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A Review Of The Effect Of Oil Pollution On Wildlife And Biodiversity Conservation In Niger Delta, Nigeria

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ABSTRACT
An extensive examination is necessary to fully understand the adverse effects of oil contamination on wildlife and biodiversity conservation in the Niger Delta, Nigeria. This abstract presents a study's methodology and conclusions and uses the oil spill incidence in the Niger Delta as a case study to highlight the numerous effects of oil pollution on wildlife and biodiversity. A thorough assessment and analysis of secondary data sources, such as academic papers, policy documents, government reports, industry reports, and pertinent laws, were combined to estimate the impact of oil pollution on wildlife and biodiversity. The study indicated significant effects of oil pollution on biodiversity and animals. Reduced population numbers, physical abnormalities, and changed reproductive patterns were all observed in aquatic species. Terrestrial species saw a decline in reproductive success, behavioral changes, and habitat deterioration. Populations of migratory birds exhibited reductions as a result of habitat degradation and feather damage from oil. The protection of biodiversity has been discovered to be seriously harmed by oil pollution. Restoration efforts were hampered by the contaminants' persistent presence, which also put native species' existence under danger. Effective conservation methods have come to rely heavily on the cooperative cooperation of local communities, regulatory bodies, and oil companies. In conclusion, this study elucidated the severe implications of oil pollution on wildlife and biodiversity conservation in the Niger Delta.
Keywords: Oil pollution, wildlife, Biodiversity, Conservation, Niger Delta.

1.0 INTRODUCTION

The biggest wetland in Africa and one of the largest in the world is the Niger Delta area, which is located in southern Nigeria (Izah and Aigberua, 2023; Nnaemeka, 2020). About 70,000 square kilometers of the area is covered by a variety of habitats, including mangroves, swamps, and tropical rainforests (Nnadi *et al*., 2022). The Niger Delta region in Nigeria is one of the most ecologically diverse and environmentally sensitive areas in Africa. However, over the past decades, it has experienced severe oil pollution due to oil exploration, production, and transportation activities (Nwafor and Okorie, 2017). This has resulted in significant ecological and environmental consequences, particularly in terms of its impact on wildlife and biodiversity conservation. The interaction between oil pollution and the delicate ecosystems of the Niger Delta has raised serious concerns about the long-term viability of its unique flora and fauna. Oil pollution in the Niger Delta is

primarily caused by oil spills, leaks, and improper waste disposal associated with oil extraction and transportation. The region has witnessed a large number of oil spill incidents, both major and minor, resulting in the contamination of water bodies, soil, and vegetation. Oil pollution is often exacerbated by inadequate infrastructure, poor regulatory enforcement, and socio-economic challenges, making the restoration of affected areas even more challenging (Nwafor and Okorie, 2017).

Oil pollution has had devastating effects on the local wildlife populations. Aquatic species, such as fish, crabs, and shrimp, are particularly vulnerable as oil spills can contaminate water bodies and disrupt the food chain. Oil-coated feathers and ingestion of contaminated prey have been documented in various bird species, leading to reduced reproductive success and population decline (Akankali and Orubu, 2015; Obiakor and Okonkwo, 2019). Marine mammals, including dolphins and manatees, can suffer from direct oil exposure and inhalation of toxic fumes, causing respiratory problems and organ damage (Akankali and Orubu, 2015). The Niger Delta is recognized as a biodiversity hotspot with rich mangrove forests, wetlands, and diverse terrestrial habitats. Oil pollution poses a significant threat to this biodiversity, with potential long-term consequences (Desmond and Ifenkwe, 2018). The mangrove ecosystems, which serve as critical breeding and nursery grounds for numerous species, in the Niger Delta, are particularly at risk. The destruction of these habitats disrupts the life cycles of many species, leading to reduced population sizes and potential extinctions (Efe and Ogbomida, 2019).

The Niger Delta, is made up of nine states with a combined population of approximately 30 million people: Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo, and Rivers (Nzeadibe *et al.*, 2011). Large-scale natural resources, notably oil and gas, are abundant in the Niger Delta and are responsible for more than 90% of Nigeria's export revenues as well as almost 80% of government revenue (Kadafa *et al*., 2012). Nigeria has had significant economic growth as a result of oil production, which has made it the largest oil producer in Africa and the 12th largest globally since the discovery of oil in the area in 1956 (Olayungbo, 2019). But the area has faced a number of environmental and social concerns, including significant wastewater and pollution problems brought on by industrial operations like gas flaring and oil spills (Ite *et al*., 2018).

Bodo in Ogoni, Rivers State, is one place where oil spill cases have been reported. It is part of the Gokana Local Government Area of Rivers State, Nigeria. Occupying (latitude 4836′N, longitude 7821′E) the upper reaches of the Andoni-Bonny estuarine system, over 65% of Bodo features a network of brackish water creeks, mangrove swamps and pockets of island forest that are collectively known as Bodo Creek (Onwugbuta-Enyi et al., 2022). Oil pollution in the area has posed a severe threat to wildlife and biodiversity conservation in the region. The delicate balance of ecosystems has been disrupted, leading to population declines, habitat destruction, and potential species extinctions (Pegg and Zabbey, 2013). Urgent and comprehensive measures are needed to address this issue, including improved spill response, strengthened environmental regulations, and community engagement. The restoration of the Niger Delta's unique biodiversity is crucial not only for the region's ecological health but also for the sustenance and livelihoods of local communities that depend on its resources.

The aim of the study titled "The Impact of Oil Pollution on Wildlife and Biodiversity Conservation in the Niger Delta, Nigeria" is to comprehensively investigate and analyze the effects of oil pollution on the region's wildlife and biodiversity, with a focus on understanding the ecological, environmental, and socio-economic implications of oil-related contamination.

Objectives:

1. **Examine Effects on Wildlife and Biodiversity:** Investigate the direct and indirect impacts of oil pollution on various wildlife species in the Niger Delta. This includes studying changes in behavior, reproductive success, mortality rates, and long-term population trends of both aquatic and terrestrial fauna.
2. **Investigate Socio-Economic Implications:** Explore the socio-economic consequences of oil pollution on local communities that depend on the affected ecosystems for their livelihoods. This could involve studying changes in fishing and agricultural practices, as well as understanding the broader economic impacts on communities.
3. **Identify Conservation Strategies:** Propose effective conservation and mitigation strategies to address the impacts of oil pollution on wildlife and biodiversity. This might include

recommending measures to prevent oil spills, enhance ecosystem restoration, and engage local communities in conservation efforts.

By achieving these objectives, the study aims to provide a comprehensive overview of the intricate relationships between oil pollution, wildlife, and biodiversity conservation in the Niger Delta, thereby informing evidence-based decision-making and promoting sustainable environmental management practices in the region.

