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Impact of illegal mining on environmental security in Plateau State, Nigeria: A case of Water Safety and food Security.

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Abstract

Mining is globally recognised as a driver of economic development; its unregulated and illicit forms have generated profound environmental, food security, and socio-economic consequences in resource-rich but institutionally fragile contexts. Illegal mining has emerged as a critical internal security challenge in Nigeria, particularly in Plateau State, where decades of mineral exploitation have increasingly intersected with environmental degradation, food insecurity, and communal violence. This study engaged Structural Conflict Theory to examine environmental security of illegal mining in Plateau State, Nigeria, with specific focus on its influence on water safety and food security. The study adopts qualitative research design, relies on content analysis of secondary data drawn from peer-reviewed journal articles, official government reports, security assessments, and environmental studies relevant to illegal mining in Plateau State. Findings reveal that illegal mining severely compromises water safety through toxic heavy metal contamination including lead, cadmium, arsenic, nickel, and cobalt microbial pollution, and bioaccumulation in aquatic life, with empirical studies confirming water quality parameters exceeding WHO and Nigerian safety standards across mining-affected communities in Butura, Jerek, Jos South, and Barkin-Ladi. Regarding food security, the study found that illegal mining encroaches on arable land, contaminates irrigation sources, displaces farming households, and diverts agricultural labour to mining activities, collectively reducing food production and undermining rural livelihoods. These findings validate Structural Conflict Theory, which explains how weak regulatory frameworks enable extractive activities to degrade environmental resources at the expense of community well-being. The study concludes that illegal mining operates as a dual threat, eroding water safety and destabilising food systems, thereby reinforcing cycles of environmental insecurity, poverty, and underdevelopment in mining-affected communities. It recommends the establishment of continuous water quality monitoring programmes, remediation of abandoned mining ponds, implementation of a mining-agriculture land-use demarcation framework, and agricultural livelihood restoration programmes for displaced farmers to mitigate the environmental security threats posed by illegal mining in Plateau State.

Keywords: Environmental Security, Food Security, Structural Conflict Theory, Water Safety

Introduction

Globally, the extractive industry plays a pivotal role in economic development, but it also poses severe challenges to environmental sustainability and governance. The unregulated expansion of mining, particularly in resource-rich developing regions, has intensified concerns over environmental degradation, biodiversity loss, and social conflict (Bebbington & Bury 2018). In Africa, the stakes are particularly high. The continent is richly endowed with mineral resources, positioning the mining sector as a cornerstone of economic growth and industrialization strategies. Yet, this economic promise is increasingly undermined by the environmental costs of unregulated and illicit mining operations. In many African countries, the

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proliferation of non-state actors, ranging from foreign corporations and informal miners to armed groups, has led to widespread deforestation, water contamination, soil degradation, and threats to ecosystem integrity (Hilson & Maconachie, 2020).

illegal mining has remained a major internal security threat in Nigeria particularly in the northwest, Northeast and Northcentral of which Plateau State, Nigeria is of a particular interest. Characterized by the unregulated and often violent extraction of mineral resources. This is to the extent that illegal mining has deepened environmental degradation, undermined food production (Nwafor, 2023), eroded communal cohesion, and weakened government control. These dynamics reflect a complex intersection of social, environmental, economic, and institutional failures, with far-reaching implications for the security and development of the region. The activities of informal and unlicensed miners have not only endangered natural ecosystems but also compromised food security (Nwafor, 2023), the stability of communities, leading to rising incidents of armed violence, banditry, and inter-group conflict (Global Rights, 2020; Ibeanu, 2022).

Environmental security, a critical dimension of internal security, is severely impacted by illegal mining in Plateau State. Studies show that mining activities in the region have resulted in deforestation, land degradation, and toxic contamination of water bodies through the use of hazardous substances like mercury and lead (Adebayo & Fagbemi, 2019). A 2025 scientific analysis of abandoned mining ponds in Jerek, Jos South LGA detected alarmingly high lead (Pb) and cadmium (Cd) levels far exceeding the WHO's acceptable limits, this poses serious health risk to communities using such contaminated water and consuming affected fish, such as catfish, which was found to have toxic cadmium concentrations (Bello et al., 2025).

