NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

AN ASSESSMENT ON THE ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS OF SAND MINING ACTIVITIES: A CASE STUDY IN THE WEST POINT COMMUNITY IN MONROVIA, LIBERIA

MSc. THESIS

DUOSALYN BLESSED TARR

Nicosia

JANUARY, 2023

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MSc. THESIS

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JANUARY, 2023

Approval

We certify that we have read the thesis submitted by Ms. **Duosalyn Blessed Tarr** titled **"An assessment on the Environmental and Socio Economic Impacts of Sand Mining Activities: A Case Study in the West Point Community in Monrovia, Liberia"** and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Applied Sciences.

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Declaration

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Duosalyn Blessed Tarr

…../…../ 2023

Acknowledgment

I am profoundly grateful to God for his guidance, wisdom and the strength he has given me to remain focused and persistent throughout my educational sojourn at Near East University. I look back sometimes and still cannot understand how everything work out for me: the finances, support, strength, and wisdom to complete my program. It must have been God's unmerited favor and love.

To my family, you are the best. Aside God, my family has been my pillar of strength. They have been my number one support system. Through thick and thin they have been by my side and for that, I am grateful.

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Duosalyn Blessed Tarr

…../…../…..

Dedication

This study is dedicated to my beloved family for their ever-loving support towards me. When the days were clear but I could not see because of the tears in my eyes, you all were right beside me as my pillar of strength. Being an international student has been a challenging one but you were my source of inspiration.

I would also like to dedicate this work to my loving mother Mrs. Sarah Y. Tarr for her love and prayers that have pulled me through. I have seen all your little sacrifices you have made and I appreciate them.

Abstract

An Assessment on the Environmental and Socio-Economic Impacts of Sand Mining Activities: A Case Study in the West Point Community in Monrovia, Liberia

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January, 2023 Page,60

Sand mining is a global sector that has received a lot of attention due to its adverse socio-economic and environmental repercussions as well as its priceless contributions to progress. Sand mining helps cities grow by supplying the building and real estate sectors with the aggregate materials they need, but it also poses a threat to the environment's sustainability, particularly in coastal areas. The socio-economic and environmental effects of sand mining on coastal communities in West Point, Monrovia, Liberia, have not been studied, despite this. Therefore, the study's goal was to evaluate the socioeconomic and environmental effects of sand mining in the West Point Community in Monrovia, Liberia. To gather the field data, focus group discussions, field observations, and questionnaire surveys were undertaken. Data was gathered from 200 participants, of which 132(66%) were men and 68(34%) were women. Even though the respondents' primary occupations varied, 107 (or 53.5%) of them were students, and 66 (or 33%) worked either as an employee or self-employed and 27 (13.5%) unemployed. 58.5% of those polled were between the ages of 18 and 29. The findings revealed that 186 (93%) respondents said they were aware of both the positive and negative effects of sand mining. Despite the fact that 69.5 percent of them confirmed that they are underpaid, the majority of them (68%) that sand mining produces jobs. In regards to the social impact, 85.5% agreed that the lack of adequate restrictions was causing a severe conflict between landowners and sand miners. As a result, 98 (49.0%), 59 (29.5%), and 43 (21.5%) of respondents identified coastal line erosion, community damage, and rising dust particles as major concerns in their community, respectively. Therefore, it is advised that the government raise public awareness of the harm that sand mining causes to the environment and local populations and take action to stop it. Sand mining is a problem for the locals at West Point and Monrovia, and it will have a significant impact on the environment as a whole.

Key words: Environmental, Socio Economic Impacts, Sand Mining, West Point

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List of Abbreviations

USAID: United States Agency for International Development

MLME: Ministry of Lands, Mines, and Energy

SPSS: Statistical Package for Social Scientists

SMS: Short Message Service

UNEP: United Nation Environmental Protection

USA: United States of America

CHAPTER I

Introduction

Overview

Sand removal from its natural state is referred to as "sand mining" (Zhang, Jianguang, et al.2020). Due to its numerous uses, sand has developed into a very important substance for our society. Sand can be found in a variety of places, including oceans, rivers, streams, flood plains, hills, and mountains. It can be used to manufacture sandpaper, bricks, glass, concrete, filling for roads and construction sites, and more. Sand has many uses, and because of anthropogenic activity of many kinds, beaches and rivers all over the world are under a significant lot of stress. The worst of them is indiscriminate sand mining since it threatens river ecosystems' ability to exist (Martín-Vide, Juan Pedro, et al., 2010). As civilization evolves because of population growth, human settlements, industrialization, urbanization, and related activities, beaches and rivers are heavily exploited for resources like sand. This has frequently led to indiscriminate in stream sand mining and floodplain areas, which have seriously harmed the ecosystem in the sea (Saviour, N. M 2012).

As sand plays an ever more important part in the development of civilization, many people have developed a variety of techniques for getting it from the natural environment. According to WiseGEEK (2003), artisanal mining is a small-scale mining industry unrelated to significant corporate corporations. For this form of subsistence sand mining, it is customary in developing nations to use a variety of hand tools and methods.

On the other hand, large-scale mining activities call for strong equipment, explosives, and chemical processing. River sand mining has been under increased scrutiny, as its environmental implications have become better known in recent years due to the importance of sand in the natural environment and the effects of excessive sand mining.

First, sand is essential for safeguarding the coastal ecosystem and can contain associated aquatic species of crustaceans and other creatures. Sand, which lessens the effects of powerful tidal waves and storm surges as they approach the shoreline, poses a threat to nearby bridges when it is mined in greater quantities than it is being

replenished because erosion will cause the river mouth to widen (http://ponce.sdsu.edu/three issues sandminingfacts01.html). In sand mining damages both public and private property since it affects riverbeds, weakens bridge piers, and exposes infrastructure (Zhang, Jianguang, et al.2020)

Sand is endangered when it is more intensely than it is being replaced because it provides a habitat for many aquatic animals, including crab species. Sand mining operations will have an effect on the ocean and river's water quality. Effects include oil spills or leaks from excavation equipment and transportation trucks, sedimentation because of the storage and disposal (Zhang, Jianguang, et al.2020). Sand, mining may have costly effects beyond the vicinity of mine sites.

I aim to acknowledge both positive and negative consequences of sand mining in this work. Describe the appropriate management strategies to lessen the effects of sand mining in West point beaches and floodplain zones. Hence, potential sand mining operations might affect the ecosystem in both good and bad ways.

Statement of the Study

The West Point Community is one of Monrovia's most populated slums. It was chosen for the current study due to its vulnerability to illegal sand mining activities. Environmental degradation, mostly brought on by illegal sand mining operations, has caused a part of the area to progressively slide into the sea. The socio-economic impacts of sand mining on the West Point neighborhood in Monrovia have not been studied, but it is thought to play a key role in the growth of the neighborhoods in the study area. Henceforth, this study wants to exhume urbanization drivers such as urban housing, road and bridge construction, livelihood, and employment to be the main forces behind sand mining activities in the studied area.

In industrial construction, sand is a non-replaceable raw material that is used regularly to create infrastructure all over the world. The expansion of society's population increases demand for a variety of goods and services, such as clothing, footwear, books, glassware, and other commodities. Every member of the mass population must rely on his or her own assets in order to exist, which increases competition for goods and services and drives up the cost of commodities.

