

# OIL EXPLORATION AND PUBLIC HEALTH CHALLENGES IN ISOKOLAND: A STUDY OF SOCIO-ECONOMIC COSTS OF POLLUTION IN THE WESTERN NIGER DELTA

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**Abstract:** The extraction of oil in the Niger Delta has played a pivotal role in bolstering Nigeria's economy; however, it has simultaneously led to substantial environmental degradation and public health crises among the communities affected by this industrial activity. This study examines the socioeconomic and health-related repercussions of petroleum-induced pollution in Isokoland, a region in the western Niger Delta. Employing a mixed-methods cross-sectional design, the study collected data from 360 households across six communities significantly affected by oil extraction. Various data collection methods were utilized, including structured questionnaires, key informant interviews, and comprehensive field observations. The quantitative data analysis, conducted with SPSS (v27), was complemented by thematic analysis of the qualitative data gathered. The results revealed alarming statistics: 82% of respondents reported significant losses in agricultural income directly linked to oil-related activities, while 63% experienced ongoing health issues, with respiratory ailments and waterborne diseases being particularly prevalent. Moreover, 71% of participants noted a profound decline in farmland productivity, which they attributed to contamination from

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oil spills and related activities. Statistical assessments indicated a robust negative correlation ( $r = -0.79$ ,  $p < 0.01$ ) between the degree of environmental degradation and the productivity of agricultural land. These critical findings underscore the urgent necessity for effective environmental remediation strategies, enhanced public health initiatives, and inclusive policies that engage local communities. Such measures are essential for fostering sustainable development in oil-producing regions and mitigating the adverse effects of petroleum extraction on both the environment and public health.

**Keywords:** Oil exploration, Environmental degradation, Public health, Socio-economic cost, Niger Delta, Isoko land

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## **Introduction**

The Niger Delta region of Nigeria is a crucial player in the nation's petroleum economy, serving as a significant source of oil and gas revenue. However, this economic wealth comes at a steep price, as the area grapples with profound environmental degradation and a myriad of social challenges. Despite the financial benefits derived from oil extraction, local communities find themselves facing severe ecological damage and a decline in their traditional livelihoods (Akpogheli *et al.* 2024).

In the western part of the Niger Delta, particularly within the Isoko North and Isoko South Local Government Areas, often collectively known as "Isoko land", the majority of the population relies on agriculture and fishing for their sustenance. However, the reality of oil-related pollution has cast a dark shadow over these communities. Issues such as oil spills, gas flaring, and pipeline leaks have wreaked havoc on the natural environment, resulting in a significant decline in soil fertility, deteriorating water quality, and decreased crop yields. These environmental impacts have critically undermined food production and threatened the very fabric of rural livelihoods (Igbinidu & Osabuohien, 2023).

A comprehensive study conducted in 2023 focused on the alarming rates of farmland degradation across the Niger Delta, revealing that approximately 31% of farmers reported experiencing severe degradation of their lands as a direct consequence of oil spills. Among the primary culprits identified were pipeline leakages and terminal-station explosions, which have transformed once fertile lands into toxic wastelands (Igbinidu, 2023).

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The health impacts stemming from pollutants associated with the petroleum industry are increasingly alarming, particularly when examined through a detailed lens of the situation in the Niger Delta. A thorough scoping review has illuminated the stark consequences of oil exploitation in this region, revealing disturbingly high levels of heavy metal contamination in the environment. These pollutants contribute to a myriad of respiratory health issues and foster a range of public health crises that disproportionately affect local communities (Faithwin and Jared, 2025).

Furthermore, another critical review has shed light on the detrimental effects of oil spills, which have wreaked havoc on soil quality and agricultural productivity. These catastrophic incidents have resulted in a significant decline in the nutrient content of crops. For instance, certain vegetables have seen a staggering reduction of as much as 36% in their ascorbic acid levels, while cassava, a staple food source, has experienced a decline of up to 40% in its protein content. Such alarming reductions in nutritional value not only threaten food security but also amplify health risks, thereby exacerbating the already troubling rates of childhood malnutrition observed in the affected communities (Best and Seiyifa, 2013).

Despite the unyielding presence of the oil industry for several decades, agriculture continues to serve as the backbone of rural economies throughout the Niger Delta. A comprehensive review of crude oil exploration has underscored the significance of farming as a primary source of employment and sustenance, especially in Nigeria's rural areas. The steady erosion of this agricultural foundation presents a formidable challenge to development and sustainability, particularly in regions like Isoko land, where traditional practices are becoming increasingly compromised (Eleke et al., 2019).