Closely tied to environmental insecurity is the issue of food security, another variable this study seeks to interrogate. As illegal mining encroaches upon agricultural land and pollutes water sources, farming activities are disrupted, reducing food production and threatening rural livelihoods. The displacement of farmers and destruction of farmland due to mining-induced violence have also contributed to food shortages, malnutrition, and increased dependency on external aid. The link between environmental degradation and declining agricultural productivity aligns with the Environmental Security Theory, which posits that ecological instability can trigger broader societal conflicts (Aliyu & Kawu, 2020).

Statement of the Problem

Mining where regulated serves as economic development purveyor and increase GDP in developed economies. However illegal mining in developing economies has emerged as one of the most persistent internal security challenges in Nigeria, with Plateau State serving as a focal point due to its long history of mineral exploitation. The absence of effective regulation has allowed informal and criminal actors to

dominate the mining sector, undermining the potential developmental benefits of natural resources and instead contributing to insecurity, environmental crises, and violent contestations over mineral-rich territories.

Environmental security nexus with food security is seen as farmlands are destroyed, agrarian communities displaced, and water sources polluted by illegal mining activities. This trigger agricultural production to drop sharply in many Plateau communities, threatening local food supply and rural subsistence economies. Farmers displaced by mining activities often face violent clashes with miners, while communities already struggling with livelihood insecurity are pushed into cycles of dependency and malnutrition. The destruction of farmlands and the forced migration of farming populations create conditions for social dislocation, further intensifying inter-communal rivalries and mistrust.

This significance of this study could be seen from its benefits to the State Government of Plateau State, Host Local Government Areas and communities, Ministry of Defence, Ministry of Interior, Northcentral Development Commission, Office of the National Security Adviser (ONSA), National Environmental Standards and Regulations Enforcement Agency (NESREA), Federal Ministry of Agriculture and Rural Development, local farmers' associations, and non-governmental organizations, Nigeria Security and Civil Defence Corps (NSCDC), Ministry of Solid Minerals Development, regulatory bodies like the Mining Cadastre Office, The Nigeria Police and other stakeholders in formulating stronger ecological safeguards and intervention strategies aimed at enabling internal security. The significance of this study lies, first, in its potential to shed light on the security implications of illegal mining activities in Plateau State.

Secondly, this study will be significant for its contribution to understanding how illegal mining impacts food security and water safety in Plateau State. The destruction of farmlands, contamination of irrigation sources, and displacement of farming communities due to mining-related violence can severely undermine agricultural productivity and access to nutritious food. Lastly, the benefitting effects on the Academia and researchers in the fields of security studies, environmental science, and development policy. Legislators and policymakers seeking evidence-based strategies to reform mining governance can not be overstated.

Objectives of the Study

The main objective of the study assessed impact of illegal mining on environmental security in Plateau State, Nigeria. While the specific objectives;

i. Examine influence of illegal mining on water safety in Plateau State, Nigeria
ii. Investigate relationship between illegal mining and food security in Plateau State, Nigeria

Literature Review

Conceptual Framework

Concept of Mining

Mining is fundamentally conceptualised as the systematic extraction of mineral deposits and geological resources from the earth's crust for industrial, commercial, and technological use. This view, rooted in the discipline of economic geology, highlights mining as a resource-mobilisation process involving exploration, excavation, processing, and beneficiation of mineral ores that contribute to national economic development (Oramah et al., 2015). The definition positions mining primarily as a legitimate economic activity designed to convert natural mineral wealth into socio-economic value. In the Nigerian context, this conceptualisation is crucial because Plateau State has historically relied on mining, especially tin, for economic opportunities and regional identity.

Mining is also conceptualised as a differentiated sector composed of large-scale mining (LSM) highly mechanised, capital-intensive operations, and artisanal and small-scale mining (ASM), labour-intensive, low-technology, community-driven operations (Hilson et al., 2017). ASM accounts for a large proportion of mineral extraction in Sub-Saharan Africa due to its accessibility and low entry barriers. In Plateau State, where small-scale tin and columbite extraction dominates, this bifurcated conceptualisation clarifies why mining-related impacts vary: LSM tends to be more regulated and technologically controlled, while ASM is frequently informal, dispersed, and poorly supervised, thereby increasing risks of environmental and security consequences.

