constitution serves as the foundation for each law, which includes provisions for the protection of wildlife, forests, air, and water supplies in Nigeria. Furthermore, they are supplemented by the FEPA Act in terms of pollution and effluent abatement, as well as hazardous waste and solid waste management (Albert et al. 2018; Joseph et al. 2014).

In contrast, despite the availability of these rules and recommendations for proper operation produced by the DPR, the oil and gas industry has indisputably and directly contributed enormously to the destruction of the ecosystem (Joseph and Inemo 2014). As a result, EGASPIN states that the petroleum business is governed by federal legislation and the Nigerian Petroleum Act (NNPC 2015).

2.13 National Oil Spill Detection and Response Agency (NOSDRA)

When an oil spill occurs in Nigeria, NOSDRA is the first and most significant agency tasked with investigating, detecting, responding to, and preparing for oil spills (NOSDRA, 2006). Instead of NOSDRA, Olawale (2015) observed that numerous oil spill inquiries are conducted solely by the responsible oil companies, obstructing the supply of accurate information from the site of the spill to protect the company's image and deceive the settlements and the Nigerian government at large (Nwaichi and Osuoha 2022). This also leads to inaccurate statistics regarding the magnitude of destruction and the number of recorded incidents (Watts and Zalik 2020). For example, in 2006 and 2007, NOSDRA confirmed 327 and 253 oil spill sites, respectively, while reporting 588 and 419 oil spill events in the first quarter of 2008 (Ayawei and Abila 2015). However, 1527 oil spill occurrences occurred in Nigeria from the beginning of 2015 to the end of 2015, with many unreported cases (Whanda et al. 2016). Surprisingly, oil corporations registered only 400 cases within the same time, with anticipatory tactics to prevent relevant bodies such as NOSDRA from conducting thorough investigations (Olawale 2015). The rate and frequency of recorded oil leak cases constitute a major threat to NOSDRA in terms of rehabilitation, remediation, and clean-up planning (Albert et al. 2018; Watts et al. 2020). As a result, NOSDRA has initiated steps to design a National Oil Spill Compensation Rate (NOSCR), which will function as a chaperon for the oil industry with appropriate and suitable compensation to the transit and host oil settlements (NOSDRA 2022).

2.14 The 1991 Guidelines and Standards for Environmental Pollution and Control Policy

Environmental issues are now a tropical concern due to the documented threat to animals, plants, man, and biodiversity (Cordes et al. 2016). Numerous environmental resolutions, declarations, and international environmental conventions have been established in this regard

(Odey 2023). The discussions, which included stakeholders, topic specialists and professionals, and policy and decision-makers, provided several standards for dealing with environmental challenges (Adi 2023). Similarly, the assembled resolutions and declarations acted as tools for national governments in various nations to create and implement legal frameworks and national policies on the ecosystem (Wenibowei 2018). To this purpose, the Nigerian government created rules and standards for environmental pollution control in Nigeria in 1991 and further updated, which were then used as a tool for environmental management in her country (FME 2021; Adi 2023). The standards were created primarily to control the amount of pollution in an area due to industrial activities (Whanda et al. 2016).

2.15 Hydrocarbon Pollution Remediation Project (HYPREP)

The establishment of HYPREP added another layer of overlap to managing contaminated land in Nigeria (Nwaichi and Osuoha 2022). Although HYPREP's goal is to implement UNEP recommendations on Ogoniland and clean up other toxic areas in the Niger Delta, its creation has exacerbated the already complex and frequently poorly managed multi-agency tasks (Sam et al. 2022). For example, new oil spills have occurred in Ogoniland since publishing the UNEP report ten years ago. It's unclear whether the recent spills are the fault of HYPREP or NOSDRA. The new regulatory system (i.e., HYPREP) may address Ogoniland's immediate demand for oil spill remediation (Jernelöv 2010; Whanda et al. 2016). However, given the overlapping funding implications with NOSDRA, long-term sustainable remediation would be complex (Nwaichi and Osuoha 2022). When an oil spill happens, for example, the operator (i.e., the facility owner) must contact the proper agencies, each of which will conduct an independent site risk assessment (Adi 2023; Watts et al. 2020). However, disagreement frequently emerges due to differing assessments obtained from different regulating authorities, whose investigations are already marred by several irregularities, which may affect the legitimacy of the management and advice made to handle such spills (Albert et al., 2018; Watts et al. 2020). The overlap will eventually result in inefficiencies in decision-making, such as double budgeting for contaminated site management, compensation, and conflicting standards (Ajai 2010; Eneh 2011; Ambituuni et al. 2014).

