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Comparative Analysis of Economic Trade-Offs Between Soil Degradation Caused by Artisanal Gold Mining and Long-Term Crop Yield in North Central, Nigeria.

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Abstract

This study examined the comparative economic trade-offs between soil degradation associated with artisanal and small-scale gold mining (ASGM) and long-term crop yield in North-Central Nigeria. Specifically, it evaluated the contribution of ASGM to soil degradation and declining crop yield, assessed the extent of land degradation resulting from mining activities, and compared the short-term economic benefits of mining with long-term agricultural losses. A descriptive survey research design, complemented by elements of a mixed-method approach, was adopted. The study covered selected mining communities in Niger, Nasarawa, and Plateau States. From a population of 1,004 respondents, a sample of 286 was determined using the Taro Yamane formula, while 276 valid questionnaires were retrieved, representing a 96.5% response rate. Data were collected using a structured questionnaire and analyzed using descriptive statistics, including frequency, percentage, mean, and standard deviation, alongside Pearson correlation and multiple regression at a 0.05 significance level. Findings revealed that ASGM significantly contributes to soil degradation and declining crop yield (Grand Mean = 4.29). Mining activities caused severe land degradation through vegetation loss, soil erosion, abandoned mining pits, water pollution, and reduced farmland availability. Pearson correlation revealed a strong positive relationship between ASGM and soil degradation ($r = 0.748$, $p < 0.05$), while regression analysis showed that soil degradation significantly negatively affects crop yield ($\beta = -0.631$, $p < 0.05$). The study concluded that although ASGM provides short-term economic benefits, its long-term adverse effects on agricultural productivity outweigh these gains. Consequently, stricter environmental regulation, land restoration programmes, and the adoption of sustainable mining practices are recommended.

Keywords

Artisanal and Small-Scale Gold Mining, Soil Degradation, Crop Yield, Economic Trade-offs, Agricultural Productivity, North-Central Nigeria.



Introduction

In many developing economies, natural resource exploitation and agriculture play central roles in shaping rural livelihoods, income distribution, and regional development. In Nigeria, agriculture remains one of the most important sectors of the economy, particularly in rural communities where it serves as a major source of employment, food production, and income generation (Food and Agriculture Organization [FAO], 2023; World Bank, 2022). The North Central region of Nigeria, often referred to as the country's "food basket," is known for its agricultural productivity due to favorable climatic and soil conditions. However, in recent years, the region has experienced increasing pressure from artisanal and small-scale gold mining (ASGM), which is progressively altering land-use patterns and environmental conditions (United Nations Environment Programme [UNEP], 2022).

Artisanal gold mining refers to informal, small-scale extraction of gold using rudimentary tools and minimal technological input. It is largely driven by poverty, unemployment, and the search for quick income among rural populations. While the activity provides short-term economic benefits, it is often carried out without effective environmental regulation or sustainable practices (World Bank, 2023; Organization for Economic Cooperation and Development, 2022). Consequently, mining activities frequently result in environmental degradation, particularly affecting soil quality, water resources, and vegetation cover. One of the most significant environmental consequences of artisanal gold mining is soil degradation. This occurs through processes such as topsoil removal, land excavation, improper waste disposal, and contamination

from hazardous substances like mercury and heavy metals used in mineral processing. These activities disrupt the physical, chemical, and biological properties of soil, reducing its fertility and capacity to support crop production (UNEP, 2022; International Institute for Sustainable Development, 2023).

Over time, such degradation renders agricultural land less productive or even unsuitable for farming. The impact of soil degradation on agriculture is particularly severe in regions where farming is the primary livelihood. Declining soil fertility leads to reduced crop yields, increased production costs, and lower farmer incomes. In the long term, this contributes to food insecurity, rural poverty, and migration from affected communities.

