



BLESSED BY OIL, BURDENED BY POLLUTION: AN ASSESSMENT OF OIL EXPLORATION AND ENVIRONMENTAL DEGRADATION IN IBENO LOCAL GOVERNMENT AREA, AKWA IBOM STATE

¹Etteobong Inieke Uko, ²Chijioke Basil Onuoha, ³Ebong Itoro Bassey

^{1,2,3}Department of Public Administration, University of Uyo, Uyo Akwa Ibom State.

Correspondence: *Itoroebon@uniuyo.edu.ng. ebongitoro951@gmail.com*

Abstract

This study examined the environmental and socio-economic impacts of oil exploration activities in Ibendo Local Government Area (LGA) of Akwa Ibom State, Nigeria, with particular emphasis on oil spillage and gas flaring. The study was guided by two objectives: to examine the effects of oil spillage on soil and water pollution and to assess the contribution of gas flaring to environmental degradation in the study area. The study was anchored on the Resource Curse Theory developed by Auty (1993) and further advanced by Sachs and Warner (1995), which explains how resource-rich regions often experience environmental degradation, weak institutional governance, and socio-economic underdevelopment despite abundant natural resources. A qualitative research design was adopted. Data were collected through in-depth interviews with purposively selected community residents and key informants in Ibendo LGA. The data were analysed using thematic analysis to identify recurring themes and patterns relating to the environmental consequences of petroleum exploration. The findings revealed that oil spillage has severely degraded soil quality, resulting in reduced soil fertility, poor crop yields, and widespread abandonment of agricultural lands. Water bodies were also found to be heavily contaminated by petroleum hydrocarbons, making them unsafe for domestic use while simultaneously reducing aquatic biodiversity and fish populations. Consequently, farming and fishing livelihoods have been seriously affected, leading to declining household incomes, increased poverty, food insecurity, and livelihood displacement. The study further established that gas flaring remains a major source of environmental degradation through persistent air pollution, increased ambient temperatures, climate variability, and deterioration of ecosystem quality. Respondents reported continuous exposure to smoky air, soot deposition, excessive heat, respiratory difficulties, eye irritation, headaches, and skin disorders, particularly among vulnerable groups such as children and the elderly. These findings corroborate existing evidence on the adverse environmental and public health consequences of petroleum exploration.



in the Niger Delta. The study concludes that unless effective environmental governance, strict regulatory enforcement, routine gas flaring elimination, and comprehensive environmental remediation programmes are implemented, environmental degradation and socio-economic vulnerability will continue to undermine sustainable development in Ibeno Local Government Area. Accordingly, the study recommends strengthening environmental regulatory institutions, accelerating investment in gas capture and utilization infrastructure, enforcing prompt oil spill remediation, restoring degraded ecosystems, and expanding public health intervention programmes to improve the well-being and resilience of affected communities.

Keywords: Oil exploration, oil spillage, gas flaring, environmental degradation, soil pollution, water pollution, climate change, sustainable development, Resource Curse and Niger Delta Region.

Introduction

The Niger Delta is one of Africa's major petroleum-producing regions and has remained central to Nigeria's oil industry since the discovery of commercial crude oil at Oloibiri in 1956. Petroleum exploitation has played a major role in the Nigerian economy through its contribution to export earnings, government revenue and national income. However, the economic importance of oil has been accompanied by substantial environmental costs in many host communities, creating a persistent tension between the benefits derived from petroleum production and the ecological consequences experienced at the local level (Agbaeze, Udeh & Onwuka, 2015). The environmental consequences of petroleum activities are particularly evident in the Niger Delta, where oil spills, gas flaring, pipeline leakages, flooding, erosion and other operational hazards have altered terrestrial and aquatic ecosystems. Ugboma (2015) notes that these activities have polluted farmlands, fishponds and other natural resources that sustain rural communities. The significance of this problem lies not merely in physical environmental damage but also in its implications for communities whose livelihoods depend substantially on agriculture, fishing and other natural-resource-based activities. Consequently, environmental degradation can reduce productive capacity, weaken household income and increase dependence on alternative sources of livelihood.

Within this broader regional context, Ibeno Local Government Area of Akwa Ibom State occupies an important position because of its longstanding involvement in petroleum production. The presence of major petroleum operations has exposed several communities to environmental pressures associated with oil exploration and production. Onuoha, Bassey and Ufomba (2018), in their assessment of oil-producing communities in Akwa Ibom State, established a relationship between petroleum exploration and environmental degradation, particularly through oil spills affecting agricultural land and aquatic environments. Their findings indicate that contamination has reduced the productivity of farming and fishing activities in affected communities, thereby placing additional pressure on traditional livelihood systems. The problem is further intensified by gas flaring, which releases combustion products and substantial quantities of heat into the surrounding environment. Ugboma (2015) identifies gas flaring as an important source of atmospheric pollution in oil-producing areas, with implications for air quality, vegetation and human wellbeing. In communities situated close to petroleum installations, prolonged exposure to flare emissions may therefore create environmental conditions that are difficult for residents to avoid. For Ibeno, where petroleum operations occur alongside residential and livelihood activities, the proximity between communities and oil infrastructure makes environmental exposure a particularly important concern.



The environmental consequences of petroleum production also have wider socio-economic implications. Despite the substantial revenues generated from the petroleum sector, many oil-producing communities continue to experience poverty, unemployment, inadequate infrastructure and limited access to essential services. Bello and Nwaeke (2020) argue that environmental degradation, together with weaknesses in the implementation of environmental protection measures, has contributed to deteriorating living conditions and recurrent tensions among host communities, oil companies and government institutions. Thus, the problem is not simply one of pollution but also one involving livelihood security, social wellbeing and environmental justice. The persistence of these conditions raises questions about the effectiveness of Nigeria's environmental regulatory framework. Although various laws and regulatory institutions have been established to control petroleum-related pollution, implementation challenges continue to affect environmental protection in the Niger Delta. Edo, Etemike and Clark (2022) identified weak enforcement capacity, overlapping institutional responsibilities and inadequate monitoring as important barriers to effective environmental regulation. Such limitations can allow pollution to continue or delay appropriate remediation, leaving affected communities to bear the consequences for extended periods.

In Ibeno, these concerns are reflected in the continuing effects of oil spills, gas flaring, pipeline leakages, drilling activities, seismic operations and petroleum-related waste. Contamination of agricultural land can reduce soil productivity and affect crop cultivation, while pollution of rivers, creeks and coastal waters can diminish aquatic resources and disrupt fishing activities. Onuoha, Bassey and Ufomba (2018) similarly documented environmental damage in Ibeno communities, including impacts on farmland and aquatic resources. The degradation of these natural-resource systems is particularly significant because farming and fishing constitute important sources of food and income for many residents. The consequences consequently extend into household welfare. When agricultural production declines and fish catches become less dependable, households may experience reduced income and increased difficulty meeting basic needs. Residents may be compelled to seek alternative occupations, while young people may increasingly depend on petty trading, casual labour, transportation and other informal activities. Such livelihood adjustments may provide temporary income but may not adequately replace the economic value of farming and fishing. Environmental degradation can therefore contribute to broader patterns of economic vulnerability within affected households.

Water pollution represents another important dimension of the problem. Oil spills and pipeline leakages can contaminate rivers, streams and other water sources used by communities for domestic purposes. The deterioration of these resources can increase the difficulty of obtaining suitable water and impose additional economic and social burdens on households. At the same time, damage to mangrove forests and other coastal ecosystems threatens biodiversity and ecological services that support fisheries and provide natural protection to coastal communities. These interconnected effects demonstrate that petroleum-related environmental degradation operates across several dimensions rather than through a single form of pollution. The persistence of environmental problems despite regulatory interventions also has implications for relations between host communities, petroleum companies and government institutions. Where residents perceive inadequate clean-up, delayed remediation or insufficient compensation following pollution incidents, grievances may develop into protests, disputes and broader demands for environmental accountability. The enforcement concerns identified by Edo, Etemike and Clark (2022), alongside the environmental impacts documented by Onuoha, Bassey and Ufomba (2018), suggest that the existence of environmental regulations alone does not necessarily guarantee effective protection for petroleum-producing communities.



It is against this background that the environmental situation in Ibeno Local Government Area requires systematic investigation. Such an assessment can also provide evidence for strengthening environmental management, improving regulatory enforcement and promoting more sustainable relations between petroleum operations and host communities.

Research Objectives

The main objective of this study is to examine the effect of oil exploration activities on environmental degradation in Ibeno Local Government Area of Akwa Ibom State.

The specific objectives are to:

- i. Examine the effect of oil spillage on soil and water pollution in Ibeno Local Government Area.
- ii. Assess the effect of gas flaring on environmental pollution in Ibeno Local Government Area.

Research Questions

- i. What is the effect of oil spillage on soil and water pollution in Ibeno Local Government Area?
- ii. How does gas flaring affect environmental pollution in Ibeno Local Government Area?

Conceptual Framework

1. Oil Exploration

Oil exploration refers to the processes involved in the search, discovery, extraction, production, transportation, and refining of crude oil and natural gas for commercial and economic purposes. It includes activities such as geological surveys, seismic exploration, drilling, pipeline construction, and petroleum distribution. Nwilo and Badejo (2006) describe oil exploration as both onshore and offshore operations that require sophisticated technology and infrastructure capable of significantly altering the natural environment, while Kadafa (2012) views it as a chain of technical activities, from seismic prospecting to crude oil transportation, each with distinct environmental consequences. In Nigeria, particularly in the Niger Delta where commercial oil production began in 1956, oil exploration remains the backbone of the national economy, contributing substantially to government revenue and foreign exchange earnings. Agbaeze, Udeh and Onwuka (2015) observe that although the petroleum sector contributes relatively little to direct employment, it remains the country's most important economic driver. The Niger Delta hosts extensive oil infrastructure, including oil wells, pipelines, flow stations, export terminals, and gas facilities, making it both the centre of petroleum production and the region most affected by environmental degradation (Kadafa, 2012).

Despite its economic benefits, oil exploration has generated significant environmental and socio-economic challenges. Activities such as drilling, seismic blasting, pipeline installation, crude oil transportation, and gas flaring frequently result in environmental pollution. Oil spills arising from pipeline vandalism, sabotage, corrosion, equipment failure, and operational accidents contaminate farmlands, rivers, streams, and groundwater, thereby reducing agricultural productivity and destroying aquatic ecosystems. Akinwumiju, Adelodun and Ogundeji (2020) found that most onshore oil spills in the Niger Delta between 2006 and 2019 resulted from sabotage and pipeline vandalism, while Nwilo and Badejo (2006) and Kadafa (2012) observed that repeated spill incidents have caused extensive ecological damage across affected communities. Gas flaring further compounds environmental degradation by releasing carbon dioxide, methane, sulphur dioxide, and other harmful gases into the atmosphere. Aghalino (2009) attributes the persistence of gas flaring to weak regulatory



enforcement, whereas Ite and Ibok (2013) identify gas flaring as a major contributor to air pollution, acid rain, climate change, vegetation loss, and respiratory illnesses in oil-producing communities.

Oil exploration also contributes to deforestation, destruction of mangrove forests, biodiversity loss, erosion, and degradation of agricultural land. Elum, Mopipi and Henri-Ukoha (2016) argue that these environmental impacts disproportionately affect farming and fishing communities whose livelihoods depend on natural resources. Similarly, Onuoha, Bassey and Ufomba (2018) found that oil exploration in Akwa Ibom State significantly reduced soil fertility and aquatic productivity, forcing many residents to abandon farming and fishing, while Ugboma (2015) attributes declining food production to the combined effects of oil spills, gas flaring, acid rain, and fire outbreaks. Furthermore, oil exploration has intensified conflicts between host communities, oil companies, and government due to environmental pollution, inadequate compensation, unemployment, and perceived neglect. Bello and Nwaeke (2020) argue that unresolved environmental damage and poor implementation of environmental protection laws have fuelled persistent conflicts over environmental justice and resource control. Likewise, Edo, Etemike and Clark (2022) identify weak institutional capacity, overlapping regulatory responsibilities, poor monitoring, and inadequate enforcement as major obstacles to effective environmental governance in the Niger Delta, a situation that reinforces the spill patterns documented by Akinwumiju, Adelodun and Ogundeji (2020). Within the context of this study, oil exploration refers to all petroleum extraction and production activities in Ibeno Local Government Area, particularly oil spillage and gas flaring, which, as established by Nwilo and Badejo (2006), Aghalino (2009), Ite and Ibok (2013), and Onuoha, Bassey and Ufomba (2018), contribute significantly to soil degradation, water pollution, air pollution, and overall environmental degradation in the area.

Concept of Environmental Degradation

Environmental degradation refers to the deterioration of the natural environment caused by human activities and natural processes that deplete natural resources, pollute air, water, and soil, destroy ecosystems, and reduce biodiversity, ultimately impairing the environment's capacity to recover and sustain human life. Ajibade and Awomuti (2009) describe environmental degradation in the Niger Delta as a consequence of intensive resource exploitation that has displaced farmers and fishermen from their traditional livelihoods, while Eyinla and Ukpo (2006) argue that extractive industries prioritize economic gains over ecological sustainability, resulting in gas flaring, acid rain, increased acidity of soils and water bodies, damage to buildings, and widespread ecological deterioration without adequate environmental restoration. In oil-producing regions, environmental degradation is closely linked to petroleum exploration activities such as oil spills, gas flaring, seismic surveys, drilling operations, pipeline construction, and waste discharge. Aghalino (2009) observes that decades of oil exploration have severely contaminated land and water resources in the Niger Delta because of weak environmental regulation, while Nwilo and Badejo (2006) report that repeated oil spill incidents have damaged agricultural land and aquatic ecosystems, thereby reducing community productivity. Similarly, Nriagu et al. (2016) identify chronic pollution from oil production, ageing infrastructure, oil theft, and pipeline vandalism as major factors that have made the Niger Delta one of the world's most environmentally degraded regions, exposing residents to elevated levels of pollution, emotional distress, and disease.

