

SAND HARVESTING AND ITS SOCIAL, ECONOMIC AND ENVIRONMENTAL EFFECTS ON HOUSEHOLD'S LIVELIHOODS IN HOMABAY COUNTY, KENYA

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ABSTRACT

Sand harvesting is an economic activity that has socio-environmental effects on people's lives. The magnitude of the effects varies from place to place based on the prevailing circumstances in such places. This study, therefore, sought to find out the socio-environmental effects of sand harvesting on residents of Kobala Sub-location in Homabay County. Subsequently, the key objective of this study was to explore sand harvesting and its social-environmental effects on household's livelihoods in Kobala sub-location in Homabay County. The study adopted a descriptive survey design and used questionnaires and key informant interviews as the instruments of data collection. Using Yamane formula, the study sampled 370 respondents from the residents of the Kobala sub-location. Purposively, 15 key informants were selected; ten residents of Kobala engaging in sand harvesting activities and

five NEMA officials of Homabay County. Data from questionnaires were analyzed using descriptive statistics while qualitative content analysis was used to analyze data from key informant interviews. The findings of the study revealed that sand harvesting in Kobala sub-location has had negative social effects on the residents by increasing the rate of education wastage among teens, an increase in domestic violence, an increase in accidents and deaths in the area. Further, the findings have established that the cost of treatment for the residents has risen due to increased mosquitos breeding in open valleys as well as in the management of waterborne diseases. The study has further established that water sources are negatively impacted with increased soil erosion and depletion of vegetation which worsen food insecurity in the area.

INTRODUCTION

Sand harvesting has been on the rise due to the increasing demand for sand in the building industry for concrete and glass making purposes (Leow, 2020). Besides the pressure to mine sand due to its need in the building industry, the changes occasioned by climate change has also isolated sand in some areas as the main source of livelihood for individuals who had relied on other sources of livelihoods whose bases have been eroded by changes brought about by climate change. Sand harvesting is therefore having both social and economic benefits ranging from job creation to a great source of raw material for the construction industry (Beiser, 2019). This makes sand harvesting an important activity that define different aspects of life and involve many actors who involve in sand mining for different purposes.

As the sand harvesting continue to intensify, the impact of such an activity continue to draw attention from both scholars and practitioners. For instance, Micomyiza (2018), has observed that the global increase in sand harvesting has different effects which include socio-economic and environmental. The intensity of sand harvesting has been reported both in the developed and developing countries. It is pointed out that United States leads other developed countries as the leading extractor and utilizer of sand (Saunders, 1991). In Africa, sand mining is predominantly carried out in South Africa and Sierra Leone. However, unlike in the developed world, where sand mining has been consistent, in Africa, sand harvesting has been determined more by events and development trends hence less consistent over time. For example, in Zimbabwe, sand harvesting became a dominant activity following the government's policy to embark on massive infrastructural project (Magidi, 2019).

The continued demand for sand has been on the rise in Africa as different countries strive to achieve their infrastructural needs. This has been happening in the absence of legal and policy frameworks that would promote sustainable sand mining in the continent. The intensification of sand mining therefore, has led to the conversion of arable land into sand mines which has had impact on agriculture and livelihood sources (Saviour, 2012). The impact of sand harvesting therefore, has been termed negative in respect with its socio-economic and environmental impact (Carey, 1999). The impact has been witnessed on the effect that sand mining has on beaches, riverbanks and even in the deserts. In Kenya for example, sand mining has been largely uncontrolled which has exacerbated such negative impacts. According to the UNEP Report of 2016, the largely uncontrolled sand mining especially in Makueni area in Kenya has led to a number of social problems like high dropout rates in schools, increased drugs and substances abuse among the youths and increased level of family level conflicts over sand mining sites and activities (Nguru, 2008).

It is equally opined that the massive sand mining in Makueni County continue to undermine food security efforts and environmental conservation initiatives (Mwaura, 2013). It is emerging that land owners seems less concerned about land degradation as well as safety as sand harvesting continue to intensify in the area. In spite of the negative impact of sand harvesting in Kenya, the need for sand for construction purposes has led to increased extraction of sand in other areas where sand harvesting hitherto had not become a serious economic activity (Bingo, 2016). Subsequently, sand harvesting has continued to be embraced in other places and is slowly replacing other economic activities in those areas. This translates to the spread of the negative impact of uncontrolled mining to these areas. Sustainability therefore, becomes an issue of serious concern that needs to be addressed before the negative impacts of sand harvesting can spread to uncontrolled levels with serious environmental concerns.