From a theoretical standpoint, the insights gained from this study are framed within the Political Ecology Framework. This approach emphasises the intricate interplay of environmental change, power dynamics, and economic structures that together produce uneven social and ecological outcomes (Bryant & Bailey, 1997). Within the context of oil-rich regions, the extraction of natural resources frequently intersects with corporate interests, regulatory voids, and the marginalisation of local communities. Consequently, environmental degradation emerges not just as an ecological crisis but as a significant social justice issue, highlighting the urgent need for equitable solutions that prioritise the well-being of those most affected.

In light of this context, the current study aims to fill the significant gap in localized empirical evidence regarding the effects of environmental degradation caused by oil exploration on agriculture, health, and socio-economic welfare in Isoko land. Specifically, the study seeks to document the various forms and drivers of degradation, quantify its impact on agricultural productivity and health, evaluate the socio-economic consequences for households, and propose relevant policy and community responses tailored to local needs.

## **Materials and Methods**

### **Study area**

The study was conducted in the lush and vibrant Isoko land, which includes the Isoko North and Isoko South Local Government Areas located in the heart of Delta State, Nigeria. This region lies gracefully between the latitudes of 5°20' N and 5°45' N and longitudes of 6°10' E and 6°35' E, showcasing a diverse topography ingrained with the rich beauty of humid tropical rainforest vegetation (Eduvwie & Ntukogu, 2022). Characterized by its abundant biodiversity, Isoko land experiences a mean annual rainfall that varies between 2,000 and 2,500 mm, contributing to the verdant landscape where various flora and fauna thrive. The climate is warm, with average temperatures oscillating between 28 to 32 °C, creating a humid environment that is both inviting and challenging for its inhabitants (NiMet, 2023).

The local economy is deeply rooted in subsistence farming and fishing, with communities relying on these practices for their daily sustenance. However, this idyllic lifestyle is tempered by the significant presence of oil exploration and gas-flaring activities in the region. This juxtaposition of natural beauty and industrial activity renders Isoko land a critical site for investigating the socio-economic ramifications and health impacts stemming from oil-induced environmental degradation. The complex interplay between economic dependence on natural resources and the threats posed by industrial activities underscores the importance of this study.

### **Research Design**

The study adopted a concurrent mixed-methods cross-sectional design, which effectively combines quantitative and qualitative approaches to provide a comprehensive understanding of the research topic. This design involves the use

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of quantitative surveys to collect numerical data that can quantify broad patterns, such as declines in agricultural yield and the prevalence of health complaints among community members. Simultaneously, qualitative methods, including in-depth interviews and observational data, are employed to gain deeper insights into the perceptions, experiences, and contexts surrounding these issues.

The qualitative interviews facilitate a better understanding of community responses to environmental changes and challenges, as well as perceived institutional failures that may exacerbate these problems. This dual approach not only allows for the identification of statistical trends but also enriches the findings by contextualizing these trends within the lived experiences of individuals and the broader community dynamics.

Such a mixed-methods design is increasingly recommended for environmental and agricultural studies in Nigeria, as it provides a holistic perspective that can inform better policy and intervention strategies. By drawing on both quantitative and qualitative data, this study aims to contribute significantly to the understanding of the interplay between agricultural practices and environmental sustainability in the region (Ozodiegwu *et al.* 2023; Onyishi, 2021).

### **Population and sampling**

The target population comprised households engaged in farming and fishing within the six purposively selected oil-impact communities in Isoko land (Ozoro, Oleh, Emede, Irri, Enhwe and Aviara). A multistage sampling procedure was used:

Stage 1: Purposive selection of 6 communities based on documented oil spill/gas flaring incidence.

Stage 2: Within each community, household lists were obtained from local agricultural extension offices.

Stage 3: Using systematic random sampling, 60 households per community were selected, resulting in a total sample size of 360 respondents. This sample size aligns with similar Nigerian agricultural livelihood studies (Onyishi, 2021).

### **Data collection instruments**

Data collection occurred between March and August 2025. Three main instruments were deployed:

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- i. Structured Questionnaire: Captured demographic characteristics, farming/fishing inputs and outputs (areas cultivated, yield, income), exposure to oil/gas-related activities and self-reported health symptoms.
  - ii. Key Informant Interviews (KIIs): Conducted with 15 stakeholders including community leaders, health officers, agricultural extension agents, and oil-company liaison officers. Questions centred on community experience of oil exploration impacts, institutional response and coping strategies.
  - iii. Field Observations and Site Visits: Researchers documented visible signs of oil contamination (e.g., spilled pipelines, flared gas stacks, degraded land) and collected geo-location data for mapping.

