Received: 23.12.2025| Accepted: 19.01.2026 |Published: 03.02.2026
Citations: Wonah, G. O. & Akan, A.T (2026) Illegal Mining and Environmental Degradation in Ogoni Land, Niger Delta, Assessing Impacts on Land and Water Resources GAIJASSVol.1.1.2026 pp.12-24
https://globreshub.org/index.php/gaijass https://doi.org/10.7616/gaijass.v1.i29

ILLEGAL MINING AND ENVIRONMENTAL DEGRADATION IN OGONI LAND, NIGER DELTA: ASSESSING IMPACTS ON LAND AND WATER RESOURCES

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ABSTRACT

Illegal mining has emerged as a critical and escalating environmental threat in Ogoni land, Rivers State, Nigeria, compounding existing ecological pressures from decades of oil pollution in the Niger Delta region. This paper assessed the impact of illegal mining on land degradation and water resources in Ogoni land, to examine the nature and extent of unregulated mining activities, evaluating their environmental consequences, and analysing their broader socio-economic implications for local communities. A descriptive survey research design was adopted, combining primary data from structured questionnaires administered to 380 respondents across the four local government areas of Khana, Gokana, Tai, and Eleme. Data were analysed using descriptive statistics and Likert scale weighting. Findings reveal that illegal mining is widespread and largely driven by poverty and unemployment and that it has caused severe land degradation through topsoil removal, soil erosion, deforestation, and the creation of abandoned pits that render land unproductive. The assessment showed that while illegal mining provides short-term income for many unemployed youth, it undermines agricultural and fishing livelihoods and perpetuates a cycle of ecological and economic decline. Anchored in "environmental degradation theory" and the "tragedy of the commons framework", the study concludes that without urgent and integrated intervention, the degradation of Ogoni land's land and water resources may become irreversible. It is recommended that government agencies strengthen regulatory enforcement, invest in alternative livelihood programmes, promote environmental rehabilitation, and forge international partnerships to support sustainable environmental management in the region.

Keywords: *Illegal mining, Environmental Degradation, Sustainable Development, Ogoni Land*

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1. INTRODUCTION

Environmental degradation has become one of the most pressing challenges in resource-rich regions of the world, particularly in developing countries where regulatory enforcement is weak. In Nigeria, the Niger Delta region is widely recognised for its rich endowment of natural resources, such as oil, gas, and solid minerals. However, decades of extractive activities, both legal and illegal, have resulted in severe environmental degradation, threatening ecosystems and human livelihoods (Nwankwo & Ifeanyi, 2019). Ogoni land, located in Rivers State within the Niger Delta region, is an environmentally sensitive area that has experienced long-standing ecological challenges, especially from crude oil exploration and spills (UNEP, 2011).

In recent years, illegal mining activities have further compounded these environmental problems. Illegal mining refers to the unauthorised extraction of mineral resources without adherence to environmental regulations, government approval, or sustainable practices (Adekoya, 2019). These activities are often carried out using crude methods that disregard environmental safety. In Ogoni communities, illegal mining activities typically involve the indiscriminate excavation of land, removal of topsoil, and disruption of natural landscapes. These practices contribute significantly to land degradation, loss of biodiversity, and contamination of water resources. The fragile ecosystem of the Niger Delta, characterised by wetlands, mangroves, and rich biodiversity, is particularly vulnerable to such disturbances (Nwilo & Badejo, 2018). Water resources in Ogoni land are also heavily affected. Rivers, streams, and groundwater systems serve as primary sources of drinking water, fishing, and irrigation for local communities. However, illegal mining introduces sediments, heavy metals, and other pollutants into these water bodies, thereby reducing water quality and threatening public health (WHO, 2021). The combined effect of illegal mining and existing environmental stressors such as oil pollution, has made Ogoni land one of the most environmentally degraded areas in Nigeria (UNEP, 2011). This study, therefore, seeks to examine the impact of illegal mining on land degradation and water resources in Ogoni land, with a view to understanding its environmental and socioeconomic implications.

