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SPECIAL ISSUE: CELEBRATING 20 YEARS OF GEOGRAPHY IN KADUNA STATE UNIVERSITY - ADVANCES AND FRONTIERS IN GEOGRAPHY

An Appraisal of The Effects of Sand Excavation on The Environment of Egume, Dekina Local Government Area, Kogi State, Nigeria

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ABSTRACT

Sand mining is a crucial activity supporting infrastructure development and economic growth; however, its environmental impact raises significant concerns. This research appraised the effects of sand excavation on the environment of Egume in Dekina LGA. The study employed multiple research methods, including surveys, expert interviews, and direct community engagement, to assess the extent of environmental degradation and public awareness. The purposive sampling method was used to select respondents and locations identified to be directly associated with sand excavation, and a simple random sampling was employed to select from each of the respondent groups, identified as elementary sampling units for data collection. A satellite image of the mining site was downloaded from Google Earth Desktop Application for the study in the determination of the areal extent of the sand mining sites (burrow pits), which showed the actual pits of the sand. A total of 400 respondents were sampled for the study; however, 389 were found useful for analysis. The study revealed that 52% go into mining as a result of employment opportunity, 91% because of the lucrativeness of the business, and 75.6% as a result of a change in social status. The findings also indicate that the effects of sand excavation on the people include demolition of houses, which is found to be 3.4 on the Likert scale and is accepted. Loss of Soil nutrients due to erosion of the top soil is 3.5 also accepted. The paper therefore suggests an urgent need for stricter regulatory frameworks, better mining practices, and increased public awareness to ensure sustainable resource utilization.

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1 Introduction

Sand mining, the process of extracting sand from various natural environments such as riverbeds, beaches, and inland dunes, has become a critical component of the construction industry worldwide. Sand is a vital raw material used in the production of concrete, asphalt, glass, and other building materials, making it an essential resource for urbanization and infrastructure development (Shah et al., 2025). Sand has been used in the construction of roads, dams, schools, health facilities, and houses for thousands of years, which can be attributed to the increasing population and economic developments. This has imposed an ever-increasing rise in the demand for sand throughout the world (Padmalal & Maya, 2014). Globally, there are around 68% - 85% of 47-59 billion tons of material that are mined every year were sand United Nations National Environment- Global Environmental Alert Bulletin (UNEP, 2014). As a result, the global demand for sand has surged in recent decades, driven by large-scale projects such as roads, bridges, and housing developments. This demand is particularly high in rapidly growing economies like India and China, where urbanization is occurring at an unprecedented pace (Shah et al., 2025; Ohaeri et al., 2021).

There is a great concern about the way the environment is disturbed by the excessive removal of soil for the construction industry, especially in urban development in Africa. Mabey et al. (2025) noted that for thousands of years, sand and gravel have been used to construct strong houses, roads, and dams in Africa since they are cheap and readily accessible resources. Sand mining and gravel extraction are common in most African states because they are done both legally and illegally. Today, demand has increased as socio economic life of Africans has improved generally. Many scholars have worked on sand mining and gravel extraction in different parts of the world. Mabey et al. (2025) added that coastal sand mining poses significant environmental and social problems. It damages ecosystems, increases coastal erosion and vulnerability to storms, threatens biodiversity, and can lead to social issues like corruption and violence.

Rentier and Cammeraat (2022) revealed that the primary effects of sand mining are riverbed widening and lowering, and in the biological environment, the overarching effect is a reduced biodiversity and stretches from the aquatic and shoreline flora and fauna to the whole floodplain area. Reduced water, air, and soil quality through pollution for the chemical environment, and effects on the anthropogenic environment include damaged infrastructure, bad working circumstances for

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workers, limited access to water, and agricultural losses. The findings of this research emphasize the complexity and cascading nature of the effects of river sand excavation, as well as the severity and urgency of the problem.

Rukmana et al. (2020) cited that in South Africa, illegal sand and gravel excavation was increasingly worrying and damaging the environment. Excavation activities can damage public property and private assets and aquatic habitats, threaten the stability of slopes and river bank deformation, and have negative consequences for the area and its surroundings. Etah et al. (2025) discussed soil mining as a threat to the environment in Kenya, though with both positive and negative impacts. The sand mining and gravel extraction are done legally and illegally on rivers, beaches, and plain fields.