2.16 Theoretical Conceptual Framework

Big Push theory is an economic development strategy proposed by economists Walt Rostow and Paul Rosenstein-Rodan (Wang 2019). The theory emerged in the mid-20th century and aimed to accelerate the economic growth and development of underdeveloped or countries. The Big Push theory suggests that developing countries like Nigeria often face significant obstacles and challenges that prevent the country from achieving sustainable economic growth through incremental changes (Ibeawuchi et al. 2016). These challenges include a lack of infrastructure, poor healthcare system, poor education system, low enforcement of oil policies, loss of agricultural land and the environment, contamination of water bodies, lack of compensation to the local farmers, inadequate transportation networks, and low levels of industrialisation just to mention but a few (Albert et al. 2018; Osuyi et al. 2023). According to the theory, a country like Nigeria is trapped in a state of underdevelopment due to these interlinked constraints.

To overcome this trap, the Big Push theory advocates for a coordinated and massive investment in various places where oils are being extracted. The idea is to implement a "big push" of investment in infrastructure, education, healthcare, and industrialisation all at once (Akakuru et al. 2022). This simultaneous push is believed to create positive feedback loops, generating self-sustaining growth and development (Olaniyan 2015). The theory assumes that by addressing multiple constraints simultaneously, the synergies between these sectors would create a virtuous cycle of growth and development, leading to economic take-off to sustain the Niger Delta region (Ibeawuchi et al. 2016).

3 AIMS OF THE THESIS

The overall objective is to determine the effect of oil exploration on agriculture in the Niger Delta.

3.1 Specific Objective

1. To identify the efforts of the policymakers and other stakeholders to reduce the effects of oil and gas pollution in the region.
2. To determine the challenges of oil spillage on agricultural land.
3. To identify the adaptation measures in the region.

4 METHODOLOGY

4.1 Study Area Description

The major occupation of the inhabitants of the area is agriculture (Ifeanyieze et al. 2016). Some of the arable crops produced by the farmers include cassava, yam, cocoyam, maize, rice, and fishing (Duru 2014). Agriculture has been a significant part of the culture and sustaining force of the people in the region (UNEP Report 2011; Ukpong 2013). The main goal of this study is to ascertain how oil drilling in the Niger Delta region affects agricultural activities. To achieve this, we evaluated the impacts of oil spills on agriculture farmlands as well as on water bodies and how they influenced livelihood within the communities in the region (Iheke 2019). The Niger Delta is a region of a wet and dry area covering around 70,000 square kilometers in the southern and southern-eastern parts of Nigeria (Jemimah and Ike 2015). The Niger Delta of Nigeria is a densely populated region in south-south Nigeria on Africa's West Coast (Chidumeje et al. 2015). It is a vast low-lying region through which the Niger River separates and drains into the Gulf of Guinea (Ogeleka et al. 2017; Akpoghelie et al. 2021). The region runs from the Benin River's west bank to the Imo River's east bank (Akpokodje 2015). The Niger Delta is made up of nine states: Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers, as depicted in Figure (8) with 185 local governments (Aa et al. 2022). It lies between latitude 4° 49' 60" North of the Equator and longitude 6° East of the Greenwich Meridian (Adekola et al. 2013). The estimated regional population is nearly 31 million people (Nwaichi and Osuoha 2022). It is the third-largest delta in the world with a coastline spanning about 4,500 kilometers (Anabaraonye et al. 2023). About 2,370 square kilometers of the Niger Delta consist of rivers, creeks, and estuaries (Ahmadu and Egbodion 2013). The region falls within the tropical rainforest zone with high rainfall and thick vegetation cover (Umar et al. 2021). The Niger Delta typically has an equatorial climate on its southern shore and a subequatorial climate in the north (Abdulkareem et al. 2012). The yearly precipitation is between 2000 mm and 4000 mm, and the relative humidity is above 70% (Tarilanyo 2011). The monthly temperature fluctuates between 25 °C and 29 °C, making the area's ecosystem highly diverse and supportive of numerous terrestrial and aquatic flora and fauna species (Chidumeje et al. 2015; Ifeanyieze et al. 2016). It is dominated by rural communities that rely primarily on the ecosystem for living, including several ecological zones, coastal ridge barriers, mangrove swamps, freshwater swamps, woodlands, and lowland rainforests (Jemimah and Ike, 2015).

