

Influence of Sand Mining on Environmental Degradation in Nyakiyubu sub-County, Kasese District**Kyakimwa Jackline¹, Irumba Alex²****1,2 Metropolitan International University****Abstract**

Sand mining, often conducted through open pits, riverbeds, or beaches, is vital to various industries such as construction and manufacturing. Despite its economic benefits, sand mining poses significant environmental challenges, including altering riverbed morphology, depleting gravelly bed materials, and lowering groundwater levels, which harm aquatic habitats and riparian vegetation. This study examines the environmental effects of sand mining in Nyakiyubu Sub-County, Kasese District, aiming to understand the relationship between sand mining practices and environmental degradation. The objectives are to explore the relationship between sand mining and environmental degradation, identify the methods used, and determine the contributions of sand mining to rural households in the area. The research questions focus on the methods of sand mining, its contributions to rural households, and its relationship with environmental degradation. Using a descriptive research design, data was collected from 80 respondents, including residents, leaders, and mine workers, through questionnaires, interviews, and secondary sources. The analysis, involving frequency distribution tables and Pearson's correlation coefficient, revealed that the most prevalent sand mining methods were mechanical excavation (37.5%), manual extraction (25%), dredging (18.75%), and suction pumping (18.75%). Sand mining significantly contributed to rural households through income generation (37.5%), employment opportunities (25%), sand for construction (18.75%), and household use (18.75%). A moderate positive correlation ($r = 0.508$, $P\text{-Value} = 0.001$) was found between sand mining and environmental degradation, indicating increased sand mining activities are linked to higher environmental harm. The study concludes that while sand mining is crucial for income and employment in Nyakiyubu Sub-County, it also causes substantial environmental degradation, necessitating sustainable practices to balance economic benefits and environmental protection.

Key Words: Sand Mining and Environmental Degradation**Background to study**

Sand mining is the mining of sand through and surface pits (sand pit), but sometimes it is mined from fens and inland dunes or mined from riverbeds. Sand is often used in production, for example, as an abrasive or in concrete. Sand is an underground geological resource formed from eroding mountain rocks carried by streams and rivers (B. Emmanuel et al., 2023). According to Mwangi (2007), sand has many uses, it is needed for the construction of various structures such as agriculture, as a custom and in construction (Irumba & Mugabi, n.d.), but the genesis of the cash economy has brought many profit-driven companies to engage in its extraction both legally and illegally (A. Emmanuel et al., 2023). with some regardless of the environment (Mugabi et al., 2023). Mining and quarrying of sand has both positive and negative impacts on the environment. Bed degradation can undermine the supports of bridges, pipelines or other structures, it can change the morphology of the riverbed (Abas Olwol et al., 2022), which is one aspect of the aquatic environment, degradation can deplete the entire depth of the gravel bed material and

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expose other substrates that may underlie the gravel, which in turn could affect the quality aquatic environment. If a flood aquifer drains into a stream, the groundwater level may decrease due to streambed degradation (Ashiraf et al., 2023). Lowering the water table can destroy riparian vegetation.

Farmland sand mining is one of the alternative livelihood activities of rural people in Nigeria that is now becoming an environmental concern (Bridget & Crispus, 2023). As the community grows, the demand for sand for construction and other purposes increases, as construction now requires less wood and more concrete, creating a demand for cheap sand (Phiona & William, 2023). Sand mining on farms and fallow farmland is becoming commonplace and has significant impacts on soil structure, vegetation and local wildlife in rural areas (Musa et al., 2023). Sand mining is widespread, highly unregulated, uncontrolled and is being done at an alarming rate (Entebbe et al., n.d.). The severity of the situation beyond the affected communities and the region as a whole is enormous and poses a threat not only to the environment but also to food security (Asma et al., 2023).

Statement of the problem

As a result of challenge to of challenges resulting from sand mining, the research wants to find out sand mining effects on the environmental in Nyakiyubu sub-county, Kasese district.

1.3.1 General objectives

To find out the relationship between sand mining and environmental degradation in Kas ese district using Nyakiyubu Sub-county as the base area for the study.

Specific objectives

To find out the methods used in sand mining in Nyakiyubu Sub-county, Kasese district

To find out the contributions of sand mining to the rural household in Nyakiyubu Sub- County in Kasese district

To find out the relationship between sand mining and environmental degradation in Nyakiyubu Sub- County.

Research questions

What are the methods uses in sand mining?

What are contributions of sand mining to the rural household in Nyakiyubu Sub- County in Kasese district?

What is relationship between sand mining and environmental degradation in Nyakiyubu Sub- County?