Sand excavation has led to the development of infrastructure, created employment opportunities, the growth of towns, and has contributed to the establishment of various industries. It has also led to environmental damage, and this has drawn the attention of researchers and scholars like Etah et al. (2025), Jiya et al. (2025), Mabey et al. (2025), and Oluku and Asikhia (2021), among others. The activities of mining in the Egume community have received little or no attention. It is on this premise that this study is hinged to appraise the effects of sand mining activities on the environment of the rural community of Egume. The study intends to identify the reasons for mining activity in the study area, examine the effects of sand excavation on the rural community of the study area, the people, and sand miners themselves, and identify the mitigation strategies to reduce the effects of sand mining on the environment in the study area.

1.1 Literature Review

In Nigeria, Jiya et al. (2020) conducted a study using the Global Positioning System (GPS) to obtain coordinates of sand excavated areas. A Google Earth map was imported into Arc GIS and georeferenced, then XY data was added and plotted on the map. From the analysis, it was revealed that excavation points are threats to the village, which will lead to disaster in the near future if excavation activities continue due to the expansion of pits that accumulate water, especially during the raining seasoning, making the area susceptible to flooding and mass movement that will be destructive to lives and properties. From the results, Bare Surface 48%, Excavated Land 27%, River 15%, Farm Land 7%, and Settlements 3%. It is then concluded that sand excavation is highly susceptible to land being flooded with mass movement in potential areas. Sand excavation activities offer employment opportunities, and therefore means of livelihood to some working population of the community, but with a great adverse effect on the environment. Saka (2025) also examined sand mining and environmental degradation and discovered that the process is highly advantageous and also a disadvantage to the community.

Oluku and Asikhia (2021) assessed the geospatial impacts of sand mining activities in Benin City. The study discovered that the spatial extent of environmental degradation is massive, which will, to a large extent, make the land and the area unproductive for other land uses. The sand mining site is close to a residential area, which will have a lot of environmental impact on the inhabitants of the area. Also, the roads in the area are not spared from destruction; some of the burrow pits are close to residential areas, which have an environmental impact on the people and the environment, like the destruction of roads, noise, and air pollution, among others. The study concluded that sand mining and development cannot be entirely separated, but mining should be done sustainably with less environmental degradation.

Obodoh et al. (2023) carried out a study to assess the environmental impact of sand harvesting in Awka North LGA, Anambra State, Nigeria. The study adopted a survey design, and the data collected were analysed using frequency tables, percentages, and weighted means. The results showed that sand harvesting has positive and negative impacts on the host communities.

Etah et al. (2025) in a research on the impact of sand and gravel dredging on the environment. This work highlighted the ecological, hydrological, and socioeconomic impacts of sand and gravel dredging and calls for sustainable practices and stronger regulatory frameworks to mitigate these adverse effects. The research discovered that sand and gravel dredging, driven by the global demand for construction materials, has significant environmental impacts on aquatic and terrestrial ecosystems. The research further highlighted that the extraction process disrupts habitats, particularly benthic ecosystems, leading to biodiversity loss and the degradation of ecosystem services. It was discovered that dredging suspends fine sediments, reducing water quality and impairing photosynthesis in aquatic plants, which further destabilizes food chains. Coastal and riverside areas face increased erosion as sediment transport is altered, threatening flood defences and exacerbating the effects of climate change. Socioeconomic consequences also arise, as communities reliant on fisheries and tourism suffer from environmental degradation.

2 Materials and Methods

2.1 Study Area

Egume is a rural community in Dekina Local Government Area of Kogi State, Nigeria, located in the south-eastern direction of Lokoja, about 100km from the Kogi State Capital in North Central Nigeria. Geographically defined by latitude 7° 28′ and 7° 32′ north of the equator and longitude $7^{o}\,9'$ and $7^{o}\,12'$ East of the Greenwich meridian (Tokula & Adekiya, 2018). The study area is shown in Figures 1 and 2.

Egume is underlain by sedimentary rocks of upper Cretaceous Age, which are mainly composed of shale, sandstone, sand, and clay. The entire region consists of deeply weathered regolith, which accounts for the significant depth of the water table (aquifer), typically ranging from 204 to 300m (Ogunkolu et al., 2019). Egume is located within the tropical area, and the climate is governed by the processes that control the tropical climate. The wet season spreads over a minimum of seven months, and it extends from late April to October, with the dry season spanning from November to March, i.e., approximately five months. Rainfall is highly seasonal, and the area enjoys double maxima rainfall in July and September. Heavy rains of conventional type fall here, and these sometimes amount to about 978.5mm, but may be more (Awosusi & Oriye, 2015).