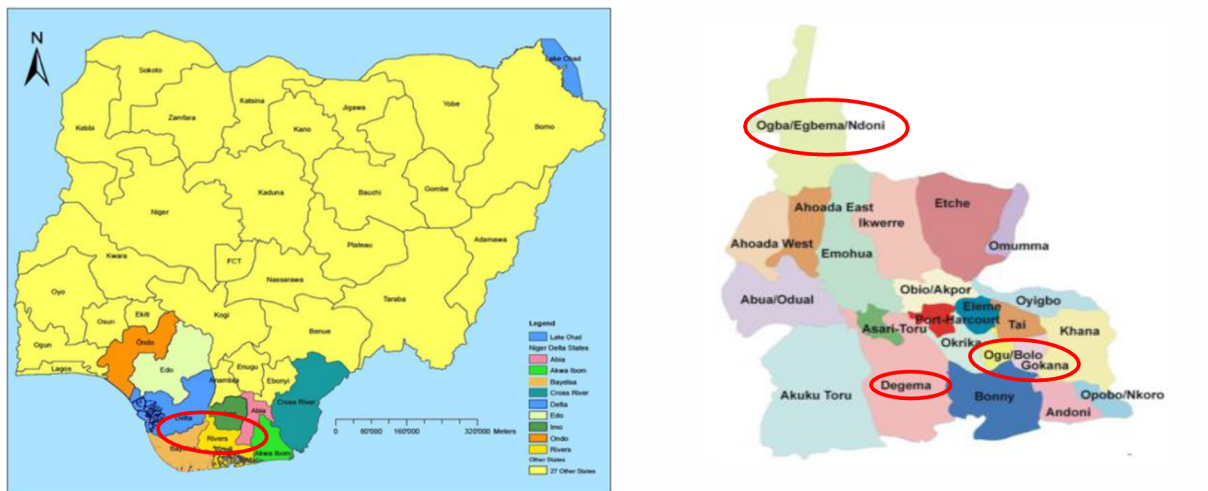



Figure 8. Map of Oil Producing States in Niger Delta (Left) and River State (Right): Degema, Ogba/Egbema/Ndoni and Ogu/Bolo LGA Study Sites (Right) Represented by  (American Journal of Environmental Protection 2013; People Gazette. 2020).

4.2 The Sampling and Data Collection

To achieve this, we used a qualitative research design with a variety of techniques, including interviews, questionnaires, field observations, secondary data from scientific literature from Web of Science, the Nigerian National Petroleum Corporation, Niger Delta Development Commission, United Nations Development Programme, Food and Agriculture Organization, World Bank Reports, and National Bureau of Statistics documents, Federal Ministry of Environment and so on. The collected data is analysed using descriptive methods.

A multi-stage sampling technique was used to select the households used in the study. In the first stage, one state was purposively selected out of the nine states due to their dependence on farming and fishing, large number of oil deposits among the nine states, and the highest level of oil exploitation in the region (Ahmadu and Egbodion 2013). In the second stage, 6 communities from the three local government areas (LGAs) (Degema, Ogba/Egbema/Ndoni, and Ogu/Bolo) out of 16 communities were selected from Rivers State purposively due to the predominance of agricultural activities. The selected communities include Omoku and Idu (both in Ogba/Egbema/Ndoni LGA); Bakana and Usokun-Degema (both in Degema LGA); and Gokana and Okrika (both in Ogu/Bolo LGA). Semi-structured questionnaires were administered to the chosen communities and farming households.

A total of 105 household heads and farmers were interviewed and where the household head was unavailable, the next available adult was interviewed. We are aware that the choice to interview the next available adult where the household head was not available could have impacted the results in some ways. Still, we cannot comment on the magnitude of any potential selection bias. The selected individuals were significant stakeholders who were negatively impacted by oil-related operations on their customary means of subsistence and food insecurity. Additionally, firsthand observations of the daily operations in each of the six communities were made. Fieldwork in the three local government areas was conducted between August and September 2023.

4.3 Data Analysis

After data cleaning, 100 responses were used; (5) were outliers. Data were further analysed by using a Microsoft Excel Workbook, which was generated from Google Forms at (<https://forms.gle/sGEzjcsHN7HyS35m6>). It was used to sort, code, and process data. Further analysis was done using Statistical Package for Social Sciences (SPSS) software 27.0. Descriptive statistics, the Likert scale, standard deviation, frequency count, mean, and percentages were among the descriptive statistics that were employed.

5 RESULTS AND DISCUSSION

Table 2. Descriptive Statistics of Categorical Variables (n = 100).

Variable	Description	%
Household Head Characteristics		
Gender	Male = 1 (HH)	64.0
	Female = 2	36.0
Marital Status	Single = 1	21.0
	Married = 2	59.0
	Divorce = 3	8.0
	Widow(er)= 4	12.0
Educational Level	No formal education = 1	6.0
	Primary education = 2	2.0
	Secondary education = 3	21.0
	Tertiary education = 4	71.0
Farm Characteristics		%
Land Ownership	Inheritance = 1	41.0
	Rented/Leased = 2	45.0
	Allocation by Chief = 3	14.0
Total land size	< 1Hectare = 1	56.0
	3-5Hectare = 2	33.0
	>5Hectare = 3	11.0
Farming/Fishing Experience	Knowledge of farming (Yes = 1)	84.0
FMARD Agricultural Practices		%
Adjustment in planting date	(Yes = 1)	40.0
Crop Diversification	(Yes = 1)	25.0
Conservation Agriculture	(Yes = 1)	2.0
Crop and Livestock Integration	(Yes = 1)	10.0

Crop Management	(Yes = 1)	4.0
Government and Institutional Characteristics.		%
Assessment/Compensation Support	Financial support (No = 2)	83.0
Remediation Support From Agencies	Effort to clean (No = 2)	85.0
Efforts to Mitigate oil Spillage	By relevant parties (No = 2)	64.0

