International Journal of Advanced Agriculture and Research

ISSN: 3121-6420

Volume 1, Issue 3, December, 2025
(An Academians Publishers of Research & Academic Resources)

Original Research Article

Received: **28-10-2025** Accepted: **16-11-2025** Published: **30-12-2025**

Reclamation Strategies for Sustainable Landuse in Abandoned Mine Sites of Kuba Town and Environs, Bokkos LGA, Plateau State, Nigeria

Reagan Mafulul Mangut*[1], Prof. Stephen J. Mallo[2], Mamuda Isiaka[3]
[1]Department of Minerals and Petroleum Resources Engineering
Plateau State Polytechnic, Barkin Ladi.
[2]Department of Mining Engineering
University of Jos, Nigeria
[3]Department of Minerals and Petroleum Resources Engineering
Plateau State Polytechnic, Barkin Ladi.

Abstract: Mining activities in many parts of Plateau State, particularly within Kuba town and its environs in Bokkos Local Government Area, have left behind extensive environmental degradation manifested in the form of abandoned mine ponds, eroded lands, and loss of vegetation. These disturbed landscapes pose serious threats to agricultural productivity, water quality, and human safety. This study, therefore, examines reclamation strategies aimed at restoring the ecological balance and promoting sustainable land use within these abandoned mine sites. Field investigations, soil and landform observations, and community consultations were carried out to identify major mine ponds and assess their potential for productive reuse. Eleven major ponds were identified, including Kuba 1–4, Sangwak, Dan Bukuru, Blue Dam, Mayanga, Maiyangan Tsofo 1 and 2, and Fofai. Each pond was prioritized and proposed for specific uses such as agriculture, aquaculture, potable water supply, and eco-tourism based on its physical characteristics, location, and suitability. The reclamation strategies proposed in this study integrate physical, biological, and socio-economic measures. Physical rehabilitation involves land reshaping, slope stabilization, and drainage improvement. Biological rehabilitation emphasizes re-vegetation with native tree species and soil fertility restoration through organic enrichment. Sustainable land use options include community-based fish farming, irrigated agriculture, and eco-tourism development. The study highlights that effective reclamation and management of these mine sites can transform the degraded environment into productive landscapes that contribute to food security, poverty reduction, and environmental sustainability. It concludes that successful implementation will depend on strong community participation, institutional support, and strict enforcement of environmental regulations.

Keywords: *Reclamation, Sustainable Land Use, Mine Ponds, Environmental Degradation, Kuba Town, Plateau State.*

1. Introduction

Mining has contributed immensely to Nigeria's economic development through mineral extraction and employment creation. However, the environmental consequences of unregulated mining are evident across several states, including Plateau State, where extensive artisanal and small-scale mining of tin and other minerals has left behind abandoned pits and disturbed landscapes. Kuba town and its environs in Bokkos Local Government Area are among the affected communities where mining has resulted in soil degradation, loss of vegetation cover, and disruption of natural drainage systems. The degradation of mined lands not only reduces agricultural productivity but also affects local livelihoods and biodiversity. Restoring these lands requires carefully designed reclamation strategies that integrate physical, chemical, and biological rehabilitation techniques to ensure sustainable reuse. Reclamation, in this context, refers to the process of returning disturbed land to a stable, productive, and ecologically balanced condition suitable for future use.

Several studies have explored reclamation of mine sites globally and within Nigeria. For example, Adekoya (2003) highlighted that the absence of post-mining management plans in Nigeria has led to widespread environmental deterioration. Similarly, Ijah et al. (2014) emphasized that reclamation efforts should combine soil fertility improvement with re-vegetation using native species. Globally, examples from South Africa and India show that successful reclamation integrates local participation, soil restoration, and adaptive land-use planning (Singh & Tripathi, 2017). Despite these advances, many mined areas in Plateau State remain unrehabilitated decades after mining ceased. There is limited scientific data on the current soil condition of abandoned mine sites in Kuba town, making it difficult to design appropriate reclamation measures. This study, therefore, aims to assess soil characteristics and propose practical reclamation strategies for sustainable land use.

2. Location, Accessibility and Geology of the Study Area

Kuba town is situated in Bokkos Local Government Area of Plateau State, north-central Nigeria. It lies approximately between latitude 09° 21'N and 09° 26'N and longitude 8° 54'E and 9° 01'E with elevation as high as 1,430m. The area is accessible through the Barkin Ladi – Bokkos main road, with laterite feeder roads linking various mining communities such as Maiyanga, Sangwak, Dan Bukuru, Maiyangan Tsofo and Fofai. The climate is typically tropical with distinct wet and dry seasons. Average annual rainfall ranges from 1200 mm to 1400 mm, and temperature varies between 18°C and 27°C. The vegetation belongs to the Guinea Savanna zone, dominated by grasses and scattered shrubs, though much of it has been disturbed by mining and farming activities.

Geologically, the area lies within the Jos Plateau, underlain by Precambrian Basement Complex rocks intruded by Younger Granites. The granitic rocks are rich in tin, columbite, and associated minerals, which explains the intensive mining in the area. The geology is characterized by weathered granites, pegmatites, and alluvial deposits, creating an undulating terrain with both dry and water-filled mine pits.

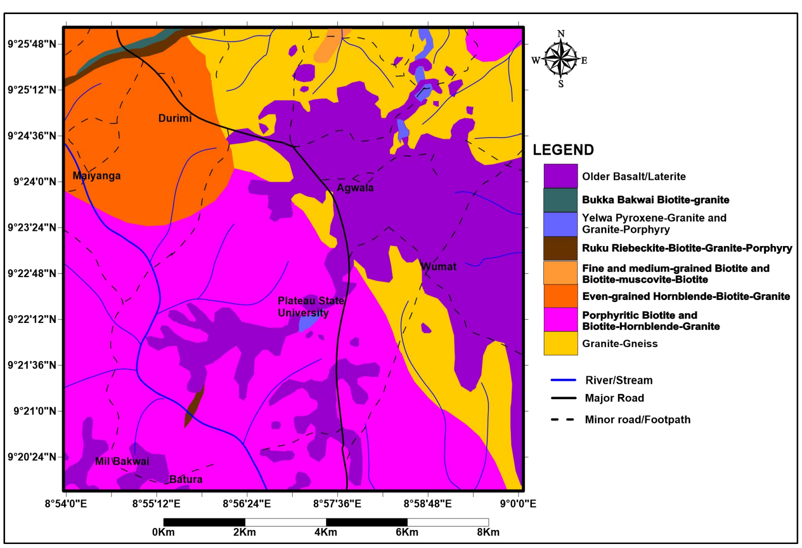

Fig.1: Modified Geologic Map of Kuba and Environs (After Macleod, 1976)

3. Materials and Methods

3.1 Materials Used

Both field and laboratory investigations required a combination of basic surveying tools, sampling instruments, and analytical equipment. During fieldwork, a hand-held GPS device was used to record the coordinates of each sampling point for accurate spatial referencing. Soil augers and clean polyethylene bags were employed for collecting and storing soil samples, while permanent markers and labels ensured proper identification. A digital camera was used to document field observations, including the physical condition of the mine sites, vegetation status, and evidence of erosion or sediment accumulation.

In the laboratory, a range of analytical instruments and reagents were used for both physical and chemical determinations. A pH meter was used for soil reaction (acidity or alkalinity) measurement, while hydrometers and sieves were used to determine soil particle size distribution. Other materials included analytical balances, measuring cylinders, beakers, and pipettes for solution preparation. For chemical analysis, reagents such as potassium dichromate, sulfuric acid, and phenolphthalein indicators were used for determining organic matter and nutrient contents. Heavy metals (such as lead, zinc, and iron) were quantified using an Atomic Absorption Spectrophotometer (AAS) at the Science Laboratory, Abubakar Tatari Ali Polytechnic, Bauchi.

3.2 Reconnaissance Field Studies

A reconnaissance survey was carried out across Kuba town and surrounding villages to identify abandoned mine sites. Eleven (11) major sites were mapped and photographed. Observations focused on the physical state of the land, vegetation cover, erosion patterns, and presence of water-filled pits. The reconnaissance exercise also involved interaction with local residents who provided information on past mining activities.

The reconnaissance survey carried out in Kuba and environs provided direct insights into the extent and implications of abandoned mine sites within the study area. Field observations revealed widespread environmental degradation caused by historical mining activities, primarily artisanal and small-scale tin and columbite mining, which dominated Plateau State for decades. These activities, though economically significant in the past, were conducted with little regard for land restoration, leaving behind large tracts of disturbed landscapes.

3.3 Laboratory Analysis

Laboratory analysis was carried out to determine the physical and chemical properties of soil samples collected from the abandoned mine sites in Kuba town and its environs. This method was essential in assessing the degree of land degradation, the quality of soil for agricultural purposes, and the suitability of pond water for reclamation and sustainable use. The results of these analyses provided scientific evidence that guided the selection of appropriate reclamation strategies for each site. Soil samples were collected from different mine ponds and their surrounding farmlands at depths ranging from 0 –100 cm using a soil auger. The samples were air-dried, crushed, and sieved through a 2 mm mesh to remove debris before laboratory testing. Several parameters were analyzed, including soil texture, pH, organic matter content, electrical conductivity, and major nutrients such as nitrogen, phosphorus, and potassium.

Soil samples were also collected from the mining dumps using clean polyethylene bags. Parameters such as pH, electrical conductivity, and concentrations of heavy metals (like lead, iron, and manganese) were tested in the laboratory. These tests helped determine the suitability of the pond water for agriculture, aquaculture, or domestic use, and to identify any potential contamination arising from past mining operations. The results from soil analyses were compared with standard values set by the World Health Organization (WHO) to evaluate environmental quality. Data obtained from the laboratory served as a scientific basis for recommending appropriate reclamation strategies.

3.4 Data Analysis

The analysis of soil data in this study was aimed at interpreting the laboratory results to evaluate the level of soil degradation and determine its suitability for reclamation and sustainable land use. The data obtained from laboratory tests on soil samples were carefully examined to understand variations in soil quality across the different abandoned mine sites. These variations provided insight into the physical and chemical limitations that must be addressed during the reclamation process.

The soil parameters analyzed included texture, pH, organic matter, electrical conductivity, and essential plant nutrients such as nitrogen (N), phosphorus (P), and potassium (K). Each parameter was interpreted in relation to standard soil quality benchmarks for agricultural productivity and land restoration.

The interpreted results were further compared across all eleven mine sites to establish spatial patterns of degradation and recovery potential. These comparisons guided the selection of appropriate reclamation measures such as soil amendment, afforestation, and controlled land use. Through this analytical process, the study was able to link soil quality assessment with practical reclamation planning, ensuring that each reclaimed area is utilized according to its natural capacity and environmental condition.

4. Results and Discussion

4.1 Field Observations

The field survey revealed extensive degradation across the study area. Most abandoned mine sites appeared as open pits ranging from 2 to 8 meters deep. Many pits were filled with water, forming temporary ponds. Vegetation was sparse, with scattered grasses and shrubs. Erosion and sedimentation were common, while some sites showed evidence of grazing and farming on marginal lands.

The reconnaissance survey revealed that most of the abandoned mine sites are located close to farmlands and residential areas. In many cases, mining pits were observed less than 500 meters from homesteads and local footpaths, thereby increasing community exposure to associated hazards. The spatial distribution pattern also showed a tendency for mining activities to concentrate along river valleys and low-lying areas where alluvial tin and columbite deposits were abundant (Table 1).

Table 1: Table showing the spatial distribution of abandoned mine sites in Kuba and environs.

S/N	Location	Location Code	Spatial Distribution of abandoned Mine sites		
			Northing	Easting	Elevation (m)
1	Kuba 1	KB1	09° 24’ 34.1’’ N	008° 55’ 59.6’’ E	1382
2	Kuba 2	KB2	09° 24’ 23.1’’ N	008° 55’ 54.1’’ E	1372
3	Kuba 3	KB3	09° 24’ 32.4’’ N	008° 55’ 50.0’’ E	1380
4	Kuba 4	KB4	09° 24’ 41.8’’ N	008° 55’ 34.8’’ E	1379
5	Blue Dam	BD	09° 24’ 42.0’’ N	008° 55’ 59.9’’ E	1382
6	Sangwak	SG	09° 23’ 12.0’’ N	008° 55’ 18.7’’ E	1350
7	Dan Bukuru	DB	09° 22’ 30.9’’ N	008° 55’ 10.9’’ E	1344
8	Maiyanga	MY	09° 24’ 09.4’’ N	008° 54’ 05.8’’ E	1361

9	Maiyanga Tsofo 1	MT1	09° 24’ 16.0’’ N	008° 54’ 36.4’’ E	1383
10	Maiyanga Tsofo 2	MT2	09° 24’ 31.3’’ N	008° 54’ 25.6’’ E	1371
11	Fofai	FF	09° 25’ 09.3’’ N	008° 56’ 31.1’’ E	1360

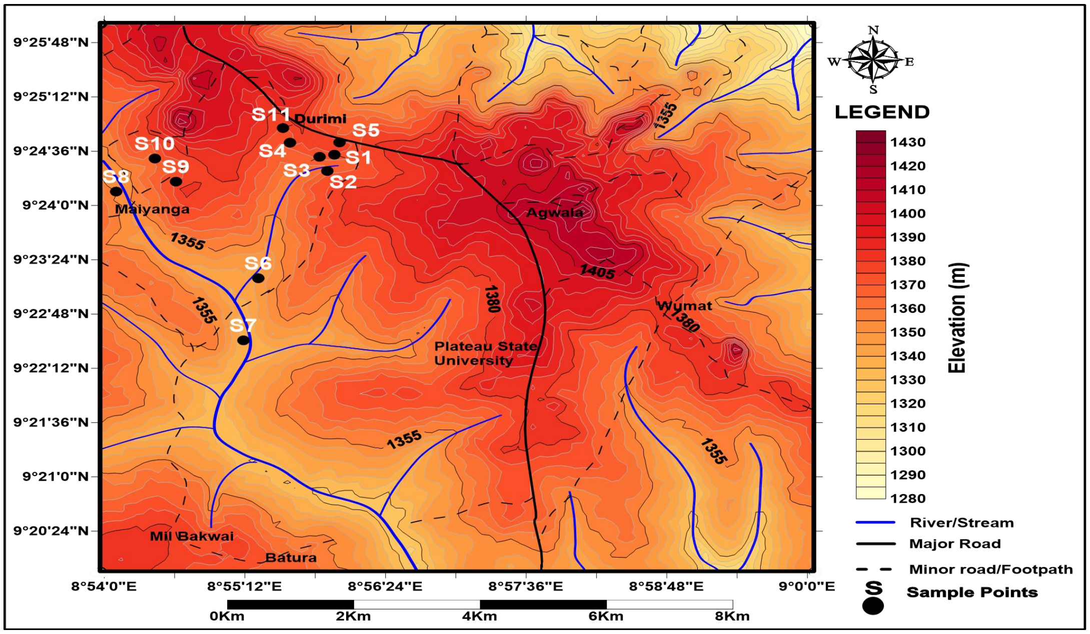

Fig 2: Map of Kuba and Environs showing Sampling Points, elevation and concentration of Mining Ponds.

The findings from the survey were further substantiated with photographic evidence, field sketches, and georeferenced points collected during the survey. These findings not only highlight the scale of environmental disruption but also underscore the urgent need for reclamation and sustainable land-use planning in the area.

Plate 1: Typical Mining Ponds found within the Study Area.

Plate 2: Artisanal Miners associated with Mining Pits scattered within the Study Area.

Plate 3: Extensive environmental land degradation characterize by erosion in the Study Area.

Plate 4: Mining Ponds used for Dry – Season farming (Irrigation) in the study Area.

Plate 5: Soil Sampling and soil erosion control measures on the field.

4.3 Physical Analysis of Soil Samples

The results of the Physical analysis included that of temperature, pH, Turbidity, chloride, total hardiness, colour and odor are given in table 3.

Table 2: Results of Physical Analysis of Soil Samples of abandoned mine sites in Kuba and environs.

S/N	Samples	pH	B.D (g/cm³)	MC (%)	E.C (dS/cm)	Porosity (%)	T.O.C (%)
1	K1	6.85	2.00	20.00	0.50	24.53	0.02
2	K2	6.90	1.82	18.00	0.50	30.00	0.05
3	K3	7.00	1.82	16.00	0.50	29.70	0.08
4	K4	7.20	1.33	14.00	0.50	50.37	0.20
5	BD	6.80	1.82	12.00	0.55	31.06	0.42
6	SG	7.10	2.00	4.00	0.50	24.81	0.64
7	DB	6.80	1.90	10.00	0.61	28.57	0.08
8	MY	6.90	1.54	12.00	0.60	41.89	0.42
9	MT1	7.20	1.90	8.00	0.58	28.30	0.74
10	MT2	6.80	2.00	16.00	0.65	24.53	0.40
11	FF	6.90	1.96	10.00	0.72	25.76	0.20

Eleven (11) soil samples were analyzed for their physical parameters, including pH, bulk density, moisture content, electrical conductivity (EC), porosity, and total organic carbon (TOC). The results are presented in ranges, and their implications are discussed in relation to World Health Organization (WHO) standards for agricultural soils and potential influence on drinking water quality. The physical parameters of the eleven (11) soil samples fall largely within WHO acceptable limits for agricultural soils. The near-neutral pH, low salinity (EC), and moderate moisture levels favor crop production and minimize risks to drinking water safety. However, variations in bulk density, porosity, and TOC indicate differences in soil quality across sites. High bulk density and low porosity may restrict root growth, while low TOC may limit nutrient retention and soil fertility. These conditions, if unmanaged, could influence agricultural productivity and the quality of groundwater recharge. Overall, the soils demonstrate good agricultural potential with minimal threat to drinking water quality, provided that site-specific management practices such as organic amendments and compaction control are implemented.

4.4 Results of Chemical Analysis of Soil Samples

The chemical composition of soils plays a vital role in determining their suitability for agricultural production and their potential impact on drinking water quality.

Table 3: Results of Chemical Analysis of Soil Samples of abandoned mine sites in Kuba and environs.

S/N	Samples	As	Cd	Pb	Hg	Cr	Zn	Cu	Mn	Fe
1	K1	4.60	5.70	5.40	12.50	100.60	7.20	200.70	76.50	230.20
2	K2	4.60	82.70	5.00	8.60	95.10	86.60	197.20	75.20	237.00
3	K3	3.10	70.80	5.90	4.60	97.90	84.10	199.30	73.10	152.7
4	K4	4.70	41.30	5.40	27.10	89.20	90.30	197.60	74.30	153.90
5	BD	3.80	84.00	6.60	14.60	84.20	4.50	202.60	152.80	151.70

6	SG	5.40	77.50	10.10	7.90	35.70	77.50	110.00	74.20	76.40
7	DB	8.10	70.50	19.40	13.70	37.60	82.10	205.40	74.0	149.10
8	MY	5.70	76.00	10.60	7.90	108.20	84.10	101.60	78.20	243.70
9	MT1	11.20	71.10	9.90	4.88	104.80	76.00	107.80	152.20	234.90
10	MT2	3.90	44.40	11.00	2.50	106.80	73.50	104.40	149.90	263.20
11	FF	5.20	42.00	8.90	15.90	53.20	75.30	106.30	76.20	163.50

Eleven soil samples were analyzed for heavy metals, including arsenic (As), cadmium (Cd), lead (Pb), mercury (Hg), chromium (Cr), zinc (Zn), copper (Cu), manganese (Mn), and iron (Fe). The concentrations are discussed in relation to WHO permissible limits and their implications for crop growth, food safety, and water quality. Arsenic concentrations in the soils ranged from 3.10 to 11.20 mg/l. According to WHO guidelines, the safe limit for arsenic in agricultural soils is 20 mg/l. The observed values are below this threshold, suggesting minimal risk of arsenic toxicity in crops or contamination of groundwater. However, since arsenic is highly mobile in waterlogged soils, continuous monitoring is needed to prevent leaching into drinking water, where WHO's maximum permissible limit is 0.01 mg/L. Cadmium levels ranged widely, from 5.70 to 84.00 mg/L. WHO standards set the safe limit for Cd in agricultural soils at 3 mg/l, making all the recorded values significantly above the permissible threshold. Elevated Cd concentrations can be toxic to plants, leading to stunted growth and reduced yields, and more importantly, cadmium can accumulate in edible plant tissues, posing serious health risks (kidney damage, skeletal disorders) if such crops are consumed. For drinking water, WHO recommends a maximum of 0.003 mg/L, meaning leaching from these soils could threaten groundwater quality. Lead concentrations ranged from 5.00 to 19.40 mg/L. WHO guidelines suggest a safe limit of 100 mg/L for Pb in soils, indicating that the observed values are well below the critical threshold. Agriculturally, the levels do not pose significant risks to crop growth. However, Pb is immobile in soils and tends to accumulate in roots rather than edible parts of plants. For drinking water, the WHO limit is 0.01 mg/L, meaning that although current soil levels are within safe bounds, improper soil management (e.g., erosion or acidification) could mobilize Pb into water sources.

Mercury concentrations in the samples ranged from 2.50 to 15.90 mg/L, exceeding the WHO guideline limit of 1 mg/L for agricultural soils. Elevated Hg levels are a concern because mercury is highly toxic, affecting microbial activity, inhibiting seed germination, and impairing plant growth. More importantly, mercury contamination of soils poses a significant risk to drinking water quality, since WHO's limit for Hg in potable water is only 0.001 mg/L. The values recorded suggest a potential risk for bioaccumulation in crops and contamination of groundwater if leaching occurs. Chromium values ranged from 35.70 to 108 mg/L. WHO guidelines recommend a safe soil limit of 100 mg/L for Cr. Most samples fall within this threshold, though the upper range (108 mg/L) slightly exceeds it. Chromium toxicity in soils can reduce seed germination and crop yields, especially when in the toxic hexavalent form (Cr^{6+}). For drinking water, the WHO limit is 0.05 mg/L, so leaching of Cr from soils must be carefully managed, particularly in areas where values approach or exceed the guideline. Zinc concentrations varied from 7.20 to 90.30 mg/L, well below the WHO permissible limit of 300 mg/kg for agricultural soils. Zinc is an essential micronutrient for plants, contributing to enzyme activity and protein synthesis. At the observed levels, Zn is beneficial rather than toxic, supporting healthy crop growth. From a drinking water perspective, WHO sets a provisional limit of 3 mg/L, and the recorded soil values suggest minimal risk of leaching into groundwater.

Copper levels ranged between 110 and 205.40 mg/kg, exceeding the WHO safe limit of 100 mg/L for agricultural soils. Excess copper can cause phytotoxicity, inhibiting seedling growth and affecting soil microbial balance. In water, WHO's guideline value is 2 mg/L. Elevated soil concentrations raise concerns about long-term copper accumulation in crops and potential leaching into groundwater, especially under acidic soil conditions. Manganese concentrations ranged from 74.00 to 152.80 mg/kg. WHO safe limits for Mn in soils are not strictly defined, but agricultural recommendations typically place the safe threshold around 200 mg/kg. The observed values are within safe bounds and beneficial, since manganese is an essential plant nutrient, contributing to photosynthesis and enzyme function. For drinking water, WHO's limit is 0.4 mg/L, and the soil concentrations do not pose a major risk of contamination. Iron levels ranged from 76.40 to 263.20 mg/L.

5. Proposed Reclamation Strategies

5.1 Site Prioritization and Design

The reclamation plan for the abandoned mine sites in Kuba town and its environs is based on site prioritization according to accessibility, level of degradation, and potential for sustainable land use. Eleven (11) major mine ponds have been identified for rehabilitation and conversion into productive uses.

Kuba Pond 1 (K1) is located along a major access route, making it suitable for conversion into a demonstration fish pond or ornamental water feature. Its proximity to the road offers easy monitoring and potential for educational or community fish farming initiatives. Kuba Pond 2 (K2) (also close to the road) given its accessibility and moderate water depth, this pond can also be utilized for fish farming and irrigation purposes. The surrounding land can be used for cultivating vegetables and legumes, providing both food and income to the local community. Kuba Ponds 3 and 4 (K3 & K4) ponds are relatively larger and more stable. They can serve as reservoirs for irrigation, supporting dry-season farming in nearby farmlands. Small-scale aquaculture could also be integrated to maximize water resource use. The Sangwak (SG) site has fertile soil and a relatively flat terrain. It will be reclaimed and developed primarily for agriculture, especially for maize, Irish potatoes, and vegetable cultivation, which are common in the area. Dan Bukuru Pond (DB) site will also be reclaimed for agricultural use, particularly for rice and other water-loving crops due to its steady water retention capacity. The pond's surroundings can support tree planting to minimize erosion.

The Blue Dam (BD), with its scenic landscape and clear blue water, has strong potential as a tourist attraction. The site can be developed for eco-tourism, including picnic areas, small lodges, and bird-watching points, generating revenue for the community. Mayanga Pond (MY) will be rehabilitated and used as a community water source for domestic and livestock use, especially during dry seasons. Adequate treatment and fencing will ensure safety and water quality. Maiyangan Tsofo 1 and 2 Ponds (MT_1 & MT_2) located close to settlements will be reclaimed for drinking water supply after proper desiltation, water testing, and installation of purification systems. They can also serve as emergency water sources for firefighting and small-scale irrigation. Finally, Fofai pond (FF) will be reclaimed for agricultural use, primarily for irrigation. The surrounding land will be leveled and fertilized organically to improve soil fertility, enabling the cultivation of vegetables and legumes. This prioritization ensures each site is rehabilitated according to its natural conditions, location, and potential economic or social benefit.

5.2 Physical Rehabilitation Measures

Physical rehabilitation focuses on reshaping and stabilizing the mined landscape to restore its natural structure and make it safe for future use. The first step involves backfilling shallow pits with overburden materials and compacting them to prevent collapse. For deeper ponds, terracing and slope stabilization will be done to reduce erosion and improve accessibility.

Drainage channels will be constructed to redirect surface runoff and prevent waterlogging or siltation of reclaimed ponds. Erosion control structures, such as contour bunds, check dams, and retaining walls, will be established where needed.

Access roads leading to the ponds will be improved with gravel surfacing, and safety signs or barriers will be placed around deep water bodies to reduce the risk of accidents. In areas with exposed tailings or unstable ground, topsoil replacement and grading will be implemented to provide a suitable base for planting and construction activities.

5.3 Biological Rehabilitation Measures

Biological rehabilitation aims to restore vegetation cover, improve soil fertility, and re-establish ecological balance. Afforestation and re-vegetation will be carried out using native and fast-growing species such as Eucalyptus camaldulensis, Azadirachta indica (Neem), and Acacia senegal. These trees will help bind the soil, reduce erosion, and improve microclimatic conditions. Grasses such as Pennisetum purpureum (elephant grass) and Vetiveria zizanioides (vetiver grass) will be planted along slopes and pond embankments to stabilize the soil. Organic compost and farmyard manure will be used to enrich the soil and encourage plant growth.

Additionally, wetland vegetation like reeds and cattails (Typha species) will be introduced around ponds to enhance water quality through natural filtration and to provide habitat for birds and aquatic organisms. Over time, these biological interventions will encourage natural regeneration and create a balanced ecosystem.

iv. Sustainable Landuse Options

Sustainable land use in the reclaimed sites will combine agriculture, aquaculture, eco-tourism, and community resource development. Agricultural zones (Sangwak, Dan Bukuru, and Fofai ponds) will support crop production using organic farming methods and water-efficient irrigation systems. The aquaculture ponds (Kuba 1, 2, 3, and 4) will serve as community fish farms managed by cooperatives, providing income and nutrition. Eco-tourism development at the Blue Dam will promote recreation, environmental education, and small business opportunities such as food stalls and craft markets. Water resource ponds (Mayanga, Maiyangan Tsofo 1 and 2) will supply clean water for domestic and livestock use. These ponds will also serve as demonstration sites for sustainable water management. Community participation and monitoring will be integral to ensuring long-term sustainability. Training programs on soil conservation, water management, and environmental stewardship will help local residents maintain the reclaimed sites effectively.

6. Conclusion and Recommendations

The field investigation and assessment of the abandoned mine sites in Kuba town and its surrounding community's revealed extensive environmental degradation resulting from past mining activities. The area is characterized by numerous mine ponds, unstable slopes, loss of vegetation, and soil erosion, all of which have affected agricultural productivity and posed safety risks to nearby residents. Despite these challenges, the study has shown that the affected sites still hold great potential for productive and sustainable land uses if properly reclaimed and managed.

The proposed reclamation strategies emphasize an integrated approach that combines physical, biological, and socio-economic measures. Physically, reshaping the land, stabilizing slopes, and improving drainage can restore stability and prevent further erosion. Biologically, revegetation using suitable native species will enhance soil fertility, encourage biodiversity recovery, and improve the overall ecosystem balance. Socio-economically, converting selected ponds for agriculture, aquaculture, water supply, and tourism will generate livelihood opportunities and stimulate local development.

Reclamation in Kuba and its environs therefore represents not only an environmental necessity but also a pathway to sustainable rural transformation. By aligning reclamation efforts with community needs and land capability, the once degraded mine sites can be transformed into productive landscapes that support food security, clean water supply, recreation, and ecological restoration. The success of this process will depend largely on continued community participation, government support, and long-term monitoring.

The following are been recommended;

1. Reclaimed ponds such as those at Sangwak, Dan Bukuru, and Fofai should be managed for irrigated agriculture and fish farming using environmentally friendly practices to enhance food production and income.
2. Sites with natural beauty and water bodies such as the Blue Dam should be developed for eco-tourism. This will create jobs, promote environmental awareness, and diversify the local economy.
3. Continuous regular environmental monitoring should be carried out to assess water quality, vegetation growth, and soil stability. Maintenance activities such as replanting and desilting should be scheduled periodically.
4. Local communities should be fully involved in every stage of reclamation, from planning to implementation and maintenance. This will promote a sense of ownership and ensure sustainability of the projects.
5. A detailed reclamation and land-use management plan should be developed for all identified mine ponds, guided by proper mapping, soil testing, and environmental impact assessment.
6. The Plateau State Government, Ministry of Mines and Steel Development, and other relevant agencies should provide technical and financial assistance to facilitate reclamation and post-mining development.

References

Adekoya, J. A. (2003). Environmental effect of solid minerals mining in Nigeria. Journal of Physical Sciences, 4(2), 625–640.

Ijah, U. J., Aransiola, S. A., & Bala, J. D. (2014). Ecological restoration of degraded mine sites in Nigeria. Journal of Environmental Management, 132, 24–30.

Singh, A., & Tripathi, R. (2017). Mine land reclamation and eco-restoration: Global perspectives and challenges. Environmental Earth Sciences, 76(8), 356–369.