Increased industrialization, housing demand, infrastructure needs, and demands for social services could all result from rapid population development. Businesses like the glass factory, sand paper mill, various potteries, and block factories face a significant need for sand in their attempts to provide goods and services for humanity. It is important to mention construction sites and the different mining operations that utilize vast amounts of sand for reclamation when considering the many businesses that use sand in one way or another to produce goods and services to meet human needs. Human settlements, urbanization, and the expansion of building activities all lead to an increase in sand consumption. Massive sand mining is humankind's attempt to solve these related issues.

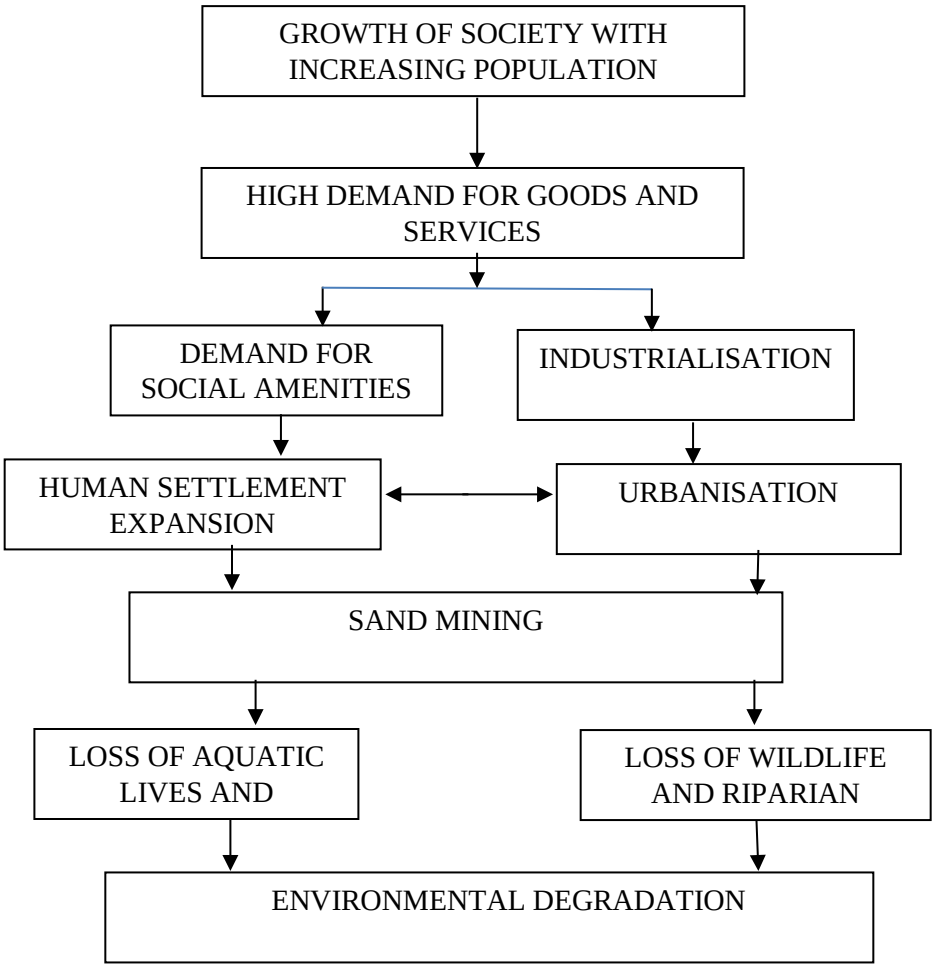
The environment suffers greatly when sand is removed faster than it can naturally replenish. In sand mining has the ability to change the channel shape of rivers since it lowers the riverbed during extraction (Padmalal, Damodharan, and K. Maya 2014). Due to erosion, excessive sand mining puts neighboring buildings like bridges and riverbanks at risk (http://ponce.sdsu.edu/three issues sandminingfacts01.html). (Zhang, Jianguang, et al.2020) acknowledges one of the costly side effects of sand mining that goes beyond the immediate mine sites is the destruction of riparian habitat because of considerable changes in the channel morphology. A few outcomes include riverbed deterioration and coarsening, water table reduction close to the streambed, and channel instability. Because of ongoing extraction, the entire streambed can erode to the point of excavation.

Impacts on biological resources include the extinction and destruction of aquatic life as well as the destruction of fisheries, which presents problems for those whose livelihoods depend on fishing. This process can cause erosion, taint water supplies, and harm riverine vegetation in addition to reducing the range of species that can be found in these woodland habitats (Liu, Haoran, Kehui Xu, and Carol Wilson 2020).

However, sand mining has adverse effects on the study area, including the threat to overpass bridges and the destruction of riparian habitat, particularly the West point community. Locally on the study area, the environmental effects of sand mining that are reportedly occurring include degradation, erosion-related changes in channel morphology, and an increase in dust particles from transportation.

Figure 1.1:

The Problem Tree



Purpose of the Study

This study's main purpose is to discover and evaluate the sociological and environmental effects of sand mining in West point community.

The following secondary purposes would also be taken into consideration:

- Determining and evaluating some significant environmental effects connected to sand mining activities
- To make recommendations for interventions that might help in reducing any unfavorable effects that the study might find.

Research Questions

- What specific environmental effects are related to West Point's sand mining operations?
- What are the Socio-Economic impacts of sand mining
- What other coping or mitigation strategies have been implemented to deal with the effects of sand mining?
- What suggestions may be made to lessen the harmful effects?

Significance of the Study

The result of this study will have greater impact on researchers, West point inhabitants and Liberians at large, for they will know the environmental and socio Economic impacts of sand mining activities referencing the west point community in Monrovia, Liberia.

Limitations

For this research, the limitations can be linked to some respondent challenges in utilizing the google structure program or form to answer the questions and also lack of finance for transport and internet data.

Definition of Terms

- Sand is defined as "a loose granular material that covers the world's beaches, riverbeds, and deserts."
- Sand mining is the process of removing sand, typically from an open pit, but it can also involve mining from inland dunes and beaches.
- Impacts: “having a strong effect on someone or something.”
- Erosion is defined as "the act of being eroded by wind, water, or other natural forces"
- Shoreline: “a line along which a huge body of water meets the land."
- Social: "concerning society or its institutions."
- Economic: “considered in relation to trade, industry, and creation of wealth.”

Summary

The chapter gave a summary of research done to ascertain the environmental impacts of sand mining in West Point community. The researcher determined the issue and provided evidence for why the study was necessary. After reviewing and consulting with other academics, the researcher put together a complete literature review in chapter two.

CHAPTER II

Literature Review

Introduction

During the 20th century, raw materials were required for infrastructure construction. Sand was one of the essential elements. Due to these positive traits, sand mining has become very popular all over the world.

(Hwang, Yorum, et al.2016) provided excellent analyses of the availability of sand from various sources by geologic province as well as the environmental implications of mining from channels and floodplains for Washington State. Sand is becoming more and more in demand all around the world, but particularly in quickly industrializing countries like China and India where the construction industry is seeing significant economic expansion.