Statement of the problem

Despite the fact that sand harvesting has provided alternative source of livelihoods to many in arid and semi-arid areas, its negative social and environmental impacts can be overwhelming especially in regions where it is being embraced as the main source of income. The negative impacts associated with sand mining in low-income areas include conflicts, prostitution, deforestation, soil erosion, and air pollution, within the local communities and beyond. In Kobala sub-location in Rachuonyo North sub-county is one such place where sand mining has been very intensive within Homa-Bay County. The sand extraction activity in Kobala has been fueled by the growing need for Sand within Homa-Bay, Kisii and Nyamira Counties.

Given the largely uncontrolled nature of this activity and the location of Kobala as a low-lying area along Lake Victoria basin, there is need to explore the socio-economic and environmental impact of sand mining in this area. The change from fishing to massive sand mining as demonstrated by constant presence of traffic to and from the place in search for sand and the gapping valleys visible in the area are of interest. Further, the fact that sand mining in Kobala is undertaken in agricultural lands and within homesteads instead of riverbeds as done in other areas similarly, makes the case of great interest to investigate. Consequently, this paper explores the socio-environmental impacts of sand mining on household livelihoods in Kobala sub-Location in Homa-Bay County.

Research Questions

This study aimed to find answers to the following questions

- i) What are the social effects of sand harvesting on households in Kobala sub-location?
- ii) What are the economic effects of sand harvesting on households in Kobala sub-location?
- iii) What are the environmental effects of sand harvesting on households in Kobala sub-location?

LITERATURE REVIEW

Kimatu (2011) found that the workers work in crude environments with the utilization of antiquated instruments (Shovels, containers, hoes) and no assurance of help if there should be an occurrence of an accident in Togo. The workers procure a normal of 3,000 CFA francs each day, and the incomes are utilized to address fundamental issues food, lease, clinical consideration, and youngsters' schooling. On well-being, sicknesses, for example, jungle fever, stomach issues, and hernias, just as sexual and actual shortcomings because of the troublesome working condition were typical. The examination discovered that of 68 respondents, 60% authenticated having counseled a specialist; however, acquiring the endorsed drugs was practically unimaginable due to the

neediness level. This study aimed to determine if the laborers in Kobala can meet their basic needs from their earnings in sand harvesting.

According to Mngeni, Musampa and Nakin (2016), sand harvesting is a predictable economic activity to upsurge the income level and raise living standards in a community. However, Mngeni *et al.* (2016) observed high levels of illiteracy and poor healthcare status in communities where sand harvesting is a significant economic activity due to high poverty levels among the residents. Nabegu (2014) reports high demand for international sand collecting because of the rising demand in the building industry. In the United States, it is mainly conducted in Florida, California, New Jersey, Virginia, and Georgia. In Australia, sand collecting is conducted in Kurnell Peninsula, where collectors utilize the money in business activities investment. As such, sand harvesting improves people's lives in Australia (Nabegu, 2014). Similarly, this study seeks to inquire if sand harvesting has improved the lives of residents of the Kobala sub-location.

Aromolaran (2012) studied how sand harvesting affected rural residents in Ogun State, Nigeria, who lived on agricultural land. Although many people agreed that sand had many beneficial purposes, the drawbacks for their land outweighed the advantages. Lawai (2011) emphasized that as demand rises in numerous states within Nigeria's industry and building sectors, sand mining is quickly turning into an ecological issue. The harvesting devalues the ecosystem because it is done both legally and illegally. According to a research by Times of India (2012), sand harvesting has a negative impact on rivers, sea, forests, and ecosystem. The destruction of the land and impending extinction of its rivers are largely being caused by the illegal sand harvesting and the absence of government. For example, river water levels are declining due to sand harvesting. The current study sought to determine if the sand harvesting rate in the Kobala sub-location is sustainable.