Table 2. shows how categorical variables are classified. The study group consisted of 100 participants in total. 64% male and 36% female – the majority of whom were married (59%). The greatest proportion of education attained was tertiary education (71%), followed by secondary education with 21%. Higher literacy levels would make them more favourably disposed to acquiring knowledge, increasing their productivity more than their colleagues in the oil spillage region. On the land ownership right, 41% have their land through inheritance while (45%) have their land through leased or rent and most of the respondents have had land size lesser than 1 hectare (56%), whilst 33% have less than 5 hectares and 11% have had land size greater than 5 hectares. This means farmers in the study areas may have had to reduce their farm size due to damage caused by oil spillage. Where farmland was not destroyed, crop production and land productivity were severely damaged. The findings revealed that 84% of farmers in the impacted communities were engaged in agricultural production. This indicates that farmers dominate the study area. It follows that to increase agricultural productivity in the region, farmers must be prioritised in the government's policy drive.

The results show that planting date adjustments are the predominant farming practices in the Degema, Ogba/Egbema/Ndoni, and Ogu/Bolo (LGAs), with 40% of the 100 respondents implementing it, whilst 25% implementing crop diversification. Furthermore, 83% of respondents had no access to compensation support, and 85% were very dissatisfied with the remediation process. Most of the respondents (64%) had no support from the oil multinational companies in cleaning the oil spill spillages.

Table 3. Descriptive Statistics of Continuous Variables (n = 100).

Variable	Description	Mean	SD	Min	Max
Farmer's Characteristics					
Age	Years	45.5	16.2	20	94
Education	Years of schooling	14.0	3.4	0	16.0
Household size	Individuals	7.2	2.8	2.0	10.0
Farming	Years of farming	17.1	10.2	4.0	50.0

The classification of continuous variables is highlighted in **Table 3**. The average age of farmers was 45.5 years, the youngest farmer being 20 years and the oldest 94 years. The average years of schooling amongst the respondents was 14.0 years, and the maximum was 16.0 years. The average household's most significant size in Degema, Ogba/Egbema/Ndoni, and Ogu/Bolo (LGAs) is 7.2 individuals, whilst the largest household comprises 10.0 people. Large family sizes will have a favourable influence on agricultural production if there is a considerable contribution of family labour to production. Thereby enhancing food security across various households. However, it would have a detrimental impact on production if household members were not actively participating in farming. The farmer with the most farming experience had 50.0 years of farming experience, whilst the average farming experience was 17.1 years. Experience in farming will strengthen farmers' abilities for efficient management procedures that will assure increased productivity, all things being fair and equity.

5.1 Efforts of Policymakers and Stakeholders to Reduce the Effects of Oil and Gas Pollution

Figure .9. Indicating data analysis of respondents on the efforts of policy makers.

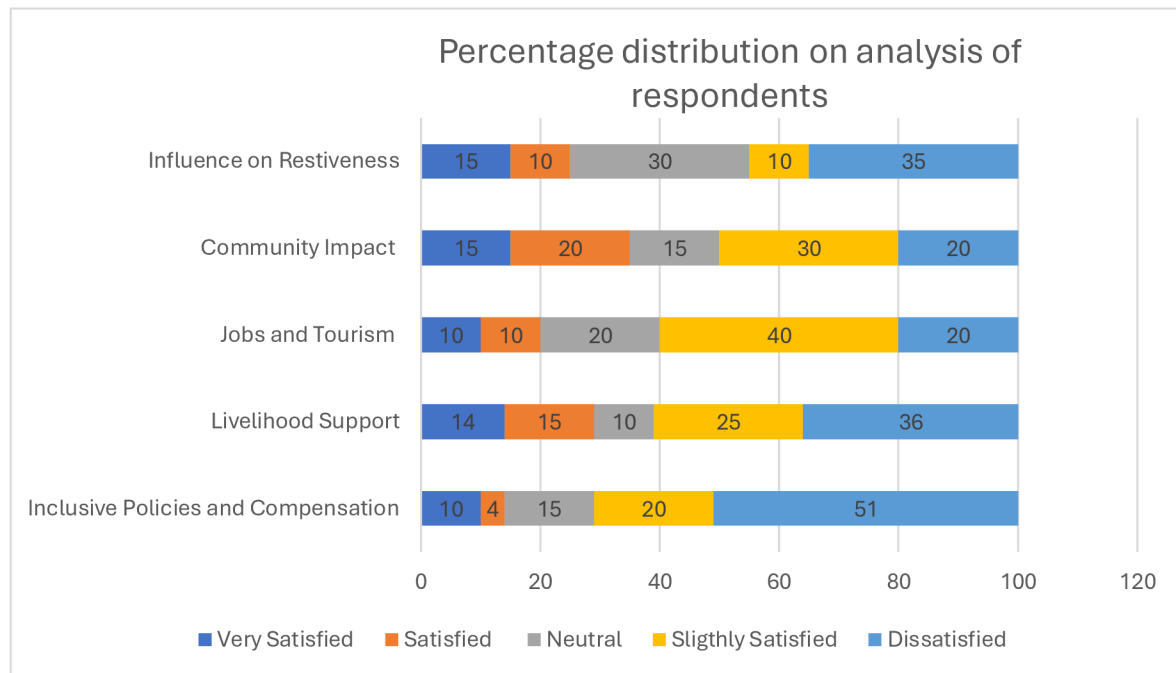


Figure 9. Perception on the Effort of Policymakers, where a likert scale was used (1= Dissatisfied and 5 = Very Satisfied).