Despite various environmental laws and policies in Nigeria, illegal mining continues to thrive in many rural communities, including Ogoni land. The absence of effective monitoring and enforcement mechanisms has allowed individuals and groups to engage in unregulated mining activities that degrade the environment. In Ogoni land, the consequences of these

activities are becoming increasingly visible. Large portions of fertile land have been destroyed through excavation, leaving behind abandoned pits and unstable soil structures. These degraded lands can no longer support agricultural activities, which is a major source of livelihood for the people (FAO, 2020). Similarly, water resources are being polluted through the deposition of mining waste and sediments into rivers and streams. Communities that rely on these water bodies for drinking, cooking, fishing, and farming are exposed to serious health risks (Obot & Akpan, 2021). The deterioration of water quality has also contributed to the decline in aquatic life, affecting fishing activities that sustain many households. The problem is further worsened by the fact that Ogoni land is already suffering from environmental damage caused by oil exploration activities. The addition of illegal mining intensifies the level of degradation, making environmental recovery more difficult (Nwankwo & Ifeanyi, 2019).

This paper seeks to contribute to existing knowledge on environmental degradation in the Niger Delta region, particularly in relation to illegal mining activities. It will also provide valuable insights for policymakers, environmental agencies, and government authorities on the need for stricter enforcement of mining regulations. The findings of this study will be useful to environmental advocacy groups and non-governmental organisations working to promote sustainable resource management in the region. By highlighting the environmental consequences of illegal mining, the study will support efforts aimed at environmental restoration and conservation.

The scope of this study is geographically limited to Ogoni land in Rivers State, Nigeria. The study focuses specifically on the impact of illegal mining activities on land degradation and water resources within the area. Thematically, the study covers environmental issues such as soil erosion, deforestation, loss of soil fertility, water pollution, and ecosystem disruption. It also considers the socioeconomic implications of environmental degradation on agriculture, fishing, and public health. The study does not extensively cover legal mining operations or oil exploration activities except where they relate to the overall environmental condition of the area.

2. CONCEPTUAL/THEORETICAL REVIEW

Illegal mining refers to mineral extraction activities carried out without official authorisation or in violation of environmental and mining regulations. According to the United Nations Environment Programme (UNEP, 2018), illegal mining often involves the use of crude and unprofessional mining methods, lack of environmental safeguards, and uncontrolled exploitation of mineral resources. In many developing countries, it is driven by poverty, unemployment, and

weak regulatory enforcement (Teschner, 2019). In Nigeria, illegal mining has expanded across rural communities, including parts of the Niger Delta. These activities are often informal and unregulated, resulting in severe environmental consequences such as land destruction and water pollution (Adekoya, 2019).

Land degradation refers to the reduction in the productive capacity of land due to natural or human-induced activities. The Food and Agriculture Organization (FAO, 2020) defines it as the decline in soil quality, vegetation cover, and ecosystem function. Illegal mining contributes significantly to land degradation through the removal of topsoil, deforestation of vegetation, soil erosion, and the formation of abandoned pits and gullies. In fragile ecosystems like the Niger Delta, these effects are more severe due to high rainfall and soft soil structures (Nwilo & Badejo, 2018). Once topsoil is removed, it is quickly washed away, leaving behind infertile subsoil that cannot support crops (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES], 2018). Water resource degradation involves the contamination or depletion of surface and groundwater resources. According to the World Health Organization (WHO, 2021), water pollution occurs when harmful substances such as chemicals, sediments, and biological waste enter water bodies, making them unsafe for human use. In mining areas, water pollution is often caused by sedimentation from excavated soil, the release of heavy metals during blasting and processing, and chemical contamination from mineral processing (Obot & Akpan, 2021). These pollutants reduce water quality and threaten aquatic ecosystems, as well as posing serious public health risks in communities that depend on natural water sources (Obinna & Ebere, 2019).