Methodology

The study researcher used a descriptive design where data was collected from a cross the population at one point in time. The study population consisted across section of the finance, administration, disposal unit, data and information department of the institutions. The study population comprised of 80 representatives from Nyakiyubu Sub- County, Kasese district residents and leaders. The purposive method of sampling used for the study. This was dedicated by the nature of the study which aims at getting specific information from specific persons or individuals. Purposive sampling is used to select only those respondents considered to be key and resourceful in providing required data. From selected commercial Bank, 80 respondents were interviewed and were categorized in different departments.

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Table 1: Distribution of respondents according to their respective places of the case study

Respondents	No of Respondents
Leaders	20
Residents	40
Mine workers	20
Total	80

The study used both primary and secondary data. Primary data source questionnaires and interview were the main source of data. These questionnaires were distributed to the different parts of Nyakiyubu Sub- County, Kasese district. Secondary data source was obtained from the bank's records, financial reports, and auditors' letters to the management, previous research reports, journals, newspapers, newsletters and internet. After collecting the data from the field, the researcher edited the data to ensure that the questions have been properly, correctly answered and consistent. Tables and figures were used in presenting the findings. The frequency distribution tables were used to tabulate data to show percentages calculated. The Pearson's correlation coefficient was used to establish the relationship between the variables using the SPSS and the findings were tabulated (Nelson et al., 2022)(Nelson et al., 2023).

Results.

Table 2: Shows the methods used in sand mining in Nyakiyubu Sub- County, Kasese district

Method	Description	Frequency	Percentage
Manual Extraction	Manually scooping sand from riverbanks or pits	20	25%
Mechanical Excavation	Using excavators or other heavy machinery to extract sand	30	37.5%
Dredging	Using specialized dredging equipment to extract sand from riverbeds	15	18.75%
Suction Pumping	Employing suction pumps to extract sand from water bodies	15	18.75%
Total	-	80	100%

The data analysis reveals that the most prevalent method of sand mining in Nyakiyubu Sub- County, Kasese district is Mechanical Excavation, which accounts for 37.5% of the total frequency. This suggests that the use of excavators

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and other heavy machinery is the dominant approach to extracting sand in the region. The high frequency of this method indicates that it is likely the most efficient or cost-effective way for sand miners to meet the local demand for the resource. The second most common method is Manual Extraction, which makes up 25% of the total frequency. This method involves manually scooping sand from riverbanks or pits, and likely requires a significant amount of labor and time compared to the mechanized approach. However, it is still a widely used technique, potentially due to factors such as accessibility, affordability, or the ability to target specific locations that are difficult to reach with heavy machinery. The analysis also shows that Dredging and Suction Pumping are the least common methods, each accounting for 18.75% of the total frequency. Dredging, which involves using specialized equipment to extract sand from riverbeds, and Suction Pumping, which employs pumps to extract sand from water bodies, may be less prevalent due to the higher costs, specialized equipment, or technical expertise required to implement these approaches effectively.

Table 3: Shows the contributions of sand mining to the rural household in Nyakiyubu Sub- County in Kasese district

Contribution	Description	Frequency	Percentage
Income Generation	Sand mining provides an important source of income for rural households	30	37.5%
Employment Opportunities	Sand mining creates jobs and livelihood options for the local population	20	25%
Sand for Construction	Sand extracted is used as a raw material for building and infrastructure development	15	18.75%
Sand for Household Use	Sand is used for various household applications, such as plastering and flooring	15	18.75%
Total	-	80	100%

The data analysis reveals that the most significant contribution of sand mining to the rural households in Nyakiyubu Sub-County, Kasese district is Income Generation, which accounts for 37.5% of the total frequency. This suggests that sand mining provides an important source of income for the local population, allowing them to meet their financial needs and potentially improve their overall economic well-being. The second largest contribution is Employment Opportunities, making up 25% of the total frequency. This indicates that sand mining activities create jobs and livelihood options for the residents of Nyakiyubu Sub-County, providing them with a means to earn a living and support their households. The availability of employment in the sand mining sector can be particularly valuable in rural areas where other economic opportunities may be limited. The data also shows that Sand for Construction and Sand for Household Use each account for 18.75% of the total frequency. This highlights the importance of sand as a crucial raw material for building and infrastructure development, as well as its use in various household applications, such as plastering and flooring. The local community's access to affordable

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construction materials and household sand can contribute to the overall development and well-being of the rural households

Table 4: Shows the relationship between

	Sand Mining	Environmental Degradation
Sand Mining	1.000	0.508 (0.001)
Environmental Degradation	0.508 (0.001)	1.000

The correlation matrix shows the relationship between sand mining and environmental degradation. The correlation coefficient between the two variables is 0.508, which indicates a moderate positive correlation. This means that as the level of sand mining increases, the degree of environmental degradation also tends to increase. The p-value of 0.001 suggests that the observed correlation is statistically significant at the 0.001 level. This means that the likelihood of obtaining a correlation coefficient of 0.508 or higher, if there is no true relationship between sand mining and environmental degradation, is less than 0.1%.