The relationship between migration, restlessness, and the environment following oil disasters is crucial to the *Influences on Restiveness*. (35%) of the respondents highlights their dissatisfaction, citing significant negative impacts, such as loss of socio-economic benefits, jobs, socio-cultural changes, and political unrest in affected communities. This was further detailed by Albert et al. (2018) and Nwaichi et al. (2022). *Community Impacts*, this section covers the socio-cultural, socio-economic, agricultural land, and environmental impact of oil spillages on the communities and how the situations and implications have been managed. To this end, the study reveals that (30%) of the respondents are slightly dissatisfied with the efforts of the policies makers, citing major negative impact oil exploration activities has on the communities, such as loss of parental values because of the inability to fully assume responsibility for their adolescent, preschool, and school-aged children due to limited income.

The expense of living is continuously rising, and there is no assistance or alternatives available for them since the destruction of their farmlands, as (Cordes et al. 2016; Ibeawuchi et al. 2016; Nwaichi et al. 2022) further revealed this, with a focus on land and environmental issues. The impact of oil spills on tourism and job opportunities is also significant. Approximately 40% of respondents express slight dissatisfaction with how leisure activities and employment are affected by oil spills. Tourism, which provides job opportunities, suffers due to environmental damage, affecting the local economy and social dynamics. Studies by Nwosu (2016) and Ukhurebor et al. (2021) elaborate on this aspect. Livelihood support is essential for sustaining communities affected by oil spills. Around 36% of respondents emphasize the destruction of social welfare, culture, and income sources due to ecosystem damage. This lack of support contributes to migration and restlessness within these communities, as highlighted in studies by Ejiba et al. (2016) and Osuagwu et al. (2018).

In Nigeria, the National Assembly debates and passes crucial legislation governing the country's oil business, including policies on compensation, cleaning up spills, and preventing future incidents. However, this study shows that (51%) of respondents are dissatisfied with how claims for oil spills compensation are handled. These claims are not addressed according to approved policies for assessing and compensating environmental damage caused by oil spills. Instead, there are various laws in place, but they are often ignored, leading to numerous disputes. As previously discussed by Albert et al. (2018), Nwaichi et al. (2022), and Watts et al. (2020).

5.2 The Challenges of Oil Spillage on Agricultural Land

Table 4. Multiple Responses on the Challenges .

Variables	Description	%
Environmental Effects	Related to Soil (Yes = 1)	79.0
Effects of Oil Exploration	Related to Crops (Negative = 2)	95.0
Effects of Spillage	Related to Soil and Water (Negative = 2)	75.0
Effort to Clean Oil Spillage	By Agencies set up by the Govt .(No = 2)	64.0

The study revealed that (79%) of the respondents, agrees that oil spillage has environmental effect on the region soil fertility, while (95%) of the respondents agrees, that oil exploration have a negative impacts on their crops production, resulting to shortage of food. Moreso, (75%) of the respondents reveal that oil spillage has affected their soil texture, water bodies, which in turn affects their income and all other socio-economic aspects of their livelihood, as further revealed by (Amnesty International 2009; Ifeanyieze et al. 2016; and Umar et al. 2021). Furthermore, (64%) of the respondents revealed that, the government or policy makers does little or nothing to clean oil spills through its agencies set up for oil cleansing. As numerous agencies set up by the government exist to care for these very needs but greed, corruption and bribery will not make the agencies do their job diligently. The impact of this is, it will make the indigenes of these communities to seek other ways to seek a redress, by engaging in terrorism, kidnapping and oil theft and pipeline vandalization. To remedy this, it is advisable for the government to take full responsibility for effective oil cleansing, by putting monitoring measures in places to monitor the activities of the agencies set up for remediation as well as restructure the jurisdictions of each agencies inline with their work, to meet every aspect of oil spillage remediation processes as further reviewed by (Nwaichi and Osuoha 2022).

A Theoretical Flow Chart on Challenges, Impacts, and Possible Solutions.