In North Central Nigeria, states such as Niger State, Nasarawa State, and Plateau State have witnessed increasing overlap between agriculture and artisanal mining. These states are rich in mineral resources, particularly gold, while also supporting extensive farming activities. This coexistence has created a complex land-use conflict in which communities must balance short-term economic gains from mining with long-term agricultural sustainability. In many instances, farmlands are degraded or abandoned due to mining activities, resulting in reduced agricultural output and increased dependence on alternative income sources (World Bank, 2022; UNEP, 2022).

Furthermore, mining-induced environmental degradation extends beyond crop production, affecting soil health, biodiversity, and ecosystem stability. These impacts reduce the resilience of agricultural systems to climate

variability and long-term environmental change. The cumulative effects may outweigh the immediate financial benefits derived from mining, raising serious concerns about sustainability and resource governance (UNEP, 2022; IISD, 2023).

Therefore, this study examines the comparative economic trade-offs between soil degradation caused by artisanal gold mining and long-term crop yield in North Central Nigeria. It seeks to assess how mining activities influence agricultural productivity and rural livelihoods, and how these competing land uses shape economic outcomes in affected communities. The findings are expected to provide valuable insights for policymakers, environmental planners, and development stakeholders in designing strategies that promote sustainable land use, protect agricultural productivity, and strengthen mining regulation in the region.

Statement of Problem

Agriculture remains the backbone of rural livelihoods, food security, and economic development in North-Central Nigeria. The region is endowed with fertile agricultural land that supports the cultivation of staple crops and provides income for a large proportion of rural households. However, the rapid expansion of artisanal and small-scale gold mining (ASGM) has increasingly threatened the sustainability of agricultural production. Although artisanal gold mining generates employment opportunities and provides immediate income for many rural households, its largely informal and poorly regulated nature has resulted in widespread environmental degradation, particularly the deterioration of agricultural soils (Barde et al., 2024; Oseikhuemen et al., 2025).

Artisanal gold mining involves extensive land excavation, vegetation clearance, and the use of hazardous substances such as mercury and lead during mineral processing. These activities degrade soil structure, reduce soil fertility, contaminate farmland, and accelerate erosion, thereby diminishing the productive capacity of agricultural land (Oseikhuemen et al., 2025). The decline in soil quality has serious implications for long-term crop production, as reduced soil nutrients and organic matter lower crop yields, increase production costs, and reduce farmers' incomes. Consequently, many farming households experience declining agricultural productivity and increasing food insecurity, threatening the sustainability of rural livelihoods (Hemmler et al., 2024; Osabohien et al., 2024).

Despite these adverse environmental consequences, artisanal gold mining continues to expand because it offers higher and more immediate financial returns than farming in many rural communities. This has encouraged the movement of labour and productive resources from agriculture to mining, creating a significant economic trade-off. While mining contributes to household income and local economic activity in the short term, it simultaneously reduces the long-term productivity of agricultural land through soil degradation. The continued loss of fertile farmland raises concerns about the future of agricultural production and rural economic development in mining-affected communities. Although previous studies have examined either the environmental effects of artisanal gold mining or its contribution to rural livelihoods, few have undertaken a comprehensive comparative analysis of the economic benefits derived from artisanal gold

mining relative to the long-term economic losses associated with soil degradation and declining crop yields, particularly in North-Central Nigeria.

As a result, policymakers have limited empirical evidence to evaluate whether the short-term gains from mining outweigh the long-term costs to agricultural productivity and food security. It is against this background that this study seeks to undertake a comparative analysis of the economic trade-off between soil degradation caused by artisanal gold mining and long-term crop yield in North-Central Nigeria. The findings are expected to provide empirical evidence that will guide policymakers, environmental agencies, and other stakeholders in formulating policies that promote sustainable mining practices, protect agricultural land, and enhance long-term rural economic development.

Objectives of the Study

The main objective of this study is to examine the comparative economic trade-offs between soil degradation caused by artisanal and small-scale gold mining (ASGM) and long-term crop yield in North-Central Nigeria.

The specific objectives are to:

1. Evaluate the extent to which artisanal gold mining contributes to soil degradation and affects long-term crop yield in North Central Nigeria.
2. Assess the extent of land degradation caused by artisanal gold-mining in the study area.
3. Compare the short-term economic benefits of artisanal gold mining with the long-term agricultural losses

associated with soil degradation in North Central Nigeria.