2.0 METHODOLOGY

2.1 Data sources and collection methods

This study is based on a thorough examination and analysis of secondary data sources, including scholarly writings, directives, official reports, business reports, and relevant legislation. By focusing on secondary data, we aim to develop an extensive understanding of the effects of oil pollution on the region's wildlife and biodiversity, with a focus on understanding the ecological, environmental, and socio-economic implications of oil-related contamination in the Niger Delta.

3.0 Assessing the Extent of Oil Pollution

3.1 The Concept and Extent of Oil Pollution

"Pollution" is defined by the Federal Environmental Protection Agency Act as "Man-made or man-aided alterations of chemical, physical, or biological quality of the environment to the extent that are detrimental to that environment or beyond acceptable limits" (ACCNNR, 1968). The United Nations Convention on the Law of the Sea defines pollution as the "introduction by man, directly or indirectly, of substances or energy into the marine environment, coastal zones and related inland waters resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairments of quality use of sea-water and reduction of amenities" (Akinjide-Balogun, 2001).

Oil spillage and gas flaring are the two ways oil pollution occurs. However, for better understanding, both forms of pollution will be examined.

Oil Spillage

There is a chance that oil contamination will contaminate the land. However, research indicates that over time, oil-based condiments have degraded the soil of Ogoni land. According to UNEP, 2011, soil pollution is a result of liquid spills and leakages of hydrocarbon solvents and chemicals caused by mining, oil exploration and production, and other downstream processes. Activities related to oil exploration and extraction harm the soil and hinder agricultural development for varied lengths of time (UNEP, 2011). These harmful consequences are brought on by the crude oil's toxicity and suffocating properties. The Shell-Bp Bomu II and Elf Obagi II explosions in 1970 and 1972, which severely damaged agricultural land, brackish water, and mangrove swamps in the Niger Delta, serve as notable examples. Osisanya (2003)however, believes that a spill will render the soil it comes into contact with infertile and transform it into a reservoir from which volatile substances can be released. Because of the soil's porosity, spills and leaks can pollute ground and surface water by moving upward through the soil by capillary action and gravity.

A clear illustration of the effect of an oil spill on land contamination may be found in the case of Shell Petroleum Development Co. Ltd v. F.B. Farar and Ors (Amokaye, 2004), involving an oil facility blow out that happened in July 1970 from a well owned and operated by the appellants. Crude hydrocarbons, sulphur, and other effluent hazardous chemicals were released in thick fountains during the blow out in this case, which persisted for many weeks (Asume, 2005). The emissions created a thick layer over the adjacent land, damaging fields, crops, valuable trees, and natural flora, leading to the desertification of the damaged regions, which covered 607 hectares and belonged to many families (CEIC Nigeria Gross National Product, 2018).

According to the National Oil Spill Detection and Response Agency of Nigeria, there have been 3203 occurrences of oil leaks in the Niger Delta alone during the past four years, according to The Guardian Newspaper (Nnimo, 2010). The Punch Newspaper stated on February 20, 1991, that there had been a total of 2796 oil leak incidents between the years 1976 and 1990, resulting in the spillage of 2,105,393 barrels of oil. 3 million barrels of oil were lost in 6817 oil spill incidents between 1976 and 2001, according to the United Nations Development Programme (UNDP), of which more than

70% of the spilled oil was not recovered. The account of oil spill incidence from 1960 to present is given below (Table 1).

Table 1: An account of Spill Incidence from 1960 to Present

Year	Quantity of oil spilled (barrels)	Place/incident	Company	Impact and notes	References
1970	–	Bomu 11 Oil Well/Kegbara Dere-Bomu	Shell	It resulted in serious hydrocarbon fire and spillage of thousands of barrels of crude oil that negatively impacted tremendously on adjoining creeks and mangrove forests and rendered vast agricultural land barren to date	Weli and Arokoyu (2014) and Zabbey (2009)
1978	300,000	GOCON's Escravos	–	It was one of the major spills in the coastal zone of Nigeria. It had untold devastation to plants, birds, fisheries resources, and ultimately livelihoods of the people	Nnabuenyi (2012) and Zabbey (2009)
1978	580,000	Forcados Terminal	Shell	One of the largest oil spills in Nigeria's history, impacted aquatic life, agriculture, and livelihoods of local communities	Nnabuenyi (2012) and Zabbey (2009)
1980	–	Oyakama	Shell	The spill contaminated farmland and a river, upending livelihoods in fishing and farming communities in part of the Niger Delta	Eriegha and Sam (2020) and Zabbey (2009)
1980	400,000	Texaco Funiwa 5	Texaco	It was another major spill in the coastal zone of Nigeria that had a negative impact on agriculture, and the livelihoods of local communities	Aroh *et al.* (2010) and Zabbey (2009)
1982	18,818	Abudu	–	The oil spill incident resulted in environmental degradation, social annihilation, and economic impoverishment in the Niger Delta region of Nigeria	Nnabuenyi (2012) and Zabbey (2009)
1984	–	Ikata	Shell	A 50% reduction in fish abundance was reported	Eriegha and Sam (2020) and Zabbey (2009)

1993	–	Oshika	–	This spill confirmed the death of floating and submerged aquatic vegetation, especially water lettuce, crabs, fish, and birds	Eriegha and Sam (2020), Sakib (2021) and Zabbey (2009)
1998	40,000	Idoho	Mobil	The spill had a heavy impact on fishing communities and cooperatives in the region, leading to many being unable to fish as well as others losing occupational tools such as nets due to oil damage	Zabbey (2009)
1998	–	Jesse	NNPC	The Jesse pipeline explosion claimed the lives of over a thousand persons in Jesse, Ethiope West local government area of Delta State	Nnabuenyi (2012)
2008–2009	560,000	Bodo	Shell	It is one of the biggest spills in decades of oil exploration in Nigeria. As a fishing town, the livelihoods of the majority of Bodo's inhabitants were destroyed. In 2015, after many years of battles with campaigners, Shell announced it would pay out $83.2 m in compensation for the spill	Pegg and Zabbey (2013) and Zabbey (2009)
2009	–	K. Dere	Shell	It is a region that has been affected by oil spills. Villagers argue that some spills are due to operational factors	Eriegha and Sam (2020) and Zabbey (2009)
2012	–	Kegbara-Dere	Shell	The oil spills devastated the villager's farms, damaged their health, and left them with bleak prospects for the future	Amnesty-International (2015) and Saint (2022)
2013	6000	Creeks and waterways of Bodo	Shell	The Ogoni people vowed not to allow oil exploration to resume in the area until conditions addressing the challenges of environmental pollution were met	Saint (2022)
2023	–	Eleme	Shell	The oil spill contaminated farmland and a river, upending livelihoods in fishing and farming communities	Reuters (2023)

Other reasons for oil spills include sabotage, pipeline corrosion, ground erosion, and pipeline collapse due to a material flaw. However, according to the Department of Petroleum Resources, equipment failure is to blame for 88% of incidents involving oil spills (UNEP, 2011). Vandalism, oil blowouts from flow stations, unintentional and intentional releases, and oil tankers at sea are some more apparent sources of oil spills in the Niger delta (Nwilo and Badejo, 2005).