Environmental scholars conceptualise mining as a high-risk ecological activity capable of causing land degradation, deforestation, soil erosion, water contamination, biodiversity loss, and atmospheric pollution when poorly regulated (Adom & Simatele, 2025). Illegal mining, in particular, exacerbates ecological insecurity because it employs crude extraction techniques, disregards reclamation policies, and leaves landscapes vulnerable to erosion, abandoned pits, and chemical contamination. This definition is essential for your first research objective: assessing how illegal mining undermines environmental security and increases vulnerability to climate hazards and livelihood disruptions in Plateau State.

Mining is increasingly conceptualised as a factor that interacts with agricultural systems by altering land availability, soil fertility, water quality, and local labour patterns. When mining, especially illegal mining, expands into farmlands or watershed areas, agricultural productivity declines, household food production drops, and long-term food security erodes (Otoijamun et al., 2021). This definition is critical because it connects mining with broader livelihood challenges, explaining how the degradation of arable land in Plateau

State contributes to food insecurity, rural displacement, and shifts from farming to unstable mining-based incomes.

Illegal Mining

Illegal mining constitutes a complex governance and security problem that extends beyond the mere unauthorized extraction of mineral resources. In its basic form, illegal mining refers to mining operations conducted without formal approval, license, or regulatory compliance, and often relies on crude technologies that evade established safety, environmental, and operational standards (Hilson, 2020). Unlike formal mining, which is embedded within institutional frameworks, illegal mining thrives in regulatory vacuums where state oversight is weak or compromised. In Plateau State, the phenomenon has become entrenched due to the region's long history of mineral exploitation and the proliferation of informal extractive practices (Auta, 2025).

From a conceptual standpoint, illegal mining is not merely an economic infraction; it is an organised, networked activity sustained by local actors, political patrons, criminal groups, and sometimes foreign collaborators operating in shadow economies (Nwajiaku-Dahou, 2020). It generates parallel governance structures that challenge the authority of the state, disrupt revenue flows, and undermine the legitimacy of regulatory institutions. Illegal mining operations in Plateau State frequently occur in remote locations where traditional authorities and security agencies possess limited surveillance capacity. This spatial advantage enables illicit actors to expand operations unchecked, contributing to environmental destruction, land degradation, and the weakening of community resilience. Increased commercialization of illicit minerals also inflates the incentives for violent competition over mining sites, fostering insecurity and conflict dynamics.

Environmental degradation is one of the principal conceptual dimensions of illegal mining. Unregulated mining activities destabilize ecosystems through deforestation, unfilled mining pits, contaminated water sources, and soil erosion, thereby compromising the ecological systems upon which communities depend for livelihood and survival (Olujobi & Irumekhai, 2024). With agriculture and mining coexisting on much of Plateau State's landscape, these environmental impacts produce cascading effects on food production, land fertility, and water availability, factors that feed directly into broader human security concerns. Illegal mining therefore constitutes an environmental security threat in line with contemporary analyses that emphasise environmental stress as a precursor to social fragility and conflict (UNDP, 2022).

Environmental Security

There is no gainsaying that illegal mining operations directly compromise environmental security in Plateau State through multiple pathways of ecological degradation (Aigbe, et al., 2025). Environmental security

refers to the protection of natural systems that sustain human life and communities from irreversible damage. Illegal mining activities have caused "extensive environmental degradation" including widespread pollution of water sources through the release of harmful chemicals used in mineral extraction. The contamination of streams and rivers that once served as the "lifeblood of local communities" represents a critical threat to both human health and ecosystem integrity, as these water sources are used for drinking, cooking, and irrigation (Auta, 2025; Gyang, 2025).

Another significant environmental impact documented in the search results is the wholesale destruction of vegetation and topsoil as mining sites expand without regulation. The clearance of vegetation for mining operations leaves "the land barren and unproductive," creating long-term challenges for ecological restoration and community livelihoods (Ojum, 2025). The technical committee established by Governor Mutfwang specifically identified "documentation of degraded lands as a result of illegal mining activities for future reclamation efforts" as one of its priority tasks, indicating recognition of the severe land devastation caused by these activities (Auta, 2025. This environmental damage echoes historical patterns from colonial-era mining that similarly left "erosion and land devastation" in its wake (Gbaoron, 2025). These forms of environmental degradation ultimately undermine human security by reducing ecosystem services that communities depend upon for survival.