Gas flaring further intensifies environmental degradation by releasing greenhouse gases and toxic pollutants into the atmosphere. Ite and Ibok (2013) demonstrate that gas flaring contributes significantly to air pollution, acid rain, climate change, and respiratory illnesses, while Aghalino



(2009) attributes its persistence to weak regulatory enforcement. The heat generated by gas flaring also reduces soil moisture, damages vegetation, and lowers agricultural productivity, reinforcing the acid-rain and soil-acidification effects documented by Eyinla and Ukpo (2006). Environmental degradation also has serious health and socio-economic consequences. Pollution of water bodies increases the incidence of waterborne diseases such as cholera, dysentery, and typhoid, while air pollution from gas flaring contributes to respiratory illnesses, eye irritation, and cardiovascular complications, as documented by Nriagu et al. (2016) and Ite and Ibok (2013). Likewise, the United Nations Environment Programme (UNEP, 2011) reported that prolonged exposure to oil-contaminated soil, sediment, and groundwater significantly increases health risks and reduces the quality of life in affected Niger Delta communities.

Beyond health impacts, environmental degradation contributes to poverty, unemployment, food insecurity, and social instability. As farmland becomes degraded and fishing waters polluted, many households lose their primary means of livelihood, resulting in economic hardship and displacement, as noted by Ajibade and Awomuti (2009). Bello and Nwaeke (2020) further argue that unresolved environmental damage and weak implementation of environmental regulations have intensified conflicts between host communities and oil companies. Frynas (2000) similarly attributes the persistence of environmental degradation to weak environmental governance, inadequate oil spill response, poor regulatory enforcement, and insufficient remediation, a conclusion reinforced by the findings of UNEP (2011) on the slow pace of environmental restoration in Ogoniland. Within the context of this study, environmental degradation refers specifically to the pollution and destruction of water bodies and deterioration of air quality in Ibeno Local Government Area resulting from oil spillage and gas flaring associated with oil exploration activities.

Oil Exploration and Environmental Degradation in Nigeria's Niger Delta: Akwa Ibom State Perspective (The Nexus)

The relationship between oil exploration and environmental degradation remains a major concern in environmental management and development studies. Although petroleum exploitation contributes substantially to Nigeria's government revenue, foreign exchange earnings, employment, infrastructure, and industrial development, its environmental costs are particularly severe in the Niger Delta, which produces virtually all of Nigeria's crude oil but continues to experience ecological degradation, biodiversity loss, declining livelihoods, and persistent poverty (Federal Government of Nigeria, 2021; World Bank, 2022; Nigerian Upstream Petroleum Regulatory Commission [NUPRC], 2024). Ibeno Local Government Area illustrates this contradiction because of its concentration of offshore and onshore petroleum facilities and its extensive coastal, wetland, mangrove, and fishing environments (Ite et al., 2013; Akpan, 2014). Scholarly perspectives differ on the extent to which petroleum production itself is responsible for environmental degradation. Supporters of the industry emphasise its contribution to national development and argue that pollution is also associated with pipeline vandalism, crude oil theft, inadequate environmental management, weak governance, and limited investment in cleaner technologies (Federal Government of Nigeria, 2021; World Bank, 2022; NUPRC, 2024; IEA, 2023). Conversely, extensive evidence links petroleum operations directly to oil spills, gas flaring, drilling wastes, produced-water discharge, pipeline leakages, and inadequate remediation, with consequences for agriculture, fisheries, livelihoods, and poverty (UNEP, 2011; Ite et al., 2013; Kadafa, 2012; Amnesty International, 2018; Watts, 2008; Obi, 2010). In Ibeno, these pressures are compounded by the presence of petroleum infrastructure alongside sensitive ecosystems and fishing settlements. NOSDRA (2023) identifies equipment failure, corrosion, operational



accidents, sabotage, and illegal pipeline connections among the causes of oil spills, while Amnesty International (2018) and the Bayelsa State Oil and Environmental Commission (2023) emphasise ageing infrastructure and inadequate maintenance.

Different stages of oil exploration and production generate distinct environmental pressures. Seismic surveys can disturb wetlands, soils, aquatic organisms, and wildlife habitats, while drilling activities produce wastes containing hydrocarbons, heavy metals, salts, chemicals, and other potentially hazardous substances (Ite et al., 2013; FAO, 2020; International Finance Corporation, 2017). Research has identified elevated concentrations of lead, cadmium, chromium, nickel, and total petroleum hydrocarbons in soils and surface waters around oil-producing communities (Ite et al., 2013; Nriagu et al., 2016). Oil spills are particularly damaging because crude oil contaminates farmlands, rivers, estuaries, wetlands, beaches, and mangroves, while petroleum residues can persist in sediments for extended periods and delay ecological recovery (UNEP, 2011; Bayelsa State Oil and Environmental Commission, 2023). The consequences are especially significant for fishing and agriculture. Petroleum contamination can destroy aquatic habitats and spawning grounds, disrupt food chains, reduce fish abundance, and increase the operating difficulties and economic vulnerability of fishing households (Ite et al., 2013; Akpan, 2014; National Bureau of Statistics, 2023). Agricultural productivity is similarly affected because oil contamination can alter soil pH, reduce microbial activity, impair aeration and water infiltration, deplete nutrients, and introduce heavy metals into agricultural systems, thereby reducing yields and household income (FAO, 2020; UNEP, 2011).

Gas flaring constitutes another important environmental pathway. Despite efforts to reduce routine flaring through gas-commercialisation initiatives, Nigeria remains among the world's major gas-flaring countries (World Bank Global Gas Flaring Reduction Partnership, 2024). Flaring releases carbon dioxide, methane, sulphur dioxide, nitrogen oxides, volatile organic compounds, and particulate matter, contributing to climate change, acid deposition, air pollution, excessive heat, vegetation damage, soot deposition, corrosion, and respiratory problems (IPCC, 2023; WHO, 2021). Although technological improvements in gas utilisation, leak detection, pipeline monitoring, satellite surveillance, and environmental reporting have strengthened pollution control (IEA, 2023; NUPRC, 2024), persistent weaknesses in spill response, remediation, compensation, and clean-up continue to sustain legacy pollution in affected communities (Amnesty International, 2018; Bayelsa State Oil and Environmental Commission, 2023). Environmental degradation also creates significant health concerns because residents may encounter petroleum-related pollutants through contaminated air, water, seafood, soil, and agricultural products. The World Health Organization (2021) associates exposure to particulate matter and hydrocarbon pollutants with respiratory and cardiovascular diseases, adverse pregnancy outcomes, and premature mortality, while UNEP (2011) highlights the risks associated with prolonged exposure to petroleum-contaminated groundwater. Although location-specific epidemiological evidence for Ibeno remains limited, environmental studies across the Niger Delta indicate heightened health vulnerabilities among populations living close to petroleum facilities (Ite et al., 2013).

The causes of oil pollution remain contested. While industry and regulatory sources attribute many recent spills to sabotage, crude oil theft, and illegal refining (NUPRC, 2024), other assessments emphasise ageing infrastructure, inadequate maintenance, insufficient pipeline replacement, weak surveillance, and delayed emergency response (Amnesty International, 2018; Bayelsa State Oil and Environmental Commission, 2023). This suggests that environmental degradation in the Niger Delta is produced by an interaction of operational, technological, institutional, governance, and criminal



factors rather than by a single source. Ultimately, the persistence of environmental degradation cannot be explained solely by the absence of environmental laws. Nigeria has established important regulatory instruments, including the Petroleum Industry Act 2021, the National Oil Spill Detection and Response Agency Act, and the National Environmental Standards and Regulations Enforcement Agency Act. However, weak institutional capacity, overlapping mandates, inadequate funding, political interference, prolonged litigation, and limited enforcement continue to constrain effective environmental governance (UNEP, 2011; World Bank, 2022; Bayelsa State Oil and Environmental Commission, 2023). The Ibeno case therefore demonstrates the need to examine not only the environmental effects of oil exploration but also the institutional and governance conditions that determine how effectively those impacts are prevented, managed, and remediated.

Empirical Review

Ite, Ibok, Ite, and Petters (2013) reviewed empirical evidence on petroleum exploration and production in the Niger Delta using scientific studies, environmental monitoring reports, and government publications. The study established that oil spills, gas flaring, drilling operations, and produced-water discharge have contributed to soil degradation, groundwater contamination, mangrove destruction, and biodiversity loss. The findings demonstrate the extensive environmental effects associated with petroleum operations in the region. UNEP (2011), through its environmental assessment of Ogoniland, employed environmental sampling, laboratory analysis, groundwater investigations, soil testing, vegetation assessment, and community consultations. The assessment found extensive contamination of soil, groundwater, wetlands, and surface water. It further established that inadequate spill response and weaknesses in environmental management had prolonged ecological damage and delayed ecosystem recovery.

Nriagu, Udofia, Ekong, and Ebuk (2016) investigated environmental health conditions associated with petroleum pollution in the Niger Delta. Their findings indicated that exposure to petroleum hydrocarbons and heavy metals was associated with respiratory problems, skin disorders, and other pollution-related health conditions. The study demonstrated that environmental contamination from petroleum activities constitutes not only an ecological concern but also a public health challenge for affected populations. Okonkwo, Kumar, and Taylor (2015) examined the ecological effects of petroleum pollution in the Niger Delta and found that contamination contributed to mangrove degradation, biodiversity loss, deterioration of agricultural land, disruption of fisheries, and threats to food security. Their findings indicate that damage to natural ecosystems can directly affect communities whose livelihoods depend on agriculture and aquatic resources.

Amnesty International (2018) examined oil pollution and spill management in the Niger Delta and found that delayed responses, inadequate clean-up, and insufficient remediation contributed to the persistence of environmental contamination in affected communities. The study also identified weaknesses in corporate and regulatory responses to pollution incidents, demonstrating how ineffective spill management can prolong ecological and livelihood consequences. Kadafa (2012) examined the causes of oil spills in the Niger Delta and identified pipeline corrosion, equipment malfunction, operational failures, sabotage, and illegal bunkering among the major contributing factors. The study established that the persistence of these factors increases the frequency of pollution incidents and complicates efforts to protect communities and ecosystems within oil-producing areas.

The World Health Organization (2021) examined the health implications of exposure to major air pollutants, including particulate matter, sulphur dioxide, nitrogen oxides, and carbon monoxide. The findings established associations between prolonged exposure and respiratory and cardiovascular



diseases as well as premature mortality. These findings provide an important basis for assessing potential health implications of air pollution in communities located near petroleum production activities. The International Energy Agency (2023) assessed strategies for reducing emissions from petroleum operations and identified methane-reduction technologies, leak detection, gas-capture infrastructure, and improved environmental monitoring as important measures for controlling petroleum-related emissions. The study demonstrates that technological interventions, when combined with effective regulation and monitoring, can reduce the environmental footprint of oil and gas production.

Chijioke, Onuoha, Ebong, Bassey, and Ufomba (2018) empirically examined the relationship between oil exploration and environmental degradation in six oil-producing communities in Akwa Ibom State using secondary data. The study found a significant relationship between petroleum exploration and environmental degradation, particularly through oil spills and gas flaring. These activities were associated with soil infertility, declining farming and fishing activities, health risks, reduced livelihood opportunities, and the abandonment of traditional economic activities. The study further identified ineffective implementation of environmental regulations as a factor limiting environmental protection in oil-producing communities.

Collectively, these empirical studies establish that petroleum exploration is associated with interconnected environmental, ecological, health, and livelihood consequences. However, much of the existing evidence examines the Niger Delta or multiple oil-producing communities collectively. The present study therefore narrows the empirical focus to Ibeno Local Government Area to examine how oil exploration activities are currently manifested in the local environment and how their consequences are experienced by different livelihood groups.

Research Gap

Existing studies have established the environmental consequences of petroleum exploration in the Niger Delta, including oil spills, gas flaring, soil and water contamination, biodiversity loss, declining fisheries, agricultural degradation, and associated health and livelihood problems (Ite et al., 2013; UNEP, 2011; Nriagu et al., 2016; Okonkwo et al., 2015). Other studies have highlighted inadequate spill response, ageing infrastructure, weak remediation, regulatory challenges, air pollution, climate impacts, and available technologies for reducing petroleum-related emissions (Kadafa, 2012; Amnesty International, 2018; WHO, 2021; Bayelsa State Oil and Environmental Commission, 2023; World Bank, 2024; IEA, 2023). Despite this extensive literature, a contextual and empirical gap remains. Much of the existing evidence examines the Niger Delta broadly or focuses on locations such as Ogoniland, with Ibeno often considered within the wider regional experience. Consequently, limited contemporary research provides an integrated assessment of how oil exploration affects soil, water, fisheries, agriculture, air quality, and household livelihoods specifically in Ibeno Local Government Area.

A further gap concerns the experiences of affected residents. While previous studies have relied considerably on environmental assessments, scientific measurements, institutional reports, and secondary data (UNEP, 2011; Ite et al., 2013; World Bank, 2024), less attention has been given to how farmers, fishermen, community leaders, and youths experience and interpret these environmental changes. This study addresses these gaps by providing a contemporary, location-specific assessment that connects environmental degradation with livelihood and wellbeing outcomes in Ibeno. Its contribution is therefore to show not simply that petroleum exploration causes environmental damage,



but how such damage is currently experienced across different livelihood groups and how it translates into socio-economic challenges within the study area.

