FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 10 No. 10, May, 2026, pp 174 – 182
DOI: https://doi.org/10.33003/fjs-2026-1010-5496

Effects of Sand Mining Burrow Pits along Kano–Ringim–Hadejia Road, Jigawa State, Nigeria

[1]Abdullahi Haruna Ajiya, [2]Aminu Hussaini and *[1]Bashir Babura Sabo

[1]Department of Forestry and Environmental Technology, Binyaminu Usman Polytechnic, Hadejia, Kano State, Nigeria.
[2]Department of Geography, Sule Lamido University, Kafin Hausa, Jigawa State, Nigeria.

*Corresponding authors' email: Ahabbabura@gmail.com Phone No.: +2348068096022

ABSTRACT

Sand mining is an important source of construction materials but often results in significant environmental and socio-economic impacts when poorly regulated. This study assessed the effects of sand mining burrow pits along the Kano–Ringim–Hadejia road corridor in Kano and Jigawa States, Nigeria. Specifically, it examined the direction of burrow pit expansion relative to roads and farmlands and evaluated the environmental impacts associated with sand mining activities. A descriptive survey and field observational design were adopted. Six active burrow pits were purposively selected, while 353 questionnaires were administered to residents of nearby communities, with 342 valid responses analyzed. Data were collected through field measurements, questionnaires, interviews, direct observation, and photographic documentation, and analyzed using descriptive statistics. The results showed that burrow pits expanded more towards farmlands than roads, with Ajaura "B" recording the highest farmland encroachment (31.26%). More than half of the respondents (56.14%) reported multiple environmental impacts, including land degradation, vegetation loss, soil erosion, and stagnant water formation, while 71.05% associated sand mining with accidents such as drowning, pit collapse, and truck-related incidents. The study concludes that uncontrolled sand mining has contributed to environmental degradation, loss of agricultural land, and increased public safety risks along the corridor. It recommends stricter enforcement of environmental regulations, rehabilitation of degraded sites, and active community participation to promote sustainable sand mining practices.

Keywords: Sand Mining, Burrow Pits, Environmental Degradation, Farmland Encroachment, Road Damage, Jigawa State

INTRODUCTION

Sand mining has become one of the fastest-growing extractive activities worldwide due to rapid urbanization, population growth, and increasing demand for construction materials. Sand is indispensable for the construction of roads, buildings, bridges, and other infrastructure, making its extraction an important contributor to economic development (United Nations Environment Programme [UNEP], 2022). In Nigeria, particularly in Kano and Jigawa States, increasing construction activities have intensified sand mining along the Kano–Ringim–Hadejia road corridor, where extensive sand deposits and good road accessibility support commercial extraction. Besides providing employment and income for local communities, sand mining contributes to the supply of construction materials for expanding urban centres (Ahmed & Yusuf, 2021).

Despite these economic benefits, poorly regulated sand mining has become a major driver of environmental degradation. Continuous excavation creates burrow pits that progressively expand into adjacent farmlands, roads, and drainage channels, resulting in land degradation, soil erosion, vegetation loss, reduced agricultural productivity, and damage to transport infrastructure (Adewumi *et al.*, 2023). In semi-arid regions such as northern Nigeria, removal of vegetation and topsoil further accelerates erosion and desertification processes (Ibrahim et al., 2020). Abandoned pits frequently accumulate stagnant water during the rainy season, creating breeding sites for disease vectors and increasing the risks of flooding and drowning (Eze & Okeke, 2021).

Along the Kano–Ringim–Hadejia road corridor, communities such as Maje, Majia, Gujungu, Ajaura, and Marke have experienced increasing expansion of sand mining burrow pits. Continued excavation has converted productive agricultural land into mining sites, while heavy trucks transporting sand have contributed to road deterioration and increased traffic hazards. Similar environmental and infrastructural impacts have been reported in other mining communities across Nigeria (Musa *et al.*, 2022; Bukar & Garba, 2023).

Although previous studies have documented the general environmental impacts of sand mining in Nigeria, limited empirical evidence exists on the spatial expansion of burrow pits and their encroachment on roads and farmlands along the Kano–Ringim–Hadejia road corridor. This knowledge gap limits evidence-based planning for sustainable sand resource management and environmental protection in the area.

Therefore, this study assessed the effects of sand mining burrow pits along the Kano–Ringim–Hadejia road corridor in Kano and Jigawa States, Nigeria. Specifically, it examined the direction of burrow pit expansion in relation to roads and farmlands and determined the magnitude of environmental damages associated with sand mining activities.