Gas Flaring

Gas flaring, which occurs when natural gas associated with the crude oil is burned off during extraction in locations without the infrastructure or ability to capture and utilize the gas, is a common practice. In addition, tons of carbon dioxide are discharged into the environment during this process as unneeded or extra natural gas is burned (Sunmoni, 2012). A gas flare, commonly referred to as a "flare stack," is a combustion device used in industrial facilities and gas production locations, including landfills, offshore gas rigs, gas wells, and oil wells. In connection with the Niger Delta crude oil drilling, Nigeria flares 17.2 billion cubic meters of natural gas per year (Michiko, 2004). It is impossible to overstate how detrimental gas flaring is to Nigeria's ecology since it has an impact on the ecosystem's delicate flora and fauna. For example, birds exposed to hydrocarbon concentrations may have difficulty flying, which would keep them from feeding. A few of the impacts of exposure to hydrocarbon concentrations on birds include irritation of the digestive system, impaired liver function, renal damage, metabolic imbalance, hormonal imbalance, including alterations in their luteinization of protein.

Nigeria flares more gas than any other country in the world (reference). More greenhouse gasses have been produced by these eruptions than by all of sub-Saharan Africa put together. The flares include pollutants that have a negative impact on local people' health and way of life, increasing the risk of early mortality, childhood respiratory ailments, asthma, and cancer for Niger Delta locals (Asume, 2005). Another issue in the Niger Delta region is acid rain, which is brought on by gas flaring, which has devastated forests and commercial crops while also causing a loss in biodiversity. According to some authors, the predominance of grasses and bushes in some areas of the region is a sign that the region's natural forests are disappearing. Acid rain may be to blame, but other activities, such as oil company exploitation and exploration, may also be to blame (Uyigue and Agho, 2007). Additionally, it appears that the Niger Delta region has a greater concentration of acid in rainwater than regions farther from it (Uyigue and Agho, 2007). Additionally, the heat produced by gas flaring is extremely concerning since it kills nearby flora, ruins mangrove swamps and salt marshes, prevents some plants from growing and blossoming, causes soil degradation, and lowers agricultural production (Mba, 2000). In addition to having a negative impact on agricultural output, flared gas is poisonous and can cause respiratory problems that can progress to renal disease, neurological conditions, and even death (Ndubuisi and Asia, 2007). According to Uyigue and Ogbeibu (2007), the cumulative environmental effects of gas flaring have led to pollution buildup on land, shallow groundwater, the greenhouse effect, and overall global warming. They have also led to a high concentration of acid rain in the area.

3.2 Effects of Oil Pollution on Wildlife and Biodiversity

A number of researches have been carried out on hydrocarbon polluted marine ecosystems. The research includes those by Akani *et al.* (2022) on the detrimental impacts of oil operations on marine wildlife, soil, air, and water, as well as Abayomi *et al.* (2021) study on the consequences of oil spillage on soil. One of the primary negative effects of oil pollution is the loss of biodiversity and the destruction of ecosystems, which is mostly caused by topsoil degradation. Wherever there are oil spills, the introduction of phytotoxins into the environment affects photosynthesis as well.

According to Adekola, (2011); the overall effects of petroleum exploration in Nigeria's Niger Delta appear to be more harmful than positive. The people that live in this area rely largely on the aquatic environment for their daily needs, mostly through fishing, farming, and collecting. As a result, oil exploration and extraction have had detrimental effects on the host communities' social, economic, and environmental well-being. The 700,000 acres of delta mangroves contain a large portion of the oil production and exploration zones. They are a crucial habitat for both locals and fishermen, making up the majority of the surviving wooded biome in Nigeria and around two-thirds of the remaining mangroves in Africa (Wunder, 2003). Oil spills cause ecological destruction by destroying vegetation, mangrove forests, food and cash crops, fishing grounds, and marine life. They also reduce the soil's nutrient value, cause land fragmentation, and, in rare instances, set communities on fire,

displacing entire communities (Adinkwu *et al*., 2020). People in the village frequently move in groups, either willingly or involuntarily, when an oil spill lowers the productivity of local farming and fishing.

As a result, the psychological and social issues related to displacement include the loss of ancestors' houses, familiar surroundings, religion, and other cultural items (Nwilo and Badejo, 2006). Additionally, the cost of fish, a staple diet in the area, has increased up to tenfold, and many fishermen are turning to new sources of income. When an oil spill happens, local drinking water supplies get polluted, and there is also a significant environmental health risk. People in the afflicted areas have a variety of medical conditions, such as respiratory problems and skin lesions. Headaches and vision issues were brought on by the oil spills at Bodo, according to an Amnesty International report published in 2015. Frequent violent clashes in the 1990s that were made worse by the lack of benefits and compensations from oil revenues are just a few of the spillover effects of environmental degradation that lead to occupational disorientation in host communities and an aggravation of poverty (Opukri and Ibaba, 2008; Pegg and Zabbey, 2013). The deterioration of traditional fishing grounds and the poverty and hunger experienced by fishing communities may have a negative impact on the communities' behaviour. According to Stakeholders' Democracy Network (SDN) (2016), there is a direct correlation between local communities' environmental and broader socioeconomic concerns and the escalation of tensions to violence brought on by incidents of oil spills.

3.2.1 Impacts of Oil Spill on Living Aquatic Resources and Marine Habitats

There are several negative repercussions of an oil spill on aquatic ecology. Because it gives people the protein and nutrition they need, the fishing sector is crucial to Nigeria's sustainability. However, due to increased demand, fish populations are diminishing because they are being destroyed more quickly than they can be replenished. Both the fish population and the fishermen who depend on fishing to provide for their families are impacted by oil pollution. Spills can cover a large area when they occur in populous places. The use of dissolved oxygen by microbes consuming the hydrocarbons discharged also leads to fish extinction (Akani *et al*., 2022).