Theoretical Framework

This study is anchored on the Resource Curse Theory, developed by Auty (1993) and expanded by Sachs and Warner (1995, 2001), which explains why resource-rich countries often experience slower economic growth, institutional weakness, environmental degradation, and persistent poverty despite abundant natural resources. Auty (1993) argues that dependence on extractive industries distorts economic structures by neglecting productive sectors such as agriculture and manufacturing, while Sachs and Warner (1995, 2001) empirically demonstrated that resource-dependent economies generally record slower long-term growth because of weak institutions, governance failures, and inefficient resource allocation. In the Niger Delta, the theory explains the contradiction between substantial petroleum wealth and persistent environmental degradation, unemployment, poverty, and underdevelopment (Obi, 2010; UNEP, 2011; Ite et al., 2013).

The theory is particularly applicable to Ibeno Local Government Area, where oil exploration contributes significantly to Nigeria's economy while local communities continue to experience declining agricultural productivity, reduced fish catches, environmental degradation, and livelihood insecurity due to delayed remediation, ageing infrastructure, inadequate environmental governance, and weak regulatory enforcement (UNEP, 2011; Amnesty International, 2018; Bayelsa State Oil and Environmental Commission, 2023). It also explains the unequal distribution of petroleum benefits, whereby economic gains accrue mainly to the federal government and multinational oil companies while host communities bear the environmental costs, thereby fuelling social conflict and demands for environmental justice (Obi, 2010; Frynas, 2000). Despite Nigeria's extensive environmental regulatory framework, including the Petroleum Industry Act (2021), environmental degradation persists because implementation remains constrained by weak institutional capacity, inadequate monitoring, overlapping regulatory mandates, and poor enforcement (UNEP, 2011; World Bank, 2022; Bayelsa State Oil and Environmental Commission, 2023).

Research Methodology

This study adopted a descriptive survey research design to examine the effects of oil exploration on environmental degradation in Ibeno Local Government Area of Akwa Ibom State. The design was considered appropriate because it enabled the researcher to investigate existing environmental conditions and document the experiences and perceptions of residents affected by petroleum activities without manipulating the study variables. Ibeno Local Government Area was purposively selected because of its long-standing exposure to oil exploration, oil spills, gas flaring, water and air pollution, ecosystem degradation, and associated livelihood challenges. The study population comprised adult residents whose livelihoods or living conditions were directly or indirectly affected by oil exploration, particularly farmers, fishermen, community leaders, and youth representatives. A total sample of 20 participants was purposively selected, comprising 4 farmers, 4 fishermen, 3 community leaders, and 3 youth representatives, 2 community health workers, 2 Artisan, 2 civil servant. The participants consisted of 11 males and 9 females, aged between 18 and 65 years. Selection was based on clearly defined criteria: participants had to be at least 18 years old, have lived in Ibeno for a minimum of five years, possess direct experience of or knowledge about environmental changes associated with oil exploration, and be willing to participate in the study. Farmers and fishermen were selected based on their active or previous involvement in farming and fishing within the area; community leaders were selected based on their recognized leadership positions and knowledge of community environmental



conditions; while youth representatives were selected based on their familiarity with youth livelihood and environmental concerns. Individuals who had not lived in the area for the required period or lacked relevant knowledge of the issues under investigation were excluded.

Primary data were collected through in-depth semi-structured interviews with the 20 selected participants. The interviews focused on experiences relating to oil spills, gas flaring, water and air pollution, vegetation and aquatic ecosystem degradation, effects on farming and fishing, health conditions, livelihood changes, and perceived responses of government and oil companies. The interviews were conducted at locations convenient and acceptable to the participants, with each interview lasting approximately 20 minutes. With participants' consent, the interviews were audio-recorded and supplemented with field notes; where a participant declined recording, detailed notes were taken. Secondary data were obtained from peer-reviewed journal articles, textbooks, government publications, policy documents, conference papers, and reports from relevant institutions, including the United Nations Environment Programme (UNEP) and the National Oil Spill Detection and Response Agency (NOSDRA). These sources provided documentary evidence for contextualising and corroborating the primary findings.

The interview data were analyzed manually using qualitative thematic analysis; no computer-assisted qualitative data analysis software such as NVivo was used. Analysis involved transcription, repeated reading of the interview materials, identification of significant statements, coding, categorization, and development of themes and sub-themes. The coding process combined deductive and inductive approaches. Deductive codes were derived from the study objectives and interview questions and included oil spillage, gas flaring, water pollution, air pollution, temperature increase, climate stress, ecosystem degradation, effects on farming and fishing, health challenges, livelihood disruption, and socio-economic consequences. Inductive codes were added where new issues emerged from participants' accounts. Related codes were subsequently grouped into broader themes, and responses were compared across farmers, fishermen, community leaders, and youth representatives to identify commonalities and differences. The credibility of the findings was enhanced through triangulation of responses across participant groups and comparison of interview evidence with relevant scholarly and institutional sources. Field notes were also used alongside interview transcripts to retain contextual information and clarify participants' accounts. Ethical considerations were observed throughout the study by explaining the purpose of the research to participants, obtaining informed consent, ensuring confidentiality and anonymity, and informing participants of their voluntary participation and right to decline any question or withdraw from the study at any stage.

Data Analyses

Developed Themes for qualitative analysis with the aid of Interview discussion

The qualitative analysis of this study will be based on interview responses guided by the research questions on oil spillage and gas flaring in Ibeno Local Government Area. The interview data will be analyzed thematically by developing key themes and sub-themes in line with the research objectives. For oil spillage, the themes will focus on soil degradation, water contamination, fishing and agricultural activities, and livelihood disruption, while gas flaring will cover air pollution, excessive heat, climate and environmental changes, vegetation damage, and health impacts. This thematic approach will provide a clear understanding of the environmental and socio-economic effects of oil exploration activities on residents of Ibeno LGA.



Evaluation of research question one: What is the effect of oil spillage on soil and water pollution in Ibeno Local Government Area?

To evaluate the research questions raised in this study, interview sections were organized and several sub-themes were developed in line with the specific research objectives to guide the discussion and ensure a structured interpretation of findings. These sub-themes were drawn directly from the major issues emerging from respondents' experiences and were used to organize the qualitative data into clear and meaningful patterns. This approach made it possible to examine the effects of oil exploration activities in Ibeno Local Government Area in a systematic manner, focusing on both environmental and socio-economic dimensions. The sub-themes helped to break down complex environmental issues such as oil spillage and gas flaring into more specific areas of analysis. For instance, under oil spillage, attention was given to soil degradation, water contamination, impacts on fishing activities, and livelihood disruption. Similarly, under gas flaring, sub-themes were developed around air pollution, temperature increase, climate variability, and health-related impacts. Each of these sub-themes reflects a key aspect of environmental change experienced by residents in the study area.

By organizing the data into these thematic categories, the study was able to closely align the analysis with the research objectives. It also allowed for a clearer interpretation of how oil exploration activities contribute to environmental degradation in Ibeno. Furthermore, this thematic structure ensured that respondents' views were not analyzed in isolation but were instead connected to broader environmental and developmental issues affecting the Niger Delta region.

Theme 1: Effects of Oil Spillage on Soil and Water Pollution in Ibeno LGA

Interview Responses on Oil Spillage, Farmland Degradation and Agricultural Productivity in Ibeno LGA.

Interview Respondent – Female Farmer, 37 years old:

“My concern is mainly about the declining harvests we now experience. Farmers put considerable effort into clearing, planting and maintaining their farms, but the final yields are often disappointing. The condition of the soil appears to be one of the reasons for this problem. When harvests become poor repeatedly, farmers cannot recover their expenses and families have less food and income. This has made agricultural activities less attractive and has created uncertainty for people who depend on regular farm production” (Farmer, Field Interview, 2026).

This respondent focused on the economic consequences of declining agricultural yields. The farmer explained that reduced productivity makes it increasingly difficult for farmers to recover production costs. Repeated poor harvests therefore affect both household food availability and income while reducing the attractiveness of farming as a livelihood.

Interview Respondent – Male Farmer, 54 years old:

“Oil spills have changed the way we use farmland around here. Some areas that were once reliable for cultivating crops are now covered with crude oil after contamination occurs. Crops planted on such land may not develop properly, and farmers can lose their investment. What worries us most is when the affected areas remain untreated for a long period. Without prompt intervention, the soil continues to lose its usefulness, while farmers are forced to search for alternative land or livelihoods” (Farmer, Field Interview, 2026).



The respondent emphasized the prolonged effects of contaminated farmland. According to the farmer, untreated polluted areas remain difficult to cultivate and may result in financial losses for farmers who invest in seeds, labour and other inputs. The participant explained that prolonged contamination can force households to search for alternative land or sources of livelihood.

Interview Respondent – Female Farmer, 42 years old:

“What we need most after an oil spill is a quick and effective response. Farmers cannot wait for years before contaminated land is examined and restored because agricultural activities depend on the availability of productive soil. When remediation is delayed, farmers lose planting seasons and household earnings. The longer the pollution remains, the greater the difficulty of returning the land to normal use. Government and oil companies should therefore treat clean-up and restoration as urgent responsibilities” (Farmer, Field Interview, 2026).

The farmer identified delayed remediation as a major concern. According to the respondent, failure to restore contaminated farmland promptly results in lost planting seasons and reduced household earnings. The participant therefore called for faster assessment, clean-up and restoration of polluted agricultural areas.

Interview Respondent – Female Farmer, 65 years old:

“From what I have observed, oil spills change the physical condition of farmland. Some affected portions become dark, oily and difficult to work on, making normal cultivation almost impossible. Farmers who attempt to plant on such land often experience poor crop development or complete crop failure. As a result, the quantity of land available for farming has gradually reduced in some areas. This situation is affecting agricultural productivity and creating additional pressure on households that depend on farming” (Community Leader, Field Interview, 2026).

The community leader described the visible physical transformation of contaminated farmland. According to the respondent, oil-affected portions can become difficult to cultivate, effectively reducing the amount of productive land available to farmers. The participant noted that this reduction in usable farmland places additional economic pressure on households dependent on agriculture.

Interview Respondent – Male Community Leader, 63 years old:

“Oil spillage has become a serious environmental concern because its effects remain after the initial incident. When contaminated areas are not properly cleaned, the damage extends to vegetation, farmland and surrounding ecosystems. Some affected locations remain unusable for agricultural purposes for considerable periods. The major issue is therefore not simply the occurrence of spills but also the response that follows them. Government agencies and oil companies need to ensure that polluted areas are properly assessed, cleaned and restored” (Community Leader, Field Interview, 2026).

The respondent emphasized that the consequences of oil spills can extend beyond the initial contamination event. According to the community leader, inadequate clean-up allows damage to persist across farmland, vegetation and surrounding ecosystems. The participant therefore stressed the importance of proper environmental assessment, remediation and restoration following oil spills.

Interview Respondent – Male Fisherman, 48 years old:

“The effects of oil pollution are not limited to farmland because our rivers and creeks are also affected. When crude oil enters the water, fish and other aquatic resources become less



available. Fishermen may have to travel farther from their communities to obtain reasonable catches, which increases the cost and difficulty of fishing. Some people have even stopped fishing because their catches are no longer sufficient. Therefore, water contamination has directly affected our traditional occupation and household income” (Fisherman, Field Interview, 2026).

The fisherman explained that oil pollution produces interconnected effects across both land and water resources. According to the respondent, contamination of rivers and creeks reduces the availability of aquatic resources and forces fishermen to travel farther in search of productive fishing grounds. The resulting increase in fishing costs and declining catches have negatively affected household income and the sustainability of traditional fishing activities.

Interview Respondent – Female Youth Representative, 31 years old:

“Many young people are beginning to lose interest in farming because some productive farmlands have been affected by oil spills. When land becomes difficult to cultivate, young farmers look elsewhere for opportunities. Some engage in petty trading, casual labour or other temporary activities to survive. This reduces the contribution of agriculture to youth employment in the community. If productive farmland continues to disappear, young people may become increasingly dependent on uncertain sources of income rather than sustainable agricultural enterprises” (Youth Representative, Field Interview, 2026).

The youth representative explained that farmland degradation is also influencing the occupational choices of young people. According to the respondent, declining access to productive farmland has encouraged youths to move into petty trading, casual labour and other temporary activities. The participant expressed concern that continued loss of agricultural land could weaken agriculture as a source of sustainable youth employment.

Interview Respondent – Female Community Health Worker, 45 years old:

“The contamination of agricultural land has consequences for household welfare because many families depend on farming for food and income. When farmers reduce cultivation or abandon polluted plots, household earnings can decline and access to food may become more difficult. Some families then have to depend on other occupations to meet their needs. In my observation, the effects of oil pollution therefore extend beyond the environment and can contribute to economic hardship among households in affected communities” (Community Health Worker, Field Interview, 2026).

The community health worker explained that farmland contamination can have indirect consequences for household welfare. According to the respondent, reduced agricultural production may affect both food availability and household income, forcing families to seek alternative occupations. The participant therefore viewed oil pollution as an issue with environmental, economic and household welfare implications.

Interview Respondent – Male Community Development Leader, 59 years old:

“The persistence of polluted farmland raises questions about environmental responsibility and accountability. Communities expect oil companies and relevant government institutions to respond promptly whenever contamination occurs. Where affected sites are left unattended, farmers suffer losses while the environmental damage becomes more difficult to reverse. Proper monitoring, transparent assessment and effective remediation are necessary to restore



productive land. Without stronger enforcement and sustained attention to affected communities, oil pollution may continue to undermine agriculture, food security and rural development in Ibendo” (Community Development Leader, Field Interview, 2026).

The community development leader emphasized the institutional dimension of farmland degradation. According to the respondent, effective environmental management requires timely intervention, transparent assessment, proper monitoring and sustained remediation. The participant further argued that weak enforcement and inadequate attention to affected communities could allow oil pollution to continue undermining agricultural production, food security and rural development.

