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A Holistic Review of three-Decade Oil Spillage across the Niger Delta Region, with Emphasis on its Impact on Soil and Water

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ABSTRACT

This article aims to review studies on the impact of oil spillages on soil and water within the Niger Delta Region (NDR). Secondary information, citing relevant articles from Google search engine that discussed the effects of oil spills on the ecosystem was retrieved. Carefully selected papers published throughout the last thirty years served as the articles for this investigation. Keywords that were specifically considered in the searches that make up the secondary information were oil spillage within the NDR, water quality, soil quality, oil spillage devastation, etc. Findings from this study suggested that there has been a decline in water quality, acidification of soils and rainwater, corrosion of metal house roofs, and significant increases in concentrations of sulfates, nitrates, and dissolved solids in water resources, especially, around oil-producing communities of NDR. The presented results lack appropriate and adequate qualitative and quantitative data that justifies 30-year period assessments of soil and water quality within the region, due to oil spillages on soil and water. This study suggests that to mitigate the negative effects of oil spillage, people should view it as a "violent action against them" and that periodic sensitization campaigns should be implemented. The conclusion is not in line with the study's title and aim, which was to holistically assess the effects of a 30-year period of oil spillages on soil and water. The conclusion of the study, therefore, should be on study findings, with regards to the quality and profiles of the soil and water in the Niger Delta region, and recommendations on the findings!

Keywords: Hydrocarbon exploration, devastation, oil spillage, soil, water

1. INTRODUCTION

Hydrocarbon exploration/oil spillage poses a significant threat to the delicate balance of the environment, impacting ecosystems on both soil, and water. Hydrocarbons are made up of carbon and hydrogen atoms, are ubiquitous in modern industrial activities, transportation, and energy production. While these compounds play a crucial role in powering our societies, their unintended release into the environment can have severe consequences. In a similar vein, human-caused phenomena such as environmental degradation and climate change, have become not just an issue of regional concern but a renowned concern of global magnitude. The aforementioned phenomena no doubt, have given rise to multiple hazardous environmental issues.

This is exemplified by the buildup, over time, of harmful chemical compounds emitted into the atmosphere, and drained into the hydrosphere to interact with the biosphere and geosphere.

This is visibly seen in the deterioration of water and soil quality. Despite the several actions taken by governmental and inter-governmental agencies, corporate organizations, and multinationals, as well as relevant experts in both academia and other invested parties alike; these issues have persistently bedeviled large portions of the NDR. Oil spillage is identified as the most common means of environmental pollution within the region. It has been found to have adverse effects on both public health and the ecosystems [1]. [2] attributed these spills to be a result of industrial effluent discharges, offshore drilling activities, as well as transportation accidents from facilities, and/or pipeline sabotage (interdiction). According to them, this is associated with the social and political unrest in the region. It is more obvious now that the combined effect of oil spillages and carbon emissions is worsening the climate change emergency by the day, causing disruptions to global ecosystems, elevated sea levels, and leading to increased extreme weather conditions.

Sections of the ecosystem become contaminated with oil spills thereby disrupting the terrestrial and marine ecosystems. Crude oil contamination can also have several negative effects on soil. It can impact both the physical and biological properties of the soil. Contamination from crude oil can lead to decreased pore spaces, saturated hydraulic conductivity, increased bulk density, and reduced total porosity and air-filled porosity [3]. Additionally, it can also greatly decrease the biological activity of the soil, such as dehydrogenase and urease activity [3]. It can improve the soil's availability of nutrients and water, affecting plant growth and development [4][5]. Furthermore, it can harm soil microorganisms, reducing their number and activity, which in turn affects plant health. The chemical composition and structure of the soil can also be seriously altered by petroleum pollution [6].

For instance, soil contaminated by crude oil can have a significant pH increase and decrease in the amounts of available phosphorus [6][7]. Crude oil contamination can also have several negative effects on soil's biological and physical properties. Contamination from crude oil can lead to decreased pore spaces, Enhanced bulk density, decreased total porosity, air-filled porosity, and saturated hydraulic conductivity [3]. Additionally, it can greatly reduce soil biological activities, such as dehydrogenase and urease activity[3]. Furthermore, it can harm soil microorganisms, reducing their number and activity, which in turn affects plant health. The chemical composition and structure of the soil can also be seriously altered by petroleum pollution [6].

For instance, the presence of crude oil in the soil can dramatically raise its pH and lower the amounts of available phosphorus. [6][8]. Petroleum contamination and pollution of surface and groundwater also represent a pervasive environmental challenge with far-reaching implications for ecosystems, and the overall well-being of communities.