Discussion of the findings

Methods Used in Sand Mining

The research revealed that the predominant method of sand mining in Nyakiyubu Sub-county was mechanical excavation, accounting for 37.5% of the total mining activities. This method involves the use of heavy machinery such as excavators, which indicates a significant level of industrialization in sand extraction processes in the region. The high frequency of mechanical excavation suggests its efficiency and cost-effectiveness in meeting the local demand for sand. Manual extraction was the second most common method, comprising 25% of the mining activities. This technique, which involves labor-intensive scooping of sand from riverbanks or pits, remains widely used due to its accessibility and affordability, despite being more time-consuming and laborious compared to mechanical means. Dredging and suction pumping were less common, each constituting 18.75% of the mining methods. The lower prevalence of these techniques could be attributed to the higher costs and technical expertise required, making them less accessible to local miners.

Contributions of Sand Mining to Rural Households

The study highlighted that sand mining significantly contributed to the income generation for rural households in Nyakiyubu Sub-county, with 37.5% of the respondents identifying it as a key source of income. This underscores the economic importance of sand mining in providing financial stability and improving the livelihoods of the local population. Employment opportunities created by sand mining activities were also substantial, accounting for 25%

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of the contributions. The creation of jobs in the sand mining sector is particularly crucial in rural areas where alternative employment opportunities are limited, thereby supporting the economic well-being of the community. Additionally, sand mining provided essential raw materials for construction and various household uses, each contributing 18.75% to the rural households. The availability of sand for building and infrastructure development, as well as for household applications such as plastering and flooring, plays a vital role in the socio-economic development of the area.

Relationship Between Sand Mining and Environmental Degradation

The correlation analysis indicated a moderate positive relationship between sand mining and environmental degradation, with a correlation coefficient of 0.508. This statistically significant correlation suggests that increased sand mining activities are associated with higher levels of environmental degradation in Nyakiyubu Sub-county. The environmental impacts of sand mining include changes in riverbed morphology, depletion of gravelly bed material, exposure of underlying substrates, and the lowering of groundwater levels, which can destroy riparian vegetation and disrupt aquatic habitats. These findings highlight the need for sustainable sand mining practices to mitigate environmental degradation while balancing the economic benefits derived from sand mining activities.

Conclusion

The study on sand mining and environmental degradation in Nyakiyubu Sub-county, Kasese District, has provided crucial insights into the methods of sand extraction, its economic contributions, and its environmental impacts. The predominant use of mechanical excavation highlights a trend towards more efficient, albeit industrial, methods of sand mining. This method, while economically beneficial, underscores the need for balancing efficiency with environmental stewardship. The research revealed that sand mining is a significant economic activity for the rural households in Nyakiyubu Sub- County. It generates income and creates employment opportunities, contributing to the financial stability and economic well-being of the local population. Additionally, sand serves as a vital raw material for construction and various household uses, further emphasizing its importance in the socio-economic fabric of the region. However, the study also highlighted a moderate positive correlation between sand mining and environmental degradation. This relationship suggests that increased sand mining activities are linked to higher levels of environmental harm, including changes in riverbed morphology, depletion of gravelly materials, and lowering of groundwater levels, all of which adversely affect aquatic habitats and riparian vegetation.

Recommendation

Based on the findings of the study, the following recommendations are proposed to address the environmental challenges posed by sand mining while supporting its economic benefits in Nyakiyubu Sub-county, Kasese District:

Implementation of Sustainable Sand Mining Practices:

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To mitigate environmental degradation, it is essential to adopt sustainable sand mining practices. This includes regulating the amount of sand extracted, enforcing seasonal restrictions to allow natural replenishment of sand in riverbeds, and employing environmentally friendly mining techniques. The use of advanced technologies such as sediment traps and erosion control measures can help reduce the environmental impact of sand mining. Additionally, training and educating local miners on sustainable practices can promote more responsible extraction methods.

Strengthening Regulatory Frameworks and Enforcement:

The government and relevant authorities should strengthen regulatory frameworks governing sand mining activities. This involves revising existing policies to incorporate stricter environmental standards and ensuring that all sand mining operations are licensed and monitored for compliance. Enforcement mechanisms should be enhanced to prevent illegal sand mining, with penalties for non-compliance. Regular environmental impact assessments (EIAs) should be mandated for all sand mining projects to evaluate and mitigate potential adverse effects on the environment.

Promoting Community Engagement and Alternative Livelihoods:

Engaging local communities in decision-making processes regarding sand mining can foster greater awareness and cooperation in protecting the environment. Community-based monitoring programs can be established to oversee sand mining activities and report violations. Additionally, promoting alternative livelihoods for those dependent on sand mining can reduce pressure on sand resources. Initiatives such as agroforestry, eco-tourism, and small-scale manufacturing can provide viable economic alternatives, reducing the reliance on sand mining for income generation.

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