Numerous studies have examined the effects of sand mining beaches and rivers (Hauer, C., K. Skrame, and M. Fuhrmann. 2021). Because of this, there is a wealth of information available about the possible negative effects of sand extraction on beaches and rivers, the most important of which is ocean bed degradation. River bank instability, avulsion processes, and modifications in channel pattern are some other morphological repercussions of sand mining. Structures may sustain substantial damage because of these effects, and the balance of the ocean and river may be significantly disturbed.

The extraction of sand has several detrimental environmental repercussions that were first discovered in industrialized nations (Ghosh, Prasanta Kumar, et al.2016) and (Wohl, Ellen 2020). Other countries, like China, and India, are increasingly reporting worries about the effects on the environment because of the aforementioned globalization of sand mining (Padmalal et al. 2014).

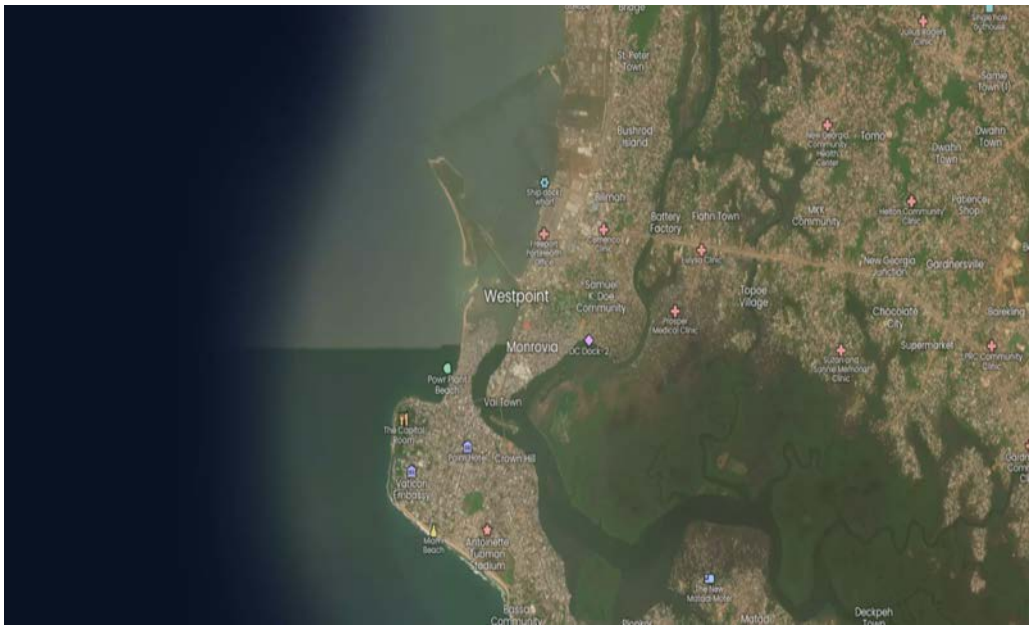
Background of the Study Area

The municipality of West Point is located in the Liberian capital city of Monrovia on a 0.53 km2 peninsula that protrudes into the Atlantic Ocean between the Mesurado and Saint Paul rivers (Figure 1). West Point is one of the slums in Monrovia with the largest population. As a result of limited social and economic benefits of people in rural areas over the last decade in most African Countries, especially in developing

countries like Liberia, there has been increased in population in urban cities. The migration of people from rural to urban area has created the problem of overpopulation in the urban areas. Like most communities in many African Cities, West Point is experiencing an increase in population growth as a result of search for better social and economic benefits of people from rural to urban Liberia. Because of environmental degradation, a part of the peninsula has gradually eroded into the ocean (David, Victor Emery, Jiang Wenchao, et al. 2020).

Figure 2.1:

Map of Monrovia referencing West Point Community



Source: Westpoint, Monrovia – Wikipedia

Definitions and Concepts

Sand and Types of Sand

Sand is a loose, disorganized mass of mineral components created by natural, including weathering and abrasion of pre-existing rocks (aggregates of minerals). Sometimes, sand is described as a loose, naturally occurring substance composed of little pieces of crushed rock. Sediments having particle sizes larger than silt or clay but smaller than gravel are referred to as sand. Different varieties of sand can be categorized

in a variety of ways. Classification criteria include factors including the product's origin, method, and sand color.

Natural Sand

Although silica, which is created when quartz crystals are broken down, makes up the majority of sand, the precise mineral makeup varies on the host rock. This type of sand is highly resistant to weathering and deterioration due to its chemical hardness and will last longer as arena footing.

White Sand

White sand is the most common type and is typically found on beaches that extend into the sea. White sand is created when coral breaks and because of wave erosion.

Black Sand

Black sand can be found on beaches, though it is more common around river mouths. It is a result of rocks breaking, which is frequently brought on by rivers running.

Manufactured Sand

Sand from rock quarries is referred to as manufactured sand and rock quarries sell the tiniest fragments of crushed rock, referred to as fines. If used alone, pointy particles, which have sizes ranging from 5 mm to minuscule dust, will compact firmly. Because the mineral composition can vary significantly and these particles do not contain the robust quartz grains that have withstood the impact of the tumbling river, they may be softer and disintegrate into dust more quickly.

Sand Mining Techniques

Sand extraction from open pits or more abundant locations, such as rivers, streams, and lakes, is referred to as "sand mining." Sand removal from its natural state is referred to as "sand mining" (Zhang, Jianguang, et al.2020).

Referencing (Carss, Keren J., et al.2017) asserts that sand can be mined or removed utilizing a variety of methods. The type of mining method to be applied to a certain sand deposit depends on a number of factors, including the deposit's thickness and depth, like the presence of a specific plant species or riparian habitat nearby.

Open Pit Technique

The simplest method of resource extraction on high, well-drained ridges with deep water tables is excavation from dry open pits. Materials are pushed into dry pits using typical truck, and then they are quickly loaded into trucks (Figure 2). When implemented correctly, this technique has minimal hydrologic effects because it does not require changing groundwater flow. Once the vegetation has fully recovered, they typically blend in with nearby properties.

Since the majority of commercial sand deposits are located in areas with shallow water tables and green swamps, it is impossible to completely extract them without breaking the water table. The procedure used, known as dewatering, may lower the water table close to the dewatered pit, which could harm the riparian flora. Floods could also happen if the water from the pit is not properly stored or drained. Pumped water has the potential to be contaminated and lose quality when incorrectly handled and released.

Figure 2.2:

Loading Trucks with Sand using Excavator Machine at West point

Source: Dreamstime.com

Mine Dredging Technique

Sand and gravel make up the bulk of the sediments. Usually, a dredge a floating excavation device uses suction to lift silt off the water's surface. A dredge resembles an underwater vacuum cleaner. The sand products are sorted and sized at the processing facility where slurry is frequently pushed through a pipeline.

Dredging can be either an open-loop dredge or a closed-loop dredge method, depending on whether the material the dredge pushes is processed and then returned to the dredge pond or disposed elsewhere.

Theoretical Framework

Malthusian Theory of Population

According to Malthus, two distinct population controllers restrict population growth in accordance with the expansion of the food supply everywhere and at all times (resources).

Many academics are interested in the writings regarding sand mining practices by both natural and social scientists. The least developed countries have experienced the worst effects of sand mining because their populations depend so heavily on the local environment and natural resources, according to (Zhang, Jianguang, et al.2020), one of these researchers.