The interconnectedness of how environmental changes have exacerbated the problem of food insecurity in the state, could be seen as agricultural activities become increasingly unsustainable in some areas. This connection demonstrates how environmental security is not merely an ecological concern but a fundamental component of human survival and community resilience. By systematically examining the extent of environmental damage and its impact on community welfare, this aspect of the research aims to provide empirical evidence that can inform more effective environmental protection policies and reclamation efforts in mining-affected areas. In Plateau State, unregulated mining of tin and other solid minerals has scarred landscapes, destroyed farmlands, and polluted rivers, which undermines ecological sustainability. Environmental security theory posits that threats to natural resources constitute direct risks to human survival and stability (Matthew, 2013). Therefore, illegal mining is conceptualised as a driver of environmental insecurity by depleting resources, increasing vulnerability to erosion and flooding, and generating long-term ecological crises.

Food Security

Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. That illegal mining directly compromises food security through multiple mechanisms is long established (Kwarteng-

Dofuor et al., 2025), beginning with the conversion of agricultural land into mining sites. Historical and contemporary mining operations have "reduced the amount of arable land available for crop production" 2, diminishing the agricultural base upon which local communities depend for both subsistence and income.

Illegal mining also undermines food security by contaminating arable land, displacing agricultural communities, and reducing access to clean water for irrigation (Adekoya, 2023). The United Nations Food and Agriculture Organization (FAO, 2017) defines food security as when all people have physical and economic access to sufficient food. In Plateau State, abandoned mining pits have reduced farmland availability and productivity, while toxic pollutants such as mercury and lead infiltrate food chains, threatening both crop yields and livestock health (Olade, 1987). Thus, food insecurity emerges as a direct consequence of illegal mining's disruption of agricultural systems.

Perhaps most significantly, the search results reveal that illegal mining has created a labour diversion effect that draws agricultural workers away from farming activities. School dropouts in communities in Bassa, Riyom, Jos North, Jos South, Mangu, and Barkin Ladi were distressingly high due to the volume of illegal mining activities," with schools in these areas virtually empty because young men and women have abandoned education and opted for mining (Rintep & Akoji, 2025). This shift from agriculture to mining represents a fundamental transformation in livelihood strategies that may offer short-term economic benefits but threatens long-term food security by depleting the agricultural labour force and disincentivizing food production (Maconachie & Conteh, 2025).

Impact on crop yields in a study in Jos South LGA showed that 54.2% of farmers identified low crop yield as the major consequence of mining. This directly supports the impact argument as also seen on land suitability as research also revealed that land degraded by previous mining in Barkin Ladi LGA is rated "permanently not suitable" for most crops, rendering much agricultural land completely unusable (Danjuma, 2024; Nwafor 2023).

Water Safety

The World Health Organization (2017) defines safe drinking-water as Water that does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. Quevauviller et al. (2024) sees water safety as the quality or chemical status of the water resources that has to comply with the defined quality standards for drinking water specifically to protect human health, both from elevated concentrations of contaminants and natural geogenic elements. This definition align with illegal mining and its impact on environmental security in Plateau State context, where illegal mining introduces both elevated concentrations of contaminants (such as lead, zinc, and other heavy

metals) and where natural geological conditions exacerbate the release of harmful elements. Water safety is specifically concerned with compliance with quality standards to protect human health.

This study takes water safety as the assurance that water resources are protected and managed to be fit for purpose primarily human consumption and ecological health encompassing the entire system that delivers water from its source to the point of use. It requires that water be Safe in quality; free from microbial, chemical, and radiological contaminants that pose health risks, including those introduced by mining activities such as heavy metals, acid mine drainage, and toxic gases (Ogbole & Nentok, 2025). Water safety is also seen in sufficiency in quantity such as availability in adequate volumes to meet domestic, agricultural, and ecological needs, unimpeded by mining-induced hydrological disruption or aquifer depletion (Ephraim, 2025). Water safety is also seen when physically reachable within reasonable distance, economically affordable, and not impeded by physical hazards such as open mining pits, and managed to ensure that current water needs do not compromise the ability of future generations to meet their own needs (Manset et al., 2025)