RESEARCH METHODOLOGY

Mixed method approach has been used and has allowed for the collection of both qualitative and quantitative data. The quantitative data was collected using questionnaires which were administered to a sample size of 370 residents of Kobala Sub-Location. Qualitative data on the other hand was collected using interview schedules and administered to key informants who needed to provide a rich and detailed information about sand mining in Kobala and its socio-economic and environmental impacts. The use of qualitative data was informed by the need to obtain information beyond the standardized responses that are often associated with the questionnaires (Oso & Onen, 2009). Further, the study adopted the use of qualitative interviewing because of the flexibility that it offers in asking questions, especially the provision of room for follow-up questions and probing that helps in obtaining useful information that is not covered in the schedule (Bryman, 2012).

In the same breath, the study also used observation as a method of data collection. It was also useful in providing cues on the day-to-day transactions that provided room for probing in gathering additional data needed to effectively meet the objectives. The collected information via observation aided in the verification of the data collected through other methods in enhancing accuracy. The data obtained were recorded and then analyzed to draw insights on the impact of sand mining in Kobala. Quantitative data was analyzed using simple descriptive statistics and presented in tables, percentages and charts. Qualitative statistics on the other hand was analyzed using content analysis and textual presentation done. The findings have been triangulated to enhance both reliability and validity of the findings of this study.

RESEARCH FINDINGS AND DISCUSSION

Social effects of sand harvesting

Sand harvesting in Kobala has been established to have various negative social effects like increased rate of school dropout among school going children, increased societal conflicts, fatal accidents and drugs and substance abuse. The table below provides details of the manifestation of the above stated effects.

Table 1: Social Effects of Sand Mining in Kobala Sub-Location

Variables	Frequency	Percentage	Rank
School drop-out rates	85	24.3	1
Community conflict and insecurity	65	18.6	4
Drug and substance abuse	75	21.4	2
Prostitution	69	19.7	3
Water availability	50	14.3	5
Deaths/accidents	6	1.7	6

Source: Field Data (2023)

As depicted from the results in Table 1. sand harvesting has greatly impacted school drop-out rates as presented by 85 (24.3%). This was corroborated by an interview with a key informant who retorted thus “some pupils fail to go to school because they want ready cash from sand harvesting which makes their school attendance irregular” (Interviewee, 2015). In the same vein, it was observed that some school-going children were working in the sand mines during school days and class hours pointing to a pattern of school absenteeism. This trend is a dangerous sign as it serves to bar pupils from attaining their educational goals hence missing out on education as a key social pillar.

Due to the sand harvesters' easy access to money, some females have been seduced into prostitution. The area has a high prostitute index, which is likely due in part to sand mining operations. The action has drastically departed from the norm and morality of the local majority community, and as a matter of truth and serious concern, it is negatively reshaping the local culture. In addition to their younger compatriots, some older men working in the sand industry also allure girls. The teachers' remarks indicate that the majority of girls come from low-income households and that it is difficult for them to refuse gifts like cell phones and pocket money that men in the sand industry give them. As a result, there is prostitution, unexpected early marriage, and pregnancy before marriage. According to a study by Kisipan (2019) on the impact of sand harvesting on students' learning in public primary schools, students tend to drop out beginning in standard six and peak at standard seven, which is right before they enter standard eight, the last year of the primary school cycle. These findings are consistent with that study.

This is a result of their attraction to the sand harvesting operations, which are rather common in the study area and offer the possibility of earning some cash. The common consensus is that there is a negative correlation between child labor and attendance in school. Children's participation in sand harvesting disrupts their education since it puts physical and psycho-social burden on them to balance work and school, which frequently results in low school attendance, subpar academic performance, and dropout (Alpha & Karim, 2016). Students who participate in physical activities like sand loading exhaust themselves physically, which leaves them with less energy for studying or attending class. Fatigue and a lack of recreational opportunities to foster the child's physical, social, and emotional growth will result in very little brain stimulation, which will cause the youngster to disregard their education.