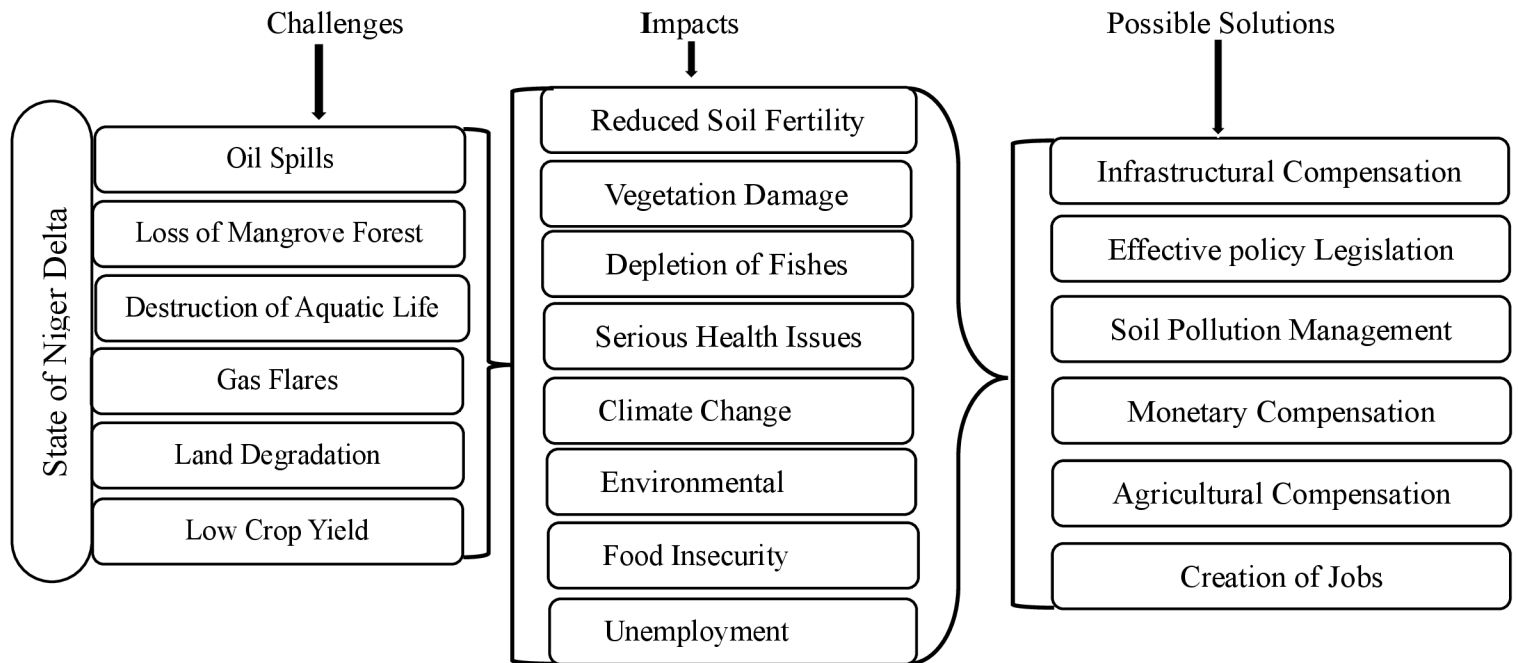


Figure 10. Challenges, Impacts, and Possible Solutions to Oil Spillage.

As shown in **Figure 10**, the people in Niger Delta face several challenges and the impacts it has on their livelihood. To overcome these challenges, it is important to adapt measures and adapt the possible solution as seen in Figure 10. Investing in infrastructural development in the affected communities will help address the lack of basic amenities such as roads, schools, hospitals, and clean water supply. Improved infrastructure can enhance the overall quality of life for residents and promote economic development in the region. Oil spills and pollution often damage agricultural lands, which are vital for the livelihoods of many Niger Delta residents. Providing compensation for farmers whose lands have been affected can help them recover their losses and transition to alternative livelihoods or sustainable agricultural practices as further revealed by (Cordes et al. 2016; Whanda et al. 2016).

According to Albert et al. (2018) and FME (2021), enacting and enforcing robust environmental regulations and policies can hold oil companies accountable for their actions and ensure that they operate in an environmentally responsible manner. This can include measures such as strict pollution control standards, regular monitoring of oil facilities, and penalties for non-compliance. Implementing measures to clean up oil-contaminated soil and prevent further pollution can help restore the fertility of agricultural lands and protect public health. Remediation efforts may involve techniques such as soil excavation, bioremediation, and the use of chemical dispersants.

Providing monetary compensation to communities impacted by oil exploration activities can help alleviate immediate hardships and support long-term recovery efforts. Compensation can be used to compensate individuals for property damage, loss of livelihoods, health expenses, and other adverse effects. Investing in job creation initiatives, such as vocational training programs, small-scale enterprises, and infrastructure projects, can help diversify the local economy and reduce dependency on the oil industry. Providing alternative sources of income, and job creation efforts can help mitigate the socio-economic impacts of oil exploration activities, such as unemployment and poverty (Obi 2021; Osakwe 2021).