Oil spills can have immediate and catastrophic effects on surface water bodies such as rivers, lakes, and oceans. Petroleum's lighter fractions, like gasoline and diesel, tend to float on the water's surface and form slicks that can harm aquatic ecosystems [9]. These hydrocarbons can coat the feathers of birds, impede the photosynthesis of aquatic plants, and have toxic effects on fish and other aquatic organisms [9]. Therefore persistence of petroleum compounds in surface water can lead to long-lasting ecological damage, affecting the balance of aquatic ecosystems.

While the impact of petroleum contamination on surface water is often visible, the consequences for groundwater can be more insidious. Spills or spillages that infiltrate the soil can result in the downward migration of petroleum constituents into underground aquifers, contaminating the primary source of drinking water for many communities [10]. The Petroleum's heavier fractions, such as oil and lubricants, may accumulate in the subsurface, creating persistent plumes of contamination [11]. This poses a direct threat to human health when groundwater wells draw from these polluted aquifers, potentially leading to the ingestion of harmful substances [12, 13].

Furthermore, delicate equilibrium fluctuation by impeding sunlight penetration, disrupting nutrient cycling processes and oxygen exchange resulting in a decreased rate of plant growth, decreased photosynthesis, and increased disease contraction in humans and wildlife; are today contributing to increased global warming due to the greenhouse effect [14, 15]. In addition, [1, 11, 16-19] have all reported that oil spills do have severe effects on human health. It is on record that communities near spill-affected areas are particularly very susceptible to health risks and have diminished levels of well-being. For example, alarming levels of contaminants in soil samples from Ogoni Land, Rivers State were observed by [20], whose findings show that drinking water wells had values as high as $42\ 200\ \mu\text{g L}^{-1}$, benzene as high as $9000\ \mu\text{g L}^{-1}$, over 900 times those recommended by the World Health Organization, and easily extracted petroleum hydrocarbons (EPHs) ($>10\text{--}C40$) in surface waters as high as $7420\ \mu\text{g L}^{-1}$. EPH concentrations in sediments were up to $17,900\ \text{mg kg}^{-1}$; while polycyclic aromatic hydrocarbon concentrations reached $8.0\ \text{mg kg}^{-1}$, in the most contaminated sites. To mitigate the impact of the spilled petroleum, containment booms, skimmers, and dispersants were then used [20]. This review examines some of the problems associated with oil spillage vis-à-vis, the resultant effects on the water, and soil quality in oil-producing host communities in the ND-region. It will further suggest mitigation steps to take to tackle this menace.

1. 1. The Nigeria's Niger Delta Region and Petroleum Hydrocarbons Contamination

The Niger Delta Basin, which lies within latitudes 3° and 6° N and longitudes 5° and 8° E (Figure 1), occupies the Gulf of Guinea continental margin in equatorial West Africa [21-23]. The Niger Delta basin has a total area of about $75,000\ \text{km}^2$ and occupies the coastal and part of the ocean-ward part of the Benue trough that makes up 7.5% of Nigeria's land mass. According to [1 and 26]; the basin is home to over 40 different ethnic groups, and is a low-lying floodplain that was initially built over an older transgressive Paleocene prodelta. The basin is the youngest and southernmost of the three large sediment bodies that filled the aulacogen formed after the separation of the African and South American plates [21, 25, 26].