MATERIALS AND METHODS

Study Area

The study area lies along the Kano–Ringim–Hadejia road corridor within Kano and Jigawa States in northwestern Nigeria. The area occupies part of the southwestern rim of the Chad Basin depression and lies within the Sudan Savannah ecological zone. Geographically, the region forms part of the extensive Hausa plains characterized by relatively flat to undulating topography with sandy and loamy soils suitable for agriculture and sand mining activities. The elevation of the area ranges from approximately 400 meters above sea level in the southeastern parts to over 1000 meters in the southern section of the region (Olofin, 2014). The region shares physiographic boundaries with the Niger and Benue river systems to the south and southeast and with the Chad Basin drainage system to the northeast.

The climate of the area is tropical continental in nature and is characterized by two distinct seasons namely the wet and dry seasons. The rainy season generally lasts from May or June to September or October, while the dry season extends from October to April. Annual rainfall ranges between 600 mm and 900 mm with higher rainfall recorded in the southern parts of the study area (Garba *et al*., 2011). Mean annual temperatures are generally high and range between 26°C and 34°C due to the influence of the tropical continental air mass. The dry season is associated with the Harmattan wind which originates from the Sahara Desert and is characterized by cold and dusty conditions between November and February (Ayoade, 2003).

Vegetation within the study area is predominantly Sudan Savannah consisting of short grasses, shrubs, and scattered drought-resistant tree species such as neem (*Azadirachta indica*), acacia (*Acacia spp.*), and baobab (*Adansonia digitata*). The vegetation has however been significantly modified by human activities such as farming, grazing, fuelwood collection, and sand mining. According to Areola (2001), the Sudan Savannah region of northern Nigeria has experienced increasing environmental degradation due to population pressure and unsustainable land-use practices.

The soils within the study area are generally sandy and friable, making them highly suitable for sand extraction and road construction materials. The abundance of loose sandy deposits along the Kano–Ringim–Hadejia corridor has encouraged intensive sand mining activities over the years. However, continuous extraction of sand has contributed to land degradation, soil erosion, vegetation destruction, and formation of burrow pits in several communities along the road corridor.

The inhabitants of the area are predominantly Hausa and Fulani whose major occupations include farming, livestock rearing, trading, transportation, and artisanal activities. Agriculture constitutes the major source of livelihood with crops such as millet, sorghum, maize, rice, beans, and groundnut cultivated extensively during the rainy season. Livestock production involving cattle, sheep, goats, and poultry is also widely practiced within the area due to the availability of grazing lands and favorable climatic conditions (JARDA, 2005).

The Kano–Ringim–Hadejia road is one of the major transportation routes connecting Kano metropolis with several commercial and agricultural settlements in Jigawa State. Rapid urbanization and infrastructural development in Kano and Jigawa States have increased the demand for sand used in building and road construction. Consequently, sand mining activities have intensified along the road corridor, particularly around communities such as Maje, Majia, Gujungu, Ajaura, and Marke where suitable sandy deposits are readily available. The continuous extraction of sand in these areas has significantly altered the natural landscape and contributed to environmental degradation including gully erosion, farmland encroachment, stagnant water accumulation, and road damage (Musa *et al.*, 2022).

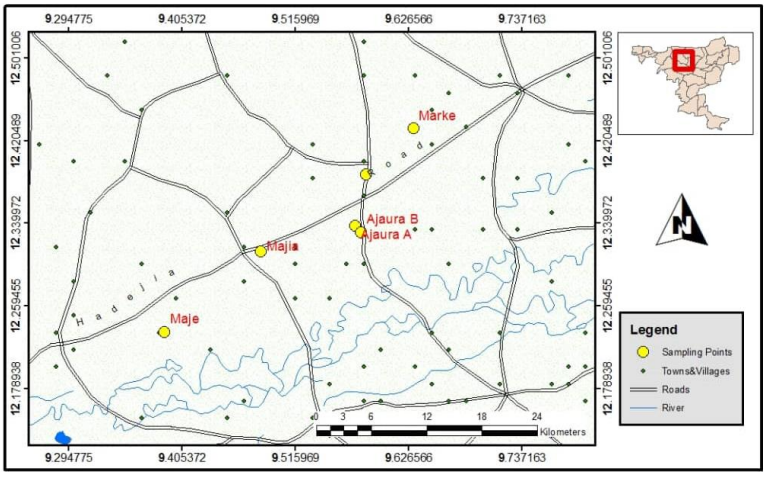

Figure 1: Map of the Study Area Showing the Sampled Burrow Pits.
Sources: cartography Lab BUK, 2026

Research Design

The study adopted a descriptive survey and field observational research design in assessing the environmental effects of sand mining burrow pits along the Kano–Ringim–Hadejia road corridor. The descriptive survey design was considered appropriate because it enabled the researcher to obtain information directly from respondents regarding their perceptions and experiences concerning the impacts of sand mining activities within their communities. Field observational techniques were also employed to assess the physical extent of environmental degradation associated with sand mining activities.

Photographs were used to document and illustrate the magnitude of environmental damages caused by excessive sand mining activities in the study area. Field measurements were conducted to determine the dimensions of burrow pits and the distances between pits, roads, farmlands, drainage channels, and nearby settlements. Questionnaire surveys and interviews were also used to gather information on environmental, socio-economic, and infrastructural impacts of sand mining activities from residents of the affected communities.

Types and Sources of Data

Both quantitative and qualitative data were collected for the study from primary and secondary sources. Quantitative data included measurements of pit dimensions, distances between pits and roads, frequencies of environmental impacts, and demographic characteristics of respondents. Qualitative data included respondents' perceptions, observations, and experiences regarding sand mining activities and their associated environmental effects.

Primary data were obtained through field measurements, questionnaire administration, interviews, direct observation, and photography. Measurements were conducted using a measuring wheel and a 100-meter measuring tape to

determine the extent of road and farmland encroachment by the burrow pits. Direct field observations were carried out to assess the physical conditions of the mining sites and surrounding environments.

Secondary data were obtained from textbooks, academic journals, government publications, conference papers, environmental reports, and previous studies related to sand mining, land degradation, and environmental management.

The study covered six active burrow pits located along the Kano–Ringim–Hadejia road corridor. The sampled burrow pits included Maje, Majia, Gujungu, Ajaura "A", Ajaura "B", and Marke mining sites. Data collection was conducted between the end of the dry season and the middle of the rainy season in 2018 in order to capture both dry season and wet season environmental conditions associated with sand mining activities.

Sample Size and Sampling Technique

The sample size for the study was determined using Cochran's sample size formula for finite populations:

$$n = \frac{no}{\left(\frac{no-1}{N}\right)} \quad (1)$$

Where:

n = adjusted sample size

n_o = initial sample size

N = population size

The initial sample size was determined using:

$$no = \frac{Z^2 pq}{e^2}$$

Where:

No = Initial sample size

Z = standard normal deviation at 95% confidence level (1.96)

p = estimated proportion of the population involved in sand mining activities (0.5)

q = 1 - p

e = margin of error (0.05)

Using the formula, a sample size of 353 respondents was obtained for the study. However, only 342 questionnaires were properly completed and returned, representing a response rate of 96.8%. The study adopted both purposive and convenience sampling techniques. Purposive sampling was used to select the six active burrow pits because they represented the most environmentally affected mining sites along the Kano–Ringim–Hadejia road corridor. Convenience sampling was used to select respondents from neighboring communities based on their availability and willingness to participate in the study. Respondents included farmers, sand miners, transporters, traders, village residents, and other individuals directly affected by sand mining activities.

Materials Used

Several materials and instruments were used during the fieldwork to facilitate data collection and environmental assessment. These included a digital camera used for capturing photographs of mining sites and environmental damages, a measuring wheel and a 100-meter measuring tape used for field measurements, structured questionnaires for obtaining respondents' opinions, notebooks for recording observations, and writing materials for documentation of field information.

Methods of Data Collection

Data collection involved a combination of field measurements, questionnaire administration, interviews, direct observation, and photography. Field measurements were carried out to determine the dimensions of burrow pits and the extent of encroachment into roads and farmlands. Measurements of distances between pits and nearby infrastructures were taken using a measuring wheel and measuring tape.

Structured questionnaires were administered to residents of the sampled communities to obtain information regarding the environmental, economic, and social impacts of sand mining activities. Interviews were also conducted with community leaders, sand miners, farmers, and truck drivers to obtain additional qualitative information concerning the effects of burrow pits on livelihoods and infrastructure.

Direct observation techniques were employed to assess visible environmental conditions such as vegetation destruction, erosion, stagnant water accumulation, landslides, and road degradation. Photographs were taken to provide visual evidence of environmental damages caused by excessive sand mining activities within the study area.

Method of Data Analysis

Data collected during the study were analyzed using descriptive statistical techniques. Frequencies, percentages, tables, and charts were used to summarize and present the data obtained from questionnaires, interviews, and field observations. Measurements obtained from the field were analyzed to determine the direction of burrow pit expansion and the extent of road and farmland encroachment.

The results were presented using tables, graphs, photographs, and descriptive explanations in order to clearly illustrate the magnitude of environmental damages associated with sand mining activities along the Kano–Ringim–Hadejia road corridor.

RESULTS AND DISCUSSION

Questionnaire Returns

Table 1 presents the distribution of valid questionnaires returned from the five study communities. A total of 342 valid questionnaires were retrieved and used for analysis, representing a 96.9% response rate from the 353 questionnaires administered. This high response rate indicates good participation and enhances the reliability of the study findings.

Table 1: Returns from Questionnaire Administrated

Villages	Frequency	Percentage (%)
Maje	51	14.91
Majia	71	20.76
Gujungu	73	21.35
Ajaura	80	23.39
Marke	67	19.59
Total	342	100

Source: Field Survey, 2026

Among the surveyed communities, Ajaura recorded the highest number of valid responses (80; 23.39%), followed by Gujungu (73; 21.35%), Majia (71; 20.76%), Marke (67; 19.59%), and Maje (51; 14.91%). The relatively balanced

distribution of respondents across the five communities ensured adequate representation of areas affected by sand mining activities along the Kano–Ringim–Hadejia road corridor. The higher proportion of responses from Ajaura and Gujungu reflects the greater concentration of active sand mining operations and the larger number of households directly affected by burrow pit expansion and its associated environmental impacts in these communities.

Therefore, the broad spatial coverage of respondents provided a suitable basis for assessing the environmental and socio-economic effects of sand mining across the study area while minimizing location-specific bias in the analysis. High questionnaire return rates are often considered reliable indicators of community interest and validity of survey-based environmental studies (Creswell & Creswell, 2018).

Gender Distribution of the Respondents

The gender composition of the respondents is presented in Figure 2. Understanding the gender distribution of participants is important because it provides insight into the demographic characteristics of individuals involved in sand mining activities and facilitates the interpretation of subsequent findings on the environmental and socio-economic impacts of sand mining in the study area.

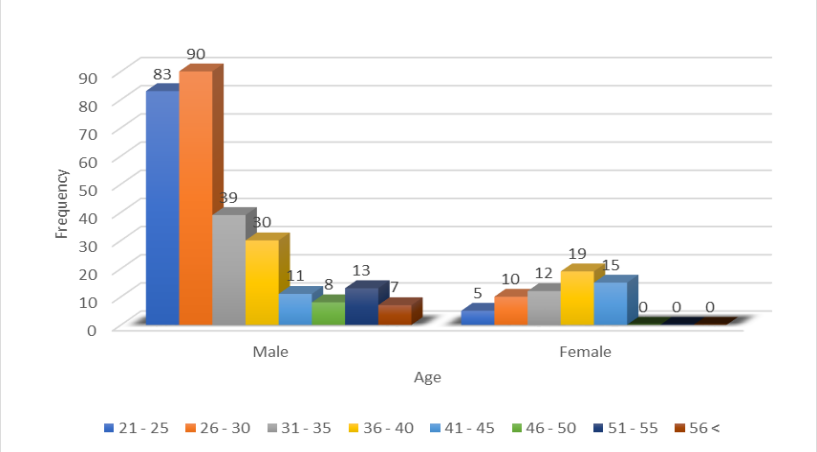

Figure 2: Gender Distribution of the Respondents
Source: Field Survey 2026

Male respondents constituted 82.16% of the total respondents, while females accounted for 17.84%. The dominance of male respondents reflects the gender structure commonly associated with sand mining activities in northern Nigeria, where mining, loading, transportation, and excavation are largely undertaken by men due to the physically demanding nature of the occupation. Women in the study area were mainly involved in supportive economic activities such as food vending, petty trading, and fuel wood collection around mining sites. Similar gender patterns have been reported in studies on artisanal mining and extractive activities in developing countries, where male participation significantly outweighs female involvement because of cultural and occupational factors (Hilson, 2016; Lawal, 2011).

The age distribution further revealed that the majority of respondents were within the economically active age bracket of 21–35 years. This indicates that sand mining activities are largely sustained by young adults who possess the physical strength required for excavation, loading, transportation, and other mining-related activities. Respondents within this age category were also actively involved in farming and livestock production, thereby combining mining activities with other rural livelihood practices. The concentration of young adults in sand mining activities suggests increasing dependence on extractive occupations as alternative sources of income due to rising unemployment and economic hardship in rural communities. Studies by Mensah (2017) and Ako et al. (2014) similarly observed that young people constitute the largest proportion of labor involved in informal mining activities across many developing countries because mining provides quick income opportunities despite associated environmental risks.

The findings also imply that the expansion of sand mining activities has significant socio-economic implications for rural communities along the Kano–Ringim–Hadejia road corridor. While the activity provides employment opportunities and household income, excessive dependence on mining by economically active youths may reduce participation in sustainable agricultural activities, thereby contributing to land degradation and declining agricultural productivity. Furthermore, the youthful nature of the workforce increases the frequency of human interaction with hazardous mining environments, exposing workers to accidents, landslides, dust pollution, and other occupational health risks associated with uncontrolled sand extraction (UNEP, 2019).

Direction of Flow of the Pits

Table 2 presents the direction of expansion of the sampled burrow pits in relation to adjacent roads and farmlands. The field measurements indicate that burrow pit expansion occurred predominantly towards agricultural lands rather than road corridors, demonstrating that continued sand extraction poses a greater threat to farmland than to transport infrastructure within the study area. Among the sampled sites, Ajaura "B" recorded the greatest farmland encroachment (31.26%), followed by Majia (25.43%) and Maje (18.83%), whereas Ajaura "A" exhibited the least encroachment (4.50%). Although road encroachment was also observed, its extent was generally lower than that recorded for farmlands, except at Ajaura "B", where the pit had expanded considerably towards the road corridor.

Table 2: Direction of Flow of the Pits

Sampled Burrow Pits	Distance from Pit to Road (m)	Percentage (%)	Distance from Pit to Farmland (m)	Percentage (%)
Maje	39.8	6.89	9.29	18.83
Majia	9.00	1.56	12.54	25.43
Gujungu	10.5	1.82	3.41	6.91
Ajaura “A”	3.75	0.65	2.22	4.50
Ajaura “B”	500	86.49	15.42	31.26
Marke	15.00	2.59	6.45	13.07
Total	578.05	100	49.33	100

Source: Field Survey, 2026

The observed pattern suggests that repeated excavation, combined with erosion and inadequate site rehabilitation, has progressively converted productive agricultural land into degraded mining landscapes. Expansion towards farmlands reduces cultivable land, lowers agricultural productivity, and threatens the livelihoods of farming households that depend on land resources for food production and income generation. Similar findings have been reported in Nigeria and other developing countries, where uncontrolled sand mining has resulted in the loss of agricultural land, landscape alteration, soil degradation, and increasing pressure on rural livelihoods (Adewumi *et al.*, 2023; Ahmed & Yusuf, 2021; United Nations Environment Programme [UNEP], 2022). Previous studies have also shown that continuous expansion of borrow pits accelerates soil erosion, destabilizes surrounding land surfaces, and increases the vulnerability of nearby infrastructure to environmental degradation (Musa *et al.*, 2022; Ibrahim *et al.*, 2020). These findings underscore the need for effective regulation of sand mining activities and the rehabilitation of degraded mining sites to minimize further encroachment on agricultural land and protect environmental sustainability.

Distribution of Road and Farmlands Encroachments by Sampled Pits

Figure 3 presents the spatial distribution of burrow pit encroachment towards road corridors and adjacent farmlands across the sampled sand mining sites. The figure provides a comparative illustration of the direction and extent of pit expansion, highlighting the relative vulnerability of transportation infrastructure and agricultural land to the impacts of uncontrolled sand mining.

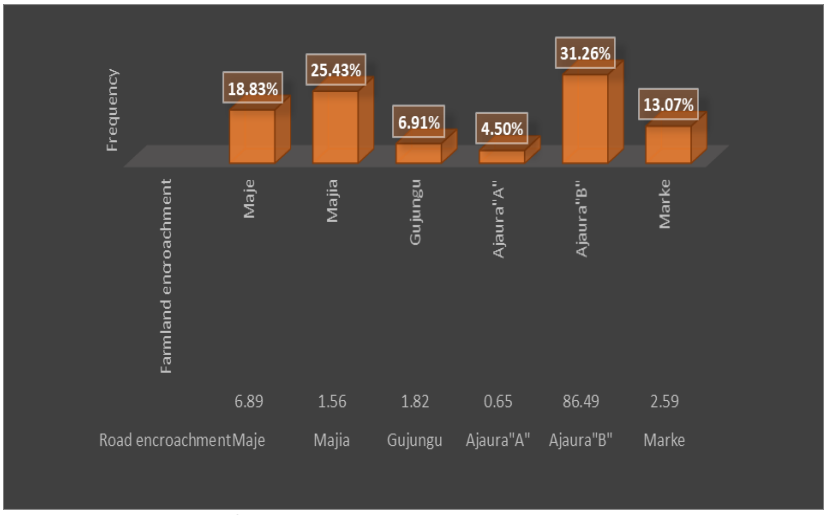

Figure 3: Distribution of Road and Farmlands Encroachments by Sampled Pits
Source: Field Survey, 2026

The expansion of burrow pits into farmlands has significantly reduced the quantity of cultivable land available to local farmers within the study area. Field observations showed that several hectares of croplands previously used for cultivation of millet, sorghum, cowpea, and groundnut had either been partially degraded or completely converted into sand mining sites. This has negatively affected agricultural productivity and rural livelihoods because farming remains the major occupation of the inhabitants of the area. Similar observations were made by Lawal (2011), who reported that uncontrolled sand mining activities in northern Nigeria contribute to reduction in agricultural land availability and decline in crop production.

The findings (Figure 3) further indicate that economic pressures and environmental vulnerability contribute to the increasing conversion of farmlands into mining areas. Many landowners reportedly lease or sell portions of their farmlands to sand miners because of immediate financial benefits and fear that erosion may eventually destroy the land if mining activities continue nearby. This finding supports the earlier work of Imoru (2010), who observed that landowners in mining communities often release their lands to miners due to economic hardship, weak land protection measures, and fear of environmental degradation. In many cases, farmers perceive sand mining as a temporary source of income despite the long-term environmental consequences associated with land degradation.

The encroachment of burrow pits into farmlands also contributes to increased soil erosion and land instability within the affected communities. Removal of topsoil and vegetation during excavation weakens soil structure and exposes the land surface to runoff and gully erosion during

the rainy season. According to Ako *et al.* (2014), excessive sand extraction alters geomorphological processes and accelerates environmental degradation through destabilization of land surfaces and increased susceptibility to erosion. Similarly, Ayuba (2005) noted that degradation of agricultural lands through extractive activities contributes significantly to declining soil fertility and reduced agricultural sustainability in northern Nigeria.

Another important implication of farmland encroachment observed during the study is the growing scarcity of productive land for farming and grazing activities. As burrow pits continue to expand, farmers are forced to cultivate smaller plots of land, while pastoralists experience reduction in available grazing areas for livestock. This situation has the potential to intensify land-use conflicts between farmers, miners, and herders within the study communities. Studies by Mensah (2017) and UNEP (2019) emphasized that unsustainable sand mining threatens food security and sustainable land management by reducing the availability of productive agricultural land and disrupting ecosystem stability.

Furthermore, the study observed that erosion around the pits often widens the excavated areas beyond their original boundaries, thereby increasing the rate of encroachment into adjacent farmlands. During the rainy season, runoff water flows into the pits and enlarges them through gully formation and lateral erosion. This continuous expansion creates dangerous depressions that are difficult to rehabilitate and unsuitable for future agricultural use. Akintola (1978) similarly reported that mining-induced erosion and land subsidence contribute to permanent alteration of landforms and destruction of productive landscapes in Nigeria.

Overall, the findings indicate that excessive and poorly regulated sand mining activities have become a major driver of farmland loss and environmental degradation along the Kano–Ringim–Hadejia road corridor. Without effective environmental regulation, land reclamation, and sustainable mining practices, continued expansion of burrow pits may further reduce agricultural productivity and threaten the livelihoods of rural households that depend heavily on farming activities.

Magnitude of Damages Caused by Excessive Sand Mining

Table 3 presents respondents' perceptions of the major environmental damages associated with excessive sand mining in the study area. The table summarizes the frequency and percentage distribution of the reported impacts, highlighting the extent to which sand mining has contributed to land degradation, landscape alteration, vegetation loss, and soil erosion.

Table 3: Negative Impacts of Sand Mining

Impacts	Total	Percentage (%)
Land degradation, deepening pit edges, soil erosion	79	23.10
Deep pits, landscape alteration, loss of vegetation	71	20.76
All of the above	192	56.14
Total	342	100

Source: Field Survey, 2026

The findings of the study (Table 3) revealed extensive environmental degradation associated with excessive sand mining activities along the Kano–Ringim–Hadejia road corridor. Responses obtained from the questionnaire survey showed that the majority of respondents (56.14%) indicated that all identified environmental impacts were occurring simultaneously within the study area. These impacts included soil erosion, land degradation, destruction of vegetation, formation of deep pits, stagnant water accumulation, landslides, and encroachment into roads and farmlands. About 23.10% of respondents specifically identified land degradation and soil erosion as the most serious environmental problems, while 20.76% emphasized deep pits, landscape alteration, and vegetation loss as the dominant impacts of sand mining activities.

Photographic Evidence of Environmental Degradation Associated with Sand Mining along the Kano–Ringim–Hadejia Road Corridor

Plates presents photographic evidence of the environmental impacts of excessive sand mining observed during the field survey. The photographs illustrate key forms of environmental degradation, including deforestation and vegetation loss (Plate 1), formation of water pools due to excavation and raised water tables (Plate 2), stagnant water accumulation in abandoned burrow pits (Plate 3), erosion of protective barricades constructed to prevent road encroachment (Plate 4), landslides resulting from unstable pit slopes (Plate 5), and deterioration of access roads caused by heavy trucks transporting sand (Plate 6). Collectively, these field observations corroborate the questionnaire findings by demonstrating that uncontrolled sand mining has contributed to land degradation, increased erosion, destruction of vegetation, public safety risks, and damage to transportation infrastructure within the study area.

Figure 4: Deforestation and Loss of Vegetation
Source: Field Survey, 2026

Figure 5: Formation of Pool due to Raised Water Table due to Erosion Triggered by Excessive Sand Mining
Source: Field Survey, 2026

Figure 6: Stagnant water on a Burrow Pit
Source: Field Survey, 2026

Figure 7: Eroded Barricade Constructed to Avert Road Encroachment from a Neighboring pit
Source: Field Survey, 2026

Figure 8: Land slide Caused by Mining of Pit Sand
Source: Field Survey, 2026

Figure 9: Access Roads Stock Pilled by Heavy Vehicles
Source: Field Survey, 2026

Distribution of Environmental Impacts Associated with Sand Mining Activities

Table 4 presents the distribution of respondents' perceptions regarding the environmental impacts of sand mining activities in the study area. The table summarizes the frequency and percentage of reported environmental effects, highlighting the extent to which sand mining has contributed to land degradation, soil erosion, destruction of farmlands, landscape alteration, and vegetation loss.

Table 4: Distribution of Environmental Impacts of Sand Mining Activities

Environmental Impacts	Frequency	Percentage (%)
Land degradation, soil erosion, and destruction of farmlands	79	23.10
Deep pits, landscape alteration, and vegetation loss	71	20.76
All of the above impacts	192	56.14
Total	342	100

Source: Field Survey, 2026.

Field observations conducted during the study revealed that excessive excavation of sand had significantly altered the physical landscape of the study communities. Large burrow pits with steep edges were observed in Maje, Majia, Gujungu, Ajaura, and Marke communities. These pits expanded rapidly during the rainy season due to runoff erosion and weakening of pit walls. Continuous removal of topsoil and sand deposits exposed the land surface to accelerated erosion processes and increased vulnerability to gully formation. Similar findings were reported by Ako *et al*. (2014), who noted that uncontrolled sand extraction destabilizes land surfaces and alters geomorphological processes, thereby increasing environmental vulnerability.

The destruction of vegetation was another major environmental problem identified during the study. Vegetation along pit edges and access routes had been cleared extensively to create space for excavation activities and movement of heavy trucks transporting sand. The removal of shrubs, grasses, and trees reduced vegetative cover and exposed the soil surface to wind and water erosion. According to Ayuba (2005), degradation of vegetation through extractive activities significantly increases surface runoff, soil erosion, and desertification risks in northern Nigeria. Similarly, Mensah (2017) observed that sand mining contributes to ecosystem disturbance and biodiversity loss through indiscriminate clearing of natural vegetation.

The study also observed that abandoned burrow pits frequently accumulated stagnant water during the rainy season, resulting in the formation of artificial ponds and pools. These stagnant water bodies created breeding grounds for mosquitoes and other disease vectors, thereby increasing environmental health risks within surrounding communities. In addition, some of the pits weakened nearby land surfaces and contributed to landslides and pit wall collapse, especially in areas where excessive excavation occurred without safety measures. UNEP (2019) emphasized that poorly managed sand mining activities contribute to hydrological instability, flooding, and environmental hazards in many developing countries.

Another significant environmental problem observed during the study was road encroachment caused by expanding burrow pits and erosion. In several locations, erosion from mining sites gradually extended towards road shoulders, threatening transportation infrastructure along the Kano–Ringim–Hadejia road. Heavy trucks transporting sand also contributed to road deterioration through repeated movement on weak surfaces. Similar observations were made by Lawal (2011), who reported that uncontrolled sand mining contributes to road degradation and increased maintenance costs in mining communities.

Accidents Associated with Sand Mining

Table 5 show that sand mining activities were associated with numerous environmental and occupational accidents within the study area. Results from the questionnaire survey indicated that 71.05% of respondents were aware of accidents occurring either within mining sites or along roads used by trucks transporting sand, while only 28.95% indicated that they were not aware of such accidents.

Table 5: Respondents' Awareness of Accidents Associated with Sand Mining

Response	Frequency	Percentage (%)
Aware of accidents associated with sand mining	243	71.05
Not aware of accidents	99	28.95
Total	342	100

Source: Field Survey, 2026.

Table 5 reported accidents included drowning of children in stagnant water pools formed within abandoned burrow pits, collapse of pit edges on miners, traffic accidents involving sand transport trucks, and injuries caused by landslides during excavation. Respondents explained that children frequently visit abandoned pits during the rainy season to swim or play, thereby increasing the likelihood of drowning incidents. Field observations also confirmed the presence of deep water-filled pits located close to residential and farming areas.

Pit collapse and landslides were identified as common occupational hazards faced by miners within the study area. Miners often excavated sand from unstable inner pit walls without protective measures, thereby increasing susceptibility to wall collapse. During fieldwork, evidence of recent landslide events and collapsed pit sections were observed in some mining locations. Akintola (1978) similarly reported that mining activities increase susceptibility to landslides, mudflows, and structural collapse due to weakening of soil stability and alteration of natural landforms.

Heavy-duty trucks transporting sand also contributed significantly to accidents and environmental hazards along the road corridor. Repeated movement of overloaded trucks damaged access roads, loosened soil surfaces, and increased dust pollution within surrounding communities. According to Mensah (2017), poorly regulated mining transportation systems contribute to increased accident risks, road deterioration, and environmental instability in mining regions.

The findings therefore indicate that excessive sand mining not only degrades the environment but also exposes local communities and workers to serious safety and health risks. The absence of effective environmental monitoring, rehabilitation measures, and occupational safety regulations further aggravates the environmental and human impacts associated with sand mining activities within the study area.

CONCLUSION

The study revealed that excessive sand mining activities along the Kano–Ringim–Hadejia road have caused significant environmental degradation and farmland encroachment. Burrow pits were found to expand more towards agricultural lands than roads, resulting in loss of productive farmlands, soil erosion, destruction of vegetation, stagnant water formation, road encroachment, and accidents. The absence of proper environmental regulation and rehabilitation measures has intensified the environmental impacts of mining activities within the study area. The study recommends strengthening the enforcement of environmental regulations governing sand mining through mandatory Environmental Impact Assessments (EIAs), designated mining zones, and strict monitoring of excavation activities. Degraded mining sites should be rehabilitated through land reclamation, while abandoned pits should be properly managed to minimize environmental and public health risks. Community participation, public awareness, improved road safety, and alternative livelihood programmes should also be promoted. Furthermore, integrating sustainable sand mining practices into local land-use planning will help balance economic benefits with environmental protection and ensure the long-term sustainability of natural resources.

REFERENCES

Adewumi, T. O., Ibrahim, A. A., & Sani, M. (2023). Environmental implications of uncontrolled sand mining in semi-arid regions of Nigeria. Journal of Environmental Management and Sustainability, 11(2), 55–68.

Ahmed, M. I., & Yusuf, U. A. (2021). Sand mining and rural livelihoods in northern Nigeria. Nigerian Journal of Geography and Development, 9(1), 77–89.

Akintola, F. O. (1978). Environmental problems associated with mining activities in Nigeria. Nigerian Geographical Journal, 21(2), 112–124.

Ako, T. A., Shimada, J., Hosono, T., & Ichiyanagi, K. (2014). Environmental impacts of sand mining on land degradation and ecosystem stability. Environmental Earth Sciences, 72(5), 1851–1861.

Areola, O. O. (2001). Ecology of Natural Resources in Nigeria. Ibadan: Evans Brothers Publishers.

Ayoade, J. O. (2003). Introduction to Climatology for the Tropics. Ibadan: Spectrum Books Limited.

Ayuba, H. K. (2005). Environmental effects of deforestation and land degradation in northern Nigeria. Savanna Journal of Environmental Studies, 2(1), 45–57.

Bukar, A. M., & Garba, S. I. (2023). Road infrastructure deterioration associated with mining activities in northern Nigeria. African Journal of Environmental Studies, 15(3), 112–126.

Cochran, W. G. (1977). Sampling Techniques (3rd Ed.). New York: John Wiley and Sons.

Creswell, J. W., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed.). Thousand Oaks, CA: Sage Publications.

Eze, P. N., & Okeke, C. C. (2021). Hydrological effects of abandoned mining pits in rural communities. International Journal of Environmental Research, 8(4), 201–214.

Garba, M. L., Abdulkadir, A., & Ahmed, B. (2011). Rainfall variability and environmental conditions in northern Nigeria. Journal of Environmental Studies, 5(2), 44–56.

Hilson, G. (2016). Artisanal and small-scale mining and agriculture: Exploring their links in rural sub-Saharan Africa. International Journal of Rural Studies, 23(2), 1–12.

Ibrahim, H. D., Musa, A. U., & Bello, K. (2020). Land degradation and vegetation loss associated with extractive activities in northern Nigeria. Savanna Journal of Environmental Science, 6(2), 90–104.

Imoru, A. Y. (2010). Effects of sand winning on agricultural lands and livelihoods in rural communities. Journal of Environmental Management and Safety, 1(2), 45–53.

Imoru, Y. (2010). Sand mining and livelihood implications in rural communities. Journal of Environmental Management, 6(3), 55–68.

Jigawa Agricultural and Rural Development Authority (JARDA). (2005). Jigawa State Agricultural Development Report. Dutse: JARDA Publications.

Lawal, P. O. (2011). Effects of sand/gravel mining in Minna Emirate Area of Nigeria on stakeholders. Journal of Geography and Regional Planning, 4(1), 1–9.

Mensah, J. K. (2017). Sand mining and environmental sustainability in developing countries. International Journal of Environmental Studies, 74(2), 245–257.

Musa, M. A., Abdullahi, Y. M., & Lawan, A. U. (2022). Farmland encroachment and environmental impacts of sand mining in Jigawa State, Nigeria. Journal of Environmental Geography, 14(1), 33–45.

Olofin, E. A. (2014). Geographical Regions of Northern Nigeria. Kano: Adamu Joji Publishers.

Olofin, E. A. (2014). Wudil within the Kano Region: A Geographical Synthesis. Kano: Adamu Joji Publishers. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches by Creswell (2014).

United Nations Environment Programme (UNEP). (2000). Global Environmental Outlook Report. Nairobi: UNEP.

United Nations Environment Programme (UNEP). (2019). Sand and Sustainability: Finding New Solutions for Environmental Governance of Global Sand Resources. Nairobi: UNEP.

United Nations Environment Programme (UNEP). (2022). Sand and Sustainability: 10 Strategic Recommendations to Avert a Crisis. Nairobi: UNEP.