Similarly, it has been shown that sand harvesting activities significantly impact drug and substance consumption. The majority of sand harvesters are drug and substance abusers, according to data from questionnaires. These include the use of marijuana, alcohol, and bhang (FGD 001, 2022). Peer influence among sand miners and loaders has been pointed out as the key factor that makes the abuse of drugs an appealing activity. The peers often associate the abuse of drugs with gaining strength which is required in undertaking sand mining activities. The availability of ready cash from sand mining activities often fuels the use of drugs among the key stakeholders in this industry. These results are supported by the UNEP (2019) report, which found that uncontrolled sand harvesting causes a wide range of social problems in Makueni, such as an increase in school dropout rates among youth, a decline in security, and drug and substance abuse due to young people's increased disposable income.

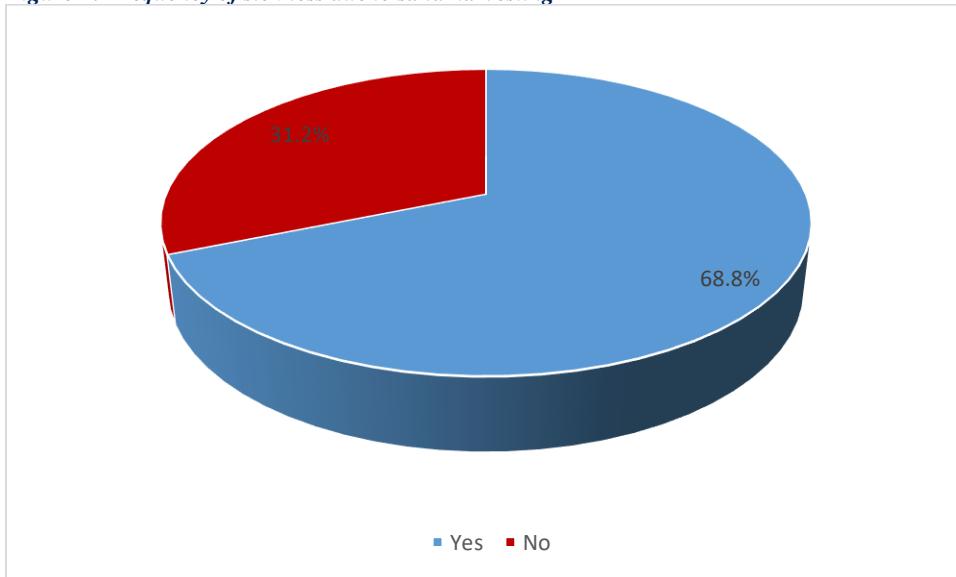
However, the study also found that the occurrence of conflicts and insecurity in the community has been significantly impacted by sand mining operations. In relation to this, the locals in this area occasionally clash with the sand miners since sand mining has disrupted the natural water sources that are dammed in sand aquifers. Additionally, the office of the chief confirmed that

conflicts often arise over land ownership as parties seek to gain legal ownership as the first step towards turning such pieces of land into sand mines. The conflict has often risen out of a lack of clarity on land inheritance rights within families (Interviewee 0011, 2022).

Upon probing further during the interview, some respondents gave their opinions concerning the conflicts resulting between the sand miners and land owners. This was reported to be stemming from the failure on the part of the miners to pay land owners their dues since some miners hire mines at a fee payable over an agreed time or based on activities carried out. An interview with one of the NEMA key informants also confirmed that there exists some form of conflict between the county government and landowners: “The Homa-bay county government had a proposal of forming County Sand Harvesting and managing committee to register and advise sand dealers exempting land owners, this brought tension and conflict with the land owner” (Interviewee 0009, 2022).