This demonstrates how the inappropriate use of natural resources, like sand, occurs in developing countries due to rapid population growth and severe poverty. A different researcher, Daniels, examined sand mining. He talked on how sand mining generally affects the order of soil layers, soil structure, and soil productivity. He demonstrates that sand mining has roughly the same causes and effects across Asia, Latin America, and Africa.

Researchers like Gavril Tea & John Bull have examined the challenges sand mining in terms of how they affect the larger ecology. Additionally, they studied the sand industry and the social impacts of sand mining in river valleys and coastal locations. In their investigation, they discovered that managing sand resources in a way that allows for sustainable use of the resource while also maintaining the interaction. This is primarily because human activities have an effect on the environment's soil

health while also relying on healthy soil resources for people's livelihoods. Sand extraction, exploitation, and management of soil resources cannot be seen in isolation. This is unquestionably an important subject in terms of local environmental protection initiatives.

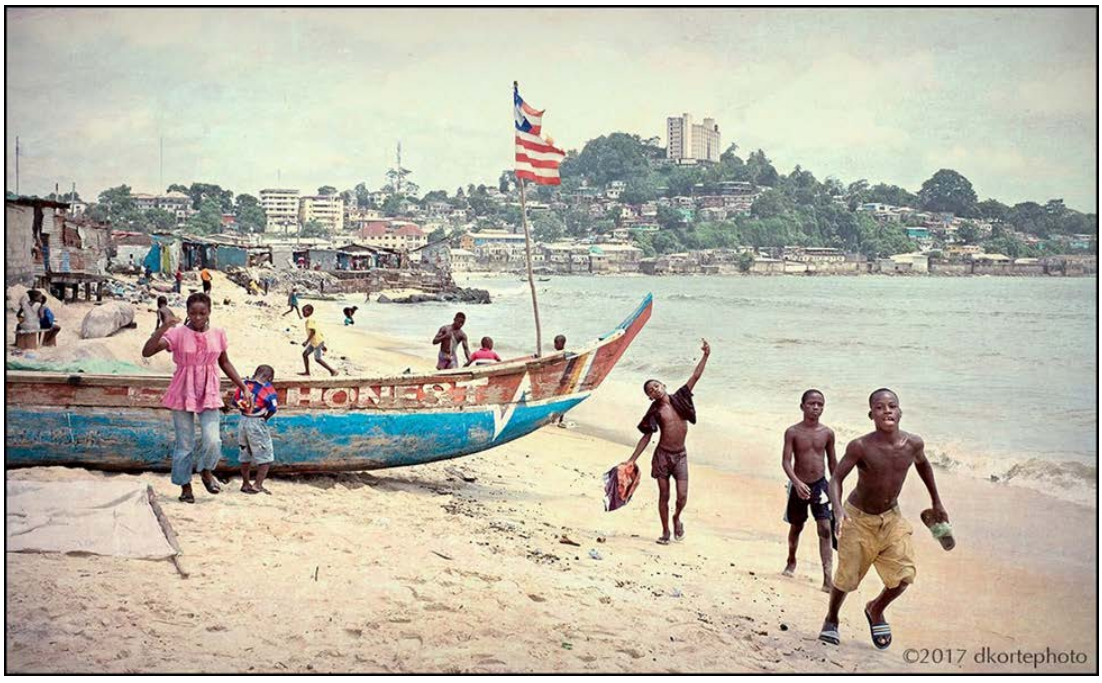
Related Research

Most reports on sand mining operations have a very small geographic focus (if the mining is ever documented at all). In some locations, including Buchanan, Greenville, Harper, and Robertsport, erosion is causing the shoreline to retreat, according to a 2008 United States Agency for International Development (USAID) assessment on the environmental threat in Liberia. Additionally, it is asserted that beach mining is the main culprit.

The threats posed by sand mining in the West Point neighborhood are become much more important given the likelihood of a significant rise in the world's sea level during the coming decades (Figure 2.3 & 2.4).

Figure 2.3:

Increased Shoreline Erosion Rates in the West Point Neighborhood



Source: David Korte Photographs

Figure 2.4:

Coastal Erosion caused by sand mining in West-Point

Source: Harry K. Sworh

Because of the detrimental consequences that sand mining has on the neighborhood, the Liberian government has banned mining in a number of locations. The implementation of these protections has proven challenging, and there has not been much of a movement to stop sand mining in the West Point community. In many cases, overcoming the local issues that contribute to the persistence of the sand mining problem is necessary in order to address the sand mining issue. Now, some of the area issues that still surround sand mining in the West Point neighborhood include poverty, corruption, and unrestrained development. In areas where sand mining significantly helps the local economy, efforts must be taken to guarantee that local workers are given alternate forms of income and those builders have access to an affordable sand substitute (e.g., crushed rock). The West Point neighborhood's sand mining operations have the potential to harm the ecosystem during and long after the mining process. These consequences have damaged the majority of homes.

According to (Elizabeth Saysay Dede, 2016) Sand Mining Law, all mining organizations must submit their petitions to the Ministry of Lands, Mines, and Energy (MLME). The MLME is a responsible government institution for directions and decision makers, despite the fact that it has long erred in the performance of its obligations because the activity is frequently carried out illegally. Sand mining has been determined to have a substantial negative influence on the ecosystem. The aforementioned judicial statements state that in the West Point community, recent environmental burdens and land degradation brought on by the practice of exploiting sand resources have unfortunately gone unchecked.

Summary

Sand is a key natural resource for the expansion of the economy. Mining is possible in open areas, on beaches, in inland dunes, rivers, and streams. Although necessary, mining operations can be environmentally harmful. According to (Igwe, P. U., et al., 2017), poor management and pervasive corruption may encourage illegal sand mining, endangering resources. It is important to protect the financial and societal benefits that come from resource extraction. Governments must exercise prudence, define borders, and supervise mining through an appropriate institutional framework when leasing riverbeds and open ground. A high-level council will enforce rules across all countries in response to environmental challenges (Igwe, P. U., et al.2017).

CHAPTER III

Methodology

Research Strategy

This chapter includes a description of the methodologies, approaches, and procedures were used to collect and analyze the data pertinent to the study's field. This kind of productive research would not have been viable without the use of statistical sampling techniques to choose a sample size from the target population. Working with the complete targeted population would have been time-consuming, impractical, and monetarily inadequate, thus the sample methodology, materials, and procedures indicated below had to be used in order to ensure the research's success. It was also required to analyze previously published publications and journals because this research on sand mining is not the first of its kind (Takyi, Richard, et al., 2021), and (Opoku-Ware, Jones 2010).

Research Design

This research major objective is to present an assessment of the social and environmental effects of sand mining activities through a case study of the West Point neighbourhood in Monrovia, Liberia. Many Liberians are suffering due to the detrimental economic and environmental effects of sand mining activities. The research methodology employed is called the qualitative research strategy. Some researchers also employ a method called the "mixed approach," which "integrates the qualitative and quantitative research approaches into a single study" (Hantrais, Linda.2014). For this investigation, we employed a qualitative approach. For this technique, an organized survey was created and sends to the respondents by email using an automatic Google structure application and posting. An organized poll is advantageous for this proposal research since it is the least expensive method of data collection, takes just a reasonable amount of time to receive replies, and allows for the examination of large examples spread throughout a large area (Applen, J. D., and Rudy McDaniel 2009).