According to Powell (1985)'s impact analysis of the 1983 Oshika oil leak, both floating and submerged aquatic vegetation, including water lettuce, crabs, fish, and birds, perished. According to Olujimi *et al.* (2011), Albert *et al.* (2018), Akani *et al.* (2022), oil spills in the Niger Delta have caused significant fish extinctions, endangering the social and economic well-being of the local inhabitants that depend on the contaminated waters for their livelihood. Ibaba (2001) noted that years of oil prospecting and drilling in Oloibiri have effectively castrated aquatic life and halted fishing activity. In a survey on the effects of oil pollution in the Niger Delta conducted by Nwoko (2014), 87% of the Ogoni land population agreed that fish harvests had decreased because of oil pollution in their area. In the estuary zone, oil destroys gastropods and other plants and animals (Ekpo *et al.*, 2018; Akani *et al*., 2022). Oil lands on beaches and kills the species that reside there. It also settles on the ocean floor and kills benthic invertebrates, which include crabs and other bottom-dwelling creatures. According to Nwilo and Badejo (2005), oil harms algae, upends important life cycles, and reduces the production of edible crustaceans. Additionally, it covers birds, diminishing their ability to fly or the insulation value of their feathers, increasing their susceptibility to cold. Fish of high economic value have their meat contaminated by oil, putting fish hatcheries in coastal waters at risk (Nwilo and Badejo, 2005; Agunobi *et al*., 2014). Large portions of the mangrove environment in the Niger Delta have been devastated. The mangrove, which previously provided the locals with firewood and served as a refuge for the region's biodiversity, is no longer able to withstand the toxicity of the oil (Nwilo and Badejo, 2005). The effect of oil spill on living aquatic resources is thereby summarized in Table 2 and shown in Fig. 2.

Table 2: Summary of the effects of oil pollution on the living aquatic resources in Bodo, Rivers State

S/N	Effects on aquatic organisms
1	Kill organisms inhabiting the benthic zone (creeks and rivers floor).
2	Kill organisms on beaches when oil is washed up ashore.
3	Modification in major habitats.
4	Destroy mangroves and other shoreline plants with breathing roots.
5	Endangers fish hatcheries and wipes out eggs/larvae.
6	Poisons algae and phytoplankton disrupt the food chain in the aquatic ecosystem.
7	Deaths of submerged and floating aquatic macrophytes.
8	Contamination and or mortality of cultivable species in tidal brackish water ponds.
9	Disruption in life processes such as growth, reproduction, photosynthesis, etc.
10	Damage to internal organs such as lung, liver and kidney of mammals, amphibians, etc.
11	Disruption in physiological processes such as respiration, osmo-regulation, etc.
12	Generally, loss in species richness and diversity; genetic and ecological diversity.

Adapted and modified from Nwilo and Badejo, 2005; Kadafa, 2012; Ekpo *et al.,* 2018; Akani *et al.,* 2022.

Birds splattered in oil are a worldwide representation of the harm that oil spills due to the environment. Some shorebird species may relocate to safety if they spot danger in time, while others might not. Following an oil spill, certain marine birds that swim and dive for food are potential victims and will be coated in oil. Oil spills can have major long-term consequences on entire species by destroying breeding habitats. The long-term environmental effects of the 2013 oil spills in Bodo (Saint, 2022 and Reuters, 2023), for instance, won't be understood for years. That spill may have happened during the peak mating and nesting season for many bird and marine species. By polluting places where migratory birds often stop, oil spills might alter migratory patterns.

Birds can be fatally affected by even little amounts of oil. Oil makes it hard for birds to fly while also destroying their natural waterproofing and insulation, making them susceptible to hypothermia or hyperthermia. Bird frequently ingests oil as they hurriedly preen their feathers to regain their natural defences, which can seriously harm their internal organs and cause death. The Exxon Valdez oil disaster is believed to have killed 250,000 seabirds, according to the best estimate (Haney *et al.*, 2014). The laughing gull was by far the most affected, with 32% of the entire northern Gulf of Mexico population killed because of the spill.

Marine mammals including whales, dolphins, seals, and sea otters are regularly killed in oil spills. Whales and dolphins' blowholes can become clogged with oil, preventing them from breathing normally and interfering with their ability to communicate. Otters and seals with oil-coated fur are more susceptible to hypothermia. A marine mammal's food source can get contaminated by an oil spill even if they are not affected right away. Marine animals that consume fish or other foods contaminated with oil may become unwell or die as a result of the oil poisoning (Ekpo *et al.,* 2018; Akani *et al*., 2022).

3.3 Socio-Economic Implications

The economic impacts can be categorized into four (4) groups as follows:

1. **Food Shortages and Nutritional Deficiency:**

Oil pollution results in the destruction of the Ogoni traditional local economic support systems of fishing and farming. The combined impacts of gas flare-ups and oil spills have resulted in soil deterioration, which has an impact on agricultural productivity and harvest (Pyagbara, 2007; Akpomuvie and Orhioghene, 2011). Due to contamination from gas flaring, fish are forced from near-shore or shallow areas towards the deep sea.

2. **Destruction of Traditional Means of Livelihood:**

Oil pollution makes the agricultural sector, one of Nigeria's main employers of labour, especially in the Niger-Delta area, unproductive, which causes youth and women to lose their jobs since their local fishing and farming economies can no longer be sustained.

3. **Migration and the Rise of Environmental Refugees:**

The plight of the Ogoni people is a striking illustration of community movement and a rise in environmental refugees. The Ogoni people were intimately tied together and had a thriving economy

that met their fundamental requirements. The majority of Ogoni residents have relocated as a result of oil producing businesses being established.

4. Militancy:

Militancy operations were started in the Niger-Delta as a result of the impacts of oil pollution on the local population and the Federal Government's inability to improve their plight quickly and bring sustainable development to the region (Ebienfa, 2011).

5. Health Implications

Basically, oil pollution gives rise to the occurrence of certain ailments in areas that have suffered from oil pollution in Nigeria. This is often as a result of inhalation of contaminated air, intake of contaminated food from areas that have suffered oil pollution, and also as a result of the consumption of contaminated water.

3.4 Conservation Strategies

3.4.1 Legal Framework on Biodiversity

These three categories; municipal, regional, and international, are used to categorize the legal framework for protecting biological diversity.

Municipal:

The Nigerian government has established the following laws and rules for environmental protection, planning, pollution prevention and control, and the preservation of Nigeria's biological variety.

CAP E9, LFN 2004: THE ENDANGERED SPECIES (CONTROL OF INTERNATIONAL TRADE AND TRAFFIC) ACT, 1985 This Act focuses on managing and protecting Nigeria's wildlife, including those species that are at risk of becoming extinct owing to overexploitation. In order to satisfy the commitment made under the Convention on International Trade in Endangered Species, the Act was passed.

The Sea Fisheries Act, Cap S4, LFN 2004, states: By using explosives, dangerous or noxious chemicals to capture or injure fish in Nigerian seas, it is against the law according to the Sea Fisheries Act. In Nigerian seas, Section 1 forbids the use of motor fishing boats without a license. Fish destruction is prohibited under Section 10, which carries a fine of N50,000 or a two-year jail sentence. The competence to take actions for the preservation and conservation of marine fish is provided under Section 14(2).