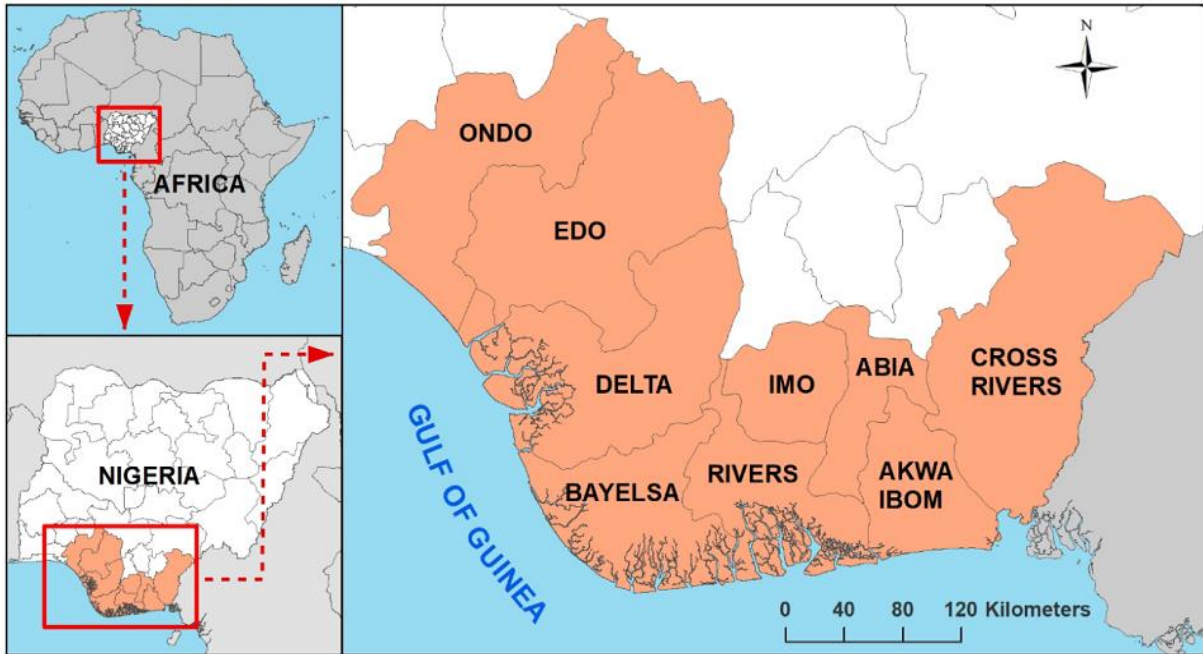


Figure 1. Map of the Niger Delta region (NDR) of Nigeria (Source: Eromose, et al., 2020)

The NDR cuts across over 800 oil-producing communities with an extensive network of over 900 producing oil wells and several petroleum production–related facilities. Over the past five decades, a total of about 1,182 exploration wells have been drilled to date in the delta basin, and about 400 oil and gas fields of varying sizes have been documented [1, 27-30]. Nine oil-producing states make up the Nigeria's Niger Delta Region. Of these, six states—Akwa-Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers states—are reported to be the focal points of continuous insurgency and civil disturbance [31]. From a geological perspective, The NDR is a province rich in hydrocarbons, with an estimated 40 billion barrels of oil remaining for eventual recovery. This makes up more than 70% of sub-Saharan Africa's total hydrocarbon reserves. [21, 30]. Even though the Niger Delta is one of the most resource-rich regions in the world for petroleum hydrocarbons, it is nonetheless plagued by conflict cycles that have put human security, underdevelopment, habitat destruction, artisanal refining and bunkering, and petroleum pollution of the environment at risk. [2, 32-38]. Few scholars have thoroughly examined the Niger Delta region's brief history of petroleum production and exploration. [34, 39]. In addition to their detrimental effects on natural resources, petroleum hydrocarbon production can also lead to several environmental issues that will alter the chemical, physical, and biological composition of the soil, air, and water from activities such as gas flaring, oil spillages, and incessant effluent discharge [34].

Every step involved in the production of oil ranging from the exploration to the transportation of finished product, often has a detrimental effect on the environment, endangers public health, erodes culturally valuable artifacts, and creates financial problems for the host communities that extract the oil in the area. some of these include the inappropriate disposal of significant amounts of hazardous waste streams originating from petroleum, such as the mud from drilling and oily and noxious sludge, pipeline explosions, gas flaring, and spillages of oil

[12, 40], equipment failure and oil spills related to aging facilities, sabotage of petroleum facilities, illegal oil bunkering, and artisanal refining, are the main causes of environmental pollution in the Niger Delta region. Oil spills, pipeline explosions, gas flaring and venting, and the improper disposal of large volumes of hazardous waste streams derived from petroleum, such as drilling mud and oily and toxic sludge [40], The primary sources of environmental contamination in the Niger Delta area include aging infrastructure, vandalism of petroleum facilities, illicit oil bunkering, artisanal refining, and machinery breakdowns and spillages of oil. [2, 34, 41]. Others are blowouts from oil wells, oil blasts, and operational wastes/discharges. [20, 29, 34, 42-46]. According to [47, 48], The Texaco Funiwa-5 offshore station blowout in 1980, which resulted in an oil spill of approximately 400,000 barrels, and the Royal Dutch Shell oil export terminal tank failure in 1978, which resulted in an oil spill of approximately 580,000 barrels, or are the two largest single oil spills in Nigerian history. Between 1958 and 2010, it is estimated that 10.8 million barrels of crude oil escaped into the environment yearly [49]. This much oil has the potential to gravely impair human health, ecosystems, and the well-being of communities [18, 50]. The oil and gas industries operating in the Niger Delta have over time generated serious environmental concerns, with over 4,000 oil spillage recorded since 1991 [51, 52, 94]. An examination of the data on oil spills from 2007 to 2015 indicates that the NDR has witnessed the spillage of more than 90 million liters of crude oil. [53]. [18] further noted that the NDR of Nigeria experiences an average of 240,000 barrels of crude oil spill annually, with the reasons for the spills being attributed to unidentified sources (31.85%), outside interference (20.74%), and technical malfunctions (17.04%). Although many of the world's worst oil spills have been caused by unintended terrestrial blowouts, the bulk of the petroleum pollution of the terrestrial environment in the NDR may have resulted from pipeline breaches caused by sabotage, operational failures, and neglected maintenance [53-56]. The unsustainable practices of some petroleum companies within the oil-rich areas, such as the NDR, reflect the shoddy execution of environmental protection measures combined with the ineffectual statutory laws and regulations [57-63]. In light of this, the petroleum industry's exploration and production efforts have had a detrimental effect on the NDR and its inhabitants during the past few decades [1, 32, 57, 64-66]. Several notable major disasters have been documented, such as the significant Texaco spillage in 1980, which resulted in 180 deaths and poisoned streams that served as supplies of drinking water, along with numerous other incidents that killed children and hospitalized over a hundred residents after they drank petroleum hydrocarbon contaminated [67, 68]. Because some of the different hydrocarbon compounds have the potential to induce cancer and mutagenesis, the contamination of soil and water resources by petroleum hydrocarbons during the past five decades has become a severe environmental concern and risk to human health [54].