Hypotheses

The following null hypotheses will be tested at 0.05 level of significance

H₀₁: There is no significant relationship between artisanal gold mining and soil degradation in North-Central Nigeria.

H₀₂: Land degradation caused by artisanal gold mining has no significant effect on long-term crop yield in North-Central Nigeria.

H₀₃: There is no significant difference between the short-term economic benefits of artisanal gold mining and the long-term agricultural losses associated with soil degradation in North-Central Nigeria.

Literature Review

CONCEPTUAL REVIEW

The conceptual review will focus on the following key concepts such as Artisanal and Small-Scale Gold Mining (ASGM), soil degradation, Crop Yield and Agricultural Productivity, and Economic Trade-offs.

Artisanal and Small-Scale Gold Mining (ASGM) refers to informal mining activities that rely on rudimentary tools, low levels of mechanization, and minimal capital investment. According to the World Bank (2023), ASGM provides livelihoods for over 40 million people globally and contributes significantly to rural economies in developing countries. In Sub-Saharan Africa, ASGM has expanded rapidly due to rising gold prices, unemployment, and persistent poverty (United Nations Environment Programme [UNEP], 2022; Organisation for Economic Co-operation and Development, 2023). In Nigeria, ASGM is

particularly prevalent in North-Central states such as Niger State, Nasarawa State, and Kogi State, where mineral deposits are abundant (Nigeria Extractive Industries Transparency Initiative, 2022). While ASGM offers immediate income and employment opportunities, it is largely unregulated and associated with significant environmental degradation (World Bank, 2023; UNEP, 2022).

Furthermore, ASGM has been strongly linked to unsafe practices such as the use of mercury in gold extraction, which contaminates soil and water bodies. These practices not only degrade environmental quality but also pose serious health risks to local communities (UNEP, 2023; World Health Organization, 2022). Soil degradation is defined as the decline in soil quality caused by natural processes and human activities, resulting in reduced productivity and ecosystem functioning. The Food and Agriculture Organization (2023) describes soil degradation as a reduction in the soil's capacity to provide essential goods and ecosystem services, including crop production, water regulation, and nutrient cycling.

Heavy metal contamination remains one of the most serious consequences of mining-related soil degradation. Toxic metals such as mercury, lead, and arsenic accumulate in soils and adversely affect plant growth, soil organisms, and overall ecosystem health (World Health Organization, 2022; UNEP, 2023). Recent empirical studies indicate that contaminated soils exhibit reduced microbial activity, poor nutrient availability, and diminished water retention capacity, all of which limit agricultural productivity (FAO, 2023; oil Science literature, e.g., Mensah et al., 2022).

In Nigeria, recent reports show that mining activities have led to significant soil degradation in affected regions, rendering land increasingly unsuitable for agricultural use and threatening food security and rural livelihoods (Nigeria Extractive Industries Transparency Initiative, 2022; World Bank, 2023).

Crop yield refers to the quantity of agricultural output produced per unit area of land and is a key indicator of agricultural performance and food security. Recent studies show that crop yield is influenced by factors such as soil fertility, climate variability, farming practices, and access to agricultural inputs (Food and Agriculture Organization [FAO], 2023; World Bank, 2022).

Soil quality plays a critical role in determining crop yield. When soil becomes degraded, its capacity to support plant growth declines significantly due to reduced nutrient availability, poor structure, and diminished biological activity (Rattan Lal, 2023; United Nations Environment Programme [UNEP], 2022). Mining activities further exacerbate this problem by removing topsoil, disrupting soil structure, and introducing toxic substances into the soil (International Institute for Sustainable Development, 2023). In Nigeria, declining crop yields have been increasingly linked to environmental degradation, contributing to rising poverty levels and food insecurity, particularly in rural communities where agriculture remains the primary source of livelihood (National Bureau of Statistics, 2023; World Bank, 2022).