The results of this study have also established that there have been several cases of deaths or accidents of sand harvesters, loaders, drivers, and community members. Numerous accidents had been reported in and near sand mining regions, according to an interview with key informants conducted in Kobala. Two lower primary pupils who had accompanied their elder brother to the mines at night drowned and died at the mines after the pit got filled up with rain water while they were inside (Interviewee 006, 2022). The NEMA county director also confirmed that there are over 16 people who have died as a result of sand harvesting in the last two years. Closely related to accidents are deaths caused by teen pregnancies since the only dispensary available does not have a well-equipped C-section with no doctor hence necessitating referrals and due to poor road network, some teens get to lose their lives in the process. Other road accidents have been reported as a result of road narrowing from sand harvesting and erosion, and slow-moving tipper trucks generate traffic congestion, making it hard for two vehicles to pass at the same time (FGD 0002, 2022). When transporting exposed sand, these trucks may cause accidents to other cars and people. The one-kilometer stretch from the Kisumu-Homa Bay Road that connects to Chuwe Beach is not wide enough for two cars to pass at the same time. One must wait for the other to cross, and the driver needs to be careful to avoid falling into the sand-harvesting-created ditch. (Observation by Author, 2022). Residents do not appear to see anything wrong with what they are doing, despite the clear destruction of their surroundings. It is also astounding how often they damage their land in an attempt to make quick money rather than adopting sustainable ways over the long run. Electricity poles become weak due to a series of large holes left by harvesters that run deep below the surface. Upon visiting the location, one finds that there is already a risk from fallen electrical poles and high-voltage power cables that are strewn around. Infrastructures such as electricity poles carry the huge potential of causing disaster especially when they fall on the ground as they can electrocute humans as well as animals with the dangers of starting fire.

Figure 1: Frequency of sickness due to sand harvesting



Source: Field data (2023)

The results exhibited in Figure 1 shows that 234 (68.8%) of the participants noted that laborers fall sick by regularly being involved in sand harvesting while 106 (31.2%) contradict the statement. This is in line with Mangeni et al (2016), who stated that there are high levels of illiteracy and poor healthcare status in communities where sand harvesting is a major economic activity. Because they do their jobs in the water for extended periods of time, sand miners and sand loaders are more vulnerable to illnesses like malaria and bilharzia. In addition to providing mosquito breeding grounds during the rainy season, the abandoned pits collect water, which aids in the spread of malaria. The villagers, particularly the sand miners, bathe in the pits out of a lack of clean water, which causes them to get skin infections. From observation within the study area, very few homesteads have pit latrines due to the presence of alternative defecating areas- gullies- left behind by sand miners-thus constituting one of the principal pathways for infection which in turn increase the health burden that overshadows the economic benefits of sand harvesting in this area.

Notwithstanding the detrimental social effects connected to sand harvesting, the practice also benefited the community and the people who participated in it, with 43% finding work as miners, 40% as loaders, and 17% as truck drivers. Sand miners can make ksh1000 a day, loaders make ksh900 and truck drivers make ksh1000 with every trip. This is roughly ksh30, 000 in a month (FGD 001, 2022). Some community members and teachers have attributed increased school enrolment to this activity as those involved in sand harvesting can afford tuition fees and the basic school requirements for their children. “Children from sand harvesting homes are hardly sent home for fee balance as their parents always pay on time”, says a teacher from Osodo secondary school in Kobala.

Economic effect of sand harvesting

Finding out how the Kobala sub-location's residents will be affected financially by sand harvesting was the study's second objective. The construction boom in both developed and emerging nations has led to a recent increase in the extraction of natural sand aggregate globally. Kenya is no exception to this human settlement and expansion of urbanization. The economic aspects were analyzed using descriptive statistics. The results were displayed in Table 2.

Table 2: Economic effect of sand harvesting

Statements	Frequency	Percentage	Rank
Employment creation opportunities	72	22.5	1
Development of infrastructure	50	15.6	3
Villagers buy sand at cheap prices	44	13.8	5
Act as a source of income for miners, loaders, and drivers	68	21.3	2
Generation of new taxes revenue	38	11.9	6
Open up of small business	48	15.0	4
Total	320	100.0	

Source: Field Data (2023)

The results displayed in Table 2 reveal that 72 (22.5%) of the participants noted that sand harvesting resulted in the creation of employment opportunities. The residents of the Kobala location benefit from sand harvesting as they were employed as sand harvesters, loaders, and drivers. The results are consistent with a research conducted by Suherman (2015), who found that sand mining can benefit the local economy by creating jobs and employment, promoting local businesses, and giving inhabitants a source of income. Mattamana (2013) and Gunaratne (2016) both made the same claim, namely that sand mining, particularly in poor nations, can directly or indirectly boost local economies.