### **Variables and measurement**

- i. Independent Variable: Environmental Degradation (ED): Operationalised via respondents' reported exposure to oil spills, gas flaring, water pollution and soil infertility, rated on a 5-point Likert scale (1=very low, 5=very high).
- ii. Dependent Variables: Agricultural Decline (AD): Measured by changes over the past ten years in crop yield (tons/ha), area under cultivation (ha) and farm income (₦).
- iii. Public Health Outcomes (PHO): Measured by frequencies of health symptoms (respiratory, dermatological, gastrointestinal) and self-reported health-cost burden.
- iv. Control Variables: Socio-demographics (age, gender, education, household size), and livelihood type (farming vs fishing).

### **Data analysis**

Quantitative data were processed using IBM SPSS Statistics v27. Descriptive statistics (means, percentages, standard deviations) summarized the key variables. Inferential techniques included:

- i. Pearson correlation to assess the relationship between ED and AD/PHO.
- ii. Multiple regression analysis to identify the predictive effect of ED on AD and PHO, controlling for socio-demographics.
- iii. ANOVA to test for differences in outcomes between communities.

Qualitative data from KIIs and observations were analyzed via thematic analysis, following the five-step process outlined by Braun & Clarke (2019):

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familiarization, coding, theme development, review and naming. Triangulation of quantitative and qualitative findings enhanced the robustness of the results (Onyishi, 2021).

### **Validity and reliability**

The questionnaire instrument underwent a comprehensive expert review, involving detailed evaluations by two environmental scientists and one agricultural economist affiliated with Delta State University. This multi-disciplinary expertise ensured that the content and structure of the questionnaire were rigorously aligned with the research objectives. Following the expert review, a pilot study was conducted involving 30 households within a community that was not included in the final sampling framework. The analysis of the pilot data yielded a Cronbach's alpha coefficient of 0.81, indicating a strong level of internal consistency among the Likert-scale items used in the questionnaire.

Additionally, the study employed a mixed-methods design that integrated diverse data collection techniques, including surveys, in-depth interviews, and direct observations. This methodological triangulation significantly enhanced the overall validity of the findings, as it allowed for the corroboration of data across different sources and methods, thereby providing a more comprehensive understanding of the research questions (Ozodiegwu *et al.* 2023). Such a robust approach ensures that the conclusions drawn from the study are well-supported and reflective of the complexities present in the subject matter.

### **Study limitations**

This study acknowledges several limitations that may impact the findings. Firstly, the reliance on self-reported past yields raises concerns about recall bias, as participants might not accurately remember or may unintentionally exaggerate their previous agricultural outputs. Additionally, access to comprehensive records from oil companies was restricted, which limited the ability to verify certain data points and could potentially lead to gaps in the information. Furthermore, field access to heavily contaminated zones was occasionally restricted due to safety concerns, which may have hindered thorough investigation and observation in these critical areas.

To address these limitations, the research implemented several strategies. It further cross-checked self-reported data with existing extension records to enhance accuracy and reliability. Moreover, we utilized observational data wherever feasible to supplement our findings, providing a more robust context for the results. Although these measures helped to mitigate the effects of the noted limitations, they should still be considered when interpreting the overall conclusions of the study.

## **Discussion of Findings**

### **Demographic characteristics of respondents**

A total of 360 respondents participated in the study across six oil-producing communities in Isokoland. As shown in Table 1, 56.4% of respondents were male, with an average age of 43 years ( $\pm 12$ ). Over 71% attained at least secondary education, while 84% engaged in farming or fishing as their major occupation. The mean household size was six members, indicating high dependency ratios typical of rural Niger Delta communities. These characteristics align with patterns documented by Suleiman *et al.* (2022), who note similar socio-economic pressures in rural oil-bearing regions.