Empirical Review

illegal Mining and Water Safety

Ogbole and Nentok (2025) interrogated physico-chemical characteristics of water from abandoned tin mine ponds in Butura, Plateau State, north central Nigeria. Study opine that mining has had a negative impact on the environment including the creation of mine ponds that is detrimental to human health and water quality. Water samples were collected during the dry season and analysed for parameters such as colour, appearance, odour, taste, temperature, electric conductivity, turbidity, total hardness, pH, total alkalinity, manganese (Mn), calcium (Ca), sodium (Na), iron (Fe), magnesium (Mg), chloride (Cl), fluoride (F), nitrate (NO3), and microbial count using various analytical techniques. The results revealed that electric conductivity (775 µS/cm), turbidity (196.7Ntu), total hardness (18.5Mg/l), pH (6.7), total alkalinity (265Mg/l), Mn (3.85Mg/l), Ca (58.35Mg/l), Na (6.75Mg/l), Fe (0.015Mg/l), Mg (85Mg/l), Cl (40.25Mg/l), F (0.015Mg/l), NO3 (7.85Mg/l) are all within the World Health Organization (WHO) water quality permissible limit for consumption, except for parameters such as temperature, colour, appearance, odour, turbidity and microbial count, which were over the recommended limits. The study concluded that the physico-chemical characteristics of water from the mine ponds is aberrant for consumption, which could be detrimental to humans.

Bello et al. (2025) investigated heavy metal contamination and physiochemical parameters of water, fishes and sediments in two abandoned mining ponds in Jerek community, Jos South Local Government Area of Plateau State, Nigeria. The results of the water quality assessment showed that the water samples in Pond 1

had a Pb and Cd contamination value above the WHO (World Health Organization) acceptable limit, while Pond 2 had higher contamination of Pb also above the WHO acceptable limit and the catfish in pond 2 had the highest concentration of Cd (5.08mg/L) which signifies a toxic level. The study concludes that the fish from the selected ponds especially catfish are potentially harmful to consumers' health.

Gungshik et al. (2021) trace metals contamination of surface water and sediments due to mining activities remain a global treat to biodiversity and human. This study was carried out to assess the levels of metal contamination in selected mining ponds in Jos South and Barkin-Ladi LGA. Plateau State. The trace metals concentrations were analysed using a atomic absorption spectrophotometer (Model PG-990). Results of the analysis showed that pH values ranged from 5.64-6.42 (Slightly acidic) and organic matter content ranged from 4.60-18.6% for sediments. The concentration of Pb (0.06±0.00mg/l), Cd (0.02±0.00mg/l), As (0.31±0.14mg/l), Ni(0.19±0.02mg/l) and Co (0.12±0. 01mg/l) were higher than the WHO/USEPA (2002) maximum permissible limits and the Nigerian Standards for Drinking Water Quality NSDWQ (2007). This could be detrimental to the aquatic organisms. However, the concentrations of Cu and Zn were below the safety limits. The results obtained from the mining sites were higher than the values from non- mining site. It can be inferred that mining activities had impacted the concentration of trace metals in surface water and sediments from these mining ponds.

illegal Mining and food Security

Haruna et al. (2022) explored impact of mining and advances in food security and sustainability in northern Nigeria. The study was a qualitative research with reliance on extant literature and peer review journals. Findings from the study revealed that Mining activities have had tremendous negative effects on agricultural productivity in northern Nigeria directly or indirectly, thus threatening the nation's food security. Among the far-reaching impacts of mining are water and air pollution, soil mining and land competition, among others. The study focus did not capture arms proliferation as a result o illegal minings which this work will consider

Godwin and Umaru (2018) assessed illegal gold mining, land degradation and food security in Yauri, Kebbi state, Nigeria. The research elicited data from both primary and secondary sources. A total of 250 copies of questionnaire were administered to the respondents in the study area using systematic random sampling technique. Descriptive statistics such as simple percentages, graph and frequency among others were used to analyse data. Result showed that majority of the respondents (97.1%) and (98.4%) used farmland as their mining site and excavated soil and tailings were dumped on the farmland respectively. The result further showed that more respondents abandoned farming activities for illegal gold mining. This finding translates loss of farm labour which may result to food insecurity in the study area. The study calls for constitutional

provision that will empower states to control and extract whatever minerals deposited within their domain for the overall economic benefit of the citizenry.