This study is anchored on the Environmental Degradation Theory, which explains how human activities disrupt natural ecosystems. The theory argues that unsustainable exploitation of natural resources leads to long-term environmental damage, especially when regulatory systems are absent or weakly enforced (Meadows *et al*., 2018). In the context of Ogoni land, illegal mining represents a human-induced stressor that accelerates land and water degradation. The theory helps explain the link between resource exploitation and environmental decline. Hardin's (1968) "Tragedy of the Commons" theory is also relevant. It posits that individuals acting in their self-interest tend to over-exploit shared resources, leading to collective environmental destruction. In Ogoni land, land and water resources are communal. Illegal miners exploit these resources for personal gain without considering long-term environmental consequences, leading to degradation of shared ecosystems (Olawale & Dauda, 2020).

Several studies have examined the environmental impacts of illegal mining in Nigeria and similar regions. Oti (2018) observed that artisanal mining in the Niger Delta leads to the destruction of agricultural land and reduction in soil fertility, affecting food production and rural livelihoods. In a related study, Okeke & Eze (2020) reported that mining activities in southern Nigeria significantly increase sediment load in rivers, thereby reducing water quality and aquatic biodiversity. Focusing on the Niger Delta specifically, Nwankwo & Ifeanyi (2019) noted that environmental degradation in the region is compounded by both oil exploration and illegal mining activities, making restoration efforts more difficult. UNEP (2011), in its assessment of Ogoni land, highlighted severe environmental contamination caused primarily by oil spills but also warned that other extractive activities, including mining, could worsen ecological damage if not controlled. More recently, Chiadikobi *et al*. (2020) documented how mining-related activities in the Niger Delta disrupt hydrological systems, further underscoring the need for integrated environmental management. Additionally, Salami *et al*. (2021) found that water contamination from mining activities in southern Nigeria resulted in elevated levels of heavy metals exceeding WHO permissible limits, with direct implications for human health and food safety.

Water resources in Ogoni land are highly vulnerable to pollution due to the region's wetland ecosystem. Obot & Akpan (2021) note that sedimentation from mining activities increases turbidity in rivers and reduces oxygen levels required for aquatic life, leading to fish death and a decline in biodiversity. UNEP (2011) also reported that water contamination in the Niger Delta has led to widespread health challenges, including waterborne diseases and exposure to toxic substances. Furthermore, environmental degradation caused by illegal mining has significant socioeconomic impacts. Adekoya (2019) explains that loss of fertile land reduces agricultural productivity, leading to food insecurity and poverty in rural areas. Okeke & Eze (2020) further argue that environmental damage increases rural-urban migration as young people leave degraded communities in search of better opportunities.

3. MATERIALS AND METHODS

3.1 Research Design

The study adopted a descriptive survey research design. This design is appropriate because it allows the researcher to collect data from respondents in order to describe and analyse existing conditions as they relate to illegal mining and environmental degradation. According to Kothari & Garg (2019), descriptive survey design is useful in environmental studies where opinions, experiences, and observable conditions are assessed. In this study, it helps to

understand how illegal mining affects land and water resources in Ogoni communities.

3.2 Study Area

The study area is Ogoni land in Rivers State, Niger Delta region of Nigeria. Ogoni land comprises four local government areas: Khana, Gokana, Tai & Eleme. It is situated on longitudes 7^0 5^l 16.66^{ll} to 7^0 33^l 9.92^{ll} and latitudes $4^0$33^{l}7.73^{ll} to 4^0 50^l 02.ll^{ll} as shown in Figure 1. The region is characterised by tropical rainforest vegetation, wetlands, and fertile agricultural land. It is also heavily impacted by environmental degradation due to oil exploration and other human activities, including illegal mining (UNEP, 2011; National Bureau of Statistics [NBS], 2020).