1. 2. Oil Spillage

Oil spills may occur for numerous reasons such as equipment failure, disasters, deliberate acts, or human error (Anderson and LaBelle, 2000). Table 1 shows the percentage that each subcategory contributed to the total number of oil spills in Nigeria during the previous five years [69-71]. An estimated 1.89 million barrels of oil were released into the environment through spillages into the Niger Delta in 4,835 events between 1976 and 1996, out of a total of 2.4 million barrels. Of these spills, 69% happened offshore, 25% happened in marshes, and 6% happened on land [72]. According to a different study, the Niger Delta sees an average of 240,000 barrels of crude oil spill annually, mostly as a result of a technical failure (17.04%),

third-party activity (20.74%), and (31.85%) occurs due to unknown causes [18]. According to [73] oil spillage has greatly affected water resources and crops, this has also led to the occurrence of radioactive materials, and trace metals are also found in food crops. Oil spills have the ability to reduce the amount of food that is available to families by 60%, as well as to reduce the amount of ascorbic acid in vegetables by 36% and the amount of crude protein in cassava by 40%.

These might result in a 24% increase in the prevalence of childhood malnutrition. According to studies on animals, coming into touch with Nigerian crude oil may be toxic to the liver and hemotoxic, as well as induce cancer and infertility [73-75]. According to another report, the oil spills affected at least 1500 communities in the eight oil-producing states in Nigeria, and were mainly from the 5284 oil wells that were drilled (as of 2006) and the 7000 km of a crude oil pipeline that crisscrosses the NDR. The causes of the petroleum hydrocarbon spillages due to pipeline failures is shown in Table 1 [76].

Table 1. The causes of oil pipeline failures between 1999 and 2005

Cause	Percentage % [71]	Percentage % [70]
Mechanical failure	17.04	6
Corrosion	15.56	36
Operational error	12.59	2.5
Third-party activity/ Sabotage/Bunkering	20.74	36
Natural hazard	2.22	
Unknown	31.85	2.5

1. 3. Brief information on oil-spill in Nigeria

Between January 2019 and April 2021, 881 occurrences of oil spillage were reported in recent years. Within the nation, 12 states experienced this spill. The aforementioned data was gathered from the NOSDRA, a satellite tracker operated by the government. It was also noted that only 3 oil-producing states in Nigeria accounted for 77% of the spills. The entire amount of oil spilled over this period is estimated to be over 43,000 barrels, with a market value of \$3 million on the international market and 1.23 billion naira in the domestic markets. It is important to realize that these numbers are not static because new spills are continually being reported every day. According to [77], the Rivers, Delta, and Bayelsa States had the most spills. Rivers State is in the lead by 352 spills. 233 incidents in Delta State and 89 in Bayelsa State, for a total of 674 spills (Table 2). Around the overall quantity of oil spillage, data shown in Fig. 2 reveals that about 26,268,1219 and 9134 barrels were lost in Rivers, Bayelsa, and Delta State. Similarly, the data from oil spillage also provides spillage statistics from the 1970s, when there was an average of 79% spills per year; however, by 2010, that percentage had dropped to 50% (Fig, 3) [78].