The soil is made up of loamy soil conducive for vegetation; there are variations in the appearance of plant growth found in Egume and its environment, basically as a result of different soil types (Ifatimehin et al., 2009). The vegetation of the study area is predominantly Guinea Savannah type, which is characterized by discontinuous canopy, shrubs, and tall grasses, giving the area a park appearance. The relief is also composed of rounded to flat top hills that were seen as ferruginised sandstone (Awosusi & Oriye, 2015).

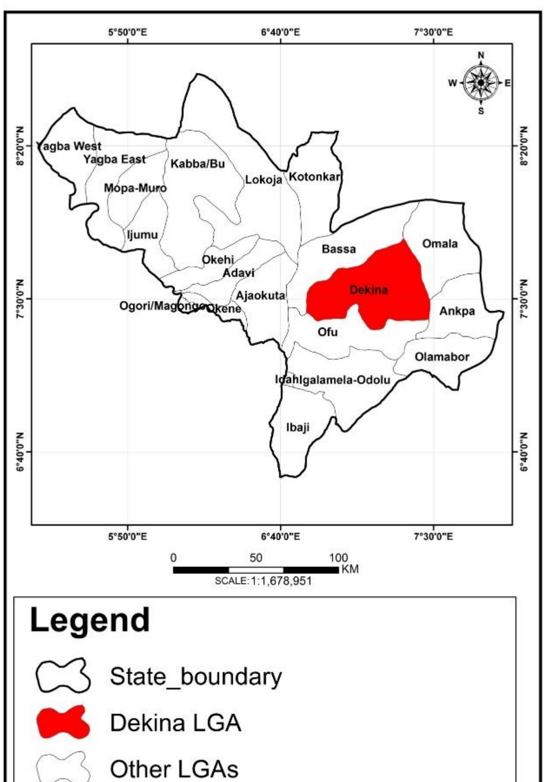

Figure 1: Kogi State showing the Dekina Local Government Area
Source: Kogi State Geographic Information System, 2025

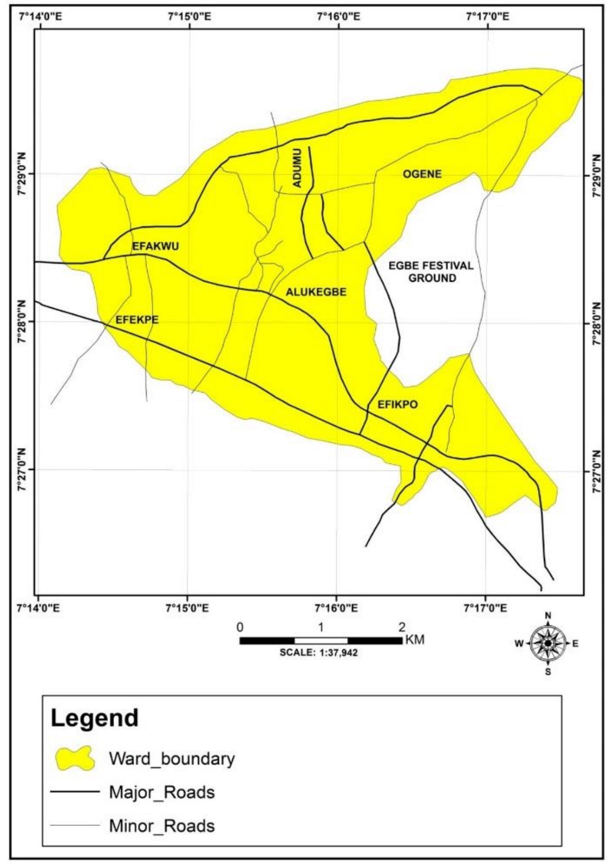

Figure 2: Egume Community in Dekina LGA
Source: Kogi State Geographic Information System, 2025

Trading is a major viable socio-economic activity of the people; they also engage in peasant farming and other agricultural activities. There are other socio-economic activities such as weaving, barbing, petty trading, banking, and others contributing to the development of the area. Cashew farming is also another major socio-economic activity in the area.