The findings uncovered that 68(21.3%) of the participants mentioned that drivers, loaders, and miners make their living from sand mining. While some work as carvers, many others are employed in the mines area to improve sand harvesting and transportation. According to a ICMM (2012) research, mining plays a major role in economic growth by fostering the development of infrastructure and services, creating jobs, and, with proper management, reducing global poverty while preserving environmental integrity. According to Affairs (2003), sand harvesting in Ghana has given young people jobs. Those who are involved in the industry have been able to raise their

income levels and buy necessities such as basic electronic goods, which in part reflect the socioeconomic status of an individual worldwide. Furthermore, because of their daily profits, the respondents reported that their diet had improved since beginning the activity. This suggests that, like any other economic activity, sand harvesting can enhance the quality of life for those who live in a community. Sand harvesting, according to Al Rawashdeh, Campbell, and Titi (2016), is an economic activity that can enhance the quality of life for local residents and contribute to their empowerment.

According to the results shown in Table 2, 50(15.6%) of the participants stated that the construction of infrastructure was a direct result of sand harvesting. The table shows that the development of residential homes, schools, and hospitals as a result of sand harvesting may have standardized the social welfare of the populace. It hastened the construction of structures that needed large amounts of sand. The results are consistent with a study by Musah (2009), who found that the construction of infrastructure, such as buildings, roads, and electricity supply, as well as the creation of jobs, are two of the economic benefits of sand mining.

The results also revealed that 48(15.0%) of the participants noted that sand harvesting resulted in the opening up of small businesses. Small enterprises such as hotels are opened where sand harvesters, loaders, and drivers took their breakfast and lunch. The results concur with the outcomes of a research by Musyoka (2022) who established that small business is plowed back to the local area for development due to sand harvesting activities in Makueni County.

From the key informants and observations, a number of small, mostly female-owned businesses were noted, such as the improvised mini-hotels that were erected by the side of the road and close to harvesting locations. The growth of lodging options and hotels has also boosted shopping districts like Kobala. It was also observed that fruit vendors in malls were mostly female. All of these businesses supported the sand harvesting activity by feeding the loaders and transports.

Additionally, Table 2's results showed that 44 (13.8%) of the respondents mentioned that because they live close to mining locations, villagers may purchase sand for a low price. The availability of sand within the locality resulted to decrease in price. Therefore, the majority of the residents of Kobala sub-location have formed bricks for house development.

In addition, 38 (11.9%) of the participants mentioned that taxes collected from sand harvesting provide funding for the government. In consequence, the growth of jobs related to sand mining generates more tax income, particularly locally. Local governments make more money by expanding their buildings and recruiting staff; county governments gain a great deal from higher property tax receipts. It's reasonable to assume that ethical sand mining is bringing in a sizable amount of additional tax revenue, which relieves some of the strain on nearby property taxes.

From the interviewed schedules it was noted that;

“Sand mining activities have brought some benefits not only to our village but also to the community. People can generate income for various social and economic developments; youths engage in mining, loading, and act as drivers to the lorry for carrying sand”. (Interviewee 0003, 2022)

Environmental Effects of Sand Harvesting

The findings depict that sand harvesting has impacted water availability. The water sources are negatively affected by sand miners. A significant section of the populace uses water from the lake, wells, and Miriu River that has been tainted by the activity. This is in line with the findings of Gathogo and Amimo (2017), who have demonstrated that sand mining in perennial rivers causes the water table to drop, particularly in wells that are close to the river. In one instance, it was noted that the water table in the sand reserves beside the transient stream channel had dropped. Since the area only got one source of surface water; the river Miriu whose location is a little bit far, the majority of the community members rely on water from sand aquifers as the only other alternative source of water apart from the dirty water from Lake Victoria. The extensive mining activities have led to the drying up of such aquifers which have had a negative impact on the water sources for the residents of the Kobala sub-location.

There was no doubt that sand mining in some locations had led to some unstable patterns based on the information obtained from questionnaires. These comprise: waterway insecurity (40%), cumulative potable water loss (25%) and low water quality (20%), as well as health problems (15%) brought about by sand mining dust and vehicle emissions. The dead don't rest in Kobala. A respondent noted that “exhuming bodies to harvest sand is a normal activity here, we don't see anything wrong with it as the dead will have rested enough, added a woman in a joking way.” Houses built deeply in the ground have been converted into large holes. All of them are the result of sand harvesting, which has deteriorated the ecosystem.