Sample Size and Sampling Technique

In terms of this research, the main focus was on targeting those who live in and around the coastal line that are been affected by sand mining in that area also taking into consideration those who mined the sand. A survey was conducted having a total sample size of 200 survey questionnaire. Based on the sample size, any inferences derived based on a specific individual's perception of sand mining and its associated effects were assumed indicative of the entire population.

Additionally, using the purposive sample technique, zone heads and assemblymen of the community impacted by sand mining were questioned about their individual awareness, knowledge, and opinions regarding sand mining.

Data Collection Tools

In order to evaluate the socioeconomic and environmental effects of sand mining, target groups for interviews were selected referencing individuals included particular landowners, and sand miner. For the qualitative method, an organized survey was created and sends to the respondents by email using an automatic Google structure application. The data that was collected is totally primary since it was collected by the distribution of the questionnaires and there by asking close-ended questions. Following that, the responses were loaded into the SPSS software for a detailed analysis of the review's findings (Huntington, 2000). The interview questions were categorized in both socio-economic and environmental effects.

Ethical Considerations

Ethics

Every study method should take participant ethics and the sensitive nature of the subject into consideration. According to Zinyama, Rumbidzai Precious 2016, ethics are the justifiable moral principles developed by individuals or groups that direct the conduct of research regard to sample subjects, respondents, and all other research process participants. It is the researcher's duty to secure the subjects' safety, clearly explain the purpose of the study, and provide them the freedom to quit at any time while they are participating in it.

Data Analysis

The data which is gotten from the on-field research were analyzed using a statistical software called as Statistical Package for Social Sciences (SPSS) which also produced descriptive statistics, frequency tables, pie charts, bar graphs, and other visual displays. Therefore, the data obtained from this software were presented in pie chart and frequency tables in order to explain the results which is obtained from the survey questionnaire. Qualitative study was used to assess how the communities perceived sand mining activities, their impacts on neighborhood people, and the ecosystem as a whole.

Summary

The approach utilized to collect data for the study to ascertain the environmental effects of sand mining extraction was described in this chapter. This chapter also gave a clear overview of how the whole research project was done. It talked about the research designs used, how data was collected, and how the results were analyzed.

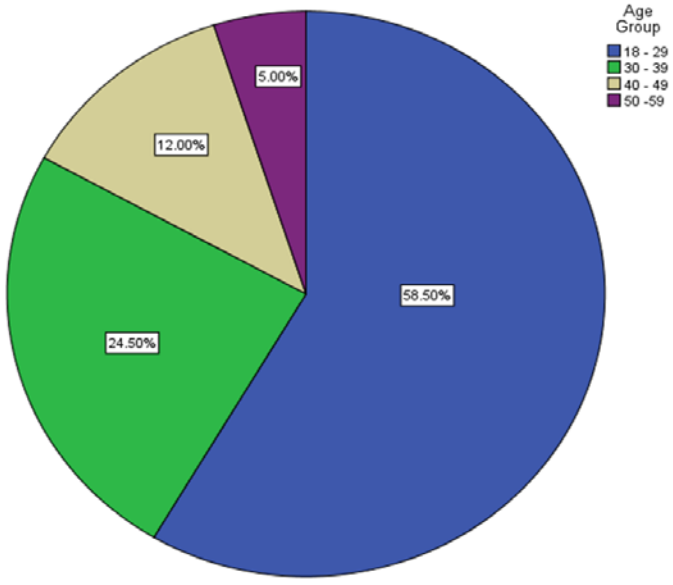
CHAPTER IV

Findings and Discussion

Results

Socio-Demographic Characteristics of the Respondents'

Among the 200 participants that were questioned, 132 (66%) of the respondents were male while 68(34%) were female. The occupation levels were divided into three groups: Students, Employed and Unemployed. According to the findings, 107 (53.5%) of the respondents in the study region were students, 66 (33%) were employed (self-employed or employee) and 27(13.5%) were unemployed. The highest number of respondents fall between the ages ranging from 18-29 which is 117(58.5%). Followed by 30-39 age gatherings establishing 49(24.5%) of the absolute respondents. Ages ranging from 40-49 had 24 respondents which is 12% and age group 50-59 had 10 respondents which is equivalent to 5%. The respondents' age shows that many youths are focusing closely on environmental issues that are affecting this region.



This chat illustrates the respondent age categories. This helps understands how the respondents' ideas and information fluctuates with age.

Table 1:

Gender

Valid	Frequency	Percent	Valid percent	Cumulative percent
Female	68	34.0	34.0	34.0
Male	132	66.0	66.0	100.0
Total	**200**	**100.0**		**100.0**

The data collected involved 200 participants. As per the above table, it is known that majority of respondents were male.

Table 2:

How far do you live from the sand mining site?

Valid	Frequency	Percent	Valid Percent	Cumulative percent
0-500m	67	33.5	33.5	33.5
501-1000m	61	30.5	30.5	78.0
1001-1500m	28	14.0	14.0	47.5
Above 1500m	44	22.0	22.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. The above table shows that majority of the respondents live closer to the mining sites.

Table 3:

Have you ever paid a visit to the sand mining site in your community?

Valid percent	Frequency	Percent	Valid Percent	Cumulative
No	36	18.0	18.0	18.0
Yes	164	82.0	82.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. As per the above table, it is known that majority of respondents have visited the mining sites whereby giving them knowledge on what is happening there.

Table 4:

Who are the usual owners of the sand mining sites in this area?

Valid percent	Frequency	Percent	Valid percent	Cumulative
Companies	45	22.5	22.5	22.5
Government	35	17.5	17.5	40.0
Individual	120	60.0	60.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. As per the above table, it is shown that individuals are the highest owner of the mining areas.

Table 5:

Is there any institution that regulates the activities of sand mining in this area?

Valid percent	Frequency	Percent	Valid Percent	Cumulative
Maybe	57	28.5	28.5	28.5
No	74	37.0	37.0	65.5
Yes	69	34.5	34.5	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. As per the above table, majority of the respondents said that there is not any institution that regulates the activities of sand mining in WestPoint.

Table 6:

Do you think sand mining has led to subsequent growth in the community?

Valid percent	Frequency	Percent	Valid Percent	Cumulative
No	102	51.0	51.0	51.0
Yes	98	49.0	49.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. As per the above table, it is shown that sand mining has not led to any subsequent growth in the community.

Table 7:

Is your community benefiting from the uses of sand?

Valid	Frequency	Percent	Valid percent	Cumulative
percent				
No	33	16.5	16.5	16.5
Yes	167	83.5	83.5	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. As per the above table, it shown that many respondents agree that the community is benefiting from the uses of sand.

Table 8:

If yes, how are they benefiting?

Valid	Frequency	Percent	Valid percent	Cumulative
percent				
Building purpose	149	74.5	74.5	74.5
Filling roads	27	13.5	13.5	88.0
Fixing blocks	24	12.0	12.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. The above table shows that majority of the inhabitants of WestPoint are benefiting from sand through building purposes.

Table 9:

Are the positive impacts more?