Nigeria's national objective is to conserve and sustain biodiversity utilization. This is due to the fact that the clause in Article 6 of the Sea Fisheries Act and Article 10(a) of the Convention on Biological Diversity are quite similar. Both call for include biodiversity preservation and sustainable use in the national programs of party nations (Declan, 2016).

LFN 2004's INLAND FISHERIES ACT, CAP I10: The conservation of the aquatic habitat and its species is the main objective of this Act. Motor fishing boat activities without a license are forbidden in Nigeria's inland waterways, according to Section 1. The capturing or destruction of fish via harmful means is prohibited under Section 6. This offense is punishable with a fine of 3000 USD or an imprisonment term of 2 years or both.

To encourage the protection of fish resources and the sustainable use of their constituent parts, the Inland Fisheries Decree was passed (Etikerentse, 2004). Sanctions are made available in case of disobedience.

The Water Resources Act, CAP W2, LFN 2004, aims to increase the quantity and quality of water resources by developing and enhancing them. Fisheries, flora, and animals can be protected by rules and pollution control plans made under Sections 5 and 6. According to this Act's Section 18, violators are subject to a fine of up to $2,000 or a six-month jail sentence. In addition, he would have to pay an extra $100 fee each day that the penalty remains unpaid.

THE FEDERAL NATIONAL PARKS ACT, CAP N65, LFN 2004: The National Parks Act aims to create protected areas for the preservation of natural resources, the protection of water catchments, the preservation of wildlife, and the preservation of the balance of the country's eco-systems.

Regional and International:

Among the regional and global legislative frameworks for the preservation of biological variety are:

1), The 1968 African Convention for the Conservation of Nature and Natural Resources.

2) Rio Conference Convention on Biodiversity (1992).

CONVENTION ON THE CONSERVATION OF NATURE AND NATURAL RESOURCES IN AFRICAN CONTEXT OF 1968: The Convention's fundamental tenet is that signatory nations must "adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and fauna resources in accordance with the scientific principles and with due regard to the best interests of African people" (IUCN/UNEP/WWF, 1980).

CONVENTION ON BIODIVERSITY 1992: After the Intergovernmental Negotiating Committee for a Convention on Biodiversity, a committee established by the United Nations Environmental Programme, adopted the convention's final draft on May 22, 1992, 157 State Parties signed the Convention on Biodiversity (CBD) in Rio de Janeiro. The Convention serves as a symbol of the world's commitment to protecting biological variety, ensuring biological sustainability, and equally distributing the advantages associated with the utilization of genetic resources. The Convention, which has 42 articles, serves as a legislative framework to encourage the adoption of all policies aimed at preserving biodiversity, using it sustainably, and distributing benefits from the exploitation of genetic resources fairly and equally (Mba, 2000).

INTERNATIONAL CONVENTIONS RELATING TO OIL POLLUTION

Records and statistics reveal that offshore sources are responsible for the biggest amount of pollution, which, unsurprisingly, affects coastal nations the most (Weis, 2015). The major source of the legislation controlling pollution from off-shore causes may be linked to international treaties and conventions since efforts have been made via them to rectify this unsatisfactory condition.

The 1982 UN Convention on the Law of the Sea: This custom was established in 1958 but revised in 1982. It is typically recognized as the fundamental legal framework governing issues pertaining to marine pollution. "The introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such adverse effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment or quality for use of sea water, and reduction of amenities," is the definition of pollution of the marine environment. Nigeria signed the convention on December 10, 1982, and it was ratified on August 14, 1986. On October 25, 1994, the agreement was lodged, and on July 28, 1995, it was once more confirmed. Nigeria has consistently followed the convention's rules in order to save the environment and promote biodiversity.

3.4.2 Government Efforts in Combating Oil Pollution in Nigeria

3.4.2.1 Statutory Enactments

Oil firms were required to stop gas flaring under the Associated Gas Re-injection Act of 1979. Only with the Petroleum Minister's approval might flaring be done for practical purposes (Michiko, 2004). The 1992 Environmental Impact Assessment Act requires that an environmental impact assessment (EIA) study be performed at an early stage of the project, frequently before the project is implemented, if it is anticipated to have a major environmental impact. The Federal Environmental Protection Agency must approve the EIA (Etikerentse, 2004). Any project whose EIA has been rejected by the agency is prohibited. This will make it possible to make sure that any procedure for exploring for and producing oil and gas is adequately evaluated before the oil corporations start working on the project.

National Environmental Policy Act of 1988: The Federal Environmental Protection Agency was founded by this Act. The agency is given the mandate to set the requirements and benchmarks for safeguarding the environment in Nigeria. According to the law, the agency must promote the creation of environmental protection organizations in local and state governments. Additionally, it states that the agency shall work with the Department of Petroleum Resources (DPR) in this respect and that DPR has the primary responsibility for "removing oil related pollutants discharged into the Nigerian environment. After being amended in 1992, the agency is currently a member of the Ministry of Environment (Etikerentse, 2004).

Harmful Waste (Special Criminal Provisions, etc.) Act, 1988: The law became operative on November 25, 1988. It forbids and punishes the importation, transportation, and disposal of hazardous waste on any land, in Nigeria's territorial waterways, or in its exclusive economic zone. Anyone who violates this clause is guilty of an offense and subject to a fine as specified in Section 13 of the Act. In

effect, this Act's requirements would have been broken by any producer or marketer who dumped petroleum waste products in territorial seas or on land.

Petroleum Pipelines Act of 1956, Section 338, LFN 1990: According to Section 14 of the Oil Pipeline Act, pipes may not be built next to a public road, dam, or government structure in order to prevent pipeline damage and oil contamination. Any license holder who violates the terms of this Act is also in violation of the law, according to the Act17. Additionally, the Act gives the Minister the authority to create regulations to stop contamination of any land or water.

LFN 1990: Petroleum Act of 1969 (Cap. 350) The Minister may enact rules under the Petroleum Act. This permits the Minister to enact restrictions to stop people who have been granted an Oil Mining Lease (OML) from contaminating land and water. Additionally, this Act lays forth penalties for illegitimate crude oil prospectors, explorers, and miners. This clause will prevent oil from being discovered and utilized by those who lack the necessary skills to do so in a secure manner that prevents environmental pollution. Although laws are important, they are not always efficiently applied.