Sawadogo and Sawadogo (2025) analysed the linkages between artisanal mining and food security of agricultural households in Burkina Faso. The study used an endogenous switching regression model estimated using data from the 2023 Permanent Agricultural Survey, the National Emergency Relief and Rehabilitation Council of Burkina Faso, the National Survey on the Gold Panning Sector, and the Harmonized Survey on Household Living Conditions. Findings revealed that engagement in artisanal mining increases the food diversity and consumption scores of agricultural households for both practicing and non-practicing households. Also, the level of education of the head of household and practice of other income-generating activities have a positive effect on households' food security while the level of insecurity in the household's area of residence affects it negatively.

Theoretical Framework

Structural Conflict Theory

The Structural Conflict Theory (SCT) was propounded by Karl Marx (1848) with the thrust that societal conflict arises from the inherent inequalities within social and economic structures, especially over access to resources and power (Marx & Engels, 1848). It emphasizes that the struggle between those who control resources and those who are marginalized leads to instability and violence. Structural Conflict Theory (SCT) was developed by Johan Galtung (1969), provides an important lens for examining the dynamics of illegal mining and its security implications in Plateau State, Nigeria. The theory posits that conflict often arises from deep-rooted structural inequalities, including competition over resources, marginalization, and institutionalized exploitation. In the context of illegal mining, weak governance structures, economic disparities, and social fragmentation create fertile ground for insecurity. The present study applies SCT to interrogate the multifaceted impacts of illegal mining, with a focus on environmental, food, community, and arms-related security concerns in Plateau State.

SCT emphasizes that structural imbalances in access to and management of natural resources generate environmental degradation, which in turn fuels insecurity (Matthew & Adekunle, 2019). In Plateau State, indiscriminate mining practices, driven by unequal access to land and weak regulatory enforcement, have led to deforestation, soil erosion, and pollution of water bodies. Such degradation not only undermines ecological stability but also heightens grievances among communities dependent on the environment for survival (Okoli & Atelhe, 2014). Structural Conflict Theory explains that food insecurity often stems from unequal distribution of resources and institutional neglect (Galtung, 1969). In Plateau State, farmlands have been destroyed by unregulated mining pits, while water contamination has disrupted irrigation and livestock

production. These conditions contribute to reduced agricultural productivity, scarcity of food, and heightened hunger. As scholars have noted, competition between extractive industries and subsistence farming reflects structural contradictions that create both scarcity and insecurity (Ibrahim, 2017; FAO, 2019).

According to SCT, structural inequalities and the uneven distribution of economic benefits create resentment, which often manifests in communal conflict (Burton, 1990). In Plateau State, communities competing over mining sites have experienced violent clashes, while migration of artisanal miners has fueled tensions with host populations. The lack of equitable benefit-sharing mechanisms and the absence of effective conflict resolution frameworks further exacerbate these security threats, leading to cycles of violence and erosion of social cohesion (Agbiboa, 2013).

In conclusion, Structural Conflict Theory offers a robust explanatory framework for understanding the security implications of illegal mining in Plateau State. By highlighting how structural inequalities, resource mismanagement, and institutional weaknesses drive environmental degradation, food insecurity, communal conflict, and arms proliferation, the theory underscores the urgent need for reforms. Addressing these challenges requires not only regulation of mining activities but also structural transformation that ensures equity, justice, and sustainable resource governance. This theoretical framing aligns directly with the study's objectives, which seek to link illegal mining to broader dimensions of security and conflict in Plateau State.

Methodology

The study adopts qualitative research design while content analysis of publicly available archive documents was employed for the analysis. Secondary data were generated via journals publication and other documented materials relevant to the study with reliance on secondary data. The research is conducted by examining literature concerning illegal mining and its environmental implications, influence of illegal mining on water safety and relationship between illegal mining and food security particularly in Plateau State, Nigeria. The literature was obtained through searches in publicly available material. Literature from non-serial publications, official reports, and conferences has been included particularly if they have been cited by other references.