Valid	Frequency	Percent	Valid percent	Cumulative percent
No	101	50.5	50.5	50.5
Yes	99	49.5	49.5	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

Table 9 shows data collected based on whether the positive impacts of sand mining are more.

Table 10:

What are the negative impacts of sand mining?

Valid	Frequency	Percent	Valid percent	Cumulative percent
Coastal degradation	98	49.0	49.0	49.0
Destruction of communities	59	29.5	29.5	78.5
Increase dust particles due to Transportation of sand	43	21.5	21.5	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

Table 10 shows the negative impacts of sand mining on the people and the environment.

Table 11:

Do you think sand mining has got more environmental impacts compare to financial gain?

Valid	Frequency	Percent	Valid percent	Cumulative percent
No	32	16.0	16.0	16.0
Yes	168	84.0	84.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. The above table is to show whether sand mining has more environmental impacts compare to financial gain.

Table 12:

Are the people that mine the sand well paid?

Valid	Frequency	Percent	Valid percent	Cumulative percent
No	139	69.5	69.5	69.5
Yes	61	30.5	30.5	100.0
Total	**200**	**100.0**	**100.0**	100.0

The data collected involved 200 participants. As per the above table, it is known that the people that mine the sand well are not well paid.

Table 13:

By what means is the sand transported from your community?

Valid	Frequency	Percent	Valid percent	Cumulative percent
Canoe	32	16.0	16.0	16.0
Trucks/Pick-up	136	68.0	68.0	84.0
Wheel Barrow	32	16.0	16.0	100.0
Total	**200**	**100.0**	**100.0**	**100.0**

The data collected involved 200 participants. As per the above table, it is shown that the sand is transported from the community mainly by Trucks/Pick-up.

Table 14:

From your personal observation, have you noticed some changes in the quality of air?

Valid	Frequency	Percent	Valid percent	Cumulative percent
Maybe	52	26.0	26.0	26.0
No	37	18.5	18.5	44.5
Yes	111	55.5	55.5	100.0
Total	**200**	**100.0**	**100.0**	100.0

The data collected involved 200 participants. As per the above table, it is shown that majority of the respondents have noticed some changes in the quality of air due to sand mining.

Table 15:

Has there been any recommendation to immediate solutions aimed at stopping the negative impacts of sand mining?

Valid percent	Frequency	Percent	Valid percent	Cumulative
No	67	33.5	33.5	33.5
Yes	133	66.5	66.5	100.0
Total	**200**	**100.0**	**100.0**	

The data collected involved 200 participants. As per the above table, it is shown there have been recommendations made but it has never been implemented.

Socio-Economic Impacts of Sand Mining

The question of whether the community is benefitting from the uses of sand was put to the participants. 167 (83.5%) of the 200 people who responded in total replied "YES," while 33 (16.5%) said "NO." Another question was asked to describe how they are benefitting from sand mining. (74.5%) said by building purposes while (13.5) said by filling roads and (12.0%) said fixing blocks.

Furthermore, majority of respondents think that sand mining brings jobs to the neighborhood. However, 139 (69.5%) of the respondents stated that those who work primarily in sand mining are not rewarded adequately. Even though it generates jobs, it also leads to friction between resident of the community and sand miners. From our responses gathered, 75(37.5%) said that the relationship between both sand miners and community dwellers are bad.

Environmental Impacts of Sand Mining

When asked whether sand mining was affecting them personally as residents, the majority of respondents (74.5%) said "yes," while only (25.5%) said "no". On the other hand, when asked to identify the main adverse effects of sand mining on the environment, respondents stated that coastline deterioration, community damage, and a rise in dust particles in the air, respectively, were reported by 98 (49.0 %), 59 (29.5%),

and 43 (21.5%). Nonetheless, the majority of respondents in the research area believed that mining has positive consequences, such as improving infrastructure, such as roads and homes, and providing jobs and cash to landowners. When asked if the practices employed by sand miners were contributing to land degradation in the area, respondent's results revealed that 103 respondents strongly agreed, 78 respondents agreed, 9 respondents disagree and 10 strongly disagree.

The respondents well understand the consequences sand mining has on the coastal area and its components, such as the beach and the vegetation, because the study area West Point, is on the coast. Additionally, the majority of respondents (87.5) remarked that it might result in floods during the rainy season.

Table 16:

Perception of the respondents towards the environmental effects of sand mining

Characteristics	**Category**	**Frequeny**	**P-value**
Do you think sand mining has environmental impacts beside the financial gain?	Yes	168	0.84
	No	32	0.16
Are there accounts for the changes in the air quality?	Yes	116	0.58
	No	84	0.42
Do you think sand mining is causing depletion of costal lines around the beach and other vegetation?	Yes	188	0.94
	No	12	0.06
Is your community in high risk due to sand mining?	Yes	145	0.725
	No	55	0.275
Do sand mining activities cause flooding during rainy season?	Yes	175	0.875
	No	25	0.125

Efforts to control negative impacts of sand mining

Despite the fact that the lack of enforcement of the restrictions was obvious, 69 (34.5%) of the 200 respondents surveyed at West Point, Monrovia, were aware of the presence of regulations by the responsible institution. They also emphasized that the

main obstacle was non-compliance with the rule. Also absent from the regulations were any guidelines or deadlines for reclaiming the deteriorated mining area. 57 (28.5%) of respondents were unsure if there was a regulation or not in the mining industry, while 74 (37%) of respondents said that, to their knowledge, no institution had put any regulations in place. When asked about recommendations and solutions to stop the bad effects of sand mining, 133 (66.5%) of the respondents said they had received some. However, 67 (33.5%) of the respondents said they had never received any recommendations or solutions, so they did not have an opinion.

Table 17:

Efforts undertaken to minimize sand mining effects on the environment

Characteristics	Category	Frequency	Percentage
How does the community react to such accidents?	Legally	54	0.27
	Peacefully	80	0.40
	Violently	66	0.33
Has there been any recommendation to immediate solutions aimed at stopping the negative impacts of sand mining?	Yes	133	0.665
	No	52	0.335
Is there any institution that regulates the activities of sand mining in this area?	Yes	69	0.345
	No	74	0.37
	Maybe	57	0.285

CHAPTER V

Discussion

Socio-Economic Impacts of Sand Mining

One of the most crowded slums in Monrovia is West Point Community. It was picked for the current study because of its susceptibility to sand mining activities that are unlawful. A portion of the region has slowly eroded into the water because of environmental degradation, which is primarily the result of illicit sand mining operations. Even though there has not been any research on the socio-economic effects of sand mining on the West Point neighborhood in Monrovia, it is believed to be a significant factor in the socio-economic development of the communities in the study region. It is interesting to note that this study found that the main factors driving sand mining activities in the study area were construction activities and job provision.

Sand mining has socioeconomic effects on the nearby populations, according to earlier studies by (Rukmana et al., 2020) and (Musah, 2009). This claim was supported by the majority of respondents, 136 (68%), who said that sand mining generates jobs for the nearby communities. Because the majority of sand miners either had no prior employment or were employed elsewhere seasonally as daily laborers, some respondents claim that sand mining is a great help to their family income and they were able to earn more steadily, even with an unpredictable income. On the other hand, 139 (69.5%) of the respondents claimed that those who work primarily in sand mining are not adequately paid. In addition, some claimed that this was not because sand miners were poorly paid, but rather that there had been little increase in the wellbeing of their families.