3.4.2.2 Guidelines and Regulations

Regulations of 1991 for National Environmental Protection (Effluent Limitation): A significant government rule for the preservation of Nigeria's environment is this one, among others. It lays up rules for limiting effluent. According to Regulation 1, firms involved in oil and gas exploration and production should make every effort to keep wastewater discharge to the absolute minimum permitted levels. Regulations for National Environmental Protection (Pollution Abatement in Facilities and Industries Generating Wastes) of 1991: One of the laws FEPA established forbade the discharge of poisonous or dangerous compounds into Nigeria's ecosystem's air, land, or water in excess of the FEPA-approved limits.

The 1995 Oil and Gas Pipelines Regulations: According to this rule, pipelines must be built in a way that harms the environment as little as possible. It states that the operator must certify to DPR that suitable contingency plans have been prepared for safeguarding the environment if a pipeline crosses within 100 meters of a water course. Additionally, the legislation mandates that pipeline license holders create emergency plans to guarantee quick and effective action for the preservation of property and the environment.

The 1996 modification to the 1969 Petroleum (Drilling and Production) Regulations: The Petroleum Act of 1969 served as the basis for the creation of the Petroleum Regulations. According to this regulation, a licensee or lessee of an Oil Prospecting License (OPL); or Oil Mining Lease (OML) may not enter onto land that is inside of a village, town, market, cemetery, or within 20 meters of a reservoir, public road, railway, or any land that is actually being farmed without the Petroleum Resources Minister's prior written consent. The lessee is required to abide by all applicable town and country planning laws and rules, including those that are designed to stop or lessen oil pollution. The lessee is also required to take all reasonable efforts to avoid fluid contamination by oil, dirt, or other substances.

The Department of Petroleum Resources (DPR) published Environmental Guidelines and Standards for the Nigerian Petroleum Industry: The environmental standards at question here are those set forth in the "Environmental Guidelines and Standards for the Petroleum Industry in Nigeria" published by DPR in 1991 and updated in 2002. It lays up rules and specifications for those working in the petroleum industry so they may follow best practices and safeguard the environment from any harm from oil. The Department of Petroleum Resources (DPR) released this directive in response to growing worries about the damaging effects of pollution from oil on the environment. In order to accomplish the standardization of environmental pollution abatement and monitoring methods in the Nigerian oil and gas sector, EGASPIN strives to create guidelines and standards for environmental quality control of the petroleum industry in Nigeria.

4.1 CONCLUSION

This article explained how oil pollution affects the land, water, and air where oil is spilt or gas is vented. The ecology and, consequently, bio-diversity, which is the actual essence of natural life or nature, are clearly harmed by oil contamination. Mankind cannot potentially survive alone without other significant Bio-diversity components, since there cannot be an ecosystem without Bio-diversity.

The Niger Delta is not protected, as the International Union for the Conservation of Nature and Natural Resources determined after reviewing the coastal areas of eleven nations in West Africa. Each component has a symbiotic relationship with the others, and they all cooperate to maintain existence. Due to the fact that they supply food, medicine, and raw materials for the manufacture of other necessary items, a number of elements of the nation's biodiversity are significant. Failure to rein in activities that damage biodiversity and encourage oil pollution puts human lives in indirect danger. Therefore, because biodiversity contains the entirety of life, it is imperative to protect Nigeria's biodiversity.

Finally, the biodiversity of Nigeria has suffered significantly as a result of oil contamination. Although there are rules in place to prevent or lessen the effects of oil pollution, these laws are not always followed. It is obvious that the Nigerian legislature has not signed the protocols to the relevant international agreements, and this would only serve to maintain the current attack on the environment and the dismal state of biodiversity protection in Nigeria.

4.2 RECOMMENDATIONS

Oil pollution has long been a threat to Nigeria's biodiversity, and limited steps has been taken to address it. To put an end to the apparently inexorable condition that has continuously threatened Nigeria's biodiversity, the following are list of recommendations:

1. In order to combat oil pollution and preserve the country's biodiversity, Nigeria has adopted a triad-approach. This implies:

a. The oil companies,
b. The government, and
c. The host communities.

Planning strategies to address potential oil pollution and biodiversity loss should involve all parties involved in oil exploration and development. In essence, a coordinated effort by these three groups will help to significantly reduce the problem of oil pollution. Furthermore, firms engaged in oil exploration and production in Nigeria should enter into agreements with the host communities and offer upfront guarantors to pay for clean-up costs and potential host community relocation in the event of oil pollution.

2. It is important to take environmental impact assessments seriously. To guarantee that oil businesses exercise due diligence and follow best practices and avoid potential oil pollution and environmental harm, their activities should be carefully examined. Additionally, the Senate enacted the Gas Flaring (Prohibition and Punishment) Bill 2009 (SB. 126) into law (Declan, 2016), and the Senate is now debating the Gas Flaring (Prohibition and Punishment) Bill 2016. Additionally, oil corporations have to create and apply technology that would capture these gases and use them for other beneficial activities. Gas investments on a large scale should be strongly promoted.

3. Additionally, all oil exploration, exploitation, and production activities should be absolutely prohibited in regions that have been classified as containing endangered species of specific plants and animals. Such places need to be entirely off-limits to any type of oil exploration or production activities. To further ensure the preservation of the nation's biodiversity, the Nigerian National Assembly should adopt the global trend in environmental protection and biodiversity conservation and sign, ratify, and put into practice conventions, other international instruments, and their accompanying protocols. In order to safeguard, preserve, and conserve our biodiversity, the government should support initiatives like the Biodiversity Strategy and Action Plan and game reserves.

4. The last step is to elevate environmental protection and biodiversity conservation to the level of fundamental human rights. Since our biodiversity is in danger, food is in limited supply, and health is greatly endangered, it is imperative that all Nigerians have the right to a safe and healthy environment. Without these conditions, the right to life cannot be guaranteed.

REFERENCES

Abayomi, O., Olayemi, T and Ogungbade, T. (2021). Environmental pollution and its ecological consequences on the Niger Delta: a review of the literature. *African Journal of Environmental and Natural Science Research*, 4, 27–42.

Adekola O, Mitchell G (2011) The Niger Delta wetlands: threats to ecosystem services, their importance to dependent communities and possible management measures. Int J Biodivers Sci Ecosyst Serv Manag 7(1):50–68

Adinkwu, O., Obaghwarhievwo, A. J and Ego, C. H. (2020). Effects of crude oil exploration on the physical and mental health of residents of Okpai community, Delta State, Nigeria. *Journal of Complementary and Alternative Medical Research* 9(1), 1–12.

Agunobi, K. N., Obienusi, E. A and Onuoha, D. C. (2014). An investigation of the pattern and environmental impact of oil spillage in Etche Local Government Area of Rivers State, Nigeria. *Journal of Natural Sciences Research*, 4(16), 124-137.