Table 1. Socio-demographic characteristics of respondents (n = 360)

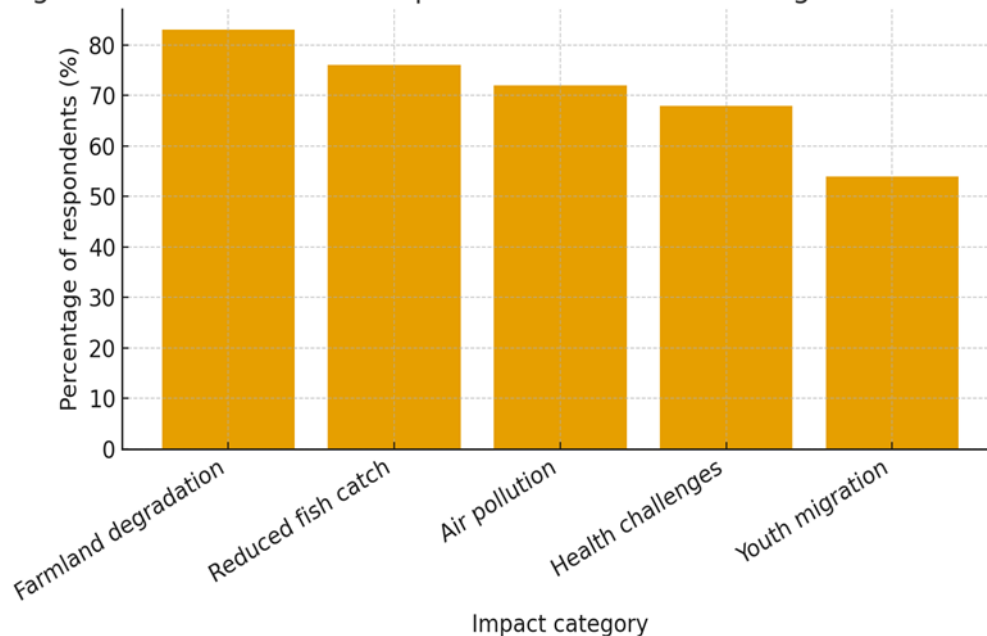
<b>Variable</b>	<b>Category</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Gender	Male	203	56.4
	Female	157	43.6
Age group (years)	20–39	124	34.4
	40–59	175	48.6
	$\geq 60$	61	17.0
Educational level	No formal education	45	12.5
	Primary	59	16.4
	Secondary	161	44.7
	Tertiary	95	26.4
Occupation	Farming	185	51.4
	Fishing	118	32.8
	Trading/others	57	15.8

Variable	Category	Frequency	Percentage (%)
Mean household size	-	-	6 ± 2.1

### Environmental Degradation Patterns

Oil exploration activities in Isoko land have resulted in visible environmental degradation, including polluted soils, water contamination, and persistent gas flaring. Figure 1 (below) shows that 83% of respondents identified farmland degradation as the most severe impact, followed by reduced fish catch (76%), air pollution (72%), health challenges (68%), and youth migration (54%).

Figure 1. Socio-economic impacts of environmental degradation in Isokoland



**Figure 1. Socio-economic impacts of environmental degradation in Isoko land**

These results mirror previous studies in Delta and Bayelsa States, where similar degradation patterns were attributed to frequent oil spills and poor remediation (Igbidun & Osabuohien, 2023; Akpogheli *et al.*, 2024). Field visits revealed extensive oil-film residues on river surfaces, soil compaction, and the death of vegetation particularly in areas near flaring sites.