Table 3: Environmental Effects of sand harvesting

Statements	Frequency	Percentage
Land degradation and soil erosion	80	25.0
Loss of biodiversity	67	20.9
Destruction of agricultural land	65	20.3
Flooding	56	17.5
Pollution (land, water, and noise pollution)	52	16.3
Total	320	100.0

Source: Field Data (2023)

The findings presented in Table 3 show that 80(25.0%) of the respondents noted that sand harvesting resulted in land degradation and soil erosion. The land becomes more prone to erosion when vegetation is consistently removed, which lowers agricultural crop yields and reduces the area's ability to sustain livestock. But this also throws the ecosystem's natural balance off balance, which can be harmful to people, other animals, plants, and insects. The investigation also found evidence of land deterioration. Environmental degradation like as wetland destruction was another great problem reported that caused soil erosion, vegetation loss, and pollution of water. This is consistent with Mensah's (2002) research in Ghana, which revealed that the primary consequences of unchecked sand harvesting include land loss, beach destruction, road destruction, and flora loss. The study has shown that sand mining has resulted in soil degradation. One of the most notable effects of mining operations is sand mining, which mostly takes the form of soil overburden, excavation, topsoil stacking, and land loss from the dumping of mine and quarries wastes. In general, sand mining degrades forest land, depletes groundwater supplies, damages property, and has negative consequences on aquatic biodiversity and public health. The findings support the findings of Lad (2014) and Samant (2014), who found that overburden and drainage from mining in India destroyed 20 times more land than is leased, including grazing, forests, and agricultural fields. The results also show that mining poses a significant risk to both the environment and human health in India due to soil erosion, overburden, deforestation, disruption of subsurface water circulation, and air and water pollution, all of which have an impact on the physical environment and the safety of the miners. There are concerns about whether mining and quarrying should continue in light of the environmental damage caused by these activities.

Sand mining also causes erosion and the narrowing of riverbanks by removing excessive amounts of silt from rivers. The loss of productive land and property is the ultimate result of all these negative effects of sand mining. It is not possible to harvest and use this much material without having a major negative environmental impact (Sonak et al., 2006). Water table levels, biodiversity, turbidity, and landscape are all impacted by extraction. The products and services provided by ecosystems are being impacted by changes in land use and land cover brought about by sand harvesting activities. Impacts on animal and plant species as well as soil degradation that lessens biological systems' capacity to meet local communities' requirements are of utmost importance. The results corroborate those of Ladlow's (2015) study, which showed that sand harvesting has detrimental consequences on biodiversity, soil erosion, loss of trees, loss of vegetation cover, and degradation of natural habitats. These results are consistent with those of Wall et al. (2012), who found that sand harvesting reduces biodiversity, which is crucial for providing essential ecosystem goods and services like food production. As a result, local communities lose out on ecosystem services when biodiversity is lost due to sand harvesting. Large areas of forest are cleared for mining, which reduces biodiversity, destroys habitat a home for many microorganisms and messes with water control (Sarma, 2005).

The study established that sand harvesting has destroyed agricultural land in Kobala sub-location. The findings indicate the increased reduction in farm productivity, fertility and vegetation hence undermining food security in the area. also stated that it reduced the productivity of farms and fertile land, destroyed vegetation, and made the community more vulnerable to food insecurity. According to FAO (2010), the devastation of vast tracts of land for various mining-related objectives is one reason why surface or open-pit mining is not the best or should be opposed by locals. The entire land area bought is anticipated to be utilized for various uses when the mines close, including heap leach facilities, mine sitting, and the clearing of a sizable portion of land for residential use after topsoil and vegetation are removed. The stunning landscape of the region is lost as a result of the land devastation. Along with destroying vegetation, cultural sites, biodiversity, and some water, the massive land clearing required for open-pit mining also destroys wildlife habitats and rich tropical forests that are home to valuable timber species.