Sand mining operations may still be advantageous to the miner's family even though their income does not increase much. This is seen from the condition of the homes used by sand miners, which have improved and grown more durable because of their employment as sand miners. The Chi square analysis result, which showed a significant ($p < 0.0001$) difference in the respondents' income, further supports this. In contrast to their prior life, where they could only meet their requirements once or twice per day, miners' basic needs can be addressed when they work as sand miners, who can do so three times each day. Similar result was referenced by (Rais et al., 2019) claimed

that an increase in secondary requirements, such as those for motorcycles, televisions, and refrigerators, followed sand mining, reported similar findings.

Sand mining negatively affects miners' social conditions, causing disagreement and conflict among them, yet these problems can be effectively resolved (Rais et al., 2019). The ways in which social interaction, cooperation, rivalry, conflict, and attempts to settle it present themselves can be utilized to assess how sand mining affects society. Sand mining has both positive and negative social impacts that relate to interpersonal relationships and teamwork referencing the interaction in the form of cooperation, specifically the intensity of cooperation and increasing mutual assistance between miners. Henceforth, cooperation in information-sharing via direct phone calls, SMS, or emails (Short Message Service); working together to resolve issues among sand miners; and keeping sand miners friendly by organizing social gatherings on a regular basis are just a few examples of how sand mining activities have a positive social impact. The majority of respondents, 171(85.5%), stated that sand mining causes friction between the land owners and the sand miners, even though the above-mentioned advantages are intended to exist. In addition, they said that almost no one works together and that there are only pointless calculations and many fights.

Sand mining is necessary for urbanization but also threatens the sustainability of the environment, which is one of the puzzling facts about the planet. Sand mining in the West Point community, however, has a number of negative environmental effects in addition to its socioeconomic effects. These effects include noise, dust, road destruction, deforestation, changing livelihoods, land degradation, flooding, erosion, danger to buildings, and water pollution on the built environment in coastal areas. These effects will be covered in more detail in the next topic.

Sand mining effects on the environment

Sand mining is widely acknowledged to have both positive and negative effects (Rais et al., 2019). There have been complaints of environmental deterioration, water contamination, soil erosion, loss of soil structure, and death traps like abandoned trenches that act as a breeding ground for water-borne diseases (Dan Gavriletea, 2017). Only a few examples of environmental degradation brought on by human activity,

primarily through sand mining, include deforestation; general degradation of ecosystems due to air, ground, and land pollution; poor or twisted topography; unproductive agricultural terrain; development of ponds for pest cultivation; and sand/gravel mining (Musah, 2009; Rizal & Syah, 2018).

The enormous amount of sand currently being extracted has a negative impact on rivers, deltas, coastal ecosystems, and marine ecosystems. This includes the loss of land due to river or coastal erosion, a decrease in water levels, a reduction in the supply of sediment, as well as the advancement of the economy and society (Filho et al., 2021). These harmful effects extend beyond the surrounding area to larger regions that are located far from the locations where sand is mined (Pitchaiah & Pradesh, 2017). For instance, it is thought that mining in China's Poyang Lake, which the UNEP estimates to be the world's largest site for sand extraction, has resulted in a decrease in the area's water levels. The rate at which sand supplies are being used up is much faster than the rate at which they are usually replaced. This is bad for both animals and plants.

The research by (Aliu et al., 2021), which suggested that sand mining could have a variety of negative environmental effects associated with small-scale mining activities in addition to the socioeconomic benefits, was published at the same time as the current study. In particular, sand mining contributes to the destruction of agricultural land, contamination of the air and water, deforestation, and worsening of the environment.

The results of this study relate to earlier research by (Adedeji, 2014) and (Rizal & Syah, 2018). The results of a questionnaire survey and resident interviews conducted by the researcher show that the activities cause crime in the areas surrounding mining sites to increase. Undocumented employees are in high demand as they search for temporary jobs loading trucks by hand. Many unemployed individuals wait for temporary work as loaders on the sandy roads that lead to the extraction sites.

Sand mining has both positive and negative effects on the environment, some of which are detrimental to the environment (Rais et al., 2019). The majority of the negative effects of resource exploitation permanently affect all ecosystems, habitats, species, and the environment. Both limiting detrimental impacts and encouraging positive results are essential. Air pollution from smoke and dust is common in and close to areas where sand is mined. The heavy dust that pollutes garments drying on

clotheslines, creeps into dwellings, and creates respiratory problems has drawn criticism from respondents. They also emphasized that dust is not the only air pollutant; old, unstable haulage vehicles that are still hauling sand also emit smoke.

(Aliu et al., 2021). The negative socio-environmental externalities of sand mining in coastal zones are categorized into the following four categories: livelihood, environmental quality, public health, and real-property consequences. For instance, in Ghana, sand mining operations have reduced farmland, which has led to concerns about the security of livelihood (Bosco & Sumani, 2019). Less farmland causes economic disadvantages, mostly because those who are impacted frequently do not receive adequate compensation. Additionally, sand mining operations cause harm to public resources like roads, utility poles, phone towers, underground pipes, and other necessities for people's livelihoods (Koehnken & Rintoul, 2018).

Sand mining activity has an even greater impact on people's lives since it leads to conflicts over land usage due to its numerous negative externalities. The socioeconomic and environmental impacts of sand mining in West Point, Monrovia, have not been studied, but the current study has greatly improved our knowledge of the reasons, nature, and effects of mining from the perspectives of residents living near the coast. This makes a big difference in how well we understand the complex social, economic, and environmental aspects of the sand mining industry and how much we care about the ecosystem's long-term health.

Attempts to Minimize the Harmful Effects of Sand Mining

According to this study, there are numbers of significant issues that expose the region to increased conflict between and among landowners and sand minors, as well as significant environmental degradation. These issues include a lack of proper regulations, a lack of enforcement, and a lack of compliance. However, by enacting laws and enforcing penalties, increasing patrols in areas primed for exploration, and keeping a close eye on the area with useful tools, governments can minimize illegal sand mining. It is extremely difficult to put things into effect because illegal operations often take place in underdeveloped or destitute countries where governments lack the necessary resources (financial, personnel, etc.) or where corruption is pervasive (Filho et al.,

2021). Although we can come up with solutions to problems related to sand exploitation, demand does not account for the time, money, or labor that each solution demands. Even though some countries have won their battles against illegal groups, the fight must go on (Adedeji, 2014).

By resolving environmental problems, technological innovation contributes to environmental sustainability. Fortunately, modern methods and environmentally friendly technologies have been developed for mining operations to minimize damage to the environment. Modern environmental management techniques and incredibly efficient environmental machinery are considered clean technology. However, switching to clean technologies is not always easy, especially in industrialized nations like the USA (Dan Gavriletea, 2017). Governments must develop programs aimed at providing incentives to encourage enterprises in this sector to use cutting-edge, ecologically friendly sand mining practices. Supporting companies in their efforts to develop and conduct cutting-edge research for the mining industry is another strategy to reduce the detrimental effects on the environment. The bed load removal from in-stream mining can be calculated to ensure that the exploitation is done without endangering the ecology. Experts can figure out how much sand can be taken from a river with the least amount of damage to the environment by looking at predictions of how fast the river will fill up.