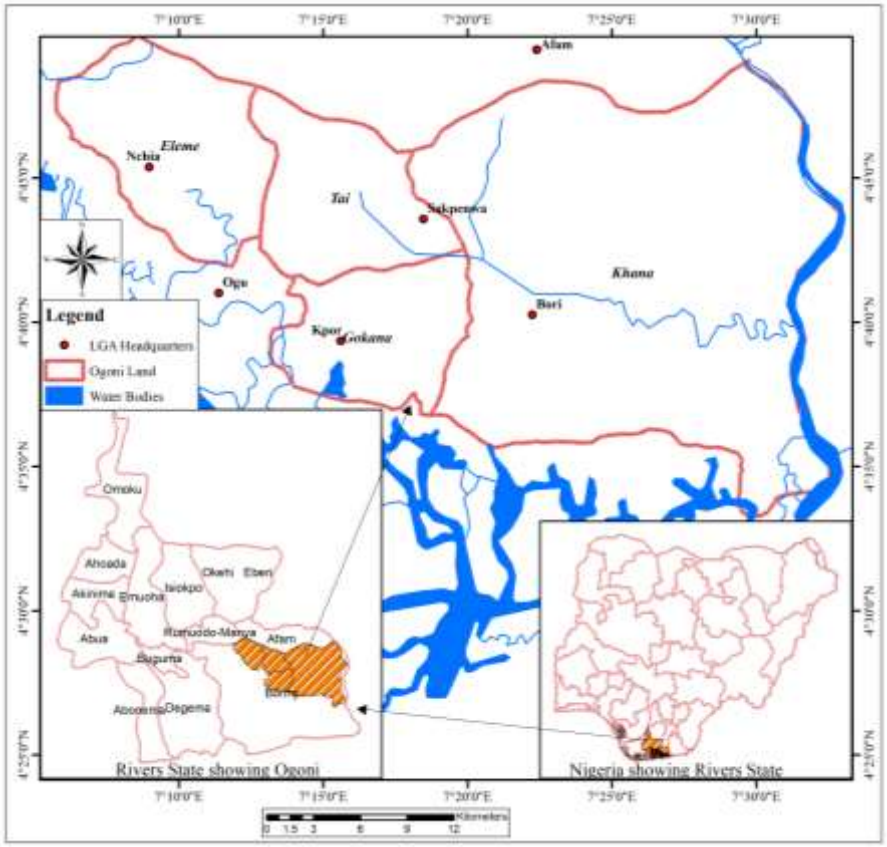

Figure 1: Ogoni Land (The Study Area)

3.3 Population and Sampling

The population of this study consists of residents in Ogoni communities, including farmers, fishermen, youth, and community leaders. These groups were selected because they are directly affected by environmental changes caused by illegal mining. Table 3.1 shows the estimated population distribution.

Table 3.1: Estimated Population Distribution of Ogoni Land

Local Government Area	Estimated Population	Major Occupations
Khana	300,000	Farming, trading
Gokana	250,000	Fishing, farming
Tai	180,000	Farming, artisans
Eleme	220,000	Trading, fishing
Total	950,000	Mixed livelihoods

Source: Estimated from community development records and census projections (NBS, 2020).

Due to the large population, a sample size was selected using the Taro Yamane formula:

$$n = N / [1 + N(e)^2]$$

Where: n = sample size; N = population (950,000); e = margin of error (0.05). This yields an approximate sample size of 400 respondents, distributed across the four local government areas as shown in Table 3.2.

Table 3.2: Sample Distribution

Local Government Area	Sample Size
Khana	120
Gokana	100
Tai	80
Eleme	100
Total	400

Source: Authors (2026).

3.4 Data Collection

The study used both primary and secondary data. Primary data were collected through structured questionnaires, key informant interviews, and field observations, while secondary data were sourced from peer-reviewed journals, government reports, UNEP reports, and online publications. The main instrument was a structured questionnaire titled the Impact of Illegal

Mining on Land Degradation and Water Resources Questionnaire (IIMLDWRQ), divided into four sections: (A) demographic information; (B) causes of illegal mining; (C) impact on land degradation; and (D) impact on water resources and livelihoods. A four-point Likert scale was used: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

3.5 Validity and Reliability

To ensure validity, the questionnaire was submitted to experts in environmental science and geography for review. Their corrections and suggestions were incorporated to improve clarity, relevance, and content accuracy. Reliability was assessed using the test-retest method, with the instrument administered twice to a pilot group within a two-week interval. Cronbach's Alpha analysis yielded a reliability coefficient of 0.82, indicating a high level of instrument reliability (Kothari & Garg, 2019).