2.2 Data collection

A reconnaissance survey was undertaken by the researcher to be well acquainted with the study area to gain first-hand information on the physical features, such as the soil, vegetation type, and general activities of the area. This study employed a purposive sampling method to select those respondents and locations identified to be directly associated with sand excavation and most suited to meet the criteria for this study, and hence contacted as primary data sources for the needed information. The respondents included sand miners, sand miners' household heads, and other key stakeholder groups. A simple random sampling was employed to select from each of the respondent groups, identified as elementary sampling units for data collection. The study used the standard statistical sample size formula developed by de Vaus (2002) in agreement with Saunders et al. (2009), which is mostly used in social research surveys, to determine the representative minimum sample size. The formula is used with relevant information from various reliable sources at the 95% confidence level (CL) and 5% margin of error. The statistical formula is as shown below:

$$n_0 = \frac{Z^2 p(1-p)}{e^2}$$

Where n = Minimum sample size required,
p = Proportion belonging to the specified category
q = Proportion not belonging to the specified category (1- p)
Z = The Z-value corresponding to the level of confidence required (1.96 at 95% CL)
e = Margin of error required

Using the above information, the population for this study is the residents of Egume (a rural community) with a population of 28,151. The Statistical Package for the Social Sciences (SPSS) and the Excel Software Package were used to analyse and assess the significance of residents' perception of the impacts of sand mining in the study area, and also used to assess the significance of the impacts of sand mining on the people. A satellite image of the mining site was downloaded from Google Earth Desktop Application for the study in the determination of the areal extent of the sand mining sites (burrow pits). 400 questionnaires were distributed, of which 389 were returned. Formal interviews with operators of sand mining activity and stakeholders, as well as the administration of a questionnaire was employed. The main instrument used for data collection was a structured questionnaire, which was systematically administered. Information collected includes: socio-economic characteristics such as age, gender, educational qualification, and occupation.

2.3 Data Analysis

The quantitative data obtained were analysed using descriptive statistics, including means and percentages, and presented in the form of a table. A simple percentage mean score was used to summarize the data on personal information, and it was presented in tables. 4-point Likert Scale, which includes the following variables. SA= Strongly Agree; A= Agree; D= Disagree; SD= Strongly Disagree with a benchmark of 2.5 was employed. Any variable above 2.5 is accepted. These were further merged into Disagree and Agree with their corresponding values, which were used to summarize the reasons for mining in the Egume community.

3 Results

Figure 3 shows the satellite imagery of the mining site that was downloaded from Google Earth Desktop Application for the study in the determination of the areal extent of the sand mining sites (Burrow Pit) in Egume, the study area. This is in line with Oluku and Asikhia (2021), where the satellite imagery of the mining sites in Benin City, Edo State, was downloaded from Google Earth Desktop Application and used for the study to show the particular location of the mining sites.

Figure 3: Google Earth showing Egume Showing the Sand Mining Site

The socio-economic attributes of Respondents in the study area include gender, age, marital status, educational qualification, and occupation. 389 questionnaires were returned out of the 400 that were distributed and used for this research. The research, as shown in Table 1, indicates that 58.9% of the respondents were males and 41.1% were females. This shows that the number of men sampled for this study was more than the women, which is expected as more male tends to do sand mining jobs from one place to another to sustain their families as breadwinners, which is a confirmation of Oluku and Asikhia (2021), where it was ascertained that males are more in sand mining than their female counterparts.

It also shows age distribution, of which 29.8% respondents were within the age bracket of 11-20, 43.2% respondents were within the age bracket of 21-30years, 4.4% respondents were 31-40, 8.7% respondents were within the age bracket of 41-50years while 13.9% respondent were 51 years and above. The table also indicated that 41.1% of the respondents are married, while 58.9% were single. It was revealed that the majority of the respondents were single, 2.6% respondents had primary education, and 59.1% had secondary education, while 38.3% had tertiary education. The implication of the findings from the demographic characteristics of respondents is that sand excavation has its effects on everyone, irrespective of their gender, age, educational background, marital status, and occupation. The research also discovered that 13.9% are miners, 13.1% are civil servants, 41.1% are traders, and farmers were 23.2% and 8.7% engaged in other vocations. This signifies the fact that mining activities probably affect diverse kinds of people. This corroborates the works of Etah et al. (2025), Oluku and Asikhia (2021), and Saka (2025), where it was ascertained that sand mining affects diverse kinds of people.