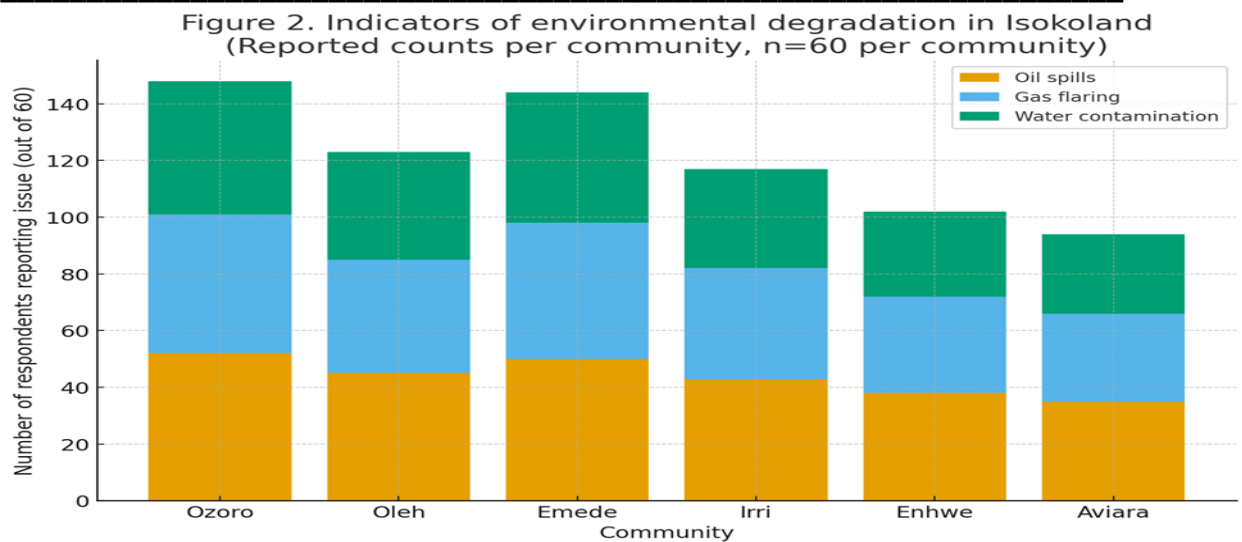


Figure 2. Indicators of environmental degradation in Isokoland

### Agricultural Productivity Decline

Agricultural production has sharply declined over the past decade. Regression analysis (Table 2) indicates a strong negative correlation ( $r = -0.68$ ,  $p < 0.01$ ) between environmental degradation and crop yield. A one-unit increase in degradation score led to an average income reduction of \$35 per household. This pattern corroborates earlier research linking hydrocarbon pollution with reduced soil fertility and declining yields (Suleiman *et al.*, 2022; Nwokocha *et al.*, 2021).

Table 2. Regression analysis of environmental degradation versus socio-economic outcomes

Dependent Variable	Independent Variable	Beta ( $\beta$ )	t-value	Sig. (p)	R <sup>2</sup>
Farm income (₦)	Environmental degradation index	-0.62	-9.41	0.000	0.46
Crop yield (tons/ha)	Environmental degradation index	-0.68	-10.02	0.000	0.51
Health expenditure (₦)	Environmental degradation index	+0.59	8.45	0.001	0.43

### Public Health Outcomes

About 68% of respondents reported suffering at least one pollution-related ailment in the past year chiefly respiratory illness (44%), skin disease (36%), and

gastrointestinal problems (27%). A chi-square test confirmed a significant association between proximity to gas flaring and respiratory symptoms ( $\chi^2 = 23.41, p < 0.01$ ). Thematic analysis of interviews revealed five key themes (Table 3), declining livelihood security, health vulnerability, community displacement, loss of trust in oil firms, and weak government response.

Table 3. Thematic summary of key qualitative findings

Theme	Description	Illustrative Quote
Declining livelihood security	Farmers and fishers report drastic yield losses and reduced income.	“Before the oil spill, we harvested enough to feed and sell. Now the soil is dead.” (Farmer, Emede)
Health vulnerability	High incidence of chronic cough, rashes, and fatigue attributed to pollution.	“Children often fall sick when the gas flares at night.” (Health worker, Ozoro)
Community displacement	Youth migration and loss of farmland ownership.	“Many young people have left for the city because the farms no longer yield.” (Community leader, Irri)
Loss of trust	Residents express frustration at oil company negligence.	“They only show up when there’s a protest.” (Elder, Oleh)
Weak institutional response	Perceived failure of environmental monitoring and compensation mechanisms.	“Government promises come, but cleanup never happens.” (Farmer, Aviara)

These findings are consistent with Okposo *et al.* (2025), who documented elevated respiratory disorders and reproductive health risks in similar oil-bearing communities. Ukaogo *et al.* (2020) also attributed increased oxidative stress and carcinogenic exposure to unregulated gas flaring in the Niger Delta.

**Conclusion**

This study highlights the dual crises of environmental degradation and public health decline induced by oil exploration in Isoko land. The consequences ranging from agricultural loss to respiratory and waterborne diseases underscore

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the unsustainable nature of current extractive practices. Environmental degradation in Isoko land is directly linked to declining agricultural productivity and rising disease burden. Oil exploration has resulted in substantial socio-economic costs, threatening livelihoods and food security. Institutional and policy responses remain inadequate to address these multidimensional challenges.

### **Recommendations**

1. **Environmental Remediation:** Immediate clean-up of oil-contaminated soils and waterways under the supervision of National Oil Spill and Detection Regulatory Agency (NOSDRA) and community representatives.
2. **Public Health Interventions:** Establishment of community health centers equipped for pollution-related disease management.
3. **Policy Enforcement:** Strengthening the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) implementation with strict penalties for oil companies violating environmental standards.
4. **Livelihood Diversification:** Promote agricultural support programs, microcredit schemes, and skill acquisition for affected households.
5. **Community Participation:** Encourage participatory environmental governance involving host communities in decision-making and monitoring.

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