Akani, G. C., Amuzie, C. C., Alawa, G. N., Nioking, A and Belema, R. (2022). Factors militating against biodiversity conservation in the Niger Delta, Nigeria: the way out. In: Biodiversity in Africa: potentials, threats and conservation. *Springer*, pp 573–600.

Akankali, J. A and Orubu, C. O. (2015). Effects of Crude Oil Pollution on Terrestrial and Aquatic Biodiversity in Niger Delta, Nigeria. *International Journal of Biodiversity and Conservation*, 7(2), 120-129.

Akinjide-Balogun, O. (2001). Nigeria: Legal Framework of the Nigerian Petroleum Industry. http://www.mondaq.com/x/10726/legal+framework+of+the+nigerian+petroleum+industry.

Akpomuvie, O. B and Orhioghene, B. (2011). Tragedy of commons: analysis of oil spillage, gas flaring and sustainable development of the Niger Delta of Nigeria. *Journal of Sustainable Development*, 4(2), 200–210.

Albert, O. N, Amaratunga, D and Haigh, R. P. (2018). Evaluation of the impacts of oil spill disaster on communities and its influence on restiveness in Niger Delta, Nigeria. *Procedia Engineering*, 212:1054–1061.

Amnesty International. (2015). The price of oil: the impact of oil pollution on Niger Delta communities. https://www.amnesty.org/en/latest/press-release/2015/11/human-face-oil-pollution-niger-delta/

Amokaye, O. G. (2004). Environmental Law and Practice in Nigeria (p. 251). Lagos: University of Lagos Press.

Aroh, K., Ubong, I., Eze, C., Harry, I., Umo-Otong, J and Gobo, A. (2010). Oil spill incidents and pipeline vandalization in Nigeria: impact on public health and negation to attainment of Millennium Development Goal: the Ishiagu example. *Disaster Prevention and Management*, 19(1), 70–87.

Asume, O. (2005). Gas Flaring in Nigeria: A Human Rights, Environmental and Economic Monstrosity. Climate Justice Programme, Friends of the Earth International. https://www.foe.co.uk/sites/default/files/downloads/gas_flaring_nigeria.pdf.

Asume, O. (2005). Gas Flaring in Nigeria: A Human Rights, Environmental and Economic Monstrosity. Climate Justice Programme, *Friends of the Earth International.* https://www.foe.co.uk/sites/default/files/downloads/gas_flaring_nigeria.pdf

CEIC Nigeria Gross National Product. (2018). https://www.ceicdata.com/en/indicator/nigeria/gross-national-product.

Declan, H. (2016). What Gas Flaring Provision Bill Will Achieve. The Punch. http://punchng.com/gas-flaring-prohibition-bill-will-achieve

Desmond, O. T and Ifenkwe, G. E. (2018). Biodiversity Conservation Strategies in the Face of Oil Pollution in Niger Delta, Nigeria. *Journal of Biodiversity and Environmental Sciences*, 12(4), 153-162.

Ebienfa, K. I. (2011). Militancy in the Niger Delta and the emergent categories. *Review of African Political Economy*, 38 (130), 637-643.

Efe, S. I and Ogbomida, E. T. (2019). Oil Pollution and its Effects on Avian Species in Niger Delta Region of Nigeria. *European Journal of Ecology*, 5(1), 1-10.

Ekpo, I. E., Obot, O. I and Dvid, G. S (2018). Impact of oil spill on living aquatic resources of the Niger Delta region: A review. *Journal of Wetlands and Waste Management*, 2(1), 48-57.

Eriegha, O. J and Sam, K. (2020). Characterization of crude oil impacts and loss of livelihood in the Niger Delta, Nigeria: a fisheries perspective. *International Journal of Interdisciplinary Research*, 1, 255–273.

Etikerentse, G. (2004). Nigerian Petroleum Law (2nd ed., p. 148). Lagos: Dredew Publishers.

Haney, J. C., Geiger, H and Short, J. W. (2014). Bird Mortality from the Deepwater Horizon Oil Spill. II. Carcass Sampling and Exposure Probability in the Coastal Gulf of Mexico. Marine *Ecology Progress Series*, 513, 239-252.

Ibaba, S. (2001). Understanding the Niger Delta crisis. Port Harcourt: Jiral Publication Company.

Ite, A. E, Harry, T. A., Obadimu, C. O., Asuaiko, E. R and Inim, I. J. (2018). Petroleum hydrocarbons contamination of surface water and groundwater in the Niger Delta region of Nigeria. *Journal of Environmental Pollution and Human Health*, 6(2), 51–61.

Izah, S. C and Aigberua, A. O. (2023). Potential threats and possible conservation strategies of biodiversity in Niger Delta Region of Nigeria. In: Sustainable utilization and conservation of Africa's biological resources and environment. *Springer*, pp 151–176.

Kadafa, A. A., Zakaria, M. P and Othman, F. (2012). Oil spillage and pollution in Nigeria: organizational management and institutional framework. *Journal of Environmental and Earth Science*, 2(4), 22–30.

Mba, C. H. (2000). Environmental Protection and National Development: Towards Optimal Resolution of Conflicting Measures and Strategies. In A. Akpuru-Aja, & A. C. Emeribe (Eds.), Policy and Contending Issues in Nigerian National Development Strategy). Enugu: John Jacob's Publishers, Ltd.

Mba, C. H. (2000). Environmental Protection and National Development: Towards Optimal Resolution of Conflicting Measures and Strategies. In A. Akpuru-Aja, & A. C. Emeribe (Eds.), Policy and Contending Issues in Nigerian National Development Strategy). Enugu: John Jacob's Publishers, Ltd.

Michiko, I. (2004). Gas Flaring in the Niger Delta: The Potential Benefits of Its Reduction on the Local Economy and Environment. https://pdfs.semanticscholar.org/a29f/69cf8551ccc35fe9d5609a1d82d46ae860fd.pdf?_ga=2.7536050.1895606060.1566574900-1196102768.1566574900

Michiko, I. (2004). Gas Flaring in the Niger Delta: The Potential Benefits of Its Reduction on the Local Economy and Environment. https://pdfs.semanticscholar.org/a29f/69cf8551ccc35fe9d5609a1d82d46ae860fd.pdf?_ga=2.7536050.1895606060.1566574900-1196102768.1566574900

Ndubuisi, A. L and Asia, I. O. (2007). Environmental Pollution in Oil Producing Areas of the Niger Delta Basin, Nigeria: Empirical Assessment of Trends and People's Perception. *Environmental Research Journal*, 1, 18-26.

Nnabuenyi, U. (2012). Impact of oil exploration and exploitation on the Niger Delta region: environmental perspective. *Niger Journal of Science and Environment*, 11(1), 83–92.