5.3 The Adaptation Measures in the Region

Figure 11. Indicates the Different Agricultural Practices Implemented by FMARD

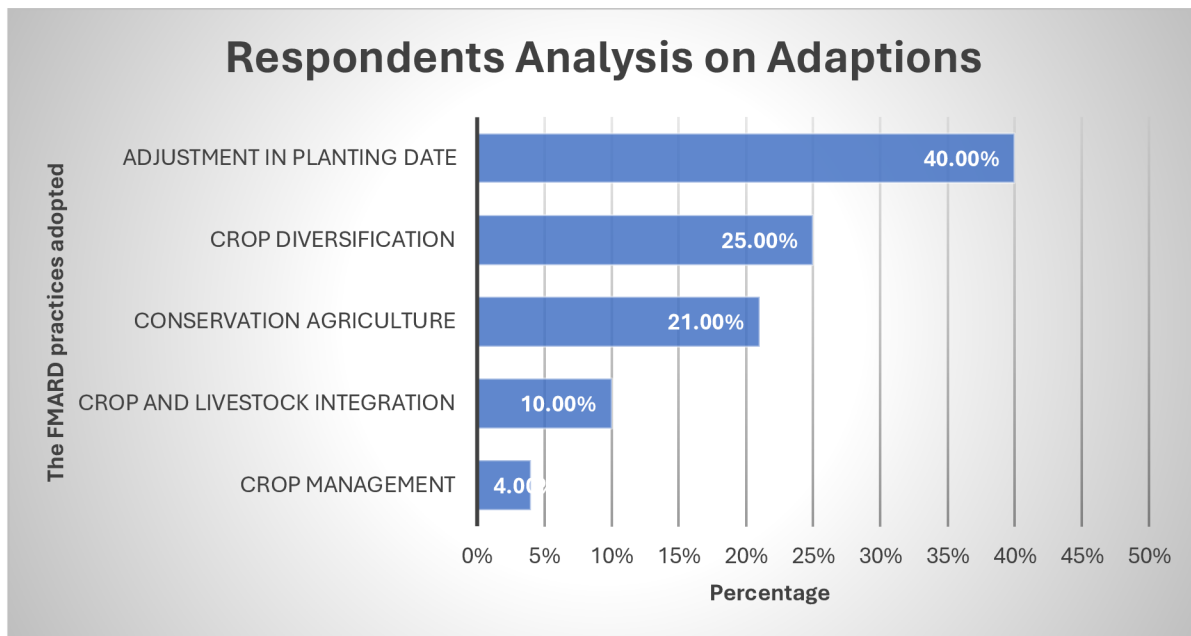


Figure. 11. Showing Individual Adaptation Practices

To address the difficulties of environmental degradation, climate change, and socio-economic vulnerabilities resulting from oil spill activities, farmers in the region are putting different adaptation methods into practice, which are being implemented by FMARD. (40%) of the respondents, agrees that adjustment in planting dates has helped them to mitigate the impacts of oil spillage by avoiding contaminated soil, allowing for soil remediation, minimising crop damage, and increasing crop yield, but can constantly be improved upon. (25%) of respondents revealed that diversifying their crop production has helped them to reduce risks associated with climate variability due to gas flaring and GHG emissions and thereby optimising their yields. (21%) of respondents used conservation agriculture, while (10%) of the respondents agreed to use crop and livestock integration. Finally, (4%) of the respondents agree to use crop management to increase their crops. However, all respondents applauded the measures, but can be further improved upon by first cleaning up all affected agricultural land and various water sources; by doing that, every agricultural practice adopted will have a significant impact on crop yield and livelihood, as further revealed by (Ejibaet al. 2016; Udotong et al. 2017; Nkomoki et al. 2018; FME 2021).

5.4 Limitations to the research

One potential limitation of this study is the lack of comprehensive data regarding the specific effects of oil exploration activities on agriculture in the Niger Delta region. The existing data may not cover all pertinent aspects of the issue or could have limitations in terms of accuracy and reliability. There was a difficulty accessing the nine states of the Niger Delta Region of Nigeria with different ethnic groups due to current security level. Time was a limiting factor for this research data collection. Inter and intra community conflicts and wars emanating from communal competition by oil bunkering lords generated high degree of unrest and pose danger accessing the area. Lastly, because of the predominant insecurity and high uncertainty in some part of the community, the risk of not obtaining precise data or insufficient support from the contributors could be anticipated.

6 CONCLUSION AND RECOMMENDATIONS

The findings of this study as indicated in objective 1, underscore the urgent need for concerted efforts to address, the issue on compensation and to consolidate and update environmental policies for remediation. About (51%) of responses, agree that there are no inclusive policies for thorough oil spill cleaning and claims for oil spills on farm lands are not handled or compensated based on approved policies for allocating compensation. Therefore, it is highly recommended that policies on fair compensation for oil spill victims, should be enforced and stringent environmental regulations should be highly enacted, to tackle oil spills by companies and any companies found culpable for bending the laws, should be held accountable for their actions.