The interview accounts are consistent with the broader literature on Niger Delta and its environment. Elum et al. (2016) maintained that petroleum-related environmental degradation weakens livelihood sustainability through declining household income, unemployment, and increasing rural poverty. The United Nations Development Programme (2006) also associated environmental degradation in the Niger Delta with food insecurity, unemployment, and deteriorating living conditions despite the region's substantial petroleum wealth. The degradation of agricultural soils is therefore one of the most direct consequences of oil spillage in Ibendo. When crude oil penetrates the soil, it can coat soil particles, restrict aeration and water movement, interfere with nutrient cycling, and reduce the activity of microorganisms essential for maintaining soil fertility. These processes can negatively affect seed germination, crop development, and eventual yields. Nriagu et al. (2016) reported that petroleum-contaminated environments may contain toxic hydrocarbons and heavy metals capable of affecting plant growth, nutrient uptake, agricultural productivity, and human health. Similarly, Okonkwo et al. (2015) observed that environmental degradation of wetlands and agricultural land in oil-producing communities has reduced their capacity to support food production. The interview findings from Ibendo therefore reveal that oil spillage has both environmental and socio-economic consequences. Its effects are evident in the deterioration of agricultural land, contamination of water resources, reduction in fishing and farming activities, declining household livelihoods, and increasing pressure on residents to seek alternative economic opportunities. The qualitative evidence consequently reinforces the view that oil exploration-related pollution in Ibendo is not merely an environmental problem but also a livelihood, food-security, and rural-development challenge.

Sub-theme 1.2: Water Pollution and Contamination of Drinking Sources

Interview Responses on Oil Pollution, Water Contamination and Its Effects on Aquatic Resources in Ibendo LGA

Interview Respondent – Male Fish Farmer, 47 years old:

The fish farmer explained that petroleum contamination has changed the quality of nearby creeks used for fish production and household activities. According to the respondent, oil entering the water often produces visible discoloration and unpleasant odours, raising concerns about domestic use. The participant further noted that polluted water affects fish health and survival, making aquaculture management more difficult. Reduced fish stocks have also increased concerns about maintaining production and protecting household income (Fish Farmer, Field Interview, 2026).

The respondent's account demonstrates that water contamination affects both aquaculture production and household welfare. The fish farmer particularly emphasized the difficulty of maintaining healthy fish stocks when the quality of the surrounding water deteriorates. This suggests that petroleum



pollution may create livelihood challenges for fish farmers in addition to its broader environmental effects.

Interview Respondent – Male Fisherman, 53 years old:

The fisherman stated that oil pollution has made fishing less dependable than in the past. The respondent observed that fish catches decline after spill incidents, while dead aquatic animals may occasionally be noticed around affected waterways. According to the participant, these changes directly threaten fishermen who depend on regular catches for their livelihood. Reduced fish availability means longer fishing periods, higher operating expenses and smaller earnings, making it increasingly difficult to meet household financial responsibilities (Fisherman, Field Interview, 2026).

The respondent emphasized the economic consequences of declining aquatic resources. Rather than focusing only on the appearance of polluted water, the fisherman highlighted how reduced fish availability increases the time and cost required to obtain catches. The resulting reduction in earnings makes fishing less reliable as a source of household income.

Interview Respondent – Male Fisherman, 50 years old:

The fisherman explained that deteriorating water quality has forced many households to reconsider their dependence on nearby streams. According to the respondent, residents increasingly seek alternative sources for drinking, cooking and other domestic purposes when oil contamination occurs. The participant noted that obtaining water elsewhere creates additional expenses and inconvenience, especially for poorer families. From the fisherman's perspective, pollution has therefore created both an environmental problem and a financial burden for households that previously relied on local waterways (Fisherman, Field Interview, 2026).

This response highlights the household economic burden associated with water contamination. The respondent explained that when local water sources become unsuitable or are perceived as unsafe, households must obtain water from alternative sources. This creates additional costs and inconvenience, particularly for families with limited financial resources.

Interview Respondent – Female Farmer, 44 years old:

The farmer reported that oil spills have noticeably changed the appearance and condition of rivers and streams around the community. According to the respondent, crude oil sometimes spreads across the water surface, leaving dark patches and producing an offensive smell. The participant explained that these conditions discourage residents from approaching affected waterways for domestic activities. In the farmer's view, repeated contamination has reduced confidence in local water resources and increased concerns about environmental cleanliness and safety (Farmer, Field Interview, 2026).

The farmer's account emphasizes the visible and sensory characteristics of water contamination. Changes in water colour, surface appearance and odour have influenced residents' perception of the safety and cleanliness of local waterways. The respondent therefore linked repeated oil pollution with declining community confidence in traditional water sources.

Interview Respondent – Male Community Leader, 60 years old:

The community leader maintained that oil pollution has affected the aquatic environment and weakened fishing activities within the area. According to the respondent, fish deaths are



sometimes noticed after spill incidents, while fishermen increasingly report difficulty obtaining adequate catches. The participant explained that changes in water quality may make the environment less suitable for aquatic organisms. In the leader's opinion, continued contamination threatens both biodiversity and the economic activities of residents who depend on fishing (Community Leader, Field Interview, 2026).

The community leader emphasized the ecological and economic dimensions of water pollution. According to the respondent, deterioration in water quality may affect aquatic organisms and reduce the productivity of fishing grounds. The participant therefore viewed persistent contamination as a threat to both aquatic biodiversity and the livelihoods of fishing-dependent households.

Interview Respondent – Female Community Youth Leader, 28 years old:

The community youth leader explained that oil pollution has created serious concerns about the safety of local water sources. According to the respondent, streams and creeks may become dark, oily and unpleasant following contamination, discouraging residents from using them as before. The participant noted that community members now question the suitability of such water for household purposes. The respondent further expressed concern that continued exposure to contaminated water could create health risks for residents, particularly children (Community Youth Leader, Field Interview, 2026).

The respondent focused on community concerns about water safety and potential health implications. The participant explained that visible contamination has reduced residents' willingness to use affected streams and creeks for domestic purposes. Particular concern was expressed about children, who may be more vulnerable to environmental exposure.

Interview Respondent – Male Youth Representative, 30 years old:

The youth representative observed that residents have become increasingly concerned about visible changes in the quality of community water sources. According to the respondent, some streams appear less clear following oil spill incidents, with noticeable changes in colour and general condition. The participant explained that these changes have generated uncertainty about whether the water remains appropriate for drinking, cooking, washing and other domestic activities. The respondent therefore viewed water contamination as an increasing community welfare concern (Youth Representative, Field Interview, 2026).

The youth representative's account further demonstrates how water pollution has created uncertainty about the suitability of traditional water sources for everyday household activities. The respondent emphasized that visible changes in water quality influence residents' decisions about whether to continue using affected streams and creeks.

The above claims are broadly consistent with evidence that petroleum pollution can produce visible and chemical changes in water and can affect aquatic ecosystems (UNEP, 2011; Ite et al., 2013). The reported search for alternative water sources also corresponds with concerns about water insecurity in oil-producing communities (United Nations Development Programme, 2006). Although the interview responses represent participants' perceptions and experiences rather than laboratory measurements, their consistency across respondents provides qualitative evidence of perceived deterioration in water resources in the study area. Similar observations were reported by the United Nations Development Programme (2006), which found that prolonged petroleum contamination has reduced access to potable water across the Niger Delta, compelling many households to purchase sachet water or rely on untreated groundwater at additional financial and health costs. Contaminated



water also poses significant public health risks. According to the World Health Organization (2021), polluted drinking water is an important pathway for the transmission of diarrhoeal diseases, gastrointestinal infections, and other environmentally related illnesses, while Nriagu et al. (2016) reported that prolonged exposure to petroleum-contaminated water is associated with respiratory disorders, skin irritation, gastrointestinal diseases, and other chronic health conditions among residents of oil-producing communities. These health risks are particularly severe in rural communities such as Ibeno, where access to treated municipal water remains limited.

Sub-theme 1.3: Effects of Oil Spillage on Fishing and Aquatic Life in Ibeno Local Government Area

Interview Responses on the Effects of Oil Pollution on Fishing, Aquatic Resources and Fishing-Dependent Livelihoods in Ibeno LGA

Interview Respondent – Male Fisherman, 51 years old:

In response to the above raised question, a respondent, a Fisherman maintained that:

“Fishing has become more difficult because oil spills have affected many of the creeks and fishing areas where we normally operate. When crude oil enters the water, the fish seem to move away, and the quantity we catch is no longer what it used to be. Some fishing grounds that were productive in the past are now difficult to use. This has reduced my income because fishing is my main source of livelihood” (Fisherman, Field Interview, 2026).

The fisherman explained that oil pollution has reduced the productivity of traditional fishing grounds. According to the respondent, fishermen now spend longer periods on rivers and creeks before obtaining smaller catches than in previous years. The participant noted that declining catches have reduced daily earnings and made fishing increasingly uncertain as a dependable livelihood for households.

Interview Respondent – Male Fisherman, 56 years old:

Another fisherman emphasized the increased cost of fishing activities:

“We now travel farther to find places where fish are still available. This means spending more money on fuel, equipment and food while staying longer on the water. Sometimes, after spending so much, the catch is still not enough to cover what we have spent. It is becoming difficult to know whether fishing will provide enough income for the family” (Fisherman, Field Interview, 2026).

The respondent highlighted the increased operational cost associated with declining fish availability. According to the participant, fishermen must travel farther and spend more resources to obtain reasonable catches. This reduces the profitability of fishing and increases financial uncertainty among fishing households.

Interview Respondent – Female Fish Trader, 39 years old, added thus:

“The reduction in fish catches has also affected those of us who sell fish. When fishermen return with small quantities, the price of fish increases and there is less fish available for us to sell. Oil pollution has affected the creeks and mangrove areas where fish used to breed. As a fish trader, I now have to travel farther to obtain enough fish, which increases my transportation costs and reduces my profit” (Fish Trader, Field Interview, 2026).



The fish trader explained that declining fish production has affected the entire fish marketing chain. According to the respondent, inadequate supply has increased purchase and transportation costs while limiting the quantity available for sale. The participant noted that reduced profit margins have made fish trading more difficult and less predictable.

Interview Respondent – Male Fisherman and Mangrove Harvester, 52 years old, added that:

“The mangrove areas and creeks are very important to our fishing activities because they provide places where fish and other aquatic animals grow. Since oil spills have become common, some of these areas have been damaged. The mangrove vegetation is affected by the oil, and the number of fish and shellfish available has reduced. This has made fishing and harvesting aquatic resources less profitable for people who depend on them” (Fisherman and Mangrove Harvester, Field Interview, 2026).

The respondent explained that damage to mangrove ecosystems has affected the availability of fish and shellfish. According to the participant, the degradation of these areas reduces the environmental conditions that support aquatic organisms and consequently affects people who depend on fishing and mangrove resources for their livelihoods.

Interview Respondent – Male Fisherman and Mangrove Harvester, 54 years old:

Another respondent in the same occupational group explained:

“Mangroves used to provide us with different resources apart from fish. We obtained shellfish, crabs and other materials from these areas. Since oil has affected some of the mangrove vegetation, those resources are becoming harder to find. The loss is not only about fishing; it affects several activities that families traditionally used to support themselves” (Fisherman and Mangrove Harvester, Field Interview, 2026).

The respondent emphasized the multiple livelihood functions of mangrove ecosystems. According to the participant, pollution has affected not only fish availability but also other aquatic resources traditionally harvested by households. This suggests that mangrove degradation can produce wider livelihood consequences for communities dependent on coastal resources.

Interview Respondent – Female Farmer, 36 years old:

The Farmer reported that several fish species previously common in nearby rivers and creeks have become increasingly scarce. According to the respondent, continuous pollution has affected the availability of aquatic resources that families once relied upon for food and supplementary income. The participant expressed concern that the reduced fish supply has affected household nutrition and increased the difficulty of obtaining affordable fish for family consumption (Farmer, Field Interview, 2026).

The farmer's account demonstrates that declining aquatic resources have consequences beyond the fishing occupation. According to the respondent, families that do not directly engage in fishing may still depend on locally available fish as an affordable source of food. Reduced availability therefore creates concerns about household nutrition and the cost of obtaining fish.

Interview Respondent – Male Community Leader, 62 years old:

The Community Leader described how oil contamination has affected fishing equipment and discouraged fishing activities:



“Fishermen sometimes retrieve their nets covered with crude oil and containing very few fish. Cleaning the nets requires additional effort and expense, while poor catches reduce fishermen's motivation and make the occupation increasingly difficult to sustain” (Community Leader, Field Interview, 2026).

The community leader explained that oil pollution creates both equipment-related and livelihood-related losses. According to the respondent, contaminated fishing gear requires additional cleaning and maintenance, while low catches reduce the economic return from fishing. The participant noted that these conditions may discourage residents from continuing with fishing as their primary occupation.

Interview Respondent – Female Youth Representative, 26 years old:

The Youth Representative explained that declining fish stocks have affected young people who previously regarded fishing as an important source of livelihood. The respondent observed that repeated pollution has made fishing less dependable, prompting some youths to seek alternatives such as petty trading, casual labour and transportation. According to the participant, these changes have weakened traditional livelihood opportunities and increased economic uncertainty among young residents (Youth Representative, Field Interview, 2026).

The youth representative explained that environmental degradation is contributing to a gradual shift in the occupational pattern of young people. According to the respondent, reduced opportunities in fishing have encouraged youths to move toward less stable forms of employment. The participant therefore viewed declining fish stocks as an issue with implications for youth employment and long-term livelihood sustainability.