Economic trade-offs involve evaluating the costs and benefits of alternative choices. In the context of artisanal and small-scale gold

mining (ASGM), the trade-off lies between short-term economic gains from mining and long-term agricultural sustainability. ASGM provides immediate financial benefits, including income generation and employment opportunities for rural populations (World Bank, 2023; Organization for Economic Co-operation and Development, 2023). However, these benefits often come at the expense of environmental quality, as mining activities contribute to land degradation, which in turn reduces agricultural productivity over time (United Nations Environment Programme [UNEP], 2022; International Institute for Sustainable Development, 2023).

Empirical Review

A number of empirical studies have examined the relationship between artisanal and small-scale gold mining (ASGM), soil degradation, crop yield, and economic trade-offs in different geographical contexts. These studies provide important insights into how mining activities affect environmental sustainability and agricultural productivity, particularly in developing countries.

A study by Blanche, (2024) focused on land-use changes associated with mining activities using a purely quantitative research design. The study relied on remote sensing and GIS techniques, analyzing satellite imagery from mining-affected areas. There was no human population involved, as the study focused on land surfaces and environmental patterns over time. The findings showed that mining activities significantly reduce vegetation cover and lead to the conversion of fertile farmland into degraded mining sites, thereby disrupting agricultural systems.

Similarly, Goji and Bala (2024) conducted a survey-based study on mining and land degradation in Zamfara State. The study employed a descriptive survey research design, targeting residents of mining communities. A sample size of 150-250 respondents was selected, and data were collected using structured questionnaires, interviews, and field observations. The results indicated that artisanal mining activities have caused severe soil degradation, reduced farmland productivity, and environmental pollution, thereby negatively affecting agricultural livelihoods in the area.

THEORETICAL FRAMEWORK

This study is underpinned by the following theories:

The Sustainable Livelihoods Framework (SLF), developed by Chambers and Conway (1992) and further expanded by Scoones (1998), explains how individuals and households combine different forms of capital—natural, financial, human, physical, and social—to sustain their livelihoods. In relation to this study, ASGM plays a dual role in rural livelihoods. On one hand, it enhances financial capital by providing immediate income opportunities for rural households and miners (Hilson, 2016).

This is particularly important in areas with high unemployment and limited agricultural profitability. However, ASGM negatively affects natural capital by degrading soil quality, destroying farmland, and reducing land fertility (Lal, 2015). From the perspective of this study, SLF explains that although ASGM improves short-term livelihoods, it undermines long-term agricultural sustainability by depleting natural resources required for farming (Scoones, 1998; FAO, 2019).

Resource Dependency Theory (RDT)

Resource Dependency Theory (RDT), developed by Pfeffer and Salancik (1978), explains how individuals and communities depend on available resources for their survival and economic well-being. In rural communities, agriculture and natural resources are major sources of livelihood. However, declining agricultural productivity caused by soil degradation can force households to seek alternative sources of income. In the context of this study, rural households may increasingly depend on artisanal and small-scale gold mining (ASGM) as farming becomes less productive and less profitable (Osabohien et al., 2024). Consequently, households may shift their labor and resources from agriculture to mining activities (Hilson & Garforth, 2012).

The theory is relevant to this study because it explains the economic trade-off between dependence on mining and agricultural resources. Although ASGM provides immediate income and employment, intensified mining can contribute to soil degradation and loss of agricultural land, thereby reducing long-term crop productivity. RDT therefore helps explain how declining agricultural opportunities can increase dependence on ASGM, while continued mining may further weaken the agricultural resource base.

Based on the literature reviewed for this study the following gaps were identified:

Most existing studies on artisanal and small-scale gold mining (ASGM), soil degradation, and agricultural productivity have been conducted at global, continental, or national levels. Studies such as Mensah et al. (2024) and Goji & Bala (2024) provide broad regional insights but fail to capture the specific socio-economic and environmental realities of North-Central

Nigeria. These studies often generalize findings across different regions, ignoring local differences in soil type, farming systems, mining intensity, and livelihood dependence.