Table 1: Demographic Characteristics of Respondents

Gender	No. of Respondents	Percentage (%)
Male	229	58.9
Female	160	41.1
Total	389	100.0
Age Bracket	No. of Respondents	Percentage (%)
11-20	116	29.8
21-30	168	43.2
31-40	17	4.4
41-50	34	8.7
51-above	54	13.9
Total	389	100.0
Marital status	No. of Respondents	Percentage (%)
Married	160	41.1
Single	229	58.9
Total	389	100.0
Educational Qualifications	No. of Respondents	Percentage (%)
Primary	10	2.6
Secondary	230	59.1
Tertiary	149	38.3
Total	389	100.0
Occupation	No. of Respondents	Percentage (%)
Miner	54	13.9
Civil Servant	51	13.1
Trader	160	41.1
Farmer	90	23.2
Others	34	8.7
Total	389	100.0

The reason why residents engage in sand mining is presented in Table 2.

Table 2: Mean Rating of Reasons for mining in Egume community using 2-Point Likert Scale

	Variables	Disagree (D)	Agree (A)	Mean(X)	Remark
1	Employment opportunity	188 (48.3%)	201 (52%)	1.51	Accepted
2	Unavailability of a Job	104 (26.7%)	285 (73.3%)	1.73	Accepted
3	The demand for sand	72 (18.5%)	317 (81.4%)	1.81	Accepted
4	Lucrative business	35 (8.9%)	354 (91.1%)	1.91	Accepted
5	Changes social class	95 (24.4%)	294 (75.6%)	1.75	Accepted
6	Solves basic needs	88 (22%)	301 (78%)	1.77	Accepted
7	Availability of a large heap of sand	111 (28.5%)	278 (71.5%)	1.71	
	Weighted Mean			12.19	

Remarks<1.50 Rejected, and 1.50 and above, Accepted

The different reasons why miners engaged in sand mining in the rural community of Egume, the study area, were analysed using the mean (X) rating to reveal each category of reason. The study discovered that all the variables that people engaged in mining were all positive and accepted because the values confirm the value of the Likert scale of above 1.5, which is the accepted mean value (Table 2). This agrees with the finding of Etah et al. (2025), which shows that sand mining and Gravel Dredging can have a positive impact in the form of job creation and employment, foster business opportunities for the surrounding community, and provide income for the region as a source of Regional Original Revenue. It also corroborates the works of Obodoh et al. (2023) in the assessment of the environmental impact of sand harvesting in Awka North LGA, Anambra State, where it was discovered that sand harvesting has both positive and negative effects on the host communities.

Table 3: Effects of sand excavation on the people living in the study area and sand miners

Item	SA 4	A 3	D 2	SD 1	Mean	Decision
Creation of an unsustainable source of livelihood for the residents	150 (38.0%)	198 (50.9%)	26 (6.7%)	15 (3.9%)	3.2	Accepted
Demolition of houses occasioned by gully erosion from the mining sites	210 (54.0%)	151 (38.8%)	24 (6.2%)	4 (1.0%)	3.4	Accepted
Has positive effects like employment, an increase in family income, and development	232 (59.6%)	149 (38.3%)	4 (1.0%)	4 (1.0%)	3.5	Accepted
Loss of soil nutrients due to erosion of top soils	252 (64.8%)	125 (32.1%)	4 (1.0%)	8 (2.1%)	3.5	Accepted
Bad road network due to the use of tippers and other big vehicles to convey sand from the mining sites	201 (51.7%)	174 (44.7%)	10 (2.6%)	4 (1.0%)	3.5	Accepted