Interview Respondent – Male Community Health Worker, 48 years old

The Community Health Worker explained that oil pollution has also created concerns about the health and food security of residents who depend on fish and other aquatic resources. The respondent noted that contamination of rivers, creeks and mangrove areas has reduced the availability of fish, making it more difficult for households to obtain sufficient and affordable sources of protein. The participant further stated that some residents are increasingly concerned about consuming fish harvested from polluted waters because of possible contamination. According to the respondent, the decline in aquatic resources has therefore created both livelihood and nutritional challenges, particularly for households that depend heavily on fishing and aquatic foods (Community Health Worker, Field Interview, 2026).

The community health worker emphasized the food-security and welfare implications of declining aquatic resources. According to the respondent, reduced fish availability can affect access to affordable protein, while concerns about the quality of fish harvested from polluted waters may further influence household food choices. The participant therefore viewed oil pollution as an environmental problem with implications for livelihood security and household nutrition.

The responses indicate that oil spillage has affected fishing activities in Ibeno through the contamination of fishing grounds, degradation of mangrove and aquatic habitats, reduction in fish availability, and declining income among households that depend on fishing and fish trading. The experiences of the respondents therefore demonstrate that the environmental consequences of oil pollution have translated directly into livelihood challenges for fishing-dependent communities. These findings are consistent with Ite et al. (2013), who established that petroleum contamination reduces fish populations through habitat destruction, disruption of aquatic food chains, and exposure



to toxic hydrocarbons. Similarly, Okonkwo et al. (2015) reported that oil pollution damages wetlands and mangrove ecosystems, destroys fish breeding grounds, reduces biodiversity, and consequently lowers fisheries productivity. UNEP (2011) further noted that petroleum hydrocarbons can persist in sediments and mangrove root systems for prolonged periods, slowing ecological recovery and continuing to affect fisheries, biodiversity, shoreline protection, and other ecosystem services. The reduction in fisheries productivity also has important socio-economic implications. Elum, Mopipi, and Henri-Ukoha (2016) found that petroleum-related environmental degradation reduces fishing opportunities, household income, and employment, thereby increasing poverty and economic vulnerability. Similarly, the United Nations Development Programme (2006) identified declining fisheries and environmental degradation as important contributors to food insecurity, unemployment, poverty, and deteriorating living conditions in Niger Delta communities. Thus, the evidence from Ibeno demonstrates that persistent oil pollution represents not only an environmental problem but also a significant threat to the traditional livelihoods and economic wellbeing of households dependent on aquatic resources.

Sub-theme 1.4: Livelihood Disruption and Economic Impact

Interview Responses on Oil Pollution, Livelihood Disruption, Household Income and Poverty in Ibeno LGA

Interview Respondent – Male Fisherman, 45 years old:

In response to the above raised question, a respondent, a Fisherman, maintained that:

“Fishing used to provide food and income for my family, but today it has become a struggle. I can spend the whole day on the water and return with very little fish. Sometimes, my children wait at home expecting food from my catch, only for me to return empty-handed. This situation has made life extremely difficult” (Fisherman, Field Interview, 2026).

The fisherman explained that oil pollution has significantly reduced the quantity of fish available in nearby rivers and creeks. According to the respondent, fishermen now spend longer periods on the water with little or no catch, thereby reducing their ability to provide food and income for their households. The participant noted that declining catches have increased household hardship and made fishing increasingly unreliable as a primary livelihood.

Interview Respondent – Male Fisherman, 58 years old:

Another Fisherman explained a related but distinct aspect of the problem:

“Fishing is no longer as profitable as it used to be because the rivers and creeks have been affected by oil pollution. We sometimes spend more time fishing but return with very little catch. This has reduced our income and made it difficult to support our families. Some people who depended on fishing have started looking for other forms of work because they can no longer depend on fishing alone” (Fisherman, Field Interview, 2026).

The respondent focused on the declining profitability and occupational transition associated with oil pollution. According to the participant, increased fishing effort no longer guarantees adequate returns, causing some fishermen to diversify into other occupations. This suggests that environmental degradation is gradually weakening fishing as a sustainable source of household income.



Interview Respondent – Male Farmer, 50 years old:

“The pollution has made farming more difficult because some of the land we used to cultivate is no longer as productive as before. When the soil is affected by crude oil, crops do not grow properly and farmers harvest less. Since farming is one of the main ways we earn a living, the reduction in harvest has affected our household income and made it difficult to meet our daily needs” (Farmer, Field Interview, 2026).

The farmer reported that oil pollution has reduced agricultural productivity through its effects on the quality of farmland. According to the respondent, poor crop performance and reduced harvests have weakened household income. The participant explained that because many families depend on farming, declining agricultural production has made it more difficult to meet daily household requirements.

Interview Respondent – Male Youth Representative, 32 years old:

A Youth Representative stated that:

“Many young people are losing hope because the occupations our parents depended on can no longer support families. Farming and fishing are becoming unreliable, so youths are turning to petty trading and casual labour just to survive. Some have even left the community in search of opportunities elsewhere. It is painful to watch our livelihoods disappear” (Youth Representative, Field Interview, 2026).

The youth representative explained that environmental degradation has weakened the traditional livelihood opportunities available to young people. According to the respondent, declining productivity in farming and fishing has encouraged youths to engage in petty trading, casual labour and migration. The participant observed that these changes have increased economic uncertainty and weakened young people's confidence in traditional occupations.

Interview Respondent – Female Small-Scale Trader, 41 years old:

“The environmental problems have affected almost every aspect of livelihood in the community. When farmers produce less and fishermen catch fewer fish, traders also experience reduced business because people have less money to spend. Many families now struggle to maintain their previous standard of living. Some people have had to engage in other small businesses or leave the community temporarily to look for better opportunities” (Small-Scale Trader, Field Interview, 2026).

The small-scale trader explained that environmental degradation has produced indirect effects on the local economy. According to the respondent, declining income among farmers and fishermen reduces residents' purchasing power and consequently affects local businesses. The participant noted that traders therefore experience declining sales as the economic effects of environmental pollution spread across the community.

Interview Respondent – Female Community Leader, 65 years old:

A Community Leader explained:

“Our community has suffered greatly because the environment that once provided for our people is gradually losing its value. Families that were once comfortable now struggle to afford food, education and other basic needs. We see poverty increasing because farming and



fishing are no longer dependable. The situation has brought hardship to many households” (Community Leader, Field Interview, 2026).

The community leader described environmental degradation as an important contributor to declining household welfare and increasing poverty. According to the respondent, the reduced productivity of farming and fishing has weakened the economic foundation of many families. The participant observed that households are increasingly struggling to provide food, pay educational expenses and meet other basic needs.

Interview Respondent – Male Community Health Worker, 47 years old, added that:

“The effects of oil pollution are not limited to farming and fishing; they also affect the general welfare of households. When people lose their income from farming and fishing, they find it more difficult to afford food, medicines and other basic needs. Some families also experience poor nutrition because they can no longer obtain enough fish and other food from the environment. The loss of livelihoods has therefore become a serious concern for the well-being of people in the community” (Community Health Worker, Field Interview, 2026).

The community health worker explained that the consequences of oil pollution extend into household health, nutrition and general well-being. According to the respondent, declining livelihood income can reduce families' ability to purchase food and medicines, while reduced access to locally available fish may worsen nutritional difficulties. The participant therefore viewed livelihood disruption as an important factor contributing to household vulnerability.

The interview findings are consistent with existing literature demonstrating that petroleum-related environmental degradation has consequences that extend beyond ecological damage to household livelihoods and broader community welfare. Elum et al. (2016) observed that oil pollution weakens livelihood resilience by reducing employment and income opportunities, while Okonkwo et al. (2015) linked the degradation of wetlands and ecosystem services with declining agricultural production, fisheries development, and food security in oil-producing communities. In Ibeno, the deterioration of agricultural land and fishing resources has compelled households to seek alternative sources of income, including petty trading, commercial transportation, casual labour, and other informal activities. However, these alternatives often provide inadequate compensation for the loss of traditional livelihoods, thereby contributing to declining living standards and greater economic vulnerability. Environmental degradation has also encouraged some economically active youths to leave their communities in search of employment opportunities elsewhere. Obi (2010) identified environmental degradation associated with petroleum production as an important driver of livelihood displacement, migration, and social instability in the Niger Delta, a situation also documented by the United Nations Development Programme (2006).

Table 1: Environmental and Socio-economic Consequences of Crude Oil Spillage in Ibeno Local Government Area

S/N	Environmental Component	Baseline Evidence/Observed Impact	Consequences in Ibeno Local Government Area
1	Agricultural Land and Soil Fertility	Petroleum hydrocarbons alter soil structure, reduce microbial activity, impair nutrient cycling, increase soil acidity, and lower soil permeability.	Declining soil fertility, reduced crop productivity, poor seed germination, delayed crop maturity, abandonment of farmlands, and long-term loss of agricultural land.



2	Surface Water and Groundwater	Crude oil forms hydrocarbon films on rivers, creeks, wetlands, and groundwater, reducing dissolved oxygen and introducing toxic hydrocarbons and heavy metals.	Contaminated rivers, streams, wells and boreholes, unsafe drinking water, unpleasant odour, water discoloration, increased household expenditure on potable water, and declining water security.
3	Fisheries Resources	Oil contamination destroys spawning grounds, mangrove nurseries, estuaries, and aquatic habitats essential for fish reproduction.	Declining fish populations, reduced fish catches, disappearance of aquatic species, contamination of fishing gear, declining fisheries productivity, and reduced household income.
4	Mangrove Forests and Wetlands	Oil adheres to mangrove roots, inhibits oxygen exchange, suppresses regeneration, and destroys wetland ecosystems.	Loss of mangrove biodiversity, destruction of nursery habitats, shoreline instability, reduced ecosystem resilience, and declining coastal ecosystem services.
5	Biodiversity Conservation	Toxic hydrocarbons disrupt terrestrial and aquatic food chains and reduce species richness.	Declining wildlife populations, habitat fragmentation, loss of flora and fauna, ecosystem imbalance, and reduced ecological resilience.
6	Food Security	Reduced agricultural output and declining fisheries lower local food production capacity.	Increased food insecurity, higher food prices, poor household nutrition, and increased dependence on imported food.
7	Public Health	Petroleum contaminants enter water, soil, crops, and aquatic food chains through bioaccumulation.	Increased exposure to heavy metals and hydrocarbons resulting in skin diseases, gastrointestinal disorders, respiratory illnesses, reproductive health risks, and chronic diseases.
8	Household Livelihoods	Destruction of productive natural resources undermines agriculture and fishing.	Loss of employment, declining household income, increased poverty, livelihood displacement, and dependence on informal economic activities.
9	Rural Economy	Reduced agricultural and fisheries production weakens local economic activities.	Increased unemployment, reduced purchasing power, declining rural investments, and economic stagnation.
10	Social Development	Environmental degradation affects education, healthcare access, and community welfare.	Rural-urban migration, increased social conflict, reduced quality of life, declining human development indicators, and weakened community resilience.
11	Environmental Quality	Persistent hydrocarbon contamination remains in soils and sediments for decades where remediation is inadequate.	Long-term environmental degradation, ecological instability, accumulation of legacy pollution, and increased environmental restoration costs.
12	Sustainable Development	Continuous environmental degradation weakens natural resource sustainability.	Reduced capacity to achieve sustainable rural development, environmental sustainability, and intergenerational resource conservation.

Source: World Bank (2024), Onuha et al. (2018), Ite et al. (2013), Nriagu et al. (2016), Okonkwo et al. (2015), United Nations Environment Programme (UNEP, 2011).

Evaluation of Research Question ii: How does gas flaring affect environmental pollution in Ibeno Local Government Area?

To evaluate the research questions, the study used interview responses as the primary source of qualitative data. The interview responses were analysed thematically using sub-themes developed in line with the research objectives. These sub-themes were derived from the experiences, perceptions,



and observations of respondents and were used to organize the qualitative findings into meaningful categories for interpretation. While oil spillage was examined in the preceding section, greater emphasis in this section is placed on gas flaring because of its continuous and widespread environmental implications in Ibeno Local Government Area. The interview analysis focuses on four major sub-themes: air pollution, rising temperature, climate variability, and health-related challenges. These themes provide a framework for examining how continuous gas flaring affects the environment and the daily lives and wellbeing of residents. The interview responses are presented and interpreted under each thematic area to show how residents experience and perceive the effects of gas flaring in their communities. This thematic approach enables the study to establish the relationship between gas flaring, environmental degradation, and socio-economic and health-related challenges in Ibeno Local Government Area. It also ensures that the views of respondents are presented systematically and linked directly to the research objectives and questions of the study.

Theme 2.1: Gas Flaring and Environmental Degradation in Ibeno Local Government Area: Evidence from Baseline Data

Interview Responses on Air Pollution, Heat and Environmental Conditions Associated with Gas Flaring in Ibeno LGA

Interview Respondent – Male Fisherman, 46 years old maintained that:

“The atmosphere around areas close to oil installations has become increasingly smoky and uncomfortable. Visible smoke is frequently present when gas flaring is ongoing, making it difficult to breathe comfortably, particularly for people who spend considerable time outdoors. These conditions have become part of the daily environment and affect fishing activities and general wellbeing” (Fisherman, Field Interview, 2026). The fisherman explained that smoke from petroleum facilities has become a noticeable feature of the local environment. According to the respondent, fishermen who spend extended periods outdoors are particularly exposed to the smoky atmosphere, which can make fishing activities uncomfortable and affect their general sense of well-being.

Interview Respondent – Male Civil Servant, 43 years old:

“The gas flares are always visible, especially at night, and the heat from them can be felt from a distance. Sometimes there is smoke around the area, and the air does not feel as clean as it used to be. As fishermen, we spend many hours outside, particularly at night, so we experience the heat and smoke from the flaring. It is something that has become part of our environment, although we are not comfortable with it” (Civil Servant, Field Interview, 2026). The second fisherman emphasized the combined effects of heat and smoke during fishing activities. The respondent noted that fishermen working at night are particularly aware of the visible flames, heat and changes in air quality around flare sites. Although residents have become accustomed to the presence of the flares, the participant maintained that familiarity has not eliminated concerns about their environmental effects.