Table 2. Oil spillage in States: A breakdown of incidents and barrels along with the proportion of spills across Nigeria's 12 impacted states

S/No	Occurrence(s)	States	Numbers of oil barrels spilled
1	74	Others	1805.65
2	41	Abia	1599.58
3	26	AkwaIbom	1.29
4	89	Bayelsa	1219.1
5	1	Bayelsa, Rivers	105
6	233	Delta	9133.99
7	19	Edo	93.45
8	31	Imo	2189.89
9	2	Kaduna	41
10	11	Lagos	100.63
11	2	Ondo	8
12	352	Rivers	26267.83
Total	881		42565.42

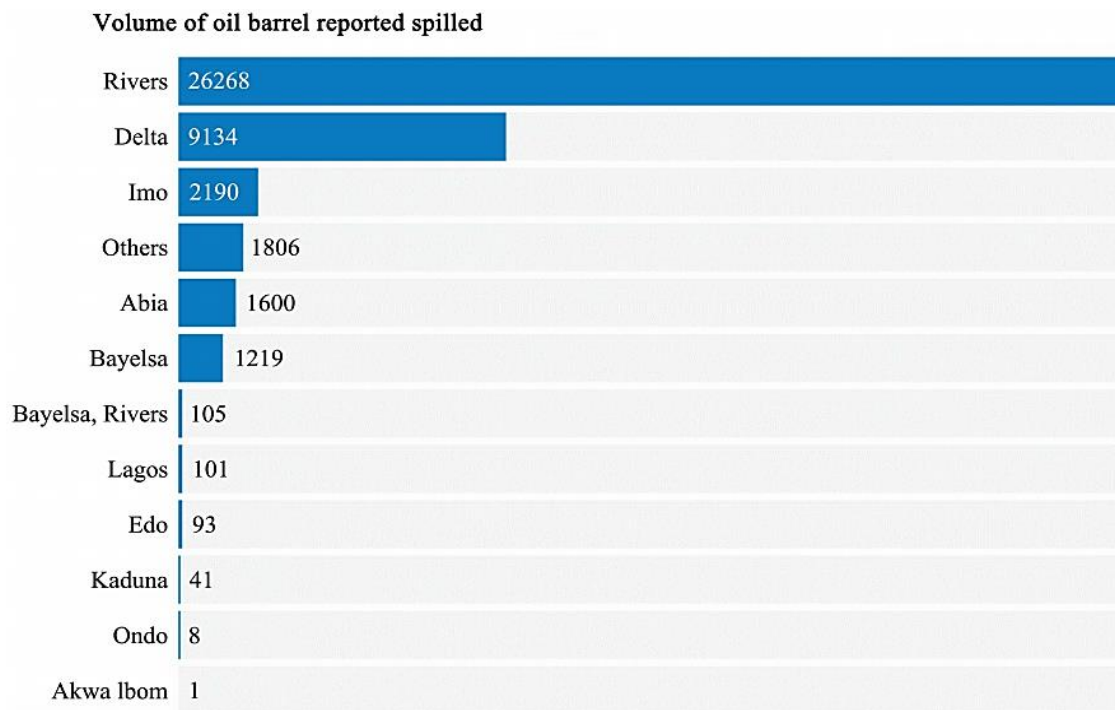


Figure 2. Showing volume of oil-spilled in Nigeria [77]