CHAPTER VI

Conclusion and Recommendation

Conclusion

To draw conclusions from the ongoing effects of sand mining in the West point community, the researcher needed to comprehend a number of distinct topics.

Even though the field survey shows that sand mining acknowledged that responded to the survey questions was separated into several sectors, and 132 (66%) of the respondents were men, while 68 (34%) were women. Even though the respondents' primary occupations varied, 107 (or 53.5%) of them were students, and 66 (or 33%) worked either as an employee or self-employed and 27(13.5%) unemployed. In addition, 58.5% of those polled were between the ages of 18 and 29. Results showed that 186 (93%) respondents said they were aware of both the positive and negative effects of sand mining. Despite the fact that 69.5 percent of them confirmed that they are underpaid, the majority of them (68%) that sand mining produces jobs. In regards to the social impact, 85.5% agreed that the lack of adequate restrictions was causing a severe conflict between landowners and sand miners.

The social and economic effects of sand mining, on the other hand, are related to odd people, whilst the other effects are related to the natural environment as a whole. Therefore, it is unimportant to mention the economic well-being of people when disputes, lawsuits, and school absences occur, as well as when the environment, which supports life, is threatened.

Therefore, it is conclusively determined that sand mining operations in the West Point neighborhood do more harm than good.

Recommendations

In the nearby communities, sand mining operations have already had negative social and environmental effects. Conflicts, legal disputes, the degradation of land and riverbeds, the loss of productive areas, the alteration of the terrain, and an increase in dust particles are some of these issues.

The following actions are recommended to mitigate the effects of sand mining:

Environmental agencies should strengthen and develop binding and enforceable standards and specifications for the efficient regulation of the sand mining and small-scale mining industries, as they are responsible for mining. All landowners, tipper truck drivers, and sand miners should be consulted about this, and they should all agree to it.

Municipalities should ensure that bylaws are developed, followed, and enforced; this may necessitate the development and execution of reclamation plans and bonds. To make sure that people are aware of what sand mining entails and what mitigating measures are necessary, sensitization and awareness-building efforts should be incorporated into this component. Landowners and other influential community members must be involved in the restoration process because, when given the authority to do so within the parameters, they can pressure sand miners to abide by established rules. This will also prevent conflicts, lawsuits, and other environmental damage related to sand mining from happening in the future.

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Appendices

Appendix 1: Interview Guide

NEAR EAST UNIVERSITY,

FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING

"An Assessment on the Environmental and Socio-Economic Impacts of Sand Mining Activities: A Case Study in the West Point Community in Liberia".

INDEPTH INTERVIEW GUIDEFOR THE COMMUNITY, LEADERS, AND TO THE SAND MINERS

Interviewee's name: _____

Date of interview: _____

Place of interview: _____

Interviewer's name: _____

Position/Status: _____

The researcher is a final year student at the above University who is pursuing a Master of Science Degree in Environmental Engineering at NEAR EAST UNIVERSITY. She is conducting a study on the topic: An Assessment on The Environmental and Socio-Economic Impacts of Sand Mining Activities: A Case Study in The West Point Community in Liberia. This study is solely meant for academic purpose only, and any information obtained would be treated with all the confidentiality that it deserves.

Appendix - 2

INTERVIEW QUESTIONS

SECTION I SOCIO-ECONOMIC RELATED ISSUES

6. Is your community benefiting from the uses of sand?

YES ☐

NO ☐

7. If YES how?

Building purposes ☐

Filling roads ☐

Making glass ☐

8. Do you think sand mining has both positive and negative impact on nearby sand mining affected Communities?

YES ☐

NO ☐

9. Are the positive impacts more?

Yes ☐

No ☐

10. What are the negative impacts?

Destruction of nearby cities ☐

Increased dust particles due to the transportation of sand ☐

Costal line degradation ☐

11. Has sand mining provided jobs for the people in your community?

Yes ☐

No ☐

12. Are workers on the sand mine well paid?

Yes ☐

No ☐

13. Do you think sand mining has led to a subsequent growth in the community?

Yes ☐

No ☐

14. Why YES?

A. Low cost of rent ☐

B. Reduced room occupancy ratio ☐

15. Has sand mining brought about conflicts between the sand miners and landowners?

Yes ☐

No ☐

16. Have you ever paid a visit to the site of sand mining in your community?

Yes ☐

No ☐

17. Are there any litigations or problems arising amongst sand miners and residents around the operation sites due to sand mining?

Yes ☐

No ☐

18. Do sand miners have access to good health care delivery?

Yes ☐

No ☐

19. How far do you live from the sand mining site?

0-500m ☐

001-1500m ☐

501-1000m ☐

Above 2000m ☐

20. What are the main negative impacts?

A. Destruction of houses. ☐

B. increased dust particles resulting from the transportation of sand ☐

21. From your personal observation, have you noticed some changes in the quality of the air?

YES ☐

NO ☐

22. Are there accounts for the changes in the air quality?

Yes ☐

No ☐

20. Do you think sand mining is causing depletion of costal lines around the beach and other vegetation?

YES ☐

NO ☐

23. Is your community in high risk due to sand mining?

Yes ☐

No ☐

24. Has sand mining has negative impact on kids growing in the community?

Yes ☐

No ☐

25. Do you have many school going kids in your community where sand mining is taken place?

Yes ☐

No ☐

26. Do you think sand mining has adverse impacts on nearby communities?

Yes ☐

No ☐

27. Is sand mining helpful in your community?

Yes ☐

☐

No

28. Have you ever heard of accidents reported during sand mining?

Yes ☐

No ☐

29. How does the community react to such accidents?

Peacefully ☐

Violently ☐

Legally ☐

30. Has there been any recommendation to immediate solutions aimed at stopping the negative impacts of sand mining?

Yes ☐

No ☐

31. Approximately, how many trucks pass through your community in a day?

0-5 ☐

6-10 ☐

11-15 ☐

16-20 ☐

20 and above ☐

32. Are you happy about sand mining in your community?

Yes ☐

No ☐

33. Is sand mining affecting you as a resident?

Yes ☐

No ☐

34. Methods used by sand miners are responsible for the degradation of land in the area.

Strongly agree ☐

Agree ☐

Disagree ☐

Strongly disagree ☐

35. What is the current relationship between those sand miners and the residents in the community?

Very Cordial ☐

Cordial ☐

Bad ☐

36. Who are the usual owners of the sand mining sites in this area?

Individuals ☐

Government ☐

Companies ☐

Others, specify

_____

_____

37. Can sand mining create a reliable and alternative job opportunity for inhabitants in the community?

Yes ☐

No ☐

38. Is there any evidence of the people in the community engaging in sand mining in this community?

Yes ☐

No ☐

39. Is there any institution that regulates the activities of sand mining in this area?

Yes ☐

No ☐

40. Do you think sand mining has some environmental impacts beside the financial gain?

Yes ☐

No ☐

Appendix – 3

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

22.06.2022

Dear Duosalyn Blessed Tarr

Your application titled **"An Assessment on the Environmental and Socio- Economic Impacts of Sand mining. Case Study: West-Point, Monrovia, Liberia"** with the application number NEU/AS/2022/159 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assoc. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnc Kanol

THESIS

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