Interview Respondent – Male Farmer, 52 years old:

“Continuous gas flaring produces noticeable heat around nearby communities. The intense heat is experienced both indoors and outdoors and makes farming activities more uncomfortable, particularly during periods of high temperature. Prolonged exposure to the heat has changed the environmental conditions under which residents work and carry out their normal daily activities” (Farmer, Field Interview, 2026). The farmer reported that excessive heat associated with continuous flaring has affected working conditions in the community. According to the respondent, farmers who work



outdoors experience greater discomfort during periods of high temperature, while the effects of heat can also be noticed around residential areas.

Interview Respondent – Female Farmer, 38 years old:

“The gas flaring around the oil-producing areas affects the air we breathe. When the flare is burning continuously, there is smoke and a strong smell in the atmosphere. Sometimes the air feels heavy, especially when the wind carries the smoke towards our community. As a farmer, I am concerned because we spend a lot of time working outdoors, and we cannot avoid the air around us” (Farmer, Field Interview, 2026). The respondent focused on the effect of flaring on outdoor air conditions. The farmer explained that smoke and unpleasant odours become more noticeable when wind carries emissions toward residential and farming areas. Since agricultural activities require prolonged outdoor exposure, the participant expressed concern about the difficulty of avoiding polluted air during routine farming activities.

Interview Respondent – Male Community Leader, 61 years old:

“Soot and dark particles frequently settle on rooftops, buildings, and other surfaces within areas affected by gas flaring. Residents are often required to clean their homes and surroundings repeatedly because of the deposits. The persistent presence of soot has become a visible indication of the deteriorating environmental conditions associated with nearby petroleum operations” (Community Leader, Field Interview, 2026). The community leader identified soot deposition as one of the most visible environmental effects experienced by residents. According to the respondent, dark particles accumulate on buildings and household surfaces, requiring frequent cleaning. The participant explained that the repeated deposition has become a noticeable sign of environmental deterioration around areas exposed to petroleum operations.

Interview Respondent – Male Artisan, 43 years old:

“The continuous gas flaring has changed the environmental condition of the community. The flames burn for long periods and produce intense heat, smoke and noise. Residents have become accustomed to seeing the flares, but that does not mean that the situation is harmless. We are concerned about the quality of the air and the long-term effects of the emissions on the environment and the people living close to the oil facilities” (Artisan, Field Interview, 2026). The community leader viewed gas flaring as a persistent environmental issue rather than an occasional disturbance. The respondent emphasized that the combination of heat, smoke and noise has altered the environmental character of the community. The participant further expressed concern about the long-term implications of continuous exposure for residents living close to petroleum installations.

Interview Respondent – Female Youth Representative, 29 years old:

“Communities located near flare sites appear considerably hotter than areas farther away from petroleum installations. The persistent heat has become noticeable during ordinary daily activities and makes outdoor work increasingly uncomfortable. Residents have become concerned about the changing environmental conditions and the possibility that continuous gas flaring is contributing to the increasing heat experienced locally” (Youth Representative, Field Interview, 2026). The youth representative associated proximity to flare sites with noticeable differences in environmental heat. According to the respondent, persistent high temperatures affect ordinary activities and make outdoor work more difficult. The participant also emphasized that residents increasingly perceive continuous gas flaring as a possible contributor to the local increase in temperature.

**Interview Respondent – Female Community Health Worker, 41 years old:**

“Gas flaring is a serious concern in the community because it releases smoke and other substances into the atmosphere. People complain about the smell, irritation, coughing and difficulty breathing, particularly when the wind carries the emissions towards residential areas. The continuous burning also produces intense heat and makes the environment uncomfortable. From what we observe in the community, the effects are more worrying for people who are regularly exposed to the emissions” (Community Health Worker, Field Interview, 2026). The community health worker explained that residents have reported several forms of discomfort associated with exposure to emissions from gas flaring. The respondent identified unpleasant odours, irritation, coughing and breathing difficulties as common complaints reported by residents, particularly when emissions are carried toward residential areas. The participant further noted that prolonged exposure is a particular concern for people living or working close to flare locations.

These interview responses indicate that residents perceive gas flaring as a persistent environmental problem characterized by air pollution, intense heat, smoke, unpleasant odours, and concerns about respiratory health. The experiences of farmers, fishermen, health workers, and community leaders further suggest that continuous exposure to gas-flaring emissions affects different aspects of daily life in Ibeno Local Government Area. The above responses are consistent with scholarly literature which upheld that gas flaring poses serious public health risks. The World Health Organization (2021) identified particulate matter (PM_{2.5}), sulphur dioxide, nitrogen dioxide, ozone, and carbon monoxide as major causes of respiratory diseases, cardiovascular disorders, reduced lung function, adverse pregnancy outcomes, and premature mortality. Similarly, Nriagu, Udofia, Ekong, and Ebuk (2016) found elevated environmental health risks among residents of oil-producing communities arising from prolonged exposure to petroleum-derived pollutants, including respiratory illnesses, skin disorders, and other environmentally related diseases. Satellite observations reported by the World Bank further showed that Nigeria continues to experience fluctuating flare volumes because of inadequate gas utilization infrastructure, ageing production facilities, and operational constraints, while the Global Gas Flaring Tracker Report (2025) revealed that Nigeria recorded one of the largest increases in flare volumes among major flaring countries in 2024 due primarily to inadequate investment in associated gas recovery infrastructure.

The International Energy Agency (2023) argued that routine flaring largely reflects inadequate infrastructure for gas gathering, processing, transportation, commercialization, and underdeveloped domestic gas markets across many African oil-producing countries. In contrast, Frynas (2000) attributed continued gas flaring to weak environmental regulation, inadequate monitoring, poor enforcement of environmental standards, and limited corporate accountability, a position reinforced by the Bayelsa State Oil and Environmental Commission (2023), which concluded that weak environmental governance, delayed remediation, and inadequate pollution control have allowed cumulative ecological degradation to persist despite improvements in environmental legislation.

2.2 Air Pollution and Emission of Toxic Gases in Ibeno Local Government Area: Evidence from Baseline Data

Interview Responses on Gas Flaring, Rising Temperature, Air Pollution and Climate Stress in Ibeno LGA

Interview Respondent – Male Fisherman, 55 years old:



The fisherman reported that temperatures have become noticeably higher than in previous years, making fishing activities more physically demanding. According to the respondent, working for extended periods under intense heat causes discomfort and exhaustion, particularly during daytime fishing activities. The participant explained that increased temperatures have changed the normal working conditions of fishermen and made outdoor livelihood activities increasingly difficult (Fisherman, Field Interview, 2026).

The respondent's account indicates that rising temperature has a direct occupational effect on fishing activities. Prolonged exposure to heat increases physical discomfort and fatigue, thereby making it more difficult for fishermen to remain on the water for extended periods.

Interview Respondent – Another Male Fisherman, 49 years old:

“When the gas is being flared, you can see the flames and sometimes smoke coming from the oil facilities. The air around the area can become uncomfortable, particularly when the wind carries the emissions towards where we live or fish. I have noticed that people complain more about coughing, eye irritation and headaches when the pollution is noticeable. We cannot simply avoid the environment because fishing is our livelihood” (Fisherman, Field Interview, 2026).

The fisherman emphasized the difficulty of avoiding exposure to petroleum-related emissions because fishing requires prolonged outdoor activity. According to the respondent, smoke and other emissions become more noticeable under certain wind conditions and are associated by residents with discomfort such as coughing, eye irritation and headaches.

Interview Respondent – Female Farmer, 35 years old:

The farmer explained that rainfall patterns have become increasingly unpredictable, creating difficulties for agricultural activities. According to the respondent, rainfall sometimes arrives later than expected or fails to follow the seasonal pattern previously relied upon by farmers. The participant noted that this uncertainty makes it difficult to determine appropriate planting periods and increases the risk of poor harvests among households dependent on rain-fed agriculture (Farmer, Field Interview, 2026).

The response highlights the agricultural consequences of changing rainfall patterns. The farmer explained that uncertainty about rainfall makes agricultural planning more difficult because planting decisions depend heavily on the timing and availability of rainfall.

Interview Respondent – Male Farmer, 57 years old:

“The gas flaring affects the quality of the air around our community. When the flare is burning, there is often smoke and an unpleasant smell, especially when the wind blows towards the farms and residential areas. As a farmer, I spend many hours outside, and sometimes I experience irritation in my eyes and discomfort when the smoke is heavy. We are worried about what continuous exposure to the polluted air may mean for our health and the environment” (Farmer, Field Interview, 2026).

The respondent focused on outdoor exposure to air pollution during farming activities. According to the participant, farmers working close to petroleum facilities may encounter smoke and unpleasant odours when emissions are carried by wind. The respondent also expressed concern about the longer-term implications of continuous exposure for residents and the environment.

Interview Respondent – Female Community Leader, 64 years old:



The community leader observed that unusually high temperatures are increasingly experienced during periods traditionally associated with cooler weather. According to the respondent, residents now experience exceptionally hot days even during seasons when temperatures were previously more moderate. The participant explained that these changing temperature conditions have affected daily routines and generated growing concerns about changes in local environmental conditions (Community Leader, Field Interview, 2026).

The community leader's account emphasizes the community-wide nature of temperature changes. Unlike the fishermen and farmers, whose responses focused primarily on occupational effects, this respondent highlighted the influence of unusual heat on general daily life and community perceptions of environmental change.

Interview Respondent – Male Community Leader, 58 years old:

“The gas flares have been part of our environment for a long time. Apart from the heat and noise, residents are concerned about the smoke and substances released into the atmosphere. When the wind changes direction, the emissions can be noticed in nearby communities. People have raised concerns about the effects on their health, vegetation and general environmental conditions” (Community Leader, Field Interview, 2026).

The respondent emphasized the broader environmental concerns associated with continuous gas flaring. According to the community leader, the effects extend beyond heat to include smoke, noise and atmospheric emissions. The participant noted that residents are concerned about possible implications for human health, vegetation and the general environmental quality of surrounding communities.

Interview Respondent 41 – Female Youth Representative, 27 years old:

The youth representative associated changing environmental conditions with continuous gas flaring around petroleum installations. According to the respondent, residents have noticed increasing heat and irregular rainfall occurring alongside persistent flaring activities. The participant explained that these changes have affected outdoor activities, farming conditions and general comfort within the community, leading many young residents to express concerns about the environmental conditions surrounding their homes (Youth Representative, Field Interview, 2026).

The youth representative highlighted the effect of environmental change on young people's daily activities and perceptions of their future environment. According to the respondent, increasing heat and irregular rainfall have affected outdoor activities and agricultural conditions, contributing to growing concern among young residents.

Interview Respondent – Female Community Health Worker, 44 years old:

“Air pollution from gas flaring is one of the environmental concerns frequently discussed by residents. People complain about coughing, breathing difficulties, eye irritation and headaches, particularly those who live or work close to the oil-producing facilities. The continuous exposure is concerning because the emissions from flaring can affect the quality of the air that residents breathe every day” (Community Health Worker, Field Interview, 2026).

The community health worker emphasized the health and environmental dimension of gas-flaring exposure. According to the respondent, residents living or working near petroleum facilities



frequently report respiratory and irritation-related complaints. The participant stressed that continuous exposure makes air quality an important community health concern.

These interview responses indicate that residents perceive gas flaring as a significant source of air pollution in Ibeno Local Government Area. The reported experiences of smoke, unpleasant odours, eye irritation, coughing, headaches and breathing discomfort demonstrate residents' concerns about prolonged exposure to emissions from petroleum activities. The responses also suggest that the effects extend beyond individual health concerns to include perceived deterioration of the general environmental quality and living conditions in communities located near gas-flaring facilities. Correspondently, Satellite observations by the European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA) consistently identify the Niger Delta as one of Africa's major gas-flaring hotspots, with prevailing winds transporting combustion products from offshore and onshore flare sites into surrounding communities such as Ibeno. Sulphur dioxide and nitrogen oxides contribute to acid deposition, while black carbon reduces photosynthetic efficiency and contributes to atmospheric warming, cloud formation changes, radiative forcing, and declining ecosystem resilience (IPCC, 2023). Likewise, the United Nations Development Programme (2006) reported persistent smoke emissions, atmospheric pollution, declining agricultural productivity, and increasing health complaints in communities near petroleum facilities. These scientific findings correspond with interview responses from residents, who associated gas flaring with increasing temperatures and changing weather conditions.

2.3 Temperature Increase and Climate Stress in Ibeno Local Government Area: Evidence from Baseline Data

Interview Responses on Temperature Increase, Climate Stress, Gas Flaring and Environmental Governance in Ibeno LGA

Interview Respondent – Male Farmer, 40 years old, maintained that:

In response to the above raised question, a respondent, a Farmer, maintained that:

“The weather in our community has become much hotter compared with what we experienced in the past. Sometimes the heat is so intense that it becomes difficult to work on the farm for long periods. The timing of rainfall has also become less predictable. As a farmer, these changes affect when we plant and harvest because we can no longer depend on the weather patterns, we were familiar with” (Farmer, Field Interview, 2026).

The farmer explained that increasing temperature and irregular rainfall have disrupted traditional agricultural practices. According to the respondent, excessive heat reduces the amount of time farmers can comfortably spend working outdoors, while unpredictable rainfall makes it difficult to determine appropriate planting and harvesting periods. The participant therefore associated climate stress with increasing uncertainty in agricultural production.