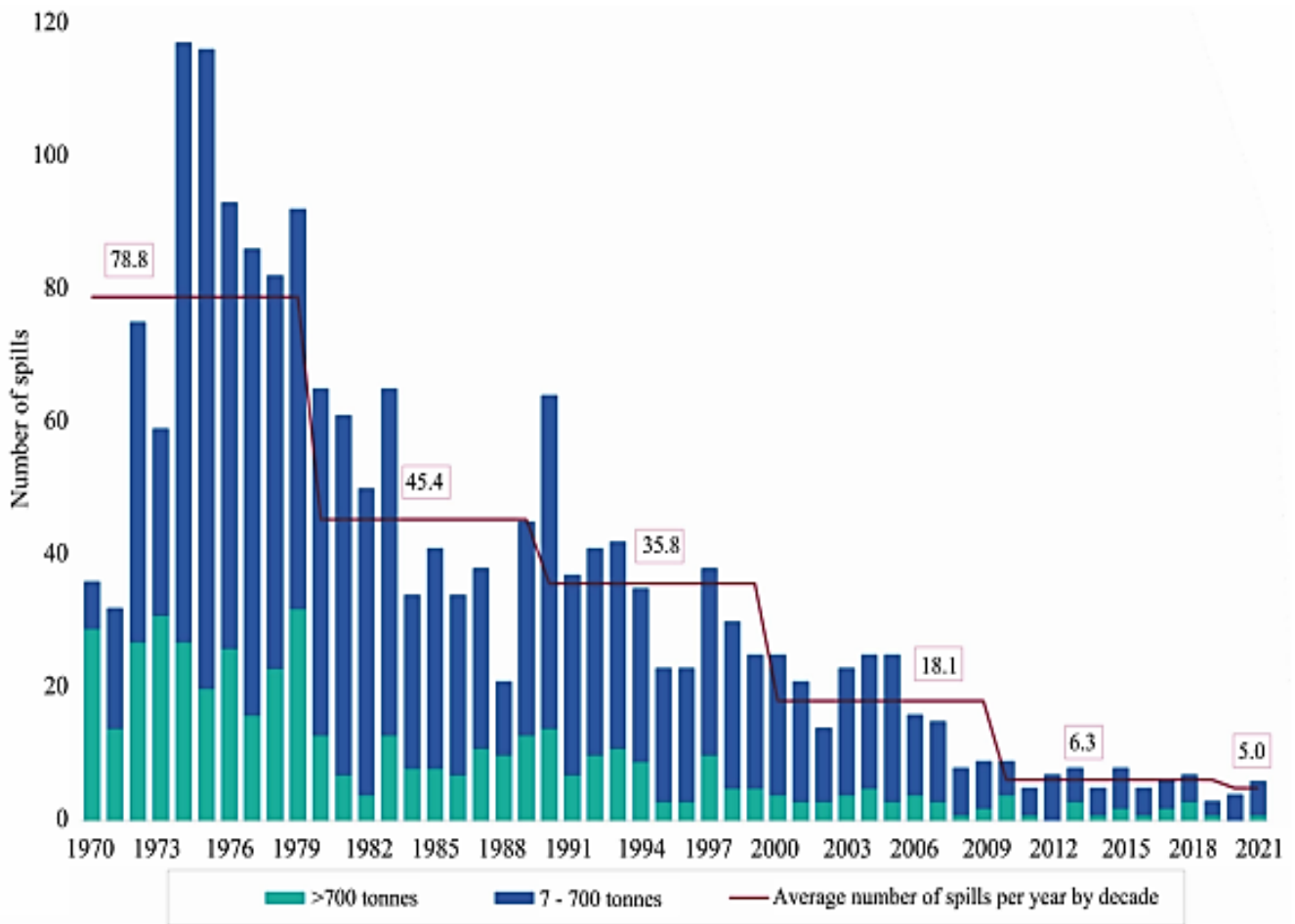


Figure 3. Nigerian oil spill totals from 1970 to 2021 [79].

1. 4 Environmental Pollution

Pollutants constitute major threats to both plant and animal life. In man’s living space, health, and wellness are often determined by the safety of the environment, often affected by their activities. Environmental pollution simply refers to problems with pollutants that interfere with the environment's natural processes and hurt it [73]. Health risks resulting from environmental contamination have put lives in danger and claimed a huge number of lives within the NDR of Nigeria [80].

The region's main economic activity, the oil sector, produces a ton of environmental annoyance every day through its production and other activities. Because of inadequate management of these wastes, disregard for the sanctity of human life, and other regrettable factors, the area is frantically fighting for survival in several different ways. These have become a grave threat to the region [73]. The majority of the region's environmental pollution problems are brought on by oil spills and gas flaring. Common causes include theft, accidents, human mistakes, and operational releases of petroleum spillage into the environment. The environmental risk prevents plants and animals from functioning to their full potential and produces environmental conditions that are unsuitable for a healthy lifestyle [81, 82]

2. MATERIALS AND METHODS

The Google search engine was utilized in this investigation to locate pertinent literature. We downloaded and reviewed articles that had been published in the last few decades about oil spills and how they have affected the water and land in within the region. These relevant papers were thoroughly studied and findings from the paper were carefully presented in tabular form with details of publication particulars, study location, period, approach, and methodology as shown in Table 3.

Table 3. Related literature used for this study.

S/No	State	Locations	Parameter	Methodology	Key Findings	Location
1	Rivers State	Ogali and Agboncha	Soil		Oil-spill has greatly affected the nutrient levels and fertility of status of Eleme soil	[83]
2	Rivers State	Niger Delta	Soil	Soil sample analysis	According to the investigation, while many other metrics were unaffected, the oil spill from carry-over crude oil had an impact on the concentration of some soil quality parameters. The soil's texture near the oil spill was unaffected by the spill's oil site. However, there were higher quantities of heavy hydrocarboncontaminants in the soils.metals and overall carbon in the soil that may have an impact on its agronomic properties at the spillage site.	[84]
3	River State	Akiogbologbo, Engenni-Ahoadal.G.A.	Soil	Soil sample Analysis	Crude oil pollution has adverse effects onthe soil's geotechnical properties	[85]
4	River State	Ogba/Egbe ma/NdoniL.G.A	Soil	Soil sample analysis	A significant amount of petroleum hydrocarbon contaminants was found in the soil at the Omoku Old Pipeline crude oil spillage site despite the cleanup measures used, according to the findings of all the variables examined in this study.	[86]
5	River State	Ogoni-land	Secondary data	Statistical analysis	Between 1976 and 2000, statistical examination of oil spill quantities and incidence revealed a drop in quantity and an increase in incidence.	[87]