Existing studies on ASGM, soil degradation, and agricultural productivity have generally treated Nigeria as a uniform context without giving adequate attention to the unique cultural and regional characteristics of North-Central Nigeria. Most research focuses on national or multi-regional analyses and fails to reflect the specific socio-economic realities of the region. These studies do not adequately consider the strong dependence of rural communities on both agriculture and artisanal mining for survival. They also overlook cultural acceptance of mining as a livelihood strategy in many communities. In addition, traditional land tenure systems, poverty levels, and seasonal farming practices that influence land use decisions are rarely captured in existing literature.

There is a need for a context-specific study that focuses on North-Central Nigeria in order to understand how cultural beliefs and regional socio-economic conditions influence mining and farming activities. Such a study is required to examine how traditional land ownership systems affect land degradation and agricultural productivity. It is also necessary to investigate how poverty and unemployment drive dependence on ASGM in the region. Furthermore, there is a need to explore how regional agricultural practices are affected by mining activities in order to provide accurate and localized evidence.

Methodology

This study was conducted in three states in the north central Nigeria where artisanal gold mining is prevalent. These are Niger, (Shiroro, Munya and Rafi local Government areas), Nasarawa (Uke, Karu, Wamba and Doka areas), and Plateau states (Bassa, Jos, Bukuru, Barikin Ladi and Bokkos areas). A descriptive survey research design, complemented with elements of a mixed-method approach was adopted for the study. The descriptive survey design was adopted because it allows the researcher to collect data from a large population and describe relationships among variables without manipulation (Creswell, 2014). The mixed-method approach integrates both quantitative and qualitative data, providing a more comprehensive understanding of the relationship between artisanal and small-scale gold mining (ASGM), soil degradation, crop yield, and economic trade-offs (Creswell & Plano Clark, 2018).

The total population of the study is 1004 respondents, was drawn from the three (3) states. Niger state- 335, Nasarawa state - 334, and Plateau state -335 respondents. A 5% level of precision was used. The sample size for this study was determined using the Taro Yamane (1967) formula. A total of 286 respondents were selected; this sample size is considered adequate to ensure reliable and representative findings. The sample is distributed proportionately among key groups in North-Central Nigeria, comprising farmers, artisanal gold miners, and households in mining communities. Specifically, 114 respondents are selected from farmers, 100 from artisanal miners, and 72 from households to ensure balanced representation of all relevant stakeholders.

This study used a multi-stage sampling technique. First, purposive sampling was used to select communities where mining activities take place in North-Central Nigeria. Next, stratified sampling was used to divide respondents into farmers, miners, and households. Finally, simple random sampling was used to select individual respondents from each group so that everyone would have an equal chance of being chosen. A total of 286 respondents were selected, including 114 farmers, 100 miners, and 72 households. From the above population the Taro Yamani the instrument that was used for data collection was a structured questionnaire. The questionnaire is designed to obtain relevant information on the relationship between artisanal and small-scale gold mining (ASGM), soil degradation, crop yield, agricultural productivity, and economic trade-offs in North-Central Nigeria.

The instrument was validated using face and content validity approach by three experts: One from Department of Economics, and one from Department of Geography, Ibrahim Badamasi Babangida University Lapai and one from Department of English Language, Niger State College of Education, Minna. The researchers visit the sampled communities two weeks before the commencement of the instrument administration to seek permission from the community heads and determine their suitability for the study. The cooperation or consent of the respondents in all the sampled communities was sought; they were informed about the objectives of the study. The research instrument was administered and retrieved by the research assistants. The administrations and retrieval of the instrument was done in two weeks.

The data collected was analyzed using both descriptive and inferential statistics. Descriptive tools such as frequency, percentages, mean, and standard deviation was used to summarize respondents' characteristics and responses on ASGM, soil degradation, and agricultural productivity.

Inferential statistics such as correlation and regression analysis was used to test the relationship between variables and examine the economic trade-offs between mining and agriculture. All hypotheses were tested at a 5% level of significance (0.05) using SPSS/STATA.