Interview Respondent – Female Community Member, 35 years old, observed:

“The climate has changed significantly. We now experience hotter days and rainfall that does not follow the pattern we used to know. Sometimes farmers plant expecting rain, but the rain does not come on time, while heavy rainfall can occur unexpectedly at other periods. These changes make farming more difficult because we are not sure when the weather will be favourable for our crops” (Farmer and Community Member, Field Interview, 2026).



The respondent emphasized the uncertainty created by changing weather conditions. The participant highlighted the combination of excessive temperature, delayed rainfall and unexpected heavy precipitation, explaining that these conditions complicate agricultural planning and increase the risk of poor crop performance.

Interview Respondent – Male Farmer, 51 years old, explained:

“The heat around our community has become more intense over the years. We cannot say that gas flaring is the only reason because the weather itself is changing, but the heat from the flare sites is noticeable, especially when we work close to the oil facilities. As a farmer, excessive heat affects how long we can work on the farm and also makes the crops more vulnerable during periods of inadequate rainfall” (Farmer, Field Interview, 2026).

The farmer acknowledged that gas flaring may not be the sole cause of increasing temperatures but maintained that heat generated around flare sites is noticeable. According to the respondent, high temperatures affect both human labour and crop conditions, particularly when intense heat coincides with inadequate rainfall.

Interview Respondent – Female Farmer, 46 years old, added:

“Areas close to oil facilities are often affected by smoke and fumes. Petroleum exploration and production activities appear to expose people living nearby to different forms of pollution. Those of us who work outdoors are particularly conscious of changes in the air and environment” (Farmer, Field Interview, 2026).

The respondent drew attention to the environmental conditions surrounding petroleum-production facilities. According to the participant, outdoor workers are particularly exposed to smoke, fumes and other environmental changes. This suggests that climate stress in the area occurs alongside broader forms of environmental pollution.

Interview Respondent – Male Fisherman, 40 years old, added:

“The heat around the oil-producing areas has become more noticeable, particularly when the gas flares are burning continuously. We also experience changes in the weather and rainfall. Sometimes the rain comes when we are not expecting it, while at other times we experience long periods without enough rain. These changes affect fishing because the condition of the water and the movement of fish are not always the same” (Fisherman, Field Interview, 2026).

The fisherman explained that changing temperature and rainfall conditions have introduced uncertainty into fishing activities. According to the respondent, variations in rainfall and water conditions influence fishing patterns and make it more difficult for fishermen to predict where and when productive fishing can take place.

Interview Respondent – Male Fisherman, 43 years old:

“The weather has changed compared with what we experienced many years ago. There are days when the heat is very strong, and the flaring around the oil facilities adds more heat to the environment. We know that there are other reasons for climate change, but the continuous burning of gas contributes to what we experience locally. It affects our comfort when we are fishing and makes working outdoors more difficult” (Fisherman, Field Interview, 2026).



The respondent distinguished between broader climate change and the local effects associated with gas flaring. The fisherman explained that continuous flaring adds noticeable heat around petroleum facilities, making prolonged fishing activities more uncomfortable and physically demanding.

Interview Respondent – Female, Fisherman, 37 years old added:

Another fisherman explained:

“Increasing heat has made fishing more physically demanding because fishermen spend several hours outdoors under stronger temperatures. Prolonged exposure causes discomfort and fatigue, particularly during daytime activities. When gas flaring becomes intense, some elderly residents also experience greater difficulty coping with the environmental conditions” (Fisherman, Field Interview, 2026).

The respondent focused on the human dimension of climate stress. According to the participant, prolonged exposure to high temperatures increases physical discomfort and fatigue among fishermen. The fisherman also expressed concern about the ability of vulnerable members of the community to cope with extreme environmental conditions.

Interview Respondent – Male Fisherman, 39 years old added:

“Oil-related emissions have continued to affect our environment. Even when gas flaring is reduced, other petroleum activities still produce emissions. The continuous release of pollutants over the years has affected the environment and the living conditions of people in the community” (Fisherman, Field Interview, 2026).

The respondent broadened the discussion beyond gas flaring alone. According to the fisherman, emissions from other petroleum activities also contribute to cumulative environmental pollution. The participant therefore viewed the environmental problem as extending across different stages of petroleum operations.

Interview Respondent –Male Community Leader, 53 years old explained:

“The community has experienced increasing heat over the years. The gas flaring contributes to the heat around the oil facilities, and residents can feel it especially when they are close to the flare sites. We have also noticed that rainfall patterns are no longer as predictable as they were before. These environmental changes affect farming, fishing and other activities that people depend on for their livelihood” (Community Leader, Field Interview, 2026).

The community leader described temperature increase and rainfall variability as community-wide environmental changes. According to the respondent, these conditions affect several livelihood activities simultaneously, particularly farming and fishing, which depend considerably on predictable environmental conditions.

Interview Respondent – Another Male Community Leader, 61 years old maintained:

“Gas flaring may not be the only cause of the increasing temperature, but it is certainly one of the things contributing to the problem in our area. The heat from the flare sites is intense and continuous, and residents living close to these facilities feel it more. We have also noticed changes in rainfall and vegetation over time. The community believes that reducing gas flaring would help to improve the environmental conditions and reduce some of the heat we experience” (Community Leader, Field Interview, 2026).



The respondent presented gas flaring as one contributing factor rather than the exclusive cause of temperature increase. The participant further associated environmental changes with variations in rainfall and vegetation and expressed the view that reducing gas flaring could improve local environmental conditions.

Interview Respondent –Female community leader, 59 years old stated:

“Gas flaring is certainly one of the major causes of poor air quality in our community, but it is not the only source. We also experience pollution from generators, vehicles, industrial activities and other activities associated with oil production. All these sources contribute to the quality of air people breathe” (Community Leader, Field Interview, 2026).

The respondent stressed that environmental pollution in Ibeno has multiple sources. According to the participant, although gas flaring is significant, emissions from generators, vehicles, industrial operations and petroleum-related activities also contribute to poor air quality. This suggests that addressing environmental stress requires a comprehensive pollution-control strategy.

Interview Respondent 29 – Male Youth Representative, 41 years old explained:

“The environmental changes associated with increasing temperature and irregular rainfall have affected outdoor activities, farming and general living conditions. Children in affected communities sometimes experience skin irritation, which residents associate with the polluted environment and prolonged exposure to emissions from nearby petroleum operations” (Youth Representative, Field Interview, 2026).

The youth representative explained that environmental stress affects both livelihood activities and everyday community life. The respondent particularly drew attention to children and the concerns of residents regarding prolonged exposure to emissions from nearby petroleum facilities.

Interview Respondent –AFemale Youth Representative, 37 years old stated:

“I believe the government needs to strengthen environmental monitoring in oil-producing communities. Regulations should not only exist on paper; they should be enforced. Companies that violate environmental standards should face appropriate sanctions so that pollution can be reduced and the health of community members protected” (Youth Representative, Field Interview, 2026).

The respondent focused on the institutional response to environmental degradation. According to the participant, effective environmental protection requires regular monitoring, proper enforcement of regulations and appropriate sanctions for companies that violate environmental standards.

Interview Respondent – Female Civil Servant, 45 years old explained:

“Government has established environmental regulations and laws to control pollution, including the Petroleum Industry Act and other air-quality regulations. There are also regulatory agencies responsible for monitoring petroleum operations. However, the major concern is whether these regulations are effectively implemented” (Civil Servant, Field Interview, 2026).

The civil servant acknowledged the existence of legal and institutional mechanisms for controlling pollution from petroleum operations. However, the respondent identified implementation and enforcement as the major challenges. The participant suggested that environmental governance



depends not only on having regulations but also on the capacity to implement and monitor them effectively.

Interview Respondent – Female Trader, 35 years old observed:

“The laws are available, but enforcement remains a problem. Sometimes monitoring of companies is inadequate, and environmental violations may not attract strong enough sanctions. If the regulatory agencies had stronger capacity and conducted regular inspections, companies would probably comply more strictly with environmental standards” (Trader, Field Interview, 2026).

The trader reinforced concerns about weak environmental enforcement. According to the respondent, inadequate inspections and insufficient sanctions may undermine compliance with environmental standards. The participant therefore advocated stronger regulatory capacity and more consistent monitoring of petroleum operations.

Interview Respondent –Female Artisan, 33 years old explained:

“From what we see around here, air pollution does not come from one activity alone. Gas flaring, generators, vehicles, artisanal refining, industrial activities and even the burning of firewood all contribute. Therefore, reducing gas flaring alone may not completely eliminate the problem” (Artisan, Field Interview, 2026).

The artisan emphasized the multiple sources of air pollution within the community. According to the respondent, petroleum-related emissions form part of a wider pollution problem involving transportation, generators, industrial activities, artisanal refining and domestic fuel use. The participant therefore suggested that environmental interventions should address several pollution sources rather than focusing exclusively on gas flaring.

Interview Respondent – Male Health Worker, 35 years old stated:

“People living close to petroleum facilities are exposed to different forms of smoke and emissions. Although pollution has several sources, petroleum-related emissions are a major concern because of their continuous nature. Regular environmental monitoring is therefore necessary to protect the health of residents” (Health Worker, Field Interview, 2026).

The health worker emphasized the importance of continuous environmental monitoring and community health protection. According to the respondent, residents living or working close to petroleum facilities may experience prolonged exposure to smoke and emissions. The participant therefore considered regular monitoring necessary for identifying environmental risks and protecting residents.

Supporting the above views, literature on Niger Delta maintain that Gas flaring increases local temperatures through continuous thermal radiation from flare stacks and greenhouse gas emissions that trap outgoing infrared radiation. The World Bank Global Gas Flaring Tracker Report (2024) estimated that global gas flaring generated approximately 381 million tonnes of carbon dioxide equivalent (CO₂e) in 2023, while methane released through incomplete combustion possesses a much higher global warming potential than carbon dioxide over shorter time horizons. Supporting this, Ite, Ibok, Ite, and Petters (2013) reported that prolonged gas flaring causes vegetation degradation, reduced soil moisture, declining agricultural productivity, biodiversity loss, leaf scorching, premature drying, reduced flowering, and stunted plant growth due to continuous heat and atmospheric pollutants. Likewise, the Food and Agriculture Organization of the United Nations (FAO, 2023)



estimated that rising temperatures and increasing climate variability are already reducing agricultural productivity across sub-Saharan Africa, particularly among rain-fed smallholder farmers, posing significant threats to crop production and household food security in Ibeno. Climate stress also undermines freshwater, coastal, and mangrove ecosystems. The IPCC (2023) reported that increasing temperatures reduce dissolved oxygen concentrations, contribute to declining fisheries productivity, coastal ecosystem degradation, and biodiversity loss in tropical marine environments, while UNEP (2011) found that hydrocarbon pollution and thermal stress delay the recovery of Niger Delta wetlands by slowing mangrove regeneration and reducing shoreline protection, carbon sequestration, fisheries habitats, biodiversity conservation, and ecosystem services.

2.4 Acid Rain and Environmental Degradation in Ibeno Local Government Area: Evidence from Baseline Data

Interview Responses on Acid Rain, Environmental Contamination and Material Corrosion in Ibeno LGA

In response to the above raised question, a respondent, Male Farmer, 42 years old maintained that:

“We have noticed that the rainwater is sometimes different from what we were used to. After periods of gas flaring, some farmers complain that their crops do not perform as well as before. The leaves of some plants become yellow or dry prematurely. We cannot say exactly what is responsible, but many people in the community believe that the smoke and gases from the flares contribute to these changes” (Farmer, Field Interview, 2026).

The farmer explained that residents have observed changes in rainwater and crop conditions during periods of intensive gas flaring. According to the respondent, yellowing leaves, premature drying and poor crop performance have become concerns among farmers. Although the participant could not scientifically establish a direct causal relationship between gas flaring and the observed changes, the respondent noted that community members commonly associate these conditions with emissions from flare sites.

Another Male Farmer, 58 years old explained:

“The soil in some areas does not seem to support crops as well as it used to. Farmers have noticed changes in crop growth and the condition of vegetation. When the rain falls after prolonged periods of flaring, we sometimes worry about its effect on our farms. We do not have the equipment to test the rainwater, but our experience tells us that the environment is changing” (Farmer, Field Interview, 2026).

The respondent focused on changes in soil productivity and vegetation. According to the farmer, some agricultural areas no longer appear to support crops as effectively as before, while changes in vegetation have increased concerns among farming households. The participant acknowledged the absence of laboratory equipment for testing rainwater but emphasized that farmers' observations provide evidence, from their perspective, that environmental conditions are changing.

Interview Respondent – Female Farmer, 37 years old further stated:

“Farmers are becoming more careful about the condition of their crops, particularly after periods of heavy flaring. We sometimes notice that plants do not maintain the same appearance or strength as they did previously. Whether this is caused by the rain, the soil or



the emissions from the oil facilities is difficult for us to determine, but the changes are noticeable to those who cultivate the land” (Farmer, Field Interview, 2026).

The respondent emphasized changes in plant appearance and crop vitality. Rather than attributing the observed conditions exclusively to gas flaring, the farmer identified rainfall, soil conditions and petroleum emissions as possible factors. The account nevertheless indicates that prolonged environmental changes have increased farmers' concerns about crop productivity and the sustainability of agricultural activities.

Interview Respondent 38 – Male Fisherman maintained that:

“The rain and water conditions have changed over the years. Sometimes when there is heavy rain after the flares have been burning for a long time, people become concerned about what is coming down with the rain. We depend on the creeks and rivers for fishing, so anything that affects the quality of the water can also affect the fish and our livelihood” (Fisherman, Field Interview, 2026).

The fisherman explained that changes in rainfall and surface-water conditions are particularly significant to households dependent on fishing. According to the respondent, heavy rainfall following prolonged flaring creates concerns about possible contamination of rivers and creeks. Such concerns are important because changes in water quality may affect aquatic organisms and consequently the livelihood of fishing households.