6	Niger Delta	Niger Delta	Mini-review	Mini-review	They were of the view that oil spill has greatly affected the freshwater bodies	[88]
7	Delta State	Ugborodo community, Warri South-West Local Government Area	Soil	Soil analysis	From their study, it was observed that soil within Orgonoko and Kana is contaminated	[89]
8	Akwa-Ibom	Warife Community, Oruk-Anam Local Government Area	Sediments	Analysis	The prescience of the oil spill was noticed in sampled sediment	[90]
9	Niger Delta	Niger Delta	Mini-review	Mini-review	They thought that oil spillage greatly affected the water resources of the Niger Delta area.	[91]
10	Delta State	Warri	Water/soil	Water/soil Analysis	Findings from their study showed oil discharged intentionally/unintentionally into the Warri riverine waters and sediment since hydrocarbon released into the environment sorb to the sediment particles where they cause harm to organisms in the sediment and overlying waters	[92]
11.	Edo State	Ekehan River	Water	Analysis	Findings from their study showed that the oil spillage had no serious impact on the studied surface water (Ekehan River)	[93]
12	Niger Delta	Niger Delta	Review	Review	Oil spill hurts water bodies within the Niger Delta region	[94]
13	Edo State	Ologbo	Soil	Soil analysis	Regardless of the season, crude oil alters soil properties by precipitating a hydrophobic layer, which leads to a conflict between vital nutrients and heavy metals.	[95]

3. RESULT AND DISCUSSION

3. 1. Impact of oil spillage on soil

According to Nigerian Coastal Erosion and Subsidence. Tech. Report No. 1 from 1991, the soils that underlie the NDR are typically described as soft, highly compressible, organic, and inorganic silty clays that are found at large depths atop fine sands. The NDR is particularly vulnerable to subsidence as a result of these soil features. Increased flooding and inundation of the barrier islands and marshes tend to indicate that the rate of subsidence is noticeable, even

though no conclusive investigations or research have been conducted to determine the degree of subsidence. Preloading survey results from the liquified petroleum gas facility in Bonny indicate that natural subsidence is still occurring in the Niger Delta [94, 96]. The physical composition of the Delta is now influenced by 19 more forces, including damming, oil, gas, and water extraction. For instance, the amount of silt reaching the coast has decreased as a result of the construction of dams across the River Niger.

The erosion issues along the shoreline have inevitably gotten worse as a result of this decline. Studies conducted by [83] in Ogali, and Agboncha in River State, Nigeria using soil analysis suggested that soil quality (nutrient and fertility status) is on the decline due to oil-spill within the area. Further studies conducted by [84] revealed that oil spills from carry-over crude oil affected the concentration of some soil quality measures, even if many other metrics were unaffected.

The soil's texture remained unchanged despite being close to the oil spill. At the spillage site, the soils did contain higher levels of heavy hydrocarbons, metals, and total carbon, which could affect the agronomic qualities of the soil. Studies from [85], showed that the earth's geotechnical qualities are negatively impacted by crude oil contamination. Findings from [86], suggested that in all the variables studied, a large amount of petroleum hydrocarbons were discovered in the soil at the Omoku Old Pipeline crude oil spillage site despite the cleanup procedures applied.

According to [95], who used a randomized block methodology to determine changes in the physicochemical parameters and heavy metals concentration in oil-polluted soil, crude oil has an impact on soil qualities throughout the year. [97] described how spills frequently occur on agricultural soils, which has a fouling effect on all kinds of life by making the soil (especially the surface layer that is biologically active) poisonous and unproductive. Because of this, soil fertility decreases, which makes it harder for plants and crops to use most of the necessary nutrients [83].

3. 2. Impact of oil spillage on water

There are numerous natural resources in the NDR of Nigeria [98-101]. Today, the NDR is currently plagued by several environmental issues, including global warming, land erosion, water pollution, and air pollution [102, 103]. The area is currently marked by total contamination of the forest, rivers, and streams, as well as decline in biodiversity due to oil pollution. [87] claims that this has had an impact on the way of life for indigenous people, who rely on ecosystem services to survive. According to studies, at least 9–13 million barrels of oil have been spilled over 50 years, which is equal to 50 Exxon Valdez spills [104].