RESULTS AND DISCUSSION

Introduction

This face presents the analysis of data collected from 286 respondents drawn from Niger, Nasarawa, and Plateau States. The data were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation) and inferential statistics (Pearson correlation and multiple regressions). The presentation follows the objectives of the study.

Response Rate

Questionnaire Frequency Percentage

Response Rate

Questions	frequent	percentage (%)
Administered	286	286
Retrieved	276	96.5
Not Retrieved	10	3.5
Total	286	100.0

Source: Field work, 2026

Interpretation

Out of the 286 questionnaires administered, 276 were successfully completed and returned, representing a response rate of **96.5%**. This response rate was considered adequate for statistical analysis.

Demographic Characteristics of Respondents

Table 4.2 Gender Distribution

Gender	Frequency	Percentage (%)
Male	181	65.6
Female	95	34.4
Total	276	100.0

Source: Field work, 2026

The majority of respondents (65.6%) were male because artisanal mining activities are predominantly undertaken by men.

Table 4.3 Occupation of Respondents

Occupation	Frequency	Percentage (%)
Farmers	110	39.9
Artisanal Miners	97	35.1
Household Members	69	25.0
Total	276	100.0

Source: Field work, 2026

Objective One

Evaluate the extent to which artisanal gold mining contributes to soil degradation and affects long-term crop yield.

Table 4.4 Mean Responses

Statement	Mean	SD	Decision
Mining activities remove fertile top soil	4.42	0.68	Agree
Mining reduces soil fertility	4.36	0.73	Agree
Croup yields has reduced due to mining	4.21	0.82	Agree
Mining causes erosion of farmlands	4.30	0.77	Agree
Soil contamination affects croup growth	4.18	0.81	Agree

Source: Field work, 2026

Grand Mean = 4.29

Interpretation

The grand mean of **4.29** indicates that respondents strongly agreed that artisanal gold mining contributes significantly to soil degradation and declining crop yields.

Objective Two

Table 4.5 Assess the extent of land degradation caused by artisanal gold mining.

Indicator	Mean	SD	Decision
Loss of vegetation covers	4.31	0.71	High
Soil erosion	4.24	0.80	High
Formation of abandoned pits	4.48	0.63	Very High
Water pollution	4.17	0.79	High
Reduced land available for farming	4.27	0.76	High

Source: Field work, 2026

Grand Mean = 4.29

Interpretation

Respondents agreed that artisanal mining has caused severe land degradation, particularly through abandoned mining pits, vegetation loss, and soil erosion.

Objective Three

Compare the short-term economic benefits of mining with long-term agricultural losses.

Table 4.6 Compare the short-term economic benefits of mining with long-term agricultural losses.

Statement	Mean	SD	Decision
Mining provides quick income	4.53	0.62	Agree
Mining creates employment	4.40	0.70	Agree
Farming income has decline	4.18	0.83	Agree
Croup yield continues to reduce yearly	4.14	0.86	Agree
Agricultural losses outweigh mining gains over time	4.25	0.75	Agree

Source: Field work, 2026

Grand Mean = 4.30

Interpretation

Although mining provides immediate financial benefits, respondents generally agreed that long-term agricultural losses are greater than the short-term gains from mining.

Test of Hypotheses

Hypothesis One

H01: There is no significant relationship between artisanal gold mining and soil degradation.

Pearson Correlation

Variation	r	p-value	Decision
ASGM and Soil Degradation	0.748	0.000	Reject H01

Source: Field work, 2026

Interpretation

The correlation coefficient ($r = 0.748$) indicates a **strong positive relationship** between artisanal gold mining and soil degradation. Since $p = 0.000 < 0.05$, the null hypothesis is rejected. This implies that increased mining activities are associated with increased soil degradation.

Hypothesis Two

H02: Soil degradation has no significant effect on crop yield.