Another Female Fisherman, 41 years old added:

“When the environment changes, we become concerned about the rivers because the fish depend on the condition of the water. We cannot determine from observation alone what substances may be entering the creeks through rainfall, but fishermen pay attention to changes in water colour, smell and the behaviour of fish. Any deterioration in water quality can create problems for fishing activities” (Fisherman, Field Interview, 2026).

The respondent highlighted the importance of observable environmental indicators to fishing communities. Changes in water colour, odour and fish behaviour are used by fishermen to assess whether aquatic conditions appear normal. The participant noted that deterioration in water quality could affect fish availability and make fishing more difficult, thereby creating additional livelihood uncertainty.

Interview Respondent – Male Community Leader, 48 years old observed:

“One of the problems we have observed around the community is the rapid deterioration of roofing sheets and other metal structures. Some roofs become rusty much earlier than expected. Residents often associate this with the smoke and emissions from the oil facilities, especially the gas flares. During periods of frequent flaring, people become more concerned about the condition of the environment” (Community Leader, Field Interview, 2026).

The community leader identified accelerated corrosion of roofing sheets and other exposed metal structures as a visible indication of environmental deterioration. According to the respondent, residents commonly associate the rapid rusting with emissions from petroleum facilities, particularly during periods of frequent flaring. The condition of buildings and exposed materials has therefore become one of the ways residents perceive changes in their environment.

Another Male Community Leader, 61 years old explained:



“Residents have become increasingly concerned about changes they can see around their homes and farms. The deterioration of buildings and vegetation, together with concerns about rainwater, has created the impression that the environment is under continuous stress. People want to know whether the emissions from petroleum activities are contributing to these changes” (Community Leader, Field Interview, 2026).

The respondent explained that environmental concerns extend beyond farming and fishing to the general physical condition of the community. According to the participant, changes in vegetation, buildings and rainwater have strengthened residents' perception that the environment is experiencing sustained pressure. The community leader therefore emphasized the need for systematic environmental assessment to determine the extent to which petroleum-related emissions contribute to these observed changes.

Interview Respondent – Female Community Health Worker, 34 years old stated:

“People in the community are concerned about the possible effects of polluted air and rain on their health. During periods of intense flaring, residents complain about unpleasant smells, eye irritation and other discomforts. There are also concerns about using rainwater collected from rooftops when there has been a lot of smoke in the atmosphere. These concerns have made some residents more cautious about the quality of the water they use” (Community Health Worker, Field Interview, 2026).

The community health worker explained that concerns about air pollution have increasingly influenced residents' perceptions of environmental health. According to the respondent, unpleasant odours and eye irritation are among the complaints reported during periods of intense flaring. The participant further noted that residents have become more cautious about harvesting rainwater from rooftops following prolonged periods of smoke and gas flaring.

Another Male Community Health Worker, 41 years old maintained:

“From a community health perspective, residents need reliable information about the quality of air and water around petroleum facilities. People often make decisions based on what they see or smell because regular environmental testing is not always available. When there is intense flaring, concerns about rainwater and other sources of water usually increase” (Community Health Worker, Field Interview, 2026).

The respondent stressed the importance of reliable environmental information and regular monitoring. According to the participant, residents often rely on visible and sensory observations because scientific testing of air and water is not consistently available. The health worker therefore considered systematic monitoring important for reducing uncertainty and helping residents make informed decisions about environmental exposure and water use.

Interview Respondent – Male Local Artisan, 41 years old explained:

“The environmental conditions have affected some of the structures we use for our work. Metal roofs, tools and other exposed materials tend to rust quickly, especially in this coastal environment. Many people believe that the emissions from gas flaring make the corrosion worse. We have to spend money more frequently on repairs and replacement, which increases the cost of maintaining our businesses” (Local Artisan, Field Interview, 2026).

The artisan explained that environmental conditions have economic implications for small-scale businesses. According to the respondent, rapid corrosion affects roofing materials, tools and other



exposed equipment, resulting in more frequent repairs and replacements. The participant noted that these additional maintenance costs increase the expenses of operating local businesses and can consequently reduce profitability.

The interview responses indicate that residents associate prolonged gas flaring with changes in rainfall, vegetation, soil productivity, water quality, and the accelerated corrosion of metal structures. Although the respondents could not scientifically establish the chemical composition or pH of rainfall, their experiences reveal a strong community perception of environmental changes associated with petroleum-related emissions. These accounts therefore provide useful qualitative evidence of residents' concerns regarding the possible effects of acid deposition and atmospheric pollution in Ibeno Local Government Area.

Table 2: Environmental and Socio-Economic Consequences of Gas Flaring in Ibeno Local Government Area.

S/N	Environmental Component	Baseline Evidence/Observed Impact	Consequences in Ibeno Local Government Area
1	Air Quality	Gas flaring emits CO ₂ , CH ₄ , SO ₂ , NO _x , CO, VOCs, black carbon, soot, and PM _{2.5} , causing atmospheric pollution.	Persistent smoke, soot deposition, offensive odours, poor visibility, declining air quality, and environmental discomfort.
2	Climate Change	Greenhouse gases released during gas flaring increase atmospheric warming and radiative forcing.	Increased contribution to global warming, localized climate change, and declining environmental sustainability.
3	Temperature Increase	Continuous flare heat elevates ambient temperatures around petroleum facilities.	Excessive heat, heat stress, reduced outdoor productivity, declining environmental comfort, and localized warming.
4	Rainfall and Climate Variability	Atmospheric emissions alter local climatic conditions and cloud formation.	Irregular rainfall patterns, prolonged dry seasons, delayed rainfall onset, increased drought risk, and reduced agricultural planning efficiency.
5	Acid Rain	Sulphur dioxide and nitrogen oxides react with atmospheric moisture to produce sulphuric and nitric acids.	Soil acidification, nutrient leaching, declining soil fertility, corrosion of roofing sheets, buildings, pipelines, and public infrastructure.
6	Agricultural Productivity	Thermal radiation and atmospheric pollutants suppress photosynthesis, reduce soil moisture, and damage crops.	Reduced crop yields, premature drying of vegetation, poor flowering, stunted crop growth, and increased food insecurity.
7	Vegetation and Forest Resources	Heat and pollutants damage plant tissues and reduce regeneration.	Leaf scorching, deforestation, biodiversity loss, declining vegetation cover, and reduced ecosystem productivity.
8	Aquatic Ecosystems	Increased atmospheric temperatures alter water temperature and reduce dissolved oxygen.	Declining fisheries productivity, reduced aquatic biodiversity, ecosystem imbalance, and increased mortality of aquatic organisms.
9	Human Health	Long-term exposure to PM _{2.5} , SO ₂ , NO _x , and VOCs increases disease burden.	Respiratory diseases, asthma, chronic cough, eye irritation, headaches, cardiovascular diseases, skin



			disorders, lung impairment, adverse pregnancy outcomes, and premature mortality.
10	Occupational Productivity	Excessive environmental heat and polluted air reduce labour efficiency.	Reduced agricultural and fishing productivity, increased occupational health risks, absenteeism, and declining household earnings.
11	Infrastructure	Acid deposition accelerates corrosion of metals and construction materials.	Rapid deterioration of zinc roofing sheets, pipelines, bridges, machinery, vehicles, and increased maintenance costs.
12	Ecosystem Services	Continuous gas flaring weakens ecosystem resilience and ecological functions.	Reduced carbon sequestration, declining pollination services, impaired nutrient cycling, biodiversity loss, and weakened environmental resilience.
13	Household Welfare	Environmental degradation increases the cost of living and reduces livelihood opportunities.	Increased healthcare expenditure, declining household income, higher poverty levels, migration, and reduced quality of life.
14	Sustainable Environmental Governance	Weak pollution control and inadequate gas utilization infrastructure sustain routine flaring.	Persistent environmental degradation, cumulative pollution, reduced resilience to climate change, and obstacles to achieving the Sustainable Development Goals (SDGs).

World Bank (2024), Onuha et al. (2018), Ite et al. (2013), Nriagu et al. (2016), Okonkwo et al. (2015), United Nations Environment Programme (UNEP, 2011).

Findings of the Study

Oil Spillage

The findings of the study revealed that oil spillage has significantly contributed to environmental degradation and socio-economic hardship in Ibeno Local Government Area. Respondents reported that repeated oil spills have contaminated farmlands, altered soil conditions, reduced crop yields, and rendered some agricultural areas unsuitable for cultivation, resulting in the abandonment of some farmlands and increased reliance on alternative livelihoods. The study also found that oil spillage has contaminated rivers, streams, creeks, wetlands, and other water sources, with respondents reporting oily films, unpleasant odours, discolouration, and concerns about the suitability of local water for drinking, cooking, fishing, and other domestic activities. Furthermore, oil pollution has adversely affected aquatic ecosystems and fisheries through declining fish catches, reduced availability of aquatic species, contamination of fishing grounds, and degradation of mangrove ecosystems that serve as breeding and nursery grounds for aquatic organisms. The combined effects of declining agricultural and fishing productivity have weakened traditional livelihoods, reduced household income and food security, and compelled some residents, particularly youths, to engage in petty trading, casual labour, or migration in search of alternative sources of income. These findings are consistent with Ite et al. (2013), who reported that petroleum hydrocarbons alter soil properties, disrupt nutrient cycling, reduce agricultural productivity, contaminate aquatic ecosystems, and impair fisheries. They also corroborate Nduka and Orisakwe (2010), who identified petroleum hydrocarbons and heavy metals in soils around oil-producing communities and associated them with poor crop growth and reduced agricultural productivity. Similarly, UNEP (2011) documented extensive contamination of agricultural land, rivers, wetlands, groundwater, and mangrove ecosystems in oil-producing communities, while Elum et al. (2016) and UNDP (2006) linked petroleum-related environmental degradation in the Niger Delta with declining livelihood opportunities, poverty, unemployment, and reduced human development.



Findings on Gas Flaring

The findings further revealed that gas flaring is a major source of environmental, climatic, health, and socio-economic stress in Ibeno Local Government Area. Respondents consistently reported smoke, soot deposition, offensive odours, poor visibility, excessive heat, and general environmental discomfort around areas affected by continuous gas flaring. The study also found that persistent flaring contributes to increasing temperatures and climate stress, as respondents described hotter environmental conditions, intense heat around flare locations, irregular rainfall, prolonged dry periods, and difficulties in planning farming and other outdoor activities. In addition, residents associated prolonged exposure to gas-flaring emissions with coughing, breathing difficulties, eye irritation, headaches, skin irritation, and other forms of physical discomfort, particularly when smoke and emissions are carried towards residential areas. The findings indicate that the effects of gas flaring extend beyond air pollution to household welfare, occupational productivity, and community resilience, as excessive heat and polluted air make farming, fishing, and other outdoor occupations more difficult and potentially reduce household earnings. These findings are consistent with Ite et al. (2013), who identified carbon dioxide, methane, sulphur dioxide, nitrogen oxides, volatile organic compounds, and particulate matter among pollutants released through gas flaring. They also agree with the World Bank Global Gas Flaring Tracker Report (2024), which highlights the continuing significance of gas flaring as a source of greenhouse-gas emissions, and with IPCC (2023), which identifies greenhouse-gas emissions from human activities, particularly fossil-fuel use, as the principal driver of contemporary global warming. The health-related findings further corroborate Nriagu et al. (2016), who reported increased risks of respiratory and other environmentally related health problems in oil-producing communities in the Niger Delta, and WHO (2021), which identifies ambient air pollution as an important contributor to respiratory and cardiovascular diseases. Overall, the findings suggest that persistent gas flaring has compounded environmental degradation and climate stress in Ibeno, while inadequate monitoring, weak enforcement, delayed intervention, and insufficient sanctions have contributed to the continued persistence of petroleum-related environmental problems.

Conclusion

Oil exploration activities, particularly oil spillage and gas flaring, have negatively affected the environment and socio-economic well-being of residents in Ibeno Local Government Area. Oil spillage has degraded farmlands, contaminated rivers and creeks, reduced agricultural and fishing productivity, and weakened traditional livelihoods that depend largely on natural resources. Gas flaring has also contributed to poor air quality, excessive heat, soot deposition, offensive odours, and environmental stress, with residents reporting concerns about associated health problems and changing climatic conditions.

The combined effects of oil spillage and gas flaring have increased household vulnerability through declining income, reduced food availability, health concerns, and loss of livelihood opportunities. Although environmental regulations and regulatory institutions exist, inadequate monitoring, weak enforcement, and delayed remediation remain major concerns. Addressing these challenges requires stronger enforcement of environmental regulations, regular monitoring of petroleum operations, prompt remediation of polluted sites, reduction of gas flaring, and greater protection of community livelihoods and natural resources.



Recommendations

- i. **Strengthen environmental regulation and enforcement in oil-producing areas**
Government agencies such as NOSDRA and the Ministry of Environment should enforce stricter compliance measures on oil companies operating in Ibeno. Regular monitoring, heavy penalties for oil spills and gas flaring violations, and mandatory environmental audits should be implemented to ensure accountability and reduce environmental damage.
- ii. **End routine gas flaring and promote gas utilization infrastructure**
Oil companies should be compelled to invest in gas capture, processing, and utilization facilities to eliminate routine flaring. Government policy should prioritize gas commercialization projects, including gas-to-power initiatives, to convert associated gas into useful energy instead of releasing it into the atmosphere.
- iii. **Implement environmental remediation and community health support programs**
A comprehensive remediation programme should be established to restore polluted soil and water systems in affected communities. In addition, healthcare facilities in Ibeno should be strengthened to address pollution-related illnesses, with regular medical outreach programmes for early detection and treatment of respiratory and other environmental health conditions.

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Authors' contributions

All authors read and approved the final manuscript.

Data availability

No datasets were generated or analyzed during the current study.



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