Nnadi, V. E, Udokporo, E. L and Okolo, O. J. (2022). Petroleum production activities and depletion of biodiversity: a case of oil spillage in the Niger Delta. In: Handbook of environmentally conscious manufacturing. *Springer*, pp 95–111.

Nnaemeka, A. N. (2020). Environmental pollution and associated health hazards to host communities (case study: Niger delta region of Nigeria). *Central Asian Journal of Environmental Science and Technology Innovation*, 1(1), 30–42.

Nnimo, B. (2010). The UN Reports on Nigerian Oil Spill Relies Too Heavily on Data from Shell. http://www.theguardian.com/environment/cif-green/2010/aug/25/un-nigeria-oil-spill-shell

Nwafor, O. K., and Okorie, O. I. (2017). Environmental Pollution and Oil Spillage in the Niger Delta Wetlands of Nigeria: A Critical Review. *Environmental Management and Sustainable Development*, 6(1), 87-101.

Nwilo, C. P and Badejo, T. O. (2005). Impacts and Management of Oil Spill Pollution along the Nigerian Coastal Areas. Administering Marine Spaces: *International Issues*, 119, 2006.

Nwilo, P. C and Badejo, O. T. (2005). Oil spill problems and management in the Niger Delta. Paper presented at International Oil Spill Conference, Miami, Florida, USA, May 2005.

Nwilo, P. C and Badejo, O. T. (2006). Impacts and management of oil spill pollution along the Nigerian coastal areas. *Admministering Marine Spaces International Issues*, 119:1–15.

Nwoko, C. N. (2014). Assessing the socioeconomic impacts arising from oil pollutions in the Niger Delta region of Nigeria: Including proposals for solution. Ph. D Dissertation. Aalto University, Helsinki.

Nzeadibe, T. C., Egbule, C. L., Chukwuone, N. A and Agu, V. C. (2011). Climate change awareness and adaptation in the Niger Delta Region of Nigeria. African Technology Policy Studies Network. *Working Paper Series* | No. 57.

Obiakor, M. O and Okonkwo, C. N. (2019). Impact of Oil Exploration and Production on Biodiversity in the Niger Delta Region of Nigeria. *African Journal of Environmental Science and Technology*, 13(5), 185-198.

Olayungbo, D. (2019). Effects of oil export revenue on economic growth in Nigeria: a time varying analysis of resource curse. *Resource Policy*, 64, 101469.

Olujimi, J. A., Adewumi, E. A. and Odunwole, S. (2011). Environmental Implications of oil exploration and exploitation in the coastal region of Ondo State. *Journal of Geography and Regional Planning,* 4(3): 110 – 121.

Onwugbuta-enyi, J., Zabbey, N and Erondu, E. (2022). Water Quality of Bodo Creek in the Lower Niger Delta. Advances in Environmental Biology, 2(3), 132-136.

Opukri, C. O and Ibaba, S. I. (2008). Oil induced environmental degradation and internal population displacement in the Nigeria's Niger Delta. *Journal of Sustainable Development in Africa*, 10(1), 173-193.

Osisanya, S. O. (2003). Environmental Problems Related to Oil Exploration Activities; the Elements of Biodiversity.http://www.biologicaldiversity.org/programs/biodiversity/elements_of_biodiversity.

Pegg, S and Zabbey, N. (2013). Oil and water: the Bodo spills and the destruction of traditional livelihood structures in the Niger Delta. *Journal of Community Development*, 48(3), 391–405.

Pegg, S and Zabbey, N. (2013). Oil and water: the Bodo spills and the destruction of traditional livelihood structures in the Niger Delta. Community Dev J 48(3):391–405.

Powell, C. B., White, S. A., Ibiebele, D. O., Bara, M., Dut Kwicz, B., Isoun, M. and Oteogbu, FU. (1985). Oshika oil spill environmental impact: effects on aquatic biology. Paper presented at NNPC/FMHE International Seminar on petroleum industry and the Nigerian Environment. Kaduna, Nigeria. pp. 168 -178.

Pyagbara, L. S. (2007). The Impact of Bio-Diversity. https://www.un.org/esa/socdev/unpfii/documents/workshop_IPPE_pyagbara.doc

Reuters, (2023). Nigeria investigates a dayslong oil spill from a Shell pipeline in a region already blighted by pollution.

Saint, E. (2022). Timeline: half a century of oil spills in Nigeria's Ogoniland. https://www.aljazeera.com/features/2022/12/21/timeline-oil-spills-in-nigerias-ogoniland

Sakib, S. (2021). The impact of oil and gas development on the landscape and surface in Nigeria. *Asian Pacific Journal of Environment and Cancer*, 4(1), 9–17.

Stakeholders Democracy Network (SDN) (2016). Recent oil spills in Delta and Bayelsa States, Nigeria. Retrieved October 27, 2023 from, http:www.stakeholderdemocracy.org/recent-oil-spills-in-delta-and-bayelsa-states-nigeria/

Sunmoni, M. (2012). Gas Flaring in Nigeria; What Are the Harmful Effects? http://www.ecoremediation.blogspot.com/2012/06/gas-flaring-in-nigeria-what-are-harmful.html

UNEP. (2011). Environmental Assessment of Ogoniland. United Nations Environment Programme. Retrieved from https://www.unenvironment.org/resources/report/environmental-assessment-ogoniland.

United Nations Environmental Program UNEP. (2011). Environmental Assessment of Ogoni Land. http://www.unep.org/nigeria.

Uyigue, E and Agho, M. (2007). Coping with Climate Change and Environmental Degradation in the Niger Delta of Southern Nigeria. *Community Research and Development Centre Nigeria*

(*CREDC*).http://priceofoil.org/content/uploads/2007/06/07.06.11%20%20Climate_Niger_Delta.pdf

Uyigue, E and Ogbeibu, A. E. (2007). Climate Change and Poverty: Sustainable Approach in the Niger Delta Region of Nigeria. https://www.researchgate.net/publication/242578916_Environmental_Sustainability_and_Sustainable_Development_Issues_in_the_Niger_Delta_Region_of_Nigeria/link/02e7e531be54084550000000/download

Weis, J. (2015). Marine Pollution: What Everyone Needs to Know. Oxford: Oxford University Press.

Weli, V and Arokoyu, S. (2014). Impact of SPDC-Bomu manifold oil pipe explosion fire on crop yield and farm income in Gokana LGA, Rivers State, Nigeria. *Research Journal of Applied Science and Engineering Technology*, 7(14), 2851–2857.

Wunder, S. (2003). Oil wealth and the fate of the forest: A comparative study of eight tropical countries. London: Routledge.

Zabbey, N. (2009). Impacts of oil pollution on livelihoods in Nigeria. In: Paper presented at the conference on “Petroleum and Pollution–How does that impact human rights".