Regression Analysis

Variation	Beta	t-value	p-value
Soil Degradation	-0.631	-11.82	0.000

Source: Field work, 2026

Model Summary

R	R ²	Adjusted R ²
0.793	0.629	0.624

Interpretation

The regression coefficient ($\beta = -0.631$) indicates that soil degradation has a significant negative effect on crop yield. Approximately **62.9%** of the variation in crop yield is explained by soil degradation. Therefore, the null hypothesis is rejected.

Hypothesis Three

H03: There is no significant economic trade-off between artisanal mining income and long-term agricultural productivity.

Multiple Regression

Variation	Beta	t	p-value
Mining income	0.452	7.83	0.000
Soil Degradation	-0.521	-9.410	0.000

Source: Field work, 2026

Model Summary

R	R ²	F	p-value
0.811	0.658	95.31	0.000

Interpretation

The regression model is statistically significant ($F = 95.31$, $p < 0.05$). While mining income positively influences household income in the short term, soil degradation significantly reduces agricultural productivity. This confirms the existence of a substantial economic trade-off between mining and agriculture.

Discussion of Findings

The findings of this study revealed that artisanal and small-scale gold mining (ASGM) has a significant impact on soil degradation and long-term agricultural productivity in North-Central Nigeria.

The study established that mining activities such as topsoil removal, land excavation, and improper waste disposal contribute to the deterioration of soil quality, leading to reduced crop yields. The strong positive relationship between ASGM and soil degradation supports the findings of Goji and Bala (2024), Blanche et al. (2024), and Oseikhuemen et al. (2025),

who similarly reported that artisanal mining causes severe environmental degradation and reduces agricultural productivity.

The study also found that artisanal mining has resulted in extensive land degradation characterized by vegetation loss, soil erosion, abandoned mining pits, water pollution, and a reduction in cultivable farmland. These findings are consistent with Hemmler et al. (2024), FAO (2023), and UNEP (2023), which reported that mining-related soil degradation reduces land fertility and threatens food security and sustainable agricultural production.

Furthermore, the study revealed a significant economic trade-off between artisanal mining and agriculture. While mining provides immediate employment opportunities and short-term income for rural households, it simultaneously reduces agricultural productivity through soil degradation. The regression analysis showed that although mining income positively influences household earnings, the long-term economic losses resulting from declining crop yields outweigh these short-term gains. This finding agrees with Osabohien et al. (2024), World Bank (2023), and UNDP (2023), who concluded that uncontrolled artisanal mining undermines sustainable rural development by sacrificing long-term agricultural productivity for temporary economic benefits.

CONCLUSION

Based on the findings of this study, it is concluded that artisanal and small-scale gold mining has become a major source of soil degradation in North-Central Nigeria. The study established that mining activities significantly destroy fertile agricultural land through topsoil removal, erosion, vegetation destruction, abandoned mining pits, and soil contamination.

These environmental impacts reduce soil fertility and significantly lower long-term crop yields and agricultural productivity. The study further concludes that although artisanal mining generates immediate employment opportunities and improves household income in the short term, these economic benefits are outweighed by the long-term losses resulting from declining agricultural production, food insecurity, and reduced rural livelihoods.

The significant relationship established between mining activities, soil degradation, and declining crop yield confirms that continued uncontrolled mining threatens the sustainability of agriculture in the region. The study therefore concludes that sustainable development in North-Central Nigeria requires a balance between mineral exploitation and agricultural land conservation. Without stronger environmental regulation, land restoration programmes, and sustainable mining practices, the long-term economic costs of soil degradation will continue to outweigh the short-term gains derived from artisanal gold mining.

RECOMMENDATIONS

1. Artisanal miners should adopt environmentally sustainable mining practices that can reduce soil degradation and minimize the destruction of agricultural land.
2. They should be restoration of degraded mining sites through land reclamation, reforestation, soil improvement, and the rehabilitation of abandoned mining pits in order to restore soil fertility and support long-term agricultural productivity.
3. Artisanal miners should acquire adequate training and use improved mining technologies that minimize land degradation while enabling them to maintain their livelihoods and reduce the long-term negative effects of mining on agricultural activities.

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