If there is an oil spill over water, it spreads right away. Both the liquid and gas components vanish. Some disperse in water and even oxidize, while others go through bacterial alterations and eventually sink to the bottom due to gravity. After that, the soil becomes poisoned, having a severe impact on terrestrial life. When water evaporates, the disintegration of the volatile lower molecular weight components impacts aerial life, so aquatic life is impacted by the emulsified water made up of less volatile substances [105]. [106] stated that over 70% of rural Niger Delta residents depend on fishing for their livelihood and that contamination of the region's rivers, streams, and creeks has severely damaged the industry. Similarly, [107], found that one of the major issues related to oil production and exploration within the NDR, which has hampered development, is the poisoning of streams and rivers. [108] reported that the Ebocha-Brass (Ogada-Brass 24) pipeline caused a 5,000-barrel oil spillage that inundated the

swamp forest and lake in Oshika village, River State. 500-barrel oil spillage in September 1979 had previously occurred in the area, resulting in the death of crabs, fish, and shrimp. As a result of oil present in the sediments of the lake, further findings from [94] revealed that the Idoho oil spillage spread through the coast and shoreline of Lagos state. The result of this was the development of an oil sheen along the shores of Lagos State, Ondo State, Akwa-Ibom State, Bayelsa State, Rivers State, and Cross River State. [109] conducted earlier research that demonstrated that the Ubeji River's water was dangerous for aquatic life and unfit for domestic use due to oil spillages. [110] investigated the physicochemical characteristics of water contaminated with oil collected from six towns in Nigeria's Ondo and River States and found that the water was unfit for home usage. Oil spillages have resulted in the introduction of petroleum products into the rivers and streams in Ilaje Community, Ondo State. This made it extremely difficult to obtain clean drinking water in many places. About 68.4% of surface and subsurface water is thought to be contaminated [111].

According to a related study by [112] the Ughoton stream in Ughoton Community of the Niger Delta Region was covered in oil films, due to spillages rendering the water unsafe for human consumption. Three of the four refineries in Nigeria are located in the NDR. Every day, these legal, and illegal refineries produce significant amounts of effluents that are either untreated or treated before being released into natural water bodies. High quantities of pollutants were present in the water due to effluent discharge oil spill, and refinery in Port Harcourt into the Okrika branch of the Bonny River estuary, which may be hazardous to various aquatic creatures. Pollutant levels were often higher during the dry season than during the wet season. The surface water of the Esi River in the Western Niger Delta was examined by [113] for the presence of total petroleum hydrocarbons (TPH) and heavy metals. The investigation found elevated levels of petroleum hydrocarbons in the river due to nearby activity related to crude oil. The Esi River was deemed unfit for consumption and other domestic uses when compared to established criteria for drinking water. UNEP discovered that the surface water in the creeks contained hydrocarbons and floating layers of oil that varied in thickness from heavy black oil to tiny sheens that were visible in the majority of the creeks during its 2011 research into oil pollution in the Ogoni Community. Ataba-Otokroma recorded the water column's highest concentration of dissolved hydrocarbons at 7,420 mgL⁻¹.

4. CONCLUSION

The research was aimed at accessing the impact of oil spillage on soil, and water in the Niger Delta region, from published literature within the last few decades. Considering the results of the investigation that was conducted:

- 1) It was determined that oil spill occurrence has caused a lot of changes. These changes have been researched and are now known to be detrimental.
- 2) If multinational organizations are adequately supervised during their operational term, our research effort has given birth to hope that the awful and disastrous state of the Niger Delta can be saved and returned to normality.
- 3) The Niger Delta region severely lacks adequate monitoring.

- 4) The government shouldn't give up on the Niger Delta's existing situation since, if money is consistently invested in the remedial cleanup project, the damaged areas would once again become habitable without any negative side effects.

It is time to rebuild the Niger Delta and other Nigerian regions impacted by oil. This will significantly contribute to ending Nigeria's oil production's destructive legacy. The resident's rights of the host communities should come first when considering rehabilitation.

- 1) The problem of violence and conflict needs to be resolved. The impacted regions' security regulations can be strengthened to achieve this. Public protests should be held in opposition to any infringement of human rights committed by multinational corporations.
- 2) The administration should work to reform the judiciary to reduce corruption and disregard for the law. Multinational corporations should make sure locals and residents have the means to protest any type of marginalization. Multinational firms should cease pressuring court officials to uphold their interests to lessen corruption and enable the objective judicial reformation to be accomplished.
- 3) Reducing the amount of hazardous waste and illicit oil exploration in our ecosystem will aid in the rehabilitation of the environment. This also entails bringing charges against the staff members and administrators in charge of approving illegal dumping. Also encouraged should be adherence to DPR cleanup guidelines.
- 4) Protecting crude oil is another strategy for addressing the Niger Delta problem. Multinationals should recognize the necessity to dedicate themselves to conducting research on land treatment technologies as well as technologies for the recovery of natural resources. Multinationals should continue to provide the donors with the proper recompense when and when it is necessary to assist in raising the level of living in the host communities.

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