Pollution was also pointed to as a negative consequence of sand harvesting. Noise and land contamination are typically linked to sand mining. For example, I saw that when loading and transportation of sand takes place via the use of large machinery, tipping trucks, and excavators, a lot of noise get to be produced which impacts residents negatively. The findings corroborate research by Oyoo (2021) which demonstrated that dust from sand harvesting locations is a significant source of air pollution. However, a number of factors, like the weather, the amount of dust in the air, its size, and the compounds it contains, will affect how much pollution there is. Dust can physically harm plants by tearing off their leaves and cuticles and obstructing and disintegrating their interior components. Furthermore, it can have chemical repercussions that compromise their long-term health. Air pollution is not only an annoyance and may have negative health effects, especially for those who have respiratory issues.

Mitigations to unsustainable sand harvesting

This study also found that in order for the entities mining sand to be able to pay taxes and support local economic development, they must be registered and professional knowledge must be taken into account when performing road maintenance on the property. From the interviewed personnel, it was emerged that:

To expand the green belt, plant a sufficient mix of trees with good leaf density and the ability to grow quickly. It will lower noise levels and serve as a buffer to collect dust particles in the air. This will also have a favorable effect from an aesthetic standpoint. (Interviewee 0004, 2022).

According to Sada (2018), the locals should use a number of strategies to lessen some of the environmental effects that are frequently felt at the location. One of the most frequent environmental issues at the location, for instance, is the road's degradation, which is brought on

by trucks entering and leaving the property. The stone fragments and mine dust left over from the mining process partially fill the mines. This indicates that sectoral policy instruments must be harmonized with the EMCA and the Constitution: The EMCA and the Constitution are not in harmony with a number of sector-specific environmental legislation and regulations. These include trade, industrial, water, forest, and agriculture policies, all of which have a big impact on the environment. The researcher had a very difficult time getting information from NEMA officers as most questions were left unanswered with the claim that they belonged to the agricultural, water, and health sector. It is imperative that the policy instruments utilized in these domains comply with the most recent version of the EMCA and the Constitution, and undergo a comprehensive environmental evaluation to ensure their alignment with sustainable development principles.

An essential foundation for resolving Kenya's long-standing conflicts over land usage and tenure is provided by the National Land Policy and the Constitution. To guarantee implementation, nevertheless, they require strong legislation. Natural and environmental resource valuation: The cost of sold goods and services seldom takes into account the worth of environmental resources. Natural resources and the environment are typically regarded as public goods. This is a sign of a failing market. A shift in production and consumption patterns would result from businesses and consumers adopting environmentally conscious practices. Policymakers continue to place little priority on the environment and natural resources, in part because they do not fully recognize the sector's entire economic worth.

Conclusion and Recommendations

Conclusion

Based on the study's findings, it was determined that sand mining majorly has negative socio-environmental impact in Kobala. The negative societal repercussions, including an increase in drug and substance misuse, accidents and deaths, increased prevalence of diseases and increased school dropout rate as well as increased local level conflicts. The study did find, however, that sand harvesting brought up significant environmental issues, including soil erosion, topographical disturbance, loss of biodiversity, loss of grazing space, air and water pollution from sand particles, and noise pollution from vehicles transporting sand. These have served to undermine food security and safety of the residents hence overshadowing any benefits that would accrue from sand harvesting activities in the area.

Recommendations

- i. Sand harvesting has had negative social consequences such as school dropouts, conflicts, drug and substance misuse, and so on. In partnership with the Ministry of Interior and National Coordination, the county administration of Homa-Bay should establish conflict

mitigation measures to improve social cohesion and discourage the use and abuse of drugs and substances.

- ii. Sand mining has had a favorable economic impact, and the Homa-Bay county administration, through its ministry of trade, can assist people in establishing loaning and saving models to help boost the value of sand mining income for communities.
- iii. The current Mining Act of 2014 should be reviewed by the government, through the Ministry of Environment, Climate Change and Forestry in collaboration with the Ministry of Petroleum and Mining, and a clear implementation mechanism and responsible parties should be provided.
- iv. To help monitor the environmental effects resulting from sand mining, regulatory bodies such as NEMA are required to undertake periodical Environmental Audits (EA) and Environmental Impact Assessments (EIA). In order to regularly update on the best practices for sand harvesting, this will assist detect early symptoms of high rates of sand mining, such as increasing slope angles, width and depth of the river channel, and bank instability.

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