3.6 Data Administration

A total of 400 questionnaires were administered personally by the researchers in selected Ogoni communities. This approach facilitated high response rates and enabled clarification of ambiguous items. Out of the 400 distributed, 380 were successfully retrieved, representing a response rate of 95% (Table 3.3).

Table 3.3: Questionnaire Distribution and Retrieval

Category	Number
Distributed	400
Retrieved	380
Not Retrieved	20
Response Rate	95%

Source: Field Survey (2024).

3.7 Data Analysis

Data collected was analysed using descriptive statistics comprising frequency counts, percentages, and mean scores. Likert scale weighting was used to determine levels of agreement. A decision rule of mean score ≥ 2.50 = ‘Agree’ and < 2.50 = ‘Disagree’ was applied. Ethical compliance was ensured through obtaining permission from community leaders, voluntary participation, and guaranteeing anonymity and confidentiality of respondents. All participants were informed

that their responses would be used strictly for academic purposes.

4. RESULTS/FINDINGS

4.1 Nature and Extent of Illegal Mining Activities

The findings of this study reveal that illegal mining activities are widespread across Ogoni land. These activities are mainly carried out by artisanal miners who operate without licences or adherence to environmental regulations. The mining practices observed include sand dredging, gravel extraction, and crude oil-related resource exploitation, often conducted using rudimentary tools and techniques. Field data indicate that illegal mining sites are commonly found in Gokana, Khana, and Eleme Local Government Areas, which are rich in natural resources. The lack of government oversight and enforcement has allowed these activities to flourish unchecked. Respondents noted that economic hardship and unemployment are major drivers of illegal mining. Many youths engage in these activities as a means of survival despite being aware of the environmental consequences, reflecting a broader issue of limited economic opportunities in the region (Teschner, 2019; Okeke & Eze, 2020).

4.2 Impacts on Land Resources

Illegal mining has had profound effects on land quality and stability in Ogoni land. The study identified several forms of land degradation, including soil erosion, loss of soil fertility, landscape distortion, and deforestation.

Soil Erosion and Decline in Soil Fertility. One of the most significant impacts of illegal mining is the removal of topsoil, which contains essential nutrients required for plant growth. The excavation process exposes the subsoil, which is less fertile and more prone to erosion, resulting in a significant decline in agricultural productivity (FAO, 2020). Farmers reported reduced yields of staple crops such as cassava, yam, and maize. In some cases, farmlands have been completely abandoned due to their inability to support crop production, which has serious implications for food security in the region.

Landscape Distortion and Abandoned Pits. Illegal mining activities often leave behind large, uncovered pits and trenches that distort the natural landscape and render land unsuitable for agriculture or construction. During the rainy season, these pits become filled with water, creating stagnant pools that pose environmental and health risks. The pits also contribute to increased soil erosion by altering natural drainage patterns and promoting surface runoff (Nwilo & Badejo, 2018). The long-term effect is a degraded landscape that is difficult and costly to rehabilitate.

Deforestation and Vegetation Loss. The clearing of vegetation is a common practice in illegal mining operations. Trees and shrubs are removed to gain access to

mineral deposits, leading to deforestation that reduces biodiversity and disrupts the ecological balance of the area (IPBES, 2018). Vegetation plays a crucial role in protecting soil from erosion and maintaining soil fertility; its removal exposes the soil to wind and water erosion, further exacerbating land degradation.

4.3 Impacts on Water Resources

The study found that illegal mining has significantly affected water resources in Ogoni land in terms of both quality and availability.

Surface Water Contamination. Illegal mining introduces various pollutants into water bodies, including sediments, heavy metals, and hydrocarbons. These contaminants originate from mining waste and runoff from disturbed land surfaces. Water samples collected from rivers and streams in mining areas showed signs of contamination, including discoloration and unpleasant odour, consistent with reports by Salami *et al*. (2021) and earlier assessments by UNEP (2011). The pollution of water bodies has made them unsafe for domestic use, forcing residents to seek alternative sources of water at higher cost.