Objective 2, focused more on identifying the challenges faced in the region and how it has affect the soil, water sources, and crops, which in turn affected their income and their source of livelihood. According to the multiple responses, about (95%) believed that oil exploration activities have a negative impact on their crops yield, thereby affecting their food production capacity. To remedy this, immediate action is needed to clean up oil spills and remediate affected agricultural lands to prevent further damage to crops, soil fertility, and water sources. Comprehensive compensation mechanisms should be established to adequately compensate farmers and landowners for their losses due to oil spills, ensuring their livelihoods are safeguarded.

Finally objective 3, focused on examining the adaptions measures, the farmers in the region are adapting to, which are being implemented by FMARD. Although (40%) of the respondents, agrees that adjustment in planting dates has helped them to mitigate the impacts of oil spillage, but there is a great need for improvement in other measures adopted. The extremely low responses from crop management (4%), and livestock integration (10%) suggested that for these strategies to be fully effective, all affected agricultural land and water sources must first be thoroughly cleaned up; as a result, government intervention is required. The recommendation would be, to implement diversified agricultural practices that are resilient to environmental changes, such as agroforestry and aquaculture, that can help farmers adapt to the challenges posed by oil pollution. Another recommendation would be investing in research and development of innovative technologies and sustainable farming methods tailored to the unique environmental conditions of the Niger Delta, which can further enhance agricultural resilience and productivity in the region.

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8 APPENDIX

Data Collections.



Oil Spill at Usokun-Degema LGA



Data Collection From a Respondent in Ogu/Bolo LGA



Oil Spill at Cawthorne Channel River



Vegetation damage due to oil spill



Data collection in Ogba/Egbema/Ndoni LGA



Reflection showing strain of oil spill in Degema LGA

Questionnaires.

My name is Oluwole Osunde, I am a student at the Czech University of Life Sciences in Prague, in the faculty of topical-agriculture. I am here to undertake my research on “The Effect of Oil Exploration on Agriculture in the Niger-Delta Region of Nigeria”. I am kindly asking you to participate in this research which I am going to use for my further research work, and it comprises four sections, please participation is voluntary and greatly appreciated.

Verbal consent Date: /...../.....

(Tick or write details in the given spaces)

Name of interviewer

SECTION 1–DEMOGRAPHIC CHARACTERISTICS

- 1) Age: _____
- 2) Gender:
 - Male Female
- 3) Marital status:
 - Single Separated
 - Married Widow(er)
- 4) Educational Background:
 - Primary school
 - Secondary school
 - College/University degree

- 5) How many years of schooling do you have? _____
- Primary school
- Secondary school
- College/University degree
- 6) Do you have any farming/ Fishing knowledge? Yes No
- 7) How many years of farming experience do you have? _____
- 8) Total land size
- ≤ 1 ha
- 3-5 ha
- > 7 ha
- 9) Land ownership
- Leased/rented Private
- Inheritance Allocation by Chief

SECTION 2—AGRICULTURE AND OIL EXPLORATION

- 10) Are you familiar with the concept of oil exploration in the Niger Delta Region?
- Yes No
- 11) Have you noticed any changes in your environment related to oil exploration activities? (e.g., pollution, land degradation, oil spill, etc.)
- Yes No Maybe
- 12) If yes, please tick what you have experience
- Land degradation Oil spill Gas flare Environmental pollution
- 13) How do you perceive the effect of gas flaring on crop yield?
- Positive Negative No effects

14) Have you personally experienced any decrease in your agricultural production due to oil exploration? Yes No Maybe

SECTION 3—ENVIRONMENTAL IMPACT

15) Have you observed any instances of oil spills in your area?

Yes No Maybe

16) If yes, how have oil spills affected the quality of soil and water in your farming area?

Positive Negative No Impact

17) Are there any efforts in your community to mitigate the environmental impact of oil spills?

Yes No Maybe

SECTION 4—COPING AND ADAPTATION STRATEGIES

18) Have you adapted your agricultural practices following the Federal Ministry of Agriculture & Rural Development (FMARD) to cope with the challenges posed by oil exploration?

Yes No Maybe

19) If Yes, please tick some of the adaptation strategies you use.

Adjustment in planting date

Crop diversification

Conservation agriculture

Crop and livestock integration

Crop management

20) Were the adaptation measures set aside by the Federal Ministry of Agriculture & Rural Development (FMARD) to cope with the challenges effective?

Yes No

21) Please indicate how you benefited from the government policies, regulations, and compensations in your area. 5 indicates very satisfied and 1, indicate dissatisfied.

Benefits 1 2 3 4 5

Community Impact -CI

Livelihood Support- LS

Jobs and Tourism - JT

Inclusive Policies and Compensation

Influence on Restiveness- IR

22) Do you receive support from the oil spill compensation and assessment process regulators?
 Yes No Maybe

23) If yes, can you name it/them_____

24) What policy changes or interventions do you think could improve the coexistence of oil exploration and agriculture in the Niger Delta Region? Please write them out_____

25) Do you believe there is a need for increased collaboration between local communities, government agencies, and oil companies to address these issues?
 Yes No

26) What other support programs did you benefit from? Please write them out_____ Click or tap here to enter text.

Thank you for your time.