Discussion of Findings

The empirical literature consistently affirms that illegal mining in Plateau State severely undermines water safety across multiple dimensions. Ogbole and Nentok (2025) found that water from abandoned mine ponds in Butura exceeded WHO limits for temperature, colour, turbidity, and microbial count, rendering it unsafe for consumption. Bello et al. (2025) documented heavy metal contamination in Jerek mining ponds, with lead and cadmium levels surpassing permissible limits in water and catfish exhibiting toxic cadmium

concentrations (5.08 mg/L), indicating bioaccumulation and health risks through the food chain. Gungshik et al. (2021) similarly reported elevated levels of lead, cadmium, arsenic, nickel, and cobalt in surface water and sediments across Jos South and Barkin-Ladi, all exceeding national and international safety thresholds, alongside acidic pH values that compromise aquatic life. Collectively, these findings validate the study's conceptualisation of water safety requiring water to be safe in quality, sufficient in quantity, and physically accessible and align with Structural Conflict Theory, which explains how weak governance and structural inequalities enable extractive activities to degrade environmental resources, thereby perpetuating community vulnerability and environmental insecurity in Plateau State.

The study finds a strong negative relationship between illegal mining and food security in Plateau State. The literature consistently shows that illegal mining encroaches on arable land, contaminates irrigation water, displaces farming communities, and diverts labour away from agriculture, thereby reducing food production and threatening rural livelihoods (Haruna et al., 2022; Godwin & Umaru, 2018). Empirical evidence from Plateau mining communities indicates widespread abandonment of farming as young men and women migrate to mining sites, resulting in labour shortages and declining agricultural output (Rintep & Akoji, 2025). These findings are consistent with studies from other African contexts, including Ghana and Burkina Faso, which demonstrate that artisanal and illegal mining contributes to reduced crop productivity, higher food prices, and long-term food insecurity despite short-term income gains (Sawadogo & Sawadogo, 2025). In Plateau State, the combined effects of land degradation, water pollution, farmer displacement, and mining-induced violence have weakened household food systems and intensified dependency on external food sources. This empirical pattern supports the argument that illegal mining undermines food security not only through environmental degradation but also through structural disruption of agricultural livelihoods, thereby reinforcing cycles of poverty, malnutrition, and insecurity in mining-affected communities.

Conclusion of Findings

This study concludes that illegal mining in Plateau State profoundly compromises water safety through toxic heavy metal contamination, microbial pollution, and bioaccumulation in aquatic life all exceeding national and international safety standards. These findings validate the study's conceptualisation of water safety (safe quality, sufficient quantity, physical accessibility) and align with Structural Conflict Theory, which attributes such degradation to weak regulation and structural inequalities. Ultimately, the erosion of water safety constitutes a critical dimension of environmental insecurity, with direct threats to public health, livelihoods, and community stability

The study also concludes that illegal mining significantly undermines food security in Plateau State by disrupting agricultural systems and rural livelihoods. Findings indicate that the conversion of farmlands into

mining sites, pollution of water sources used for irrigation, displacement of farming households, and diversion of labour from agriculture to mining have collectively reduced food production and access to nutritious food. This conclusion aligns with empirical studies in Nigeria and other African contexts which show that illegal and artisanal mining negatively affects crop yields, increases food prices, and exacerbates household food insecurity despite short-term income benefits. In Plateau State, these dynamics have intensified rural poverty, weakened subsistence farming, and heightened dependence on external food sources. Overall, the findings affirm that illegal mining operates as a dual threat eroding environmental security while simultaneously destabilising food systems thereby reinforcing cycles of vulnerability, insecurity, and underdevelopment in mining-affected communities.

Recommendations

i. That Plateau State Government, in collaboration with NESREA and the Ministry of Water Resources and relevant universities establish a continuous water quality monitoring programme across all mining-affected local government areas, with public disclosure of results and community-based water safety committees be empowered to report violations and participate in reclamation efforts. These measures, underpinned by strengthened institutional coordination and enforcement, are essential to restore water safety and mitigate the environmental security threats posed by illegal mining.

ii. Study recommends a mining-agriculture land-use demarcation framework that clearly protects fertile farmlands and irrigation zones from mining encroachment. Plateau State Government, in collaboration with the Federal Ministry of Agriculture and Rural Development, should implement agricultural livelihood restoration programmes for displaced farmers, including access to improved seedlings, soil remediation support, and alternative irrigation sources where mining has polluted waterways. Artisanal miners should be encouraged to transition into regulated cooperatives located outside agricultural zones, while youth engaged in illegal mining should be absorbed into agro-value chain initiatives to reduce labour diversion from farming.

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