Siltation and Aquatic Ecosystem Degradation. Mining activities near rivers and streams lead to increased sedimentation. This siltation occurs when loose soil and debris are washed into water bodies, reducing their depth and clarity. Obot and Akpan (2021) note that siltation affects aquatic ecosystems by reducing oxygen levels and disrupting habitats. Fishermen in the study area reported a decline in fish populations attributed to the degradation of water quality, consistent with findings by Obinna and Ebere (2019).

Groundwater Contamination. In addition to surface water pollution, illegal mining also affects groundwater resources. Pollutants seep into the soil and eventually reach underground water sources, contaminating wells and boreholes. Residents reported changes in the taste, colour, and smell of their water, indicating possible contamination. This poses serious health risks, as many households rely on groundwater for drinking and cooking, particularly where treated water is inaccessible (WHO, 2021; Chiadikobi *et a*l., 2020).

4.4 Socio-Economic Implications

The environmental impacts of illegal mining have far-reaching socioeconomic consequences for the people of Ogoni land. Agriculture and fishing are the primary sources of livelihood in the region. However, land degradation and water pollution have significantly reduced productivity in both sectors. The consumption of contaminated water has led to an increase in waterborne diseases such as diarrhoea, cholera, and skin infections. The presence of stagnant

water in abandoned mining pits also contributes to the spread of malaria. Despite its negative impacts, illegal mining remains an important source of income for many unemployed residents, particularly youth. This creates a cycle of dependency where individuals continue to engage in environmentally harmful activities due to a lack of alternatives, thereby perpetuating both poverty and ecological destruction (Olawale & Dauda, 2020; Adekoya, 2019).

4.5 Discussion of Findings

The findings of this study highlight the significant environmental and socioeconomic impacts of illegal mining in Ogoni land. The results demonstrate a clear link between unregulated mining activities and land degradation, as well as water resource contamination. These findings are consistent with the Environmental Degradation Theory, which suggests that unsustainable exploitation of natural resources leads to ecological damage in the absence of effective governance (Meadows *et al*., 2018). In the case of Ogoni land, the lack of effective environmental governance has allowed illegal mining to thrive. The findings also align with the Tragedy of the Commons framework (Hardin, 1968), wherein communal resources are over-exploited for individual gain to the detriment of the collective.

Furthermore, the study reveals a conflict between economic survival and environmental sustainability. While illegal mining provides short-term financial benefits for impoverished communities, it undermines long-term development by destroying the natural resource base that agriculture and fishing depend upon. This tension between immediate livelihood needs and long-term ecological sustainability is a recurring theme in the literature on artisanal and small-scale mining in sub-Saharan Africa (Teschner, 2019; Okeke & Eze, 2020). The results indicate that without urgent intervention, the environmental degradation observed in Ogoni land may become irreversible.

5. CONCLUSION

Based on the findings of this study, it can be concluded that illegal mining is a major driver of environmental degradation in Ogoni land. The activities associated with illegal mining have significantly altered landforms, reduced soil quality, and disrupted ecosystems. Furthermore, the contamination of water resources poses serious risks to human health and biodiversity. The reliance of local communities on polluted water sources increases their vulnerability to waterborne diseases and other health challenges.

The study also concludes that the persistence of illegal mining is closely linked to socio-economic factors such as poverty, unemployment, and weak enforcement of environmental regulations. This creates a situation where short-term economic survival is prioritised over long-term

environmental sustainability. Overall, illegal mining represents a critical environmental and developmental challenge in Ogoniland. Addressing this issue requires a balanced approach that considers both environmental protection and the economic needs of the local population.

6. RECOMMENDATIONS

In light of the findings and conclusions of this study, the following recommendations are proposed: Government agencies should enforce existing environmental laws more effectively by increasing monitoring and imposing penalties on offenders to deter further environmental damage. Concurrently, investment in agriculture, skill acquisition programmes, and small-scale enterprises is necessary to reduce community dependence on illegal mining and provide sustainable alternative livelihoods. Public awareness campaigns should also be conducted to educate residents about the environmental and health impacts of unregulated mining, with active encouragement of community participation in environmental protection. In terms of ecological recovery, deliberate efforts should be made to rehabilitate degraded lands through reforestation, soil restoration, and the filling of abandoned pits in order to restore the productivity and ecological balance of affected areas. Government and non-governmental organisations should further invest in water treatment infrastructure to provide access to clean and safe drinking water, complemented by regular monitoring of water quality in line with WHO (2021) guidelines. Finally, partnerships with international bodies such as UNEP should be pursued to support environmental remediation efforts and provide the technical expertise needed to drive sustainable development initiatives in the region.

REFERENCES

Adekoya, J. A. (2019). Environmental impacts of solid minerals mining in Nigeria: Current trends and implications for sustainable development. *Journal of Physical and Environmental Sciences, 13*(2), 45–58.

Chiadikobi, K. C., Obi, D. A., & Nwachukwu, H. P. (2020). Hydrological disruption from mining activities in the Niger Delta region of Nigeria. *Journal of Environmental and Earth Sciences, 10*(3), 112–124.

Federal Ministry of Environment. (2018). *National policy on the environment*. Government Press.

Food and Agriculture Organization. (2020). *The state of the world's land and water resources for food and agriculture: Systems at breaking point*. FAO.

Hardin, G. (1968). The tragedy of the commons. *Science, 162*(3859), 1243–1248.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2018). *The IPBES assessment report on land degradation and restoration*. IPBES Secretariat.

Kothari, C. R., & Garg, G. (2019). *Research methodology: Methods and techniques* (4th ed.). New Age International Publishers.

Meadows, D., Randers, J., & Meadows, D. (2018). *Limits to growth: The 30-year update* (Updated ed.). Chelsea Green Publishing.

National Bureau of Statistics. (2020). *Annual abstract of statistics 2020*. NBS.

Nwankwo, C. N., & Ifeanyi, O. M. (2019). Compounding environmental degradation: Oil exploration and illegal mining in the Niger Delta. *International Journal of Environmental Studies, 76*(4), 610–625.

Nwilo, P. C., & Badejo, O. T. (2018). Impacts of oil spills and other extractive activities on the Niger Delta environment. *Nigerian Journal of Environmental Science, 12*(1), 22–38.

Obinna, C. I., & Ebere, C. O. (2019). Aquatic ecosystem degradation and artisanal fishing decline in the Niger Delta: A community-level assessment. *African Journal of Aquatic Science, 44*(3), 215–228.

Obot, A. E., & Akpan, U. I. (2021). Sedimentation and water quality changes from artisanal mining activities in rivers of Ogoniland. *Journal of Water and Environmental Sustainability, 9*(2), 77–91.

Okeke, O. C., & Eze, N. B. (2020). Mining-induced river sedimentation and loss of aquatic biodiversity in southern Nigeria. *Environmental Monitoring and Assessment, 192*(7), 434–449.

Olawale, O. S., & Dauda, A. B. (2020). Informal resource extraction and the tragedy of the commons in Nigerian rural communities. *African Development Review, 32*(1), 88–101.

Oti, M. N. (2018). Artisanal mining, land degradation, and food security in the Niger Delta. *Journal of Agricultural and Environmental Science, 5*(1), 12–26.

Salami, K. D., Oladipo, O. A., & Bello, I. A. (2021). Heavy metal concentrations in water sources affected by mining activities in southern Nigeria and compliance with WHO standards. *Science of the Total Environment, 786*, 147489.

Teschner, B. A. (2019). Informal mining, sustainable livelihoods, and environmental governance: Evidence from Ghana and beyond. *Extractive Industries and Society, 6*(4), 1244–1252.

United Nations Environment Programme. (2011). *Environmental assessment of Ogoni land*. UNEP.

United Nations Environment Programme. (2018). *Global environment outlook – GEO-6: Healthy planet, healthy people*. Cambridge University Press.

World Health Organization. (2021). *Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda*. WHO.

Funding: This research is not funded.

Acknowledgments

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

Authenticity

This manuscript is an original work