Keys: SA= Strongly Agree; A= Agree; D= Disagree; SD= Strongly Disagree

Table 3, based on the calculated mean, revealed that the effects of sand excavation on the people living in the study area and sand miners include: Creation of unsustainable source of livelihood for the residents, Demolition of houses occasioned by gully erosion from the mining sites, Loss of soil nutrients due to erosion of top soils, and Bad road network due to the use of tippers and other big vehicles to convey sand from the mining sites. The result also shows that there are positive effects, as shown in the table. This was indicated by the majority of the respondents as their mean response was above the acceptance benchmark of a 4-point Likert scale of 2.5; hence, the acceptance benchmark was gotten by adding (SA)4+ (A)3+ (D)2+ (SD)1 = 10/4 = 2.5. Therefore, they were accepted. The implication of this finding is that sand excavation has mostly negative effects on the people living in the study area and the sand miners themselves. This is in line with the findings of Ohaeri et al. (2021) in the study of the impacts of sand mining in some coastal communities in Port Harcourt Metropolis. The research emphasized the negative effects of sand mining on the people of the region. The research also discovered positive effects that cannot be overruled this is in line with the works of Obodoh et al. (2023).

Table 4: Mitigation strategies to reduce the effects of sand mining in the study area

Item	SA 4	A 3	SD 2	D 1	Mean	Decision
Constituting regulatory bodies to monitor and predict potential threats	260 (66.8%)	42 (10.8%)	43 (11.1%)	44 (11.3%)	3.3	Accepted
Placing high levies on each truck to discourage sand mining activities	225 (57.8%)	150 (38.6%)	8 (2.1%)	6 (1.5%)	3.5	Accepted
Limiting the number of tippers/trucks mining sand per day	207 (53.2%)	148 (38.0%)	26 (6.7%)	8 (2.1%)	3.4	Accepted
Creation of local awareness on the effect of sand mining by the community heads	256 (65.8%)	125 (32.1%)	4 (1.0%)	4 (1.0%)	3.6	Accepted
Total prohibition of sand mining activities in Egume	208 (53.5%)	119 (30.6%)	44 (11.3%	18 (4.6%)	3.3	Accepted

Keys: SA= Strongly Agree; A= Agree; D= Disagree; SD= Strongly Disagree

The study revealed in Table 4 the mitigation strategies to reduce the effect of sand mining in the study area. The findings shows that, Constituting regulatory bodies to monitor and predict potential threats, Placing high levies on each truck to discourage sand mining activities, Limiting the number of tippers/trucks mining sand per day, creation of local awareness on the effect of sand mining by the community heads, and Total prohibition of sand mining activities in Egume are Mitigation strategies to reduce the effects of sand mining in the study area. This was indicated by the majority of the respondents as their mean response was above the acceptance benchmark of a 4-point Likert scale of 2.5; therefore, it was accepted. This finding implies that people have different opinions on the best way to carry out mitigation strategies to reduce the effects of sand mining in the study area. It indicated that the majority of the respondents 97.9% agreed that the creation of local awareness on the effect of sand mining by the community heads will reduce the effect of sand mining in the study area. This is followed by 96.4% Placing high levies on each truck to discourage sand mining activities, 91.2% Limiting the number of tippers/trucks mining sand per day, 84.1% Total prohibition of sand mining activities in Egume, and 77.6% Constituting regulatory bodies to monitor and predict potential threats could reduce the effect of sand mining in the study area. This is because indigenous problems need indigenous solutions. Hence, residents of the area needed to be carried along in every policy and decision regarding the study area. This is in line with the work of Rukmana et al. (2020) and Rentier and Cammeraat (2022).

4 Conclusion

This paper examined the effects of sand excavation on the environment of the Egume community in Dekina LGA of Kogi State, Nigeria. And based on the findings of this study, it can be concluded that it is imperative to know that housing and road construction activities will always be part of human, however, environmental sustainability should be prioritized. To this end, environmental degradation can be checked and reduced to an insignificant level to create a healthy and habitable environment. The challenges of sand mining and development can be controlled and reduced when government agencies responsible for regulating the activities of sand mining sit up to do their jobs. It is against this background that the following is recommended: that alternative materials and construction methods that reduce the demand for natural sand can help alleviate the environmental impacts of sand mining. Governments and regulatory bodies should develop and enforce strict regulations on sand mining activities. These regulations should address issues such as permissible extraction rates, mining locations, and environmental protection measures to ensure sustainable mining practices. The locals can also adopt responsible Mining practices, which will encourage sand miners to use best practices that minimize environmental impacts. These practices may include using advanced equipment that reduces sediment disturbance and employing reclamation strategies to restore mined areas. Alternatives to traditional sand mining can also be employed, such as using recycled sand, manufactured sand, or other construction materials